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Alaska District

NORTHEAST CAPE HTRW
REMEDIAL ACTIONS
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WORK PLAN
REVISION 1
JULY 2011

Submitted by:

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ACRONYMS AND ABBREVIATIONS

% RE	percent relative emittance
°F	degrees Fahrenheit
µg/kg	micrograms per kilogram
µg/L	micrograms per liter
AAC	Alaska Administrative Code
AC&WS	Aircraft Control and Warning Station
ADEC	Alaska Department of Environmental Conservation
ADF&G	Alaska Department of Fish and Game
ANCSA	Alaska Native Claims Settlement Act
AS	Alaska Statute
bgs	below ground surface
Bristol	Bristol Environmental Remediation Services, LLC
BTEX	benzene, toluene, ethylbenzene, and xylenes
CAT	Caterpillar
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CIH	Certified Industrial Hygienist
CO	Contracting Officer
CPR	cardiopulmonary resuscitation
CQC	contractor quality control
CQCP	Contractor Quality Control Plan
CQCSM	Contractor Quality Control Systems Manager
DO	dissolved oxygen
DOT	U.S. Department of Transportation
DQCR	Daily Quality Control Report
DRO	diesel range organics
DUs	decision units
E.O.	Executive Order
EM	Engineer Manual
EPA	U.S. Environmental Protection Agency

ACRONYMS AND ABBREVIATIONS (continued)

FUDS	Formerly Used Defense Sites
GRO	gasoline range organics
HSM	Health and Safety Manager
HTRW	hazardous toxic radioactive waste
HWAP	hazardous waste accumulation point
IDW	investigation-derived waste
ISO	International Standards Organization
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MNA	monitored natural attenuation
MOC	Main Operations Complex
NE Cape	Northeast Cape
NPDES	National Pollutant Discharge Elimination System
NSI	Northland Services, Inc.
ORP	oxygen-reduction potential
OSHA	Occupational Safety & Health Administration
PADS	Physical Agent Data Sheet
PAH	polynuclear aromatic hydrocarbon
PCBs	polychlorinated biphenyls
PL	Public Law
PLO	Public Land Order
POL	petroleum, oil, and lubricants
PPE	personal protective equipment
QAR	Quality Assurance Representative
QC	quality control
RA	remedial action
RCRA	Resource Conservation and Recovery Act
RIs	remedial investigations
RRO	residual range organics

ACRONYMS AND ABBREVIATIONS (continued)

SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SOW	Scope of Work
SPCC	Spill Prevention, Control, and Countermeasures Plan
SS	Site Superintendent
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SWPPP	Storm Water Pollution Prevention Plan
T&D	transportation and disposal
U.S.C.	U.S. Code
UFP-QAPP	Uniform Federal Policy-Quality Assurance Project Plan
USACE	US Army Corps of Engineers®, Alaska District
USAF	U.S. Air Force
UVOST	Ultraviolet Optical Screening Tool
WP	Work Plan

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APPROVALS

By their signatures, the undersigned approve this Work Plan.

Molly Welker
Project Manager

Date 7/27/11

Chuck Croley
Site Superintendent

July 27, 2011
Date

PLAN PREPARATION

Mr. Clark Roberts, C.I.H., has reviewed the Site Safety and Health Plan in accordance with the guidance and requirements of US Army Corps of Engineers Engineer Manual (EM) 385-1-1, 2008 edition.

Clark Roberts, C.I.H.
Health and Safety Manager

July 27, 2011
Date

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1.0 INTRODUCTION

This Work Plan (WP) has been developed for approval by the US Army Corps of Engineers® (USACE), Alaska District, as a control mechanism for the work to be performed under Contract No. W911KB-06-D-0007 for Hazardous, Toxic, Radioactive Waste (HTRW) remedial actions (RA) at Northeast Cape (NE Cape), St. Lawrence Island, Alaska. The USACE has awarded the contract to Bristol Engineering Services Corporation and Bristol Environmental Remediation Services, LLC (Bristol) and its team of subcontractors are tasked with completing the proposed contract. This WP covers the work to be performed at sites located at NE Cape, as well as one area-wide cleanup/removal effort.

The 2011 Scope of Work is addressing specific selected remedies described in the Decision Document for the HTRW at NE Cape (USACE, 2009). The Scope of Work (SOW) for this project includes the following:

- Preparing plans and reports;
- Mobilizing/demobilizing to/from the NE Cape site in 2011 and 2012;
- Excavating, processing, and disposing of petroleum-contaminated soils to a depth of up to 15 feet below ground surface (bgs), where accessible, or 2 feet below the groundwater, or whichever comes first at the Main Operations Complex (MOC), specifically Sites 10, 11, 13, 15, 19 and 27;
- Excavating and disposing of polychlorinated biphenyls (PCB)-contaminated soils from Site 13 (Heat and Power Plant) and Site 31 (White Alice Communications Station);
- Collection of nine background soils samples in the vicinity of Site 21 for arsenic analyses. Excavating and disposing of arsenic-contaminated soils from Site 21 (Wastewater Treatment Tank) may occur after background sample results have been evaluated;
- Conducting monitored natural attenuation (MNA) sampling of petroleum-contaminated soil and surface water at Site 8 (POL Spill Site);
- Transporting and disposing of 21 bulk bags containing PCB-contaminated soil staged on the concrete pad at Building 98;
- Monitoring groundwater in nine monitoring wells at the MOC;
- Removing dangerous poles, wires, and other miscellaneous debris from tundra areas sitewide, where clearly identified;
- Delineating extent and magnitude of sediment and soil contamination at Site 28 Drainage Basin through the use of new and existing data;

- Excavating and removing spilled roofing tar south of the MOC;
- Stabilizing, as detailed in the approved Storm Water Pollution Prevention Plan (SWPPP), disturbed site areas prior to demobilization or within a timely manner;
- Preparing an HTRW RA Report, which includes survey and as-built drawings, data review, and discussion of all remedial action work to include soil excavation and removal, sediment removal, waste disposal documentation, sample results, debris removal, and other relevant project details.

This WP contains the following elements:

- Waste Management Plan (Appendix A),
- Contractor Quality Control Plan (CQCP) (Appendix B),
- Site Safety and Health Plan (SSHP) (Appendix C),
- Uniform Federal Policy for Quality Assurance Project Plan (UFP-QAPP) (Appendix D),
- Spill Prevention, Control, and Countermeasures (SPCC) Plan (Appendix E).

The SWPPP is an additional document developed for the 2011 HTRW RAs at NE Cape.

2.0 SITE DESCRIPTION

2.1 PHYSICAL DESCRIPTION

2.1.1 Location

St. Lawrence Island is located in the Bering Sea, near the territorial waters of Russia, approximately 135 air miles southwest of Nome, Alaska (Figure 1). The project site, which originally encompassed 4,800 acres located near NE Cape, falls between Kitnagak Bay to the northeast, Kangighsak Point to the northwest, and the Kinipaghulghat Mountains to the south (Figure 2). The site is located at 63 degrees 20 minutes north latitude, 168 degrees 59 minutes west longitude, in Township 25 South, Range 54 West, Kateel River Meridian.

2.2 PHYSICAL ENVIRONMENT

2.2.1 Climate

St. Lawrence Island has a cool, moist, subarctic maritime climate with some continental influences during winter when much of the Bering Sea is capped with ice pack. Winds and fog are common, and precipitation occurs approximately 300 days per year as light rain, mist, or snow. Annual snowfall is approximately 80 inches per year. Total annual precipitation is about 16 inches per year, and more than half falls as light rain between June and September. Summer temperatures average between 34 degrees Fahrenheit (°F) and 48°F, with a record high of 65°F. Winter temperatures range from –2°F to 10°F, with an extreme low of –30°F. Freeze-up normally occurs in October or November, and breakup normally occurs in June.

Winds are generally in a northerly to northeasterly direction from September to June, and southwesterly in July and August. Winds exceeding 11 miles per hour occur 70 percent of the time. The average wind speed is 18 miles per hour. Gusts in the NE Cape area have measured as high as 110 miles per hour (USACE, 2002).

2.2.2 Topography

The Lower Mountain area consists mainly of flat coastal plains that gradually turn into rolling tundra toward the base of the Kinipaghulghat Mountains. The mountains rise abruptly to a maximum elevation of more than 1,850 feet above mean sea level. Elevations across the

work area range from sea level to approximately 200 feet above mean sea level; however, the borrow source area is higher.

2.2.3 Geology

St. Lawrence Island consists of isolated bedrock highlands of igneous, metamorphic, and older sedimentary rocks surrounded by unconsolidated surficial deposits overlying a relatively shallow erosional bedrock surface. In the immediate vicinity of the Lower Mountain area, shallow, unconsolidated surficial materials overlie quartz monzonitic rocks of the Kinipaghulghat Pluton. The Pluton forms the mountainous work area south of the MOC, including Kangukhsam Mountain. The Suqitughneq River drainage at the work area in the Kinipaghulghat Pluton has created an erosional valley and alluvial fan of unconsolidated sediments. Granitic bedrock materials are exposed at the coast north of the site at Kitnagak Bay, suggesting that quartz monzonitic bedrock underlies the unconsolidated materials at a relatively shallow depth on a wave-cut erosional platform.

The unconsolidated materials exhibit an alluvial soil profile in areas that have not been disturbed by man. In general, silts near the surface overlying more sand-dominated soils at depth characterize native soil stratigraphy at the site. The silt may contain varying quantities of clay, sand, organic silt, gravel, and peat, and may vary from zero to 10 feet in thickness. The silt is dark brown to dark green and sometimes exhibits a mottled texture. In some areas, the silt exhibits an aqua green or blue color. Dark brown silts are observed in outcrop. The sand at depth contains varying degrees of silt/gravel/cobbles and varies from 2 feet to more than 20 feet in thickness. These deeper, coarse-grained materials are generally unsorted and are likely to be of glaciofluvial origin. The depth to bedrock at the lower elevation areas of the site is unknown.

Beach material is primarily cobble (1-inch stones) with some sand. Some areas have large boulders and rocks (USACE, 2002).

2.2.4 Hydrology

Because of the relatively remote and undeveloped nature of St. Lawrence Island, there are few data about regional groundwater. Bedrock materials south of the site (and underlying the

unconsolidated deposits) are not expected to store and transmit significant quantities of groundwater. Typically, these types of granitic rocks are generally impermeable and transmit groundwater only through localized fractures and weathered soil zones at the surface.

The primary potential aquifer at the NE Cape site is the unconsolidated alluvial material that underlies the area, although a deeper, confined aquifer may also exist. The mountainous area to the south provides an ideal recharge area for the unconsolidated materials, providing runoff from rain and snowmelt during the summer. Based on the topography and geology of the site, the regional groundwater flow direction is expected to be from the mountainous recharge area south of the site, flowing north and eventually discharging to the Bering Sea.

A key factor influencing the flow of groundwater at the site is the existence of permafrost and frozen soils, which render the unconsolidated materials effectively impermeable in areas. The U.S. Geological Survey has classified St. Lawrence Island as an area of "moderately thick to thin permafrost." Although the depth of permafrost at St. Lawrence Island is unknown, the base of permafrost on the mainland at Nome (135 air miles to the northeast) is estimated to be at a depth of 120 feet. The deeper unconsolidated deposits at the site are probably permanently frozen, and the shallow soils represent the active layer, where soils are thawed only during portions of the year. Frozen soils have a profound effect in retarding groundwater flow during most of the year.

In addition to the Bering Sea north of the NE Cape facility, surface water in the vicinity of the work area consists of small streams, small- to moderate-sized lakes, and marshy areas. Surface water generally flows northward from the highland area to the south. Small surface waterbodies are common throughout the area. The primary stream drainage in the area is fed by runoff from the prominent drainage of the Kinipaghulghat Mountain valley in the Lower Mountain area. Several smaller tributaries feed this stream drainage as it flows north to Kitnagak Point. The smaller tributaries originate from two small, unnamed lakes (USACE, 2002).

2.3 AIR QUALITY

Air quality in the area is good. There are minimal sources of air emissions at the site because of its remote nature. The occasional boat motor, all-terrain vehicle engine, or fire has a

negligible effect. Air emissions at the site increase during RA work because more equipment and vehicles are at the site. Winds typical of the area disperse emissions (USACE, 2002).

2.4 SOCIOECONOMIC CONDITIONS

2.4.1 Community Profile

The nearest community on St. Lawrence Island to the project site is the Village of Savoonga, approximately 60 miles northwest of the site, with a population of 643 people according to the 2000 U.S. Census. There are no permanent residents at the NE Cape site, but there is a small subsistence hunting and fishing camp in the area that is inhabited in the summer by residents of Savoonga. The island is accessible by boat, regularly scheduled airlines (to Gambell and Savoonga), and chartered air flights out of Nome. There is no regularly scheduled commercial access to the project site (USACE, 2002).

2.4.2 Subsistence Activities

Savoonga is a traditional Siberian Yup'ik village with a subsistence lifestyle based on walrus and whale hunting. Whale, seal, walrus, and reindeer comprise 80 percent of islanders' diets. The economy is largely based upon subsistence hunting of walrus, seal, fish, and whale, with some cash income. Berries and edible plants are also harvested. A Native fishing and hunting camp also exists at the project site and is used primarily during the summer season. Subsistence fishing for halibut takes place in the vicinity of NE Cape.

2.5 BIOLOGICAL ENVIRONMENT

2.5.1 Vegetation

The NE Cape area has several major habitat types, including moist tundra dominated by heaths, grasses, sedges, mosses, and lichens, with shrubs that include bearberry, dwarf birch, narrow-leaf Labrador tea, and willow. These plants typically grow in one to three feet of undecayed organic mat over saturated and frozen soil. Alpine tundra plants (dwarf, prostrate plants that include heaths and tundra species adapted to dry, thin soil conditions) grow on the slopes and exposed ridges of the nearby mountains. The NE Cape area has many low-lying areas with lakes, bogs, and poorly drained soils (USACE, 2002).

2.5.2 Fish and Wildlife

Large mammals are generally not abundant on St. Lawrence Island. Polar bears may be on the island anytime during the year, but are most often present when the ice pack is near shore. Some years, polar bears are stranded on the island throughout the summer when the ice pack moves out earlier than usual. More than 1,000 reindeer can also be found on the island. Arctic foxes, cross foxes, red foxes (less commonly), wolves (rarely), and several small mammals (tundra shrews, arctic ground squirrels, Greenland collared lemmings, red-backed voles, and tundra voles) also inhabit the island. Animals usually seen in or around the buildings are small mammals, such as ground squirrels and the occasional fox.

Marine mammals are present in the vicinity of the NE Cape area as seasonal migrants in the offshore and nearshore marine waters, at haul-out sites, and in association with the advancing and retreating ice pack. No haul-out sites are within the work area. During the summer, walrus, sea lions, and spotted seals may be present in offshore waters. During the ice season, ringed seals, bearded seals, walrus, and spotted seals can be found in nearshore and offshore leads and open water. Bowhead, gray, minke, killer, right, humpback, blue, and beluga whales inhabit offshore waters.

The only breeding seabird colony known to exist at the NE Cape facility consists of about 60 glaucous gulls and 60 herring gulls at Seevookhan Mountain, about 5 miles southeast of the NE Cape site. Several other species of birds have been sighted in the vicinity of the NE Cape site, including common ravens, snow buntings, whistling swans, Lapland longspurs, and gulls.

Ten primary species of fish reside in the streams and tundra ponds of St. Lawrence Island. These include blackfish, nine-spined stickleback, grayling, whitefish, and Dolly Varden. Five of the six species of Pacific salmon occur around the island and rear in many of the larger drainages.

2.5.3 Endangered and Threatened Species

Endangered or threatened species of animals on St. Lawrence Island, which are protected under the Endangered Species Act, include the polar bear (threatened), spectacled eider

(threatened), the Steller's eider (threatened), the Steller sea lion (endangered), and the short-tailed albatross (endangered). The prevalence of these, with respect to the NE Cape site, is unknown. Alaska Natives are given some exemptions from this act and are allowed to hunt polar bears for subsistence harvests or handicrafts, as long as the population is not depleted, and the animals are not wasted. Vegetative species that have been proposed as threatened are the perennial plants, Rumex krausei, and Primula tuchuktschorum (USACE, 2002).

2.5.4 Site History

St. Lawrence Island was established as a reindeer reserve by Executive Order on January 7, 1903. The present project site was acquired by the U.S. Air Force (USAF) on January 16, 1952, under Public Land Order (PLO) 970, which removed 21,013 acres from the reserve. In 1952, the USAF Aircraft Control and Warning Station (AC&WS) was formally activated by the assignment of the 712th AC&WS Squadron and the 698th Security Squadron. The original site was designed to support 212 men. Throughout its existence, the NE Cape facility has been a surveillance station, providing radar coverage for the Alaskan Air Command and, later, for the North American Air Defense Command, as part of an Alaska-wide system constructed to reduce potential vulnerability to bomber attacks across the polar regions.

The White Alice Station area remained in operation with minimal military staff until 1972. All lands were then withdrawn from the military under PLO 5187 for classification under Section 17(d)(1) of the Alaska Native Claims Settlement Act (ANCSA) of 1971, which entitled local community village corporations to select and receive specific tracts of federal land. Interim Conveyance No. 203 (June 1979) conveyed unsurveyed lands of St. Lawrence Island to Sivuqaq, Inc., and Savoonga Native Corporation. Excluded from transfer were surveyed land, easements, and land-use permits effective before conveyance.

In 1982, transfer of the White Alice Station area, south of the MOC, to the U.S. Department of the Navy was initiated. However, this transaction was not formally completed and was superseded by ANCSA. The U.S. Navy conducted a removal action under its Comprehensive Long-Term Environmental Action Navy program. The action included removal of specified hazardous items and containerized hazardous and toxic waste.

In 2000, the White Alice Station was reclassified as a Formerly Used Defense Sites (FUDS)-eligible property and, in response the USACE included the area in the ongoing cleanup program for NE Cape (USACE, 2002).

2.5.5 Previous Studies and Actions

Environmental investigations and cleanup activities at NE Cape began in the mid 1980s with the goal of locating and identifying areas of contamination and gathering enough information to develop a cleanup plan. Remedial investigations (RIs) were initiated at NE Cape during the summer of 1994. Additional sampling was performed during subsequent investigations: Phase II RI (Montgomery Watson, 1996 and 1999); Phase III RI (Montgomery Watson Harza, 2003); and Phase IV RI (Shannon &Wilson, Inc., 2005). The studies divided the concerns among 34 separate sites. The results of the RI showed that contaminants were present at some, but not all sites.

Bristol performed removal actions in both 2003 and 2005. In 2009, Bristol returned to the island to construct a landfill cap at Site 7 Cargo Beach Landfill, remove petroleum, oil, and lubricants (POL)-containing drums, and perform a chemical oxidation study. In 2010, Bristol constructed a landfill cap over the Site 9 Housing and Operations Landfill; conducted a UltraViolet Optical Screening Tool (UVOST™) investigation to delineate the extent of diesel range organics (DRO) contamination in soil at the MOC; removed approximately 2,730 tons of POL-contaminated soil from Sites 3, 6, and 32; 1,245 tons of PCB-contaminated soil from Sites 13, 16, 21, and 31; and 17 tons of arsenic contaminated soil from Site 21. After excavating and/or collecting field-screening samples, Bristol collected confirmation samples at Sites 1, 3, 6, 16, and 32 to confirm that no contamination above cleanup levels remain in the areas excavated in 2010. Contamination still remains at Sites 13, 21, and 31 above cleanup levels. In 2010, Bristol also removed miscellaneous debris, wire, metal, and poles from various sites; developed and implemented a Sampling and Analysis Plan (SAP) for MNA of petroleum-contaminated soil at Site 8; and sampled 9 monitoring wells at the MOC.

Site-specific historical information is presented in Section 3.2 Site Descriptions for the sites that will be remediated in 2011.

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3.0 SCOPE OF WORK

3.1 SCOPE OF WORK

The SOW for this project includes the following:

- Preparing plans and reports;
- Mobilizing/demobilizing to/from the NE Cape site in 2011 and 2012;
- Excavating, processing, and disposing of petroleum-contaminated soils to a depth of up to 15 feet, or 2 feet below groundwater, or whichever occurs first at the MOC, specifically Sites 10, 11, 13, 15, 19 and 27;
- Excavating ,and disposing of PCB-contaminated soils from Site 13 (Heat and Power Plant) and Site 31 (White Alice Communications Station);
- Collecting nine background soils samples in the vicinity of Site 21 for arsenic analyses. Excavating and disposing of arsenic-contaminated soils from Site 21 (Wastewater Treatment Tank) may occur after background sample results have been evaluated;
- Conducting MNA sampling of petroleum-contaminated sediment and surface water at Site 8 (POL Spill Site);
- Transporting and disposing of 21 bulk bags containing PCB-contaminated soil staged on the concrete pad at Building 98;
- Monitoring groundwater in 9 monitoring wells at the MOC;
- Removing dangerous poles, wires, and other miscellaneous debris from tundra areas sitewide, where clearly identified;
- Delineating extent and magnitude of sediment and soil contamination at Site 28 Drainage Basin through the use of new and existing data;
- Excavating and removing spilled roofing tar south of the MOC;
- Stabilizing, as detailed in the approved Storm Water Pollution Prevention Plan (SWPPP), disturbed site areas prior to demobilization or within a timely manner;
- Inspecting Site 7 and Site 9 landfills to determine the status of the cover, cap stability, and whether necessary repairs are needed.
- Preparing an HTRW RA Report, which includes survey and as-built drawings, data review, and discussion of all remedial action work to include soil excavation and removal, sediment removal, waste disposal documentation, sample results, debris removal, and other relevant project details.

3.2 SITE DESCRIPTIONS

An overview of the NE Cape project work sites is shown on Figure 3.

3.2.1 Site 8 – POL Spill

Site 8 is located in an area where the fuel pipeline ran from the Cargo Beach pump house to the bulk storage tanks at the MOC. A break was reported in the pipeline west of the main road embankment north of the Suqitughneq River. The location of the break lies approximately 75 feet southwest of the intersection of Cargo Beach Road and the Airport Access Road. The fuel pipeline was drained and removed in 2000.

The site is a wetland with dense, grassy surface vegetation containing little soil or peat development and a spring nearby. The wetland slopes southward and narrows toward the Suqitughneq River.

Previous sampling events indicate DRO in soils above cleanup levels. Surface water samples were also collected, but contaminants were not detected. The highest concentrations of DRO in soil samples were discovered in samples taken approximately 50 feet downgradient from the pipeline break.

In 2010, Bristol developed and implemented a SAP to monitor natural attenuation parameters and collect surface water samples. Three decision units (DU) were established for soil and MNA sampling based on field observations and the approximate location of the pipeline break (See Figure 15). The middle DU near the pipeline break had two polynuclear aromatic hydrocarbon (PAH) compounds slightly above the Alaska Department of Environmental Conservation (ADEC) cleanup level in the soil. The middle DU soil concentrations of 2-Methylnaphthalene exceeded ADEC soil cleanup levels in field duplicate samples 10NC08SB02 and 10NC08SB03, with concentrations of 7,500 micrograms per kilogram (µg/kg) and 7,600 µg/kg, respectively. Sample – SBO03 had a reportable fluorine concentration of 820 µg/kg, which exceeded the 800 µg/kg cleanup level. Sample -SB02 had a fluorene concentration of 630 µg/kg. Samples from the other DUs did not return values in excess of the cleanup levels.

The MNA parameters did not vary significantly between the three DUs. Two surface water samples were collected downgradient of the Site 8 wetland near the confluence of the Suqitughneq River; all the analyses were below surface water cleanup standards and no petrogenic sheen was observed. In 2011, Bristol will continue to monitor soil and surface water at Site 8 to determine whether MNA is occurring..

3.2.2 Main Operations Complex

The MOC (Figure 3) once provided the majority of the site infrastructure, including central housing, administrative buildings, power generation sites, fuel storage tanks, and maintenance areas for the entire NE Cape facility. Multiple sites, including Sites 10, 11, 13, 15, 19 and 27 comprise the MOC.

Remedial investigations and removal actions were conducted at the MOC from 1994 to 2010. All of the main complex structures have been demolished. PCB-contaminated concrete, PCB-contaminated soils, and fuel-stained soils were excavated and transported off site during removal actions from 2000 to 2010. In 2009, a Phase I in-situ chemical oxidation study was performed by Bristol at the MOC, but was unsuccessful in remediating the soils below the DRO cleanup level. In 2010, a UVOST investigation delineated the extent of DRO-contamination at the MOC. Figure 6 shows the UVOST sampling locations. Figures 7 and 8 show the estimated contamination areas based on UVOST results. Figure 9 shows the areas to be likely excavated as part of the remedial activities. Bristol is scoped to excavate 14,500 tons of petroleum-contaminated soils on the pad area at the MOC based on the UVOST results in 2011 and 2012.

The primary contaminant of concern in soils at the MOC is DRO. Surface and subsurface soils are contaminated at depths extending to more than 15 feet bgs. Based on an evaluation of the 2010 UVOST investigation, Bristol estimates between approximately 11,000 to 16,000 tons of contaminated soil can be feasibly excavated at the MOC gravel pad, based on the 2010 UVOST investigation and the depth to groundwater. The range of the tonnage of contaminated soil depends on the depth to groundwater, which may vary by several feet.

According to the UVOST investigation, POL contamination exists at Site 13. PCB-contaminated soils remaining at Site 13 that exceed the cleanup action level must be

excavated before the POL-contaminated soil is removed. The POL-contaminated soil at Site 13 will be excavated either in 2011 or 2012.

The primary contaminants of concern in shallow groundwater at the MOC are gasoline range organics (GRO), DRO, RRO, benzene, and naphthalene. The depth to groundwater in the area varies significantly. A perched aquifer is present in some areas where groundwater is encountered between 4 and 7 feet bgs. A potentially confined aquifer is also present in areas with water depths ranging from 10 to 25 feet bgs. There are also discontinuous permafrost layers at the MOC.

Nine monitoring wells were sampled at the MOC in 2010. Three wells contain contaminant concentrations exceeding cleanup levels: MW 88-4, MW 88-5, and MW 88-10. All three wells exceed cleanup levels for DRO at 3.3 milligrams per liter (mg/L), 12 mg/L, and 1.6 mg/L, respectively. Well MW 88-5 also contains concentrations of benzene (9.3 micrograms per liter [µg/L]) and residual range organics (RRO) (1.6 mg/L) exceeding cleanup criteria.

The MNA sampling results from 2010 showed that MW 88-4, 88-5 and 88-10 had the lowest dissolved oxygen (DO) concentrations. Of these, the two wells with the highest concentrations of DRO, MWs 88-4 and 88-5, contained the highest concentrations of ferrous iron (21.4 mg/L and 45.5 mg/L), alkalinity (120 mg/L and 80 mg/L), and methane (2,100 µg/L and 99 µg/L), metabolic byproducts of microbial respiration. The wells with the highest contaminant concentrations had comparatively low DO; this suggests that aerobic microbial respiration and degradation of DRO has occurred, depleting DO concentrations. The high ferrous iron, alkalinity and methane suggest that degradation of DRO is occurring through anaerobic degradation, which is much slower than aerobic degradation. The high concentrations of methane in monitoring wells 88-4 and 88-5 indicate that in the absence of oxygen, methanogenic respiration has become energetically favorable and anaerobic degradation of DRO by methanogenic microbes may be occurring. The 2010 MNA results suggest that anaerobic degradation is occurring in the groundwater. In 2011, the same nine monitoring wells will be sampled if possible for MNA parameters, benzene, toluene, ethylbenzene, and xylene (BTEX), gasoline range organics (GRO), DRO/RRO, PAHs, PCBs, and Resource Conservation and Recovery Act (RCRA) metals, plus nickel and vanadium.

3.2.3 Site 13 – Power and Heat Building

Site 13, located in the MOC, consisted of the Heat and Electrical Power Building (Building 110). Several tanks, diesel generators, and power transformers were formerly located at this site. Prior to 2010, during previous field remediation activities, over 700 tons of PCB-contaminated soils were excavated and removed. An estimated 592 tons of PCB-contaminated soil was excavated from Site 13 in 2010. Figures 4 and 4a show the 2010 excavation extent and sample locations.

The PCB soil concentrations are elevated at various spots surrounding Building 110 and the transformer pads. A wooden utilidor corridor south of Building 110 contains PCB concentrations exceeding cleanup levels, at depths of 4 to 5 feet bgs. In 2011, additional PCB-contaminated soils will be excavated and petroleum-contaminated soils will be removed from Site 13 in 2011 or 2012.

3.2.4 Site 21 – Wastewater Treatment Tank

Site 21 included the wastewater treatment system for the main housing and operations complex. Located west of the perimeter road, the site consisted of a concrete septic settling tank, which discharged via an 8-inch insulated cast-iron pipe to the wetland area approximately 450 feet west. The septic tank compartments were cleaned and decommissioned during the 2003 RA. The utility corridor, which extended from the main complex to the septic tank, was also decommissioned in 2003, along with the wooden utilidor outfall line.

Following the 2003 RA, confirmation soil samples were collected and analyzed for PCBs. In 2003, PCBs were detected above cleanup levels in one location situated directly beneath the outfall piping, adjacent to the septic tank; 10.4 tons of PCB-contaminated soils were excavated from Site 21 in 2010 and confirmation samples confirmed that no PCB-contaminated soils above cleanup levels remain at Site 21.

Other areas at Site 21 were excavated in 2010 and still contain concentrations of arsenic above the cleanup level. In 2010, Bristol excavated 16.7 tons of arsenic-contaminated soil from this location and confirmation sample results showed that arsenic concentrations above

the cleanup level of 11 milligrams per kilogram (mg/kg), with concentrations ranging from 12 mg/kg to 180 mg/kg, still remain at the site (Figure 10). In 2011, Bristol is scoped to collect nine background samples in the vicinity of Site 21, and the analytical results will be discussed with the USACE before initiating further soil excavation at the site..

3.2.5 Site 28 – Drainage Basin

Site 28 Drainage Basin lies north of the MOC and flows north into the Suqitughneq River, as shown on Figure 3. This site has been impacted by fuel releases from the bulk fuel storage tanks and other releases. Surface water run-off and subsurface water seeps from the MOC gravel pad into this tundra and wetland area.

Three drainages originate from the MOC gravel pad and contribute flow to Site 28 (refer to Figure 13). The eastern drainage flows from the area adjacent to Sites 10 and 11, a vegetated area north of the former fuel tanks; the middle drainage originated from a culvert removed during 2010 that previously directed flow from Site 27; and the western drainage is downgradient of Site 13.

Soil staining has been observed near the head of the eastern drainage and at the former tank locations. The western drainage originated from a manhole and small concrete supporting structure just north of the perimeter access road, which emptied into an artificially created swale. The manhole likely served as the drain for Building 110 Heat and Electric Power. In 2010, the concrete manhole structure was cleaned and removed. A 12-inch corrugated metal pipe, which attached to the manhole and continued towards the MOC, was cut and 63 feet of the pipe was removed. The pipe was capped just north of the perimeter road at the head of the western drainage. The open end of the pipe that extended from the MOC was filled with bentonite and welded shut. Another 12-inch corrugated metal pipe in the eastern drainage measuring approximately 32 feet in length was completely removed. Sediments in this area have been described as stained and will produce sheen when disturbed. The extent and magnitude of sediment contamination in Site 28 will be delineated in 2011. Sampling activities have occurred at the drainage basin between 1994 and 2001. The primary contaminants of concern in sediments are chromium, lead, zinc, PCBs, PAHs, DRO, and

RRO. The highest concentrations of contaminants are located proximal to the edge of the MOC.

Surface water samples were collected in the drainage basin in 1994, 1996, and 2001. According to the Decision Document, concentrations of DRO, total recoverable petroleum hydrocarbons (TRPH), PCBs, and lead were elevated in 1994. Surface water samples collected in 2001 were analyzed for DRO, RRO, and PCBs. The samples were not analyzed for lead. DRO was detected at concentrations ranging from 0.39 to 2.3 mg/L, which is not above the ADEC Table C cleanup level. PCBs and RRO were not detected. The most heavily contaminated areas of the drainage basin are found immediately below the former locations of two culverts, located in the western and middle drainages.

3.2.6 Site 31 – White Alice Communications Station

Site 31 is located uphill from the MOC, south towards a valley at the base of Mt. Kangukhsam (Figures 3 and 5). The site formerly contained four large antennae, a central main electronics building, supporting structures, and seven aboveground storage tanks (ASTs), all of which were demolished and removed during the 2003 removal action.

A total of 118 tons of PCB-contaminated soil were excavated south and west of the former main electronics building, adjacent to a former transformer pad, and at the septic tank outfall during the 2005 field season. Seventy-nine tons of PCB-contaminated concrete were also removed from portions of the Building 1001 foundation.

Soil samples were collected to analyze for petroleum hydrocarbons and PCBs associated with the site in 2001, 2003, and 2004. There is no longer any POL-contaminated soil remaining above the cleanup level at Site 31. Three previously identified PCB-contaminated areas were excavated in 2005. Confirmation samples indicated that PCB concentrations remained above cleanup levels in one of the three areas located adjacent to the former transformer pad. In 2010, 638 tons of PCB-contaminated soil was excavated from this area at Site 31. PCB contamination above the cleanup level of 1 mg/kg still exists at Site 31 based on field-screening results and composite confirmation samples. In 2011, additional PCB-contaminated soils will be removed to reach cleanup objectives.

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4.0 2011 FIELD ACTIVITIES

The field activities at NE Cape for the 2011 field season will consist of the following major activities:

- Mobilizing/demobilizing to/from the NE Cape site in 2011 and 2012;
- Excavating, processing, and disposing of approximately 14,500 tons of petroleum-contaminated soils to a depth of up to 15 feet, or 2 feet below the groundwater, whichever occurs first, at the MOC, specifically on the gravel pad at Sites 10, 11, 13, 15, 19 and 27;
- Excavating and disposing of approximately 1,100 tons of PCB-contaminated soils from Site 13 (Heat and Power Plant) and Site 31 (White Alice Communications Station);
- Collecting nine background soils samples in the vicinity of Site 21 for arsenic analyses. Excavating and disposing of 20 tons of arsenic-contaminated soils from Site 21 (Wastewater Treatment Tank) may occur after background sample results have been evaluated;
- Conducting MNA sampling of petroleum-contaminated soil and surface water at Site 8 (POL Spill Site);
- Transporting and disposing of 21 bulk bags containing PCB-contaminated soil staged on the concrete pad at Building 98;
- Monitoring groundwater in 9 monitoring wells at the MOC;
- Removing dangerous poles, wires, and other miscellaneous debris from tundra areas sitewide where clearly identified;
- Delineating extent and magnitude of sediment and soil contamination at Site 28 Drainage Basin through the use of new and existing data;
- Excavating and removing spilled roofing tar south of the MOC;
- Stabilizing, as detailed in the approved SWPPP, disturbed site areas prior to demobilization or within a timely manner.

4.1 MOBILIZATION AND DEMOBILIZATION

4.1.1 Subcontractors

Bristol's primary subcontractors for this project are listed in Table 4-1. All subcontractors will comply with the applicable portions of the SSHP as a condition of work. Subcontractors will not be allowed to enter work zones until they have met the qualifications of the SSHP and been properly briefed by the Site Safety and Health Officer (SSHO).

Table 4-1 Major Subcontractors

Subcontractor	Assignment
Bering Air	Aircraft charters
Eco-land, Inc.	Surveying
Fairweather, Inc.	Infirmary and emergency medical services
Global Services, Inc.	Camp services
Northland Services, Inc.	Marine transportation
Security Aviation	Aircraft charters
TestAmerica Laboratories, Inc.	Fixed-based analytical testing laboratory
Waste Management, Inc.	Solid, RCRA and TSCA soil disposal

Notes:
RCRA = Resource Conservation and Recovery Act
TSCA = Toxic Substances Control Act

4.1.2 Barge Mobilization

Northland Services, Inc. (NSI) will be utilized for marine transportation of supplies and equipment to NE Cape in 2011 and 2012. An open deck barge will be used for mobilization and demobilization. NSI's barge will depart Seattle in early May 2011, and will depart from Anchorage for Nome, Alaska, by mid-May 2011. A flat-deck landing craft will shuttle equipment and supplies between the barge and Cargo Beach at NE Cape once the beach is free of ice. Bristol's Caterpillar (CAT) D6H bulldozer will be loaded on the front of the mobilization barge for transport to NE Cape. Once in Kitnagak Bay, the ramp-barge will be pushed onto the beach and the CAT D6H bulldozer will be offloaded to begin cargo offloading. Most of the cargo will be loaded on flats so that it can be rolled off the barge using a front-end loader, minimizing the time the barge is beached. Bristol will transport to St. Lawrence Island sufficient fuel, nonperishable items, and spare parts on the mobilization barge to support the camp and equipment for the 2011 field season. Additional fuel and any additional equipment required for the 2012 field season will be mobilized in May 2012.

To eliminate fuel resupply barge landings at Cargo Beach, Bristol will bring approximately 40,500 gallons of fuel to the island on the mobilization barge. The fuel will be stored in International Standards Organization (ISO) tanks that are U.S. Coast Guard-approved for over-water fuel transfer. A total of nine ISO tanks filled with approximately 4,500 gallons of fuel will be mobilized.

4.1.3 Flight Support

Most resupply items will be air-freighted to Nome on Alaska Airlines or Northern Air Cargo. Crew transport and day-to-day resupply of perishable items, critical parts, and sample shipments will be accomplished using charter flights out of Nome. Bristol will frequently utilize Bering Air for chartered aircraft flights between NE Cape and Nome. A CASA 212 chartered out of Nome will be used to transport large items that cannot be carried by a passenger aircraft. Additional charter flights will be made, as necessary, to transport local labor between Savoonga and NE Cape.

Flights will be arranged for government personnel traveling to NE Cape utilizing Security Aviation out of Anchorage. All charter arrangements for government personnel will be made with carriers that comply with Public Law (PL) 99-661 and U.S. Department of Defense Directive 5500.53.

4.1.4 Camp and Work Facilities

The construction camp, including sleeping facilities, mess facilities, restrooms, laundry and office space, will be located on the airport parking area pad, as shown on Figure 3. The camp will be capable of accommodating all personnel and will include lodging for government representatives. Satellite communications for the project will be provided.

Drinking water for the camp will be bottled water supplemented, if needed, with filtered and treated water from the nearby Suqitughneq River. Drinking water will be of sufficient quality to meet the requirements set forth in the Engineer Manual (EM) 385-1-1, Section 02.B. Toilet facilities will meet the requirements of EM 385-1-1 Section 02.C. Bristol may have a mixed-sex workforce and will set up these facilities accordingly. Other camp processes, such as water treatment, power generation, and solid waste disposal, will meet State of Alaska permitting restrictions and will be addressed in Bristol's contract with the camp provider. All gray and black water from the camp facilities will be treated through a septic system.

The medical infirmary will be located at the camp, will comply with the requirements set forth in Section 3 of the EM 385-1-1, and will be attended by a full-time Emergency Medical Technician III/Paramedic.

4.1.4.1 Container Storage Area

Containers may be stored at various locations throughout the NE Cape site. Container storage areas will be located near the intersection of the perimeter road and Airport Road on a pad at the MOC, at the Mechanic Shop area, at the camp site, and/or also at Cargo Beach. Bulk bags will be temporarily staged at the site where they were filled; then, when time allows, a loader will transport the bags down to Site 6 to be weighed. The bags will either be stored at Site 6 or moved to Cargo Beach and placed on flats until the demobilization phase. There is not enough room to store all the bulk bags on Cargo Beach, and the Savoonga Native American Lands Environment Mitigation Program (NALEMP) field effort may temporarily prohibit access to the Cargo Beach at Site 3 in August. The demobilization landing craft will begin to arrive at the end of July through the end of the 2011 field season in September or October depending on weather conditions.

4.1.4.2 Mechanics Shop

Bristol will utilize a temporary mechanics shop to support equipment maintenance operations for the duration of the project. The shop will be set up at the MOC on the former Building 103 floor slab (Figure 3).

4.1.4.3 Rock Screening Plant

Because a large percentage of the material at NE Cape is naturally coarse, Bristol will employ methods to separate larger diameter rocks from finer particles of the POL-contaminated soil. The POL material greater than 2 inches in diameter will be used as backfill in the POL excavation areas in accordance with ADEC Petroleum Hydrocarbon Cleanup for Oversize Material Technical Memorandum, which states: *Rock material greater than two inches does not require remediation or testing, unless it has the potential to hold excessive amounts of contamination or contains visible petroleum product on the surface (surface stain).*

Building Pad 98 at the MOC will serve as the primary location for the rock-screening activities. A Powerscreen® Chieftain 1400 will be set up at Building Pad 98 to screen out particle sizes exceeding 2 inches in diameter from the POL-contaminated soil. All excavated POL soils that contain coarse, rocky material will be processed through the screening plant prior to containerization. No PCB-contaminated soils will be screened. Excavated soil to be

processed at the screen plant will be transported via rock trucks from the various excavation sites to the Building Pad 98 screening plant. After the soil is screened, the minus 2-inch material will be placed into U.S. Department of Transportation (DOT)-approved bulk bags for transportation off-island.

Visibly stained rocks will not be segregated from the contaminated soil, but will be disposed and processed as required. Additionally, dense silts, peat, and frozen clumps or clods of soil will not be segregated out as oversized material but will be directly placed in bulk bags. This will be done at the excavation site based on the excavator operator's and on-site environmental personnel's observation of the type of soil excavated. Screening operations will cease during inclement weather conditions, such as heavy rains or winds (e.g., gusting to, or in excess of, 30 mph). Bristol will conduct dust control around the MOC site with a water truck.

Any secondary contamination resulting from screening activities will be remediated by sweeping and cleaning the concrete at the Building 98 Pad and disposing of any of the swept soil in a bulk bag.

4.1.4.4 On-Site Laboratory

An on-site field-screening laboratory will be set up at the camp site and will utilize gas chromatographs to provide results for DRO and RRO analyses using method AK102/103 and for PCB analyses using U.S. Environmental Protection Agency (EPA) Method 8082. Results from the on-site screening laboratory will be used to direct excavations and characterize waste, but will not be used to confirm that cleanup goals have been achieved at the sites.

4.1.4.5 Fuel Storage

The fuel storage area will be located immediately east of the MOC, as shown on Figure 3. Nine 5,500-gallon ISO tanks (filled to approximately 4,500 gallons each) are planned for this project, for total fuel storage of 40,500 gallons. A lined fuel containment area will be constructed to hold the ISO tanks and facilitate truck fueling operations. An SPCC plan for the temporary fuel facility is presented in Appendix E of this document.

4.1.4.6 Hazardous Waste Accumulation Point (HWAP)

Although not anticipated during the field season, any hazardous waste found and removed during the 2011 RAs, including drums of oily water, sludge, and totes filled with broken batteries or transformers, will be properly contained and stored on a concrete foundation pad inside Conex containers at the MOC until they are transported off site to a disposal facility in Oregon. The HWAP area will be demarcated with signs.

4.1.4.7 Borrow Source

A local borrow source is located south of the MOC. Articulating rock trucks will perform hauling operations between the borrow source and excavation sites. A signed quarry agreement between Bristol and the local Native corporations is included in Appendix F.

4.1.4.8 Surveying

The horizontal location of all confirmation soil samples, soil excavation final depths and boundaries, debris/drum/pole locations, Site 28 Drainage Basin, and points collected to produce a topographical map, will be surveyed to 1.5 foot accuracy by Eco-Land, LLC, a professional land surveyor registered in the State of Alaska. The vertical location of confirmation soils samples, soil excavation final depths and boundaries, and points collected to produce a topographical map, will be surveyed with an accuracy of 0.1 foot by the professional land surveyor.

4.1.4.9 On-site Weighing of Waste

All containers will be weighed using a scale installed on a loader. A Volvo 330L heavy lift loader has been outfitted with a scale that works off the loader's hydraulic system. This scale is rated as "Certified for Trade". The scale was installed under the supervision of a factory representative. The factory representative trained the Bristol Shop Foreman, NE Cape Site Foreman, and two NE Cape operators on its use. A calibration weight, consisting of five concrete jersey barriers mounted on a steel shipping flat was constructed. This flat was then weighed over two different "State-Certified" scales. The difference between the two scales was 20 pounds on a weight of 24,520 pounds. The scale will be field calibrated on a regular basis with this known weight.

Each bulk bag containing contaminated soil will be individually marked with bag number and individual weights after waste characterization sampling has been collected, and upon removal from the load frames. These weights are only good at the time of weighing. Individual bulk bag weights can be affected over time by natural drying of the soil after removal from the ground, or by the addition of moisture from extreme weather conditions. These sacks, even though equipped with liners, are not completely impermeable and the weights may change slightly.

4.1.5 Work Site Access

Four stream crossings, consisting of three culverts and one bridge exist within the work areas at the NE Cape site. The stream crossings were repaired during previous field operations, but may require additional work. Bristol expects culvert repairs may be required and will mobilize sections of culvert to address necessary repairs. All efforts will be asserted to minimize adverse impacts to the streams. Bristol has acquired Fish Habitat Permits for the Suqitughneq and Quangeghsaq Rivers in case bridge and road repairs are necessary on these rivers (Appendix F).

Other work to support access to the sites includes repair of road surfaces. These repairs will be accomplished where necessary, with available equipment and using on-site materials.

4.1.6 Demobilization

Demobilization will begin when fieldwork is completed at the end of the 2011 construction season. Due to the amount of contamination that exists at the MOC, Bristol has been given an option exercised by the USACE that will allow the overwintering of equipment, supplies, and the remote camp at NE Cape in 2011. Overwintering will allow the field crew to work a month longer in 2011 and return a month earlier in 2012 (approximately June 1, 2012) to complete the HTRW RAs scoped in the 2011 contract and the Contract Modification 02.

A six- to eleven-person crew, consisting of Bristol and Global Services, Inc., personnel, will require approximately ten days for dismantling the camp facilities and staging it and the equipment and containers filled with supplies for overwintering at the MOC. The barge will remove bulk bags, empty ISO tanks, and possibly some equipment at the end of the 2011 field

season. In 2012, it will take a six- to eleven-person crew, consisting of Bristol and Global Services, Inc., personnel, approximately five days to dismantle the camp facilities and approximately four days to load the demobilization barge depending on when and how many landing craft arrive at Cargo Beach during the 2012 field season. In 2012, all of Bristol's equipment and the camp facilities will be transported to Anchorage, Alaska. In 2011 and 2012, the wastes will be transported from NE Cape to Seattle (intermediate stops are expected) for transportation to their respective disposal/recycling facilities. After the barge has been loaded and the demobilization tasks are completed in 2011 and 2012 at NE Cape, aircraft will fly the demobilization crew to Nome, Alaska.

Landing craft are scheduled to begin arriving in late July 2011 to begin the task of removing bulk bags of contaminated soil from Cargo Beach and transporting them to the off-site disposal facility. When Bristol overwinters in 2011, the camp and most of the equipment and supplies will be placed back in containers, placed on pallets, bundled up, and corralled on a concrete pad at the MOC. Upon completion of fieldwork activities in 2011, if weather permits the landing craft to access Cargo Beach, Bristol will remove the remaining bulk bags of contaminated soil and all accumulated debris and waste generated during this field season off-island. Other items that may be removed from NE Cape in 2011 will include any equipment not necessary for work activities in 2012 and items such as empty ISO containers.

Demobilization typically occurs in late August until the weather prevents the landing craft from safely landing at Cargo Beach towards the end of September. All construction-related support areas will be restored to their existing conditions when all the work is completed in 2012.

4.2 SITE IDENTIFICATION AND SOIL EXCAVATION PROCEDURES

Site identification and soil excavations will utilize a crew consisting of environmental field personnel, a professional land surveyor team, and heavy equipment operators. Environmental field scientists and surveyors will locate impacted areas using a variety of methods, including, but not limited to, GPS, surveying, report figures/maps, field screening tools, environmental laboratory samples, and direct observations of existing markers. The positions of the 2010

excavations, sample locations and UVOST probe locations were surveyed in 2010 and will be relocated by the surveyor in 2011 and 2012.

At Sites 13 and 31, the existing liner from 2010 will be located and carefully removed to expose the historical excavation area and to prevent cross-contamination of the clean backfill material. The area, at Sites 13 and 31, where the clean fill will be stockpiled, will be screened for PCBs by the field laboratory. The stockpiled soil will be placed on a liner, and the field laboratory will analyze this soil for PCBs before using as backfill, the stockpile will be analyzed by the field laboratory for PCBs. The number of samples will be determined by the size of the stockpile and ADEC regulations (Table 2A ADEC Draft Field Sampling Guidance). Samples will be collected at different depths and locations to adequately represent soil contaminant heterogeneity. Samples will be collected at least 18 inches beneath the exposed surface of the stockpile. Results will be discussed with the Quality Assurance Representative (QAR) before using the stockpiled soil as backfill. After the stockpile and liner are removed, the field laboratory will screen the area again for PCBs. Excavation and field laboratory screening locations will be determined based on a combination of factors, which include the analytical composite sample results and field laboratory results from 2010.

During all soil removal excavations, Bristol will reference existing data from previous investigations, especially data collected in 2010. Bristol will utilize an on-site field-screening laboratory to analyze samples from within the limits of the excavation. Once, contaminant concentrations from confirmation samples are confirmed to be below cleanup levels based on the fixed-base analytical laboratory results, the site will be backfilled. The lab results and decision to backfill will be done with consultation with the QAR, and excavation will continue or commence at the next impacted site.

At the MOC, the POL-contaminated soils that are excavated will be evaluated by environmental personnel to determine if the particle sizes and types allow for processing in the screening plant. Cobble-size and rocky material will be loaded into a rock truck and transferred to the screening plant for processing prior to being bulked into DOT-approved bulk bags. Processed soils with particles smaller than 2 inches in diameter will be loaded into bulk bags. Excavated material with diameters exceeding 2 inches will be segregated and used

as backfill material. According to the 2005 ADEC Technical Memorandum for Petroleum Hydrocarbon Cleanup for Oversize Material "rock material greater than two inches does not require remediation or testing, unless it has the potential to hold excessive amounts of contamination or contains visible product on the surface (surface stain)" (ADEC, 2005).

Empty bulk bags will be situated into a loading frame, lined, and filled while seated in the frame. Once filled, the soil in the bulk bag will be sampled for waste characterization purposes; the bag will be zipped shut and removed from the frame by connecting the attached straps to a lifting frame, which will reside on the forks of a loader. Site personnel will not work underneath equipment buckets or loads during filling and transport operations, and will stand clear of bulk bags as they are being loaded. Each bag will be weighed, marked with a unique identifying number, and transferred to the Cargo Beach staging area.

Waste characterization procedures are discussed in Section 4.13. Decontamination procedures are discussed in Section 4.14.

4.3 PCB-CONTAMINATED SOIL REMOVAL

An estimated 1,100 tons of PCB-contaminated soils will be excavated from Sites 13 and 31. The PCB excavation crew will start by regrading surface runoff, occurring upgradient from Site 31, from the north side of the road to the south side of the road. The upgradient runoff comes from several acres during a storm event and naturally channels through the Site 31 PCB excavation area. The regrading will consist of a shallow ditch dug with a road grader that will be less than 100 feet long in an area that will be determined based on the current natural runoff patterns observed in 2011. After regrading the drainage, the PCB excavation crew will move to the Site 13 area and complete the PCB excavation at that site. This will allow timely removal of the concrete foundations that may impact the removal of the POL-contaminated soil that may extend beneath the concrete foundations.

Bristol anticipates that the concrete foundations will need to be removed to clean up the POL contamination at Site 13. Concrete testing will be done by a wipe test; the concrete will be analyzed by the field laboratory for PCB contamination prior to use for backfill. Bristol will follow the protocols based on EPA-recommended methods for determining the presence of PCBs on smooth surfaces (e.g., concrete). Samples will be collected from locations most likely

to be exposed to PCBs (e.g., edge of floor drains and areas contacted by PCB-contaminated soil). One sample per 250 square feet of exposed concrete will be collected. The sampler will brush the area to be sampled with a hand brush or push broom to remove any soil, sediment, dust or other non-concrete material from the sample location. Bristol will measure and mark a 10 cm x 10 cm square area for the wipe test. The wipe will be analyzed by the field-screening laboratory. Results will be discussed with the QAR prior to using the concrete as backfill. If the concrete cannot be used as backfill, it will be disposed of off-island.

The PCB-contaminated soils will be identified, located, excavated, and containerized in bulk bags for proper disposal off site. No PCB-contaminated soil will be processed through the screen plant. While the PCB crew is awaiting off-site laboratory confirmation analysis, they will move to alternative work areas, such as the tar removal area, the Site 21 arsenic removal, or Site 31 to remove the remaining soil contaminated with PCBs. At the completion of Site 31 confirmation sampling, this crew will move to join the POL excavation crew at the MOC excavation areas.

Heavy equipment, such as excavators, front-end loaders, or other equipment that has contacted contaminated soil, will be decontaminated using shovels, rakes, and brushes to remove any residual soil from excavator buckets, tracks, wheels, or other areas that have contacted contaminated soil. No water will be used for decontamination, which differs from the Standard Operating Procedure (SOP) presented in the UFP-QAPP. The deviation is noted on Worksheet #21 of the QAPP.

4.3.1 Site 13 Soil Removal

Site 13 consists of the former Power and Heat Building (Building 110) located in the northern portion of the MOC. Four historical sample locations were above cleanup levels for PCBs at Site 13 and were the focus of the 2010 removal.

In 2010, Bristol began by investigating historical sample locations 05NECAFSL062 and 05NECAFSL064, which indicated PCB contamination at 1.5 feet bgs. Approximately 1.0 foot of soil was removed and field-screening samples were collected, which confirmed the presence of PCBs in the soil. Remediation efforts progressed in a similar manner at the two other points of interest for this site; samples 03NECAFSB192 and 03NECAFSB522 were

collected at 5 feet and 4 feet bgs, respectively. Soils removed from above the historical sample locations were stockpiled on site.

Three excavations were opened, and soil was removed from each of the excavations. As the excavations progressed, field-screening samples were collected and analyzed in the field laboratory. The stockpiles containing soils from above the historical sample depths were also screened for PCBs. In every case, from each excavation and from stockpiled material, field-screening results indicated that PCB contamination above cleanup levels remained on site. Bristol proceeded until contracted volumes of soil were reached. In total, 592 tons of PCB-contaminated soil was removed from Site 13 in 2010. Field-screening results from Site 13 showed PCB contamination remaining on site that exceeded contract amounts. Prior to backfilling the excavation areas in 2010, Bristol placed 30-mil black, plastic liner over the excavation's floor and sidewalls as a visual marker that will be carefully removed prior to the excavation in 2011.

Based on 2010 field screening results and composite confirmation sample results, PCB contamination remains in all three excavation areas at Site 13. Figures 4 and 4a show the 2010 sample locations, excavation boundaries, and proposed 2011 excavation areas and areas that will first be field screened prior to excavating.

4.3.2 Site 31 Soil Removal

In 2010, the Site 31 White Alice Communications Station contained three sample locations (samples collected in 2005) that indicated the presence of PCB-contaminated soils approximately 2 feet bgs. In 2010, it became apparent that after 638 tons of PCB-contaminated soil was removed, contamination remained at the site in concentrations exceeding cleanup levels. Prior to backfilling the excavation areas in 2010, Bristol placed 30-mil black, plastic liner over the excavation's floor and sidewalls as a visual marker that will be carefully removed prior to the excavation in 2011.

Figures 5 and 5a show the 2010 sample locations, excavation area, and proposed 2011 excavation areas at Site 31. Figures 5 and 5a also show an area that will be field screened in 2011 to confirm whether additional excavation is required, or if confirmation samples can be collected to confirm that this area is below the cleanup level.

4.4 PETROLEUM-CONTAMINATED SOIL REMOVAL

At the MOC, petroleum-contaminated soils will be removed to a depth of up to 15 feet, or 2-feet below groundwater, whichever occurs first, for an estimated total of 14,500 tons in 2011 and 2012. Data collected using UVOST technology during the 2010 field season will be used to plan and guide the excavation at the MOC. Prior to excavating POL-contaminated soil at the MOC, the area will be topographically surveyed by the professional survey team.

Areas that will be targeted for excavation in 2011 and 2012 based on the UVOST investigation are shown on Figures 6 through 9. Figure 6 shows the UVOST probe locations that were drilled in 2010. Figure 7 shows the results of the UVOST investigation which is explained in the 2010 NE Cape Final Report Appendix E. Figure 8 shows the area based on the UVOST investigation that potentially has POL-contamination above the DRO cleanup level. Bristol will utilize the UVOST information as shown on Figure 9 and information in Table 4-2 as a guide to excavating locations and targeting depths that are above the cleanup level of 9,200 mg/kg DRO on the MOC gravel pad.

The MOC POL excavation is partitioned into several plumes, each plume defined as a contiguous area of soil estimated to exceed the cleanup level. Each plume is then divided into discrete excavation units based on common depth to contamination. Volume and tonnage estimates of excavated soil for two water table scenarios, low and high, are presented in Table 4-2; water table estimates are based on historical water levels taken from monitoring well and test pit data.

During some excavations at the MOC, it will be necessary to remove overlying soil below the cleanup level of 9,200 mg/kg prior to excavating the contaminated soils that are above 9,200 mg/kg DRO. The clean overburden will be temporarily stockpiled on a liner at convenient locations until it can be used as backfill in the excavated locations at the MOC. Confirmation sampling of the stockpile to confirm that the stockpile is clean prior to using it as backfill will occur according to Table 2A in the 2010 ADEC Draft Field Sampling Guidance.

Bristol's priority for the POL excavation crew will be to first remove the Site 11 tank pad footprints and then remove the J1A plume shown on Figure 9, which is at the easternmost edge on the gravel pad. After the Site 11 tank pad footprint area is excavated, Bristol will use

it to construct a stockpile area for materials that are above the site cleanup level and require time to drain excess moisture (e.g., soils that are excavated 2 feet below the groundwater) prior to placement in bulk bags. Confirmation samples will be collected from the tank footprint area before the stockpile area is constructed. This stockpile area or impoundment will be bermed and lined with 20-mil liner and will be sloped so that water drained from the stockpiled soil will be retained in a collection sump. Section 4.16 includes a description of the water treatment procedures. Booms will be available on site and will be used to control potential contaminant migration to clean areas.

Excavation will begin in the J1A area immediately north of the easternmost tank footprint. UVOST probe locations 10NC11UV52 and 10NC 11UV17 are located within the 4,500-square-foot J1A area. The survey crew will locate and flag the probe locations immediately surrounding the J1A area, as well as the perimeter of the J1A excavation unit as shown in Figure 9. The top 2 feet of the raised pad area of J1A will be stockpiled. Soil from 2 feet bgs to 15 feet bgs, or 2 feet below the water table, whichever occurs first, will be loaded into bulk bags for removal. The low-lying area of J1A will be excavated from the surface down. Field laboratory soil sampling will be taken at a rate of 2 samples per 250 square feet and one sample for each additional 250 square feet on the excavation floor. Sidewall samples will be taken at a rate of one per 20 linear feet. Sidewall samples will be taken at the depth of the highest percent relative emittance (%RE) response for the nearest UVOST probe location, or at preferential pathway identified in the field. If the excavation extends into the groundwater table, the excavation floor will not be field screened. If field laboratory sample results are above 7,360 mg/kg DRO, the excavation will step out and additional field laboratory samples will be taken. The field laboratory screening level of 7,360 mg/kg is 80 percent of the cleanup level of 9,200 mg/kg DRO. If field laboratory sample results are consistently below the 7,360 mg/kg cleanup level, field screening will occur at a higher %RE threshold value to be determined by the QAR and Bristol.

Confirmation sampling will occur when field laboratory results indicate that samples do not exceed 7,360 mg/kg DRO. Confirmation samples will be approximately co-located with field laboratory samples and sent to TestAmerica in Tacoma for analysis.

Stockpiled soil field laboratory samples will be taken at a rate of 3 plus one sample for each additional 200 cubic yards. If field laboratory results indicate that contamination exceeds 7,360 mg/kg DRO, the stockpiled material will be bagged for removal.

Table 4-2 NE Cape MOC UVOST™-Guided Excavation Volume and Tonnage Estimates for On Pad Excavation Units

	Area	Top Depth	Bottom Depth	Bottom Depth	Volume Excavated Soil	Weight Excavated Soil	Volume Excavated Soil	Weight Excavated Soil	Overburden Volume	Overburden Weight
Units	Sq. Ft	Ft Bgs	Ft Bgs	Ft Bgs	Cubic Yards	Tons	Cubic Yards	Tons	Cubic Yards	Tons
Location	Water Table Scenario		Low	High	Low	Low	High	High	Low	Low
A1	5,800	12	15	14	644	1,030	429	687	2,575	4,120
A2	3,600	8	15	14	932	1,492	799	1,279	1,066	1,705
B1	800	11	14	14	89	142	89	142	326	521
B2	1,800	7	15	15	533	852	533	852	466	746
C	1,800	10	14	14	266	426	266	426	666	1,066
E1	3,700	7	15	9	1,095	1,752	274	438	958	1,533
E2	6,200	4	11	10	1,606	2,569	1,376	2,202	918	1,468
E3	6,200	2	8	8	1,376	2,202	1,376	2,202	459	734
E4	1,400	5	13	11	414	663	311	497	259	414
F	600	11	15	15	89	142	89	142	244	391
G1	1,000	10	12	10	74	118	0	0	370	592
G2	1,500	8	15	9	389	622	56	89	444	710
H	1,400	6	12	9	311	497	155	249	311	497
I1	3,000	10	15	10	555	888	0	0	1,110	1,776
J1A	4,500	0	15	11	1,832	2,930	1,166	1,865	666	1066
			On Pad Totals:		**10,205**	**16,327**	**6,919**	**11,071**	**10,837**	**17,340**

Notes: The conversion factor for volume to weight is 1.6

"Low" water table scenario is calculated using a projected depth to water 2 feet below historic lows for data closest to the excavation unit.

ft bgs = feet below ground surface
sq ft = square feet
MOC = Main Operations Complex
UVOST = UltraViolet Optical Screening Tool
NE Cape = Northeast Cape

The mechanical screen plant will be set up on the Building Pad 98. Soil that is conducive to rock-screening operations will be trucked to this site. Screening operations will not be conducted during storm events, to prevent a water problem. Liners will be used under stockpiles of contaminated soil on the concrete pad. A berm will be constructed from borrow pit material around the outer edge of the concrete pad to prevent any incidental water migration from POL soil greater than the cleanup level, while stockpiled on the concrete pad. Prior to berm removal at the end of the project, the soil in the berm will be field screened to determine whether or not it is above 7,360 mg/kg level. Berm soil less than 7,360 mg/kg DRO will be used as backfill. The concrete pad will be swept clean at the end of the project, and sweepings will be placed in bulk bags for off-site disposal.

After the Site 13 PCB soil cleanup has been confirmed, the POL crew will break up the concrete foundations that will interfere with the DRO-plume removal of sites around the MOC. Concrete removed from these foundations may be used as backfill for some of the POL excavations after wipe tests have been performed by the field-screening laboratory. Samples from the concrete will be collected from locations most likely to be exposed to PCBs (e.g., edge of floor drains and areas contacted by PCB contaminated soil). One sample per 250 square feet of exposed concrete will be collected. The sampler will brush the area to be sampled with a hand brush or push broom to remove any soil, sediment, dust or other non-concrete material from the sample location. Bristol will measure and mark an area 10 cm x 10 cm square for the wipe test. The wipe will be analyzed by the field-screening laboratory for PCBs. Wipe test results will be discussed with the QAR prior to using the concrete as backfill.

Surveyors will maintain vertical and horizontal control for the POL excavations. The approved quantities and locations of POL to be removed based on the UVOST data will guide the excavation locations. Field screening of samples will be primarily used for confirmation of lateral limits of excavations and when the floor of the excavation is above the water table.

The soil excavated from the gravel pad at the MOC will be screened through the rock screen plant, and the minus 2-inch material will be placed in DOT-approved bulk bags for transport to the disposal facility in Oregon. The greater than 2-inch material screened will be used as

backfill. The contaminated soils that contain permafrost, high organic silts, and peats will not be run through the rock screen plant, but will be placed directly into bulk bags for appropriate disposal. This separation will be determined by the excavator operator and environmental scientist working together at the site.

4.5 ARSENIC SOIL REMOVAL AT SITE 21

In 2010, Bristol centered its excavation on historical sample location 94NE21167SS and excavated an area roughly 17 feet wide, 17 feet long, and 2 feet deep. After excavating 16.7 tons in 2010, Bristol determined that arsenic-contaminated soil still remains above cleanup level of 11 mg/kg in areas shown on Figure 10. In 2011, Bristol will collect nine soil samples to determine the arsenic background concentrations prior to continuing to excavate the Site 21 area, as described in the ADEC *Arsenic in Soil Technical Memorandum* (ADEC, 2009a). The nine samples will be collected upgradient from the 2010 Site 21 soil excavation, in a drainage south of the site (Figure 11). The background locations will be outside or known or suspected anthropogenic sources.

Sample locations will exhibit vegetative cover and soil type similar to those observed during the 2010 Site 21 excavation. Bristol will provide the analytical sample results to the USACE and ADEC, and render an opinion regarding whether or not the arsenic detected in previous soil samples was naturally occurring, or was a result of operations at the MOC. If arsenic concentrations at Site 21 exceed applicable cleanup levels (11 mg/kg), and are greater than naturally occurring background concentrations, a removal will be recommended at Site 21. A cumulative risk calculation using the EPA ProUCL program will be done. After discussion with the USACE and ADEC, Bristol may be instructed to excavate up to 20 tons of contaminated soil from Site 21.

4.6 ROOFING TAR REMOVAL

An area of approximately 2,500 square feet located south of the MOC contains spilled roofing tar (Figure 12). Bristol will remove the roofing tar, which is spread to an approximate thickness of 2 inches. The roofing tar will be over-excavated to depth of 4 inches and confirmation samples collected. Approximately 11 confirmation samples will be collected from the bottom of the excavated area and analyzed for PAHs. The tar and soil will be placed

into bulk bags and once each bag is filled, it will be sampled for semivolatile organic compounds for disposal characterization.

4.7 BACKFILLING EXCAVATED AREAS

Upon completion of excavation and sampling activities, the disturbed areas will be backfilled after concurrence from the QAR that the confirmation samples are below the cleanup level. Excavated petroleum-contaminated soil that has been processed through the screening plant with particle sizes greater than 2 inches in diameter will be used as backfill at the MOC excavation areas. The screened soil will be placed in the excavations and then additional clean backfill material from overburden stockpiles and the borrow pit south of the MOC will be placed on top and graded. The borrow pit material is clean, coarse angular material. Following placement and compaction of stockpiled overburden and local borrow material, the MOC area will be topographically surveyed to confirm that MOC site topography sufficiently drains without promoting erosion.

Clean backfill material will also be removed from the borrow pit south of the MOC and used for backfilling the PCB excavations at Sites 13 and 31. The available borrow material runs <30% 2-inch minus, based on previous screening of the borrow material in 2009 and 2010. Previous attempt to grow grass at the MOC have only been marginally successful due to the coarse-grain angular material that is available for backfill.

The volume of borrow material will be tracked by the truck load each day on the Daily Quality Control Report (DQCR). Backfill will be placed in 1- to 2-foot lifts and then compacted. Backfill will be compacted by running the tracked excavator back and forth over the fill area, as well as tamping with the bucket. The restored surface will be slightly mounded to promote surface water drainage and prevent pooling in the excavated area. The amount of imported backfill will depend on the volume of debris and soil removed during the field activities.

4.8 SEDIMENT AND SOIL SAMPLING AT SITE 28

The soil and sediment contamination will be delineated, and a topographic survey will be conducted at Site 28 during the 2011 field season. Sediment and soil sampling will be

conducted along 10 transects placed between the upper end of Site 28 and its confluence with the Suqitughneq River to delineate the extent and magnitude of contamination at Site 28. The transect locations have been chosen to confirm the sample results from 1994, 1996, and 2001, as well as to sample areas of the drainage that do not have any sample coverage; areas of open water will be sampled in 2011 (Figure 13).

A topographic survey (1.0 foot primary and 0.5 foot secondary contours) will encompass the entire Site 28 Drainage Basin, approximately 29 acres, and centered west-east on the Western, Middle, and Eastern drainages. The present-day edges of water, including standing water within vegetated areas, as well as open water, will be recorded during the survey.

Bristol proposes that the southernmost transect begin approximately 100 yards north of the manhole that was removed from the Western Drainage in 2010. This transect coincides with sample grouping CS-6 that was sampled in 2001. The northernmost transect will be near the confluence of the Suqitughneq River. The proposed transect locations shown on Figure 13 have been chosen to cover a number of historic sample locations and to gather additional information to fill data gaps within Site 28.

Each transect will encompass the area from the left bank and right bank of the existing, vegetated drainage. An approximate 2-foot increase in slope will define the left and right banks of the drainage. Transects will be sampled for petroleum hydrocarbons (BTEX, GRO, DRO/RRO, and PAHs), PCBs, and the 8 RCRA metals (arsenic barium, cadmium, chromium, lead, mercury, selenium, silver) plus nickel and vanadium. Analyses will also include silica gel cleanup and total organic carbon for a biogenic interference evaluation following the ADEC Technical Memorandum 06-001 (ADEC, 2006).

The Site 28 Drainage Basin is made up of swales, pooled water, flowing water, and relatively dry areas. Determination of whether or not a sample is considered a soil sample or sediment sample is dependent on what the conditions appear to be at the time of collection. Sediment will be defined as material that appears to have been transported and deposited by water; all other material will be considered soil. The project cleanup levels for contaminants of concern vary based on the type of sample; for example, sediment samples have a DRO/RRO cleanup level of 3,500 mg/kg, whereas DRO/RRO soil samples have a cleanup level of 9,200 mg/kg.

One sample location will be established along every 10 feet of transect, not to exceed seven distinct sampling locations along each transect, for a total of 70 distinct sampling locations. This protocol will be followed where possible; some transects may be less than 70 feet wide and therefore the width of the transect will determine the number of available sampling spots. If all samples are not used on a particular transect, additional samples may be collected in other transects after consultation with the on-site USACE QAR. Three samples will be collected at each sampling location, from depths of 0.5 feet bgs, 1.0 foot bgs, and 1.5 feet bgs, for a total of 210 samples. Samples will be collected using a T-handled sampler, a sediment sampler, stainless steel trowels, or a hand auger.

Twelve background samples will be collected from a nearby drainage to evaluate biogenic interference or naturally occurring organic material. The background drainage is to the east of the Site 7 landfill and is outside of the impact areas from the former military installations at NE Cape (Figure 14). The background samples will be collected from a drainage(s) similar to Site 28 that does not exhibit the presence of POL and is outside the area of impact from the NE Cape site. The drainage selected has similar topography and vegetation to Site 28. A location has been proposed and will be confirmed with the onsite QAR and ADEC. The background soil types will consist of sediment similar to Site 28 in character. Samples will be collected in accordance with ADEC Technical Memorandum 08-002 (ADEC, 2008). The results will not be used to determine alternative site cleanup levels with ADEC Method Three or Four calculators. The site-specific cleanup levels are documented in the 2009 NE Cape Decision Document.

4.9 SITE 8 NATURAL ATTENUATION MONITORING

Two surface water samples will be collected from Site 8 near the confluence with the Suqitughneq River. This will include both drainage and natural spring water samples if present. The locations will be the same as those sampled in 2010 (Figure 15). The field team will use the on-site surveyors to locate the 2010 locations. The surface water samples will be analyzed for DRO, RRO, and PAHs by TestAmerica Laboratories, Inc.

The Bristol field-sampling crew will divide the wetland area into three sample DUs as delineated in 2010. One DU was established upstream (background) of the suspected fuel

pipeline release location, one in the area of suspected highest fuel impacts, and one further downstream near the Site 3/Suqitughneq River confluence. The investigation crew will use the on-site surveyors and existing site markers to identify the DUs from 2010.

The 2010 sampling scheme at Site 8 was designed to create a baseline data set for MNA parameters that, according to the USACE, will continue to be sampled and monitored for an initial three years at Site 8. The 2011 MNA sampling event will be the second of three years. Data from each year of monitoring will be compared to determine the rate of natural attenuation.

The wetland is approximately 40 feet wide (east-west) and 300 feet long in the study area. The upper (northerly) portion will represent the non-impacted (background) DU, the center section will represent the high-fuel impact DU, and the lower portion toward the Suqitughneq River will represent a lower (downgradient) fuel-impacted area. Previous studies have not provided sufficient information to determine the magnitude of impact the fuel has had on the affected area.

Once the upper boundary of the impact area has been delineated, a sample grid will be developed for each DU. Each grid will be divided into four-sections-wide by ten-sections-long for 40 possible sample points, with grid squares measuring approximately 10 feet by 10 feet. A random number generator will select eight sample points for each DU grid for sampling. Surface water samples will be collected first and field analyzed for pH, dissolved oxygen (DO), conductivity, oxidation-reduction potential (ORP), temperature, turbidity, nitrate, sulfate, ferrous iron, alkalinity, and dissolved manganese. Surface water samples will be collected for laboratory analysis of methane.

After all of the surface water samples have been collected, soil samples will be collected for DRO/RRO, total organic carbon, PAHs, DRO-silica gel, and RRO-silica gel analysis from each of the eight sample points in each DU. The silica gel cleanup and total organic carbon samples will be used to evaluate biogenic interference, following the ADEC Technical Memorandum 06-001 (ADEC, 2006).The eight soil samples from each DU will then be composited as one sample. A field duplicate will be split from one of the composite samples after the soil has been homogenized. Soil and surface water sample collection procedures are

described in the QAPP. The soil samples will be subjected to silica gel cleanup as described in the QAPP to evaluate the presence and proportion of biogenic materials at the site.

The primary line of evidence for determining if natural attenuation is occurring at a site is the decrease in the contaminants of concern, in this case POL. The geochemical parameters are used as secondary indications that natural attenuation is occurring. The POL and MNA data will be evaluated to determine if natural attenuation is occurring at the site and if it is an adequate remedy to meet cleanup goals. If natural attenuation is occurring, DO, nitrate, and sulfate, should have relatively low or no concentrations detected with field parameters. These compounds provide a source of oxygen (electron acceptors) to facilitate beta-oxidation (aerobic) of organic compounds. It will not determine if oxidation is occurring on natural sources or POL. If anaerobic degradation is occurring, the levels of dissolved ferric iron (Fe^{2+}), dissolved manganese (Mn^{2+}), and dissolved methane, will increase. Alkalinity will also increase in the plume or source area if microbial activity is occurring as alkalinity is most influenced by carbon dioxide content in the water. A negative ORP value also indicates that natural attenuation is occurring in an anaerobic state.

4.10 MOC GROUNDWATER MONITORING

Bristol will conduct groundwater monitoring in nine wells at the MOC (Figure 16). The monitoring well locations that have been selected by the USACE for sampling include: MW 88-1, MW88-4, MW88-5, MW88-10, MW 10-1, 17MW1, 22MW2, 20MW1, and 26MW1. Bristol sampled these monitoring wells in 2010; therefore, they are expected to be accessible in 2011, unless they were damaged due to frost jacking during the winter.

Groundwater samples will be analyzed for MNA parameters in the field, including temperature, pH, DO, conductivity, ORP, turbidity, nitrate, sulfate, ferrous iron, alkalinity, and dissolved manganese. Methane will be analyzed by a fixed-based laboratory. Additional laboratory analyses will include BTEX, GRO, DRO/RRO, PAHs, PCBs, and RCRA metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver), plus nickel and vanadium.

Some monitoring wells may be in the footprint of the excavation at the MOC. These wells will be preferentially sampled prior to excavation at the MOC. Wells that are in or near the

footprint of an excavation area at the MOC (e.g., MW88-5) may eventually be dug up and abandoned in accordance with ADEC guidance (2009b). Three monitoring wells are scoped to be removed at the MOC, with options to remove up to five additional monitoring wells (see Section 4.17.7). The abandonment specifics will be detailed in notes and photographs.

4.11 BULK-BAGGED PCB-CONTAMINATED SOIL REMOVAL

There are 21 bulk bags of PCB-contaminated soil staged at the Building 98 pad at the MOC. The bags will be picked up by a landing craft that is scheduled to begin the demobilization at the end of July. Bristol will weigh, transport, and dispose of these bags at Columbia Ridge Landfill disposal facility in Arlington, Oregon.

4.12 DEBRIS REMOVAL

Miscellaneous debris can be found throughout many sites at NE Cape. Contributing to the debris are drums, wire, metal sheeting, various pieces of scrap metal, wood, tires, and other various articles. Bristol will identify areas sitewide that contain buried wooden pole stumps, miscellaneous metal debris, drums, and visible wire. Fifteen tons of wooden poles,10 tons of miscellaneous metal debris, 0.25 tons of drums, including any drum liquid, and one-half ton of wire will be removed and transported off site. An additional 10 tons has been added to this task from the Contract Modification 02.

The poles are probably encased in permafrost soil due to the amount of frost jacking that has taken place over the five years since the poles were cut down and removed. Bristol has scheduled the removal of the frost-jacked pole stubs to take place as late in the 2011 field season as possible, to let the natural seasonal thaw occur to its fullest extent. If Bristol is eventually scoped to overwinter at NE Cape the poles will be removed in the spring of 2012 when the tundra is frozen. The pole stubs will primarily be removed by excavating. If for some reason the excavation is not successful by itself, water will be injected around the pole stubs to melt the permafrost. The pole stubs will then be pulled out of the ground. An excavator and a tracked trailer equipped with a hydraulic lift will recover the poles for removal from the tundra.

Wire recovery may be accomplished by one of three methods, excavator, cable spooler, or if the wire is too thick to properly spool, it will be cut into small, manageable pieces and loaded into containers by hand.

The poles and the wire will be placed into intermodal shipping containers for transportation and disposal off site.

4.13 WASTE CHARACTERIZATION

All soils packaged for removal will undergo waste characterization sampling in order to aid in determining the most appropriate disposal methods. Waste characterization samples will consist of a soil composite comprised of material from a set of seven bulk bags. Environmental samplers will extract a small amount of material from each of seven bulk bags and mix the soil in a stainless steel bowl. Sample jars will be filled directly from the bowl using a stainless steel instrument. Any excess soil will be returned to one of the seven bulk bags.

For PCB waste characterization, the field samplers will take into account prior field-screening results and confirmation sample results to ensure that if previous results exceeded 50 mg/kg, the soil will be classified as hazardous material. Soil with PCB concentrations greater than 50 mg/kg will be sequestered from soil with PCB concentrations below 50 mg/kg for shipping and disposal purposes. Site 13, for example, contains one sample location in the northern excavation where field laboratory results exceeded 50 mg/kg. Additionally, composite Group 5 contained PCB concentrations in excess of 50 mg/kg.

Reusable equipment will be properly decontaminated following each sampling event. Non-reusable materials will be disposed of appropriately. More detail regarding waste characterization is described in the UFP-QAPP.

4.14 EQUIPMENT DECONTAMINATION

Throughout the course of the 2011 field season, work will be performed at multiple sites. Decontamination efforts will be utilized to prevent cross-contamination. Most frequently, decontamination of non-disposable sampling equipment will consist of an Alconox® wash solution followed by a fresh water rinse and a deionized water rinse. The wash and rinse

water generated during decontamination procedures will be contained in 55-gallon drums. Wash water associated with petroleum-contaminated soils will be processed through a water scrubber. The water-scrubbing material is a natural fiber cellulose material that selectively absorbs hydrocarbons while repelling water. Wash water from soils contaminated with metals or PCBs will be containerized in bung-top 55-gallon drums, appropriately characterized, and transported off-island for disposal. If an impoundment is needed for large quantities of water, the ADEC and QAR will be notified.

Heavy equipment may require decontamination following a soil excavation. Gross soil will be physically removed from the equipment using brooms and stiff-bristled brushes. The resulting soils will be bulked with excavated soils from the same waste stream.

4.15 PERSONNEL DECONTAMINATION

Level D personal protective equipment (PPE), at a minimum, will always be worn. Should site conditions require personnel to come into contact with contaminated materials, the SSHO will determine if higher levels of PPE will be required. Decontamination methods for equipment and personnel will be monitored by the SSHO to determine their effectiveness. No operations are expected at the NE Cape site that will require full body protection with inner and outer suits, gloves, boots, and respiratory protection.

4.16 INVESTIGATION-DERIVED WASTE (IDW)

Various field procedures may result in additional wastes. Decontamination procedures, in particular, will produce water and soil particles that will need to be handled appropriately. Additionally, if groundwater monitoring is implemented, excess wastewater will be generated that will be treated through a water scrubber before being discharged to the ground. Ground discharge will occur at the same site from which the sample was collected.

Excess soil produced during decontamination procedures will be added to a bulk soil container with soils from a similar waste stream.

A lined stockpile area will be built at the Site 11 tank footprint pad area for those materials that are above the site cleanup level and need time to drain moisture from the excavated materials at the MOC. This stockpile area will be lined with 20-mil liner and be sloped so

that water that drained from the stockpiled soil will be retained in a collection sump. This water will be treated with a water scrubber and then sampled to confirm that it is below the ADEC Table C groundwater cleanup level of 1.5 mg/L DRO prior to releasing to the ground.

Wastewater contaminated with metals or PCBs will be transferred into bung-top, 55-gallon drums for disposal at an appropriate off-site facility.

4.17 OPTIONS TO HANDLE ADDITIONAL WASTE STREAMS

Beyond the base SOW, Bristol will anticipate other additional miscellaneous wastes. Various options were set up in the contract to handle additional wastes or additional quantities of wastes. Several options have been exercised with Contract Modification 02. Table 4-3 presents the options with their associated task numbers and descriptions. The following sections describe each option and presents Bristol's plan for notification and handling of each option.

Table 4-3 Options

Option/Item	Exercised under Contract Mod 02	Description	Quantity per Option	Number of Options Available
Option Task 1	Yes	Additional POL-contaminated soil	2,000 tons	5
Option Task 2	Yes	Additional PCB-contaminated soil	10 tons	10
Option Task 3	Yes	Additional arsenic-contaminated soil	10 tons	1
Option Task 4	No	Additional roofing tar	10 tons	1
Option Task 5	No	Additional POL liquids	1 gallon	50
Option Task 6	Yes	Additional miscellaneous debris	1 ton	10
Option Task 7	No	Additional monitoring well abandonment	1 well	5

Notes:
PCBs = polychlorinated biphenyls POL = petroleum, oil, and lubricants

4.17.1 Additional POL-Contaminated Soil

Bristol will track the quantities of nonhazardous POL-contaminated soil excavated in the DQCRs. If it appears that soil quantities may exceed the amounts initially scoped and those exercised under Contract Modification 02, Bristol will notify the QAR.

4.17.2 Additional PCB-Contaminated Soil

Bristol will track and report the quantities of PCB-contaminated soil removed in the DQCRs. If it appears that quantities of PCB-contaminated soils will exceed those set forth in the scope and those exercised under Contract Modification 02, Bristol will notify the QAR.

4.17.3 Additional Arsenic-Contaminated Soil

If Bristol is approved to excavate at Site 21, we will track and report the quantities of arsenic-contaminated soil removed in the DQCRs. If it appears that quantities of arsenic-contaminated soil will exceed those set forth in the scope and those exercised under Contract Modification 02 (e.g., 20 tons), Bristol will notify the QAR.

4.17.4 Additional Roofing Tar

Bristol will track and report the quantities of roofing tar-contaminated soil removed in the DQCRs. If it appears that quantities of roofing tar-contaminated soils will exceed those set forth in the scope, Bristol will immediately notify the QAR. In the event that a site's scoped quantity is reached, 10 tons of additional roofing tar-contaminated soil may be removed (Optional Task 4), if approved by the USACE. A total of one option is available in the contract, if needed and approved by the USACE.

Bristol will have sufficient containers available for disposing of 10 tons of roofing tar-contaminated soil in the event that this option is used.

4.17.5 Additional POL Liquids

If POL liquids are encountered during 2010 field activities, Bristol will immediately notify the QAR. If approved by the USACE, Bristol will implement options for removal of the liquids. Bristol will remove one gallon of POL liquids per option (Optional Task 5). This option may be exercised a maximum of fifty times.

Bristol will have sufficient containers available for containing and disposing of 50 gallons of POL liquids.

4.17.6 Additional Miscellaneous Debris

In the event that debris, drums or poles are encountered in excess of those quantities previously set forth in the contract plus the 10 tons exercised in Contract Modification 02, Bristol will notify the site QAR

4.17.7 Additional Monitoring Well Abandonment

In the event that additional monitoring wells are required to be abandoned in excess of the three wells previously set forth in the contract, Bristol will notify the site QAR and request that the USACE approve the option for removing additional monitoring wells (Optional Task 7). Each option will remove one additional monitoring well and may be implemented up to five times if approved by the USACE.

Bristol will have sufficient materials available to properly abandon and remove five additional monitoring wells.

4.18 REPORTING

After completion of the project, Bristol will submit the HTRW RA Report in accordance with Section 4.5 of the SOW under Task 5. The HTRW RA Report will contain the following information:

- Cover letter signed by a Professional Engineer;
- Executive summary of fieldwork and results;
- Narrative report describing activities undertaken to complete the project;
- Deviations from the approved WP;
- Soil excavation details;
- Spilled tar removal details;
- Monitored natural attenuation results at Site 8, and groundwater sample results from MOC;
- Description of the miscellaneous debris, poles, drum and drum contents that were removed;

- Chemical data tables and figures detailing sample results;
- Survey data from all sample locations and topographic survey from Site 28 and MOC;
- Field logs, field notebooks, forms and DQCRs;
- Chemical Data Quality Review and ADEC Laboratory Data Review Checklists;
- Site photographs, permits, waste manifests certificates of disposal;
- Recommendations for additional activities to remove soil/sediment from Site 28 in areas where cleanup levels are exceeded;
- ADEC Contaminated Sites Laboratory Approval Letter;
- References.

In addition to the HTRW RA Report Bristol will prepare a technical memorandum that will describe sampling methods and results from the Site 28 soil/sediment survey. The memorandum will include a comparison of results with cleanup levels stated in the Decision Document, an evaluation of results related to silica gel extraction, and a discussion of biogenic characteristics. The memorandum will also contain map(s) showing the Site 28 Drainage Basin topography in 1.0-foot primary and 0.5-foot secondary contours, and historic and recent sample locations highlighting results above cleanup levels. Other maps included will delineate suggested soil/sediment removal area(s), suggested removal depths and volumes, and any necessary construction such as temporary roads, sediment ponds, or dewatering structures.

5.0 PROJECT ORGANIZATION AND KEY PERSONNEL

Key personnel for this project are identified in this section. A diagram of Bristol's management and support organizational structure is presented on Figure 17. Certifications and training documentation can be found in Appendix G.

5.1 KEY HOME OFFICE PERSONNEL

5.1.1 Project Manager, Ms. Molly Welker

Ms. Molly Welker, the Project Manager, is responsible for ensuring project tasks are completed on schedule and within budget, recommending and justifying project modifications, implementing methods of tracking materials and resources, coordinating work with subcontractors, and complying with normal safety procedures and regulatory requirements.

5.1.2 Safety and Health Manager, Mr. Clark Roberts, CIH

Mr. Clark Roberts, Certified Industrial Hygienist (CIH), will review Bristol's Safety and Health Program for this project. As the Health and Safety Manager (HSM), he will monitor project compliance with Bristol's Corporate Safety and Health Program. Mr. Roberts works with Bristol's SSHOs assigned to individual projects to develop and implement effective SSHPs. He is based in Bristol's San Antonio, Texas, office. For this project, Mr. Roberts will be responsible for the following:

- Reviewing and editing the SSHP;
- Being available for emergencies;
- Providing consultation as needed to ensure the SSHP is fully implemented;
- Coordinating any modification to the SSHP with the Site Superintendent (SS), SSHO, and Contracting Officer (CO).

The HSM qualification requirements and summary information for Mr. Roberts are provided in Table 5-1.

Table 5-1 Health and Safety Manager Qualifications Summary

USACE HSM Requirement	Experience and Qualifications
Minimum of 4 years' experience in developing and implementing safety and health programs at hazardous waste sites and asbestos abatement sites. At least one field season of on-site work in remote Alaska.	More than 20 years of safety and health program experience involving hazardous waste sites, asbestos abatement, demolition, and remedial actions. Occupational Safety and Health Administration (OSHA) HAZWOPER Worker (40-hour) and Supervisor (8-hour) since 1991. • HSM for White Alice Removal Action (2003 & 2005), St Lawrence Island, Alaska • HSM for Remediating Leaking Underground Storage Tanks in Indian Country for the U.S. Environmental Protection Agency • HSM for Adak, Alaska, Naval Air Station (NAS) Building Demolition and Asbestos Abatement • HSM for Whidbey Island NAS Underground Storage Tank (UST) Removals
Documented experience in supervising professional and technician level personnel.	• Industrial Hygiene Group Leader for U.S. Department of Energy (DOE) – Pacific Northwest National Laboratory • Western Regional HSM for McCrone Environmental Services • Industrial Hygiene Supervisor – OSHA
Documented experience in developing worker exposure assessment programs and air monitoring programs and techniques.	Extensive experience in developing exposure assessment plans involving hazardous, toxic, and radioactive mixed wastes. Very experienced in use and application of direct and indirect monitoring techniques and equipment for asbestos abatement, confined space operations, UST removals, and removal actions.
Documented experience in the development of personal protective equipment (PPE) programs, including programs for working in and around potentially toxic, flammable, and combustible atmospheres and confined spaces.	Developed PPE programs for Pacific Northwest National Laboratory, Lockheed-Martin Corporation, SOHIO, and Allied-Signal. Consultant to OSHA/DOE Voluntary Protection Program (VPP) for assessment of PPE program elements during on-site reviews for VPP candidate status determination.
Working knowledge of state and federal occupational safety and health regulations.	Former OSHA Compliance Officer and Supervisor. Provided consultation to clients for occupational safety and health regulations in Alaska, California, Washington, Texas, Illinois, Ohio, and Arizona.

Notes:

HAZWOPER = Hazardous Waste Operations and Emergency Response
HSM = Health and Safety Manager
USACE = U.S. Army Corps of Engineers, Alaska District

5.1.3 Regulatory Compliance Manager/Transportation and Disposal (T&D) Coordinator, Mr. Tyler Ellingboe

Mr. Tyler Ellingboe will serve as the Regulatory Compliance Manager, and oversee all activities related to collecting, manifesting, transporting, and disposing of hazardous materials and wastes for Bristol. He will work closely with the environmental field crew from Bristol to ensure wastes are properly identified.

Mr. Ellingboe will also serve as the T&D Coordinator, and will be responsible for ensuring proper manifesting, placarding, and tracking of waste streams.

5.1.4 Occupational Physician, Dr. Alexander T. Baskous

The Occupational Physician designated by Bristol for Northeast Cape HTRW Remedial Actions project is Dr. Alexander T. Baskous. Dr. Baskous has been briefed about the project hazards and the project scope. He will determine medical surveillance protocols and review examination/test results performed in compliance with Title 29 Code of Federal Regulations, Part 1910.120(f) [29 CFR 1910.120(f)] and 29 CFR 1926.65(f), Medical Surveillance. Dr. Baskous is board certified in Occupational Medicine, with an M.D. and Master of Public Health from Harvard University. He is the Director of the Northwest Segment of the American College of Occupational and Environmental Medicine, a Diplomat of the American Board of Family Practice, and is on the active staff of both Providence Alaska Medical Center and Alaska Regional Hospital in Anchorage, Alaska.

5.2 KEY FIELD PERSONNEL

5.2.1 Site Superintendent and Site Safety and Health Officer, Mr. Charles (Chuck) Croley

Mr. Chuck Croley is responsible for management of scheduling, coordination, and execution of Bristol's on-site activities in accordance with the contract specifications. He will report directly to the Project Manager.

As SSHO he will be responsible for overall planning and compliance with safety and health activities. He will conduct daily safety meetings and address worker safety concerns. The SSHO will be responsible for communicating safety issues and concerns, and reporting safety incidents to the Project Manager. The SSHO will be responsible for the following:

- Assisting with on-site training and representing the HSM during the day-to-day on-site implementation and enforcement of the SSHP, and being present on site on a full-time basis for the duration of field activities;
- Ensuring site compliance with specified safety and health requirements; federal, state, USACE Engineer Manual 385-1-1, and Occupational Safety & Health Administration (OSHA) regulations; and all aspects of the SSHP, including, but not limited to, Activity Hazard Analysis, air monitoring, use of PPE, decontamination, site control, SOPs used to minimize hazards, safe use of engineering controls, the Emergency Response Plan, confined space entry procedures, the spill containment program, and preparation of records, by performing a daily safety and health inspection and documenting results on the Daily Safety Inspection Log;
- Stopping work if unacceptable health or safety conditions exist, and taking necessary action to reestablish and maintain safe working conditions;
- Consulting with and coordinating any modifications to the SSHP with the HSM, the SS, and the CO;
- Serving as a member of Bristol's quality control (QC) staff on matters relating to safety and health, conducting accident investigations, and preparing accident reports;
- Reviewing results of daily QC inspections and documenting safety and health findings in the Daily Safety Inspection Log;
- Recommending corrective actions for identified deficiencies, in coordination with site management and the HSM, and overseeing the corrective actions.

5.2.2 Contractor Quality Control System Manager, Mr. Russell James

Mr. Russell James is responsible for management of Contractor Quality Control (CQC) and will have the authority to act in all CQC matters for the project. He will work with the Project Manager to implement the CQCP to ensure project quality objectives are met. A Letter of Authority granting Mr. James the authority to serve as the Contractor Quality Control Systems Manager (CQCSM) for this project is provided as Appendix B. Mr. James will be the primary point of contact for environmental and regulatory matters in the field and will be the liaison with the QAR.

5.2.3 Project Chemist, Mr. Marty Hannah

Mr. Marty Hannah has the responsibility for project-related quality aspects related to the collection and chemical analysis of all samples, as delegated by the Project Manager. His primary role in the office is to provide oversight to the data development and review process

and oversight of all subcontracting laboratories. In the field, Mr. Hannah will set up and operate the field screening laboratory.

5.2.4 ADEC-Qualified Samplers, Mr. Eric Barnhill and Ms. Lyndsey Kleppin

Mr. Eric Barnhill and Ms. Lyndsey Kleppin will be the ADEC-Certified Environmental Samplers for collection and processing of environmental samples. Mr. Barnhill will also be the Certified Erosion and Sediment Control Lead.

5.2.5 First-Aid/Cardiopulmonary Resuscitation (CPR) Personnel

All Bristol full-time employees who perform fieldwork are required to maintain certification in first-aid/CPR. These personnel have received training in universal precautions and the use of PPE, as required by the OSHA bloodborne pathogen standard 29 CFR 1910.1030. At least two of these staff members will always be available to render first aid, if required, at the NE Cape site.

5.2.6 Site Workers

All site workers, including subcontractors and craft labor, have the responsibility to report any unsafe or potentially hazardous situations to the SSHO/SS. Site workers will maintain knowledge of the information, instructions, and emergency response actions contained in this SSHP. All site workers will comply with the rules, regulations, and procedures set forth in the SSHP.

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6.0 SPILL PREVENTION AND RESPONSE

6.1 GENERAL PROVISIONS

All NE Cape site personnel will be properly trained and supervised in protocols for hazardous waste operations and emergency spill response. Proper equipment, procedures, and safeguards will be used when handling waste materials. To minimize the frequency of spills, personnel will be instructed during safety briefings on the proper methods for transferring and handling hazardous materials. Refer to the SPCC Plan (Appendix E) for complete details on spill prevention and control for the temporary fuel storage area. The sections below detail spill prevention and control for areas other than the temporary fuel storage area.

6.2 LIKELY SPILL SCENARIOS

Activities that could result in a spill include the general fueling, lubricating, and operating activities associated with equipment use. The potential exists for spills along Cargo Beach Road during transportation of fuels and materials between the barge landing area and their respective staging areas. The risk of a spill also exists in areas where liquids will be staged, including the fuel storage containment area, the HWAP, and the Cargo Beach barge landing area. These storage areas will be managed in such a way that releases to the surrounding environment are prevented.

Any petroleum spill in excess of 55 gallons will be reported to ADEC immediately. Spills between 10 and 55 gallons will be reported with 48 hours, and a spill less than 10 gallons will be reported on a monthly basis by the SS.

6.3 SPILL RESPONSE EQUIPMENT

To minimize the impact of spilled material by quick response, Bristol will maintain emergency spill supplies on site. These supplies will include absorbent materials (oil sorbent pads and booms) and PPE (safety glasses or goggles, chemical-resistant gloves, Tyvek® suit, and booties, etc.). Personnel on site will be familiar with the contents and use of all emergency response supplies. There will be a spill kit located at the fuel storage containment that will contain absorbents and spill booms. Supplies will be located at Site 6 and two other work sites (camp area and mechanic shop area). These supplies will be stored in containers in

their original packing. Each vehicle on site will carry oil-sorbent pads. Additionally, each vehicle will be equipped with an action packer that contains an SPC "Attack Pack®" as well as the usual required USACE fire extinguisher, first-aid kit, and other safety-related items.

6.4 SPILL RESPONSE PROCEDURES

Bristol will immediately contain any spill. Work will be stopped in areas of release if there is any reason to believe the spill represents a safety concern. The following procedures will apply in the event of a spill:

Spill Response Procedures	
1.	Protect project personnel and notify the Site Superintendent.
2.	Identify contaminant spilled, source of release, volume of release, and any associated contaminated media (such as soil).
3.	Take necessary personal precautions; isolate or segregate contaminated material from human contact (using temporary berms, absorbents, and shut-off valves, as necessary).
4.	Keep nonessential people away; isolate hazardous areas and deny entry.
5.	Take immediate measures, using properly protected personnel, to control the discharge at its source and contain the release.
6.	Stay upwind and keep out of low areas.
7.	Keep combustibles and ignition sources away from spilled materials.
8.	Use water or vapor suppression foams or sprays to reduce vapors, as needed.
9.	Take additional actions and request outside assistance, as required.
10.	Report spills as indicated in Section 8.4 of the Spill Prevention, Control, and Countermeasures Plan (Appendix E).

These procedures for responding to spills and releases will be reviewed weekly as part of the on-site health and safety meetings.

7.0 PROJECT SCHEDULE

The project schedule is presented in Appendix H. The project schedule and work sequence are summarized as follows:

- Planning documents will be finalized and all necessary permits will be in place by July 2011.
- The mobilization barge will arrive at NE Cape by early July 2011.
- The camp will be set up and mobilization complete by mid July 2011.
- Contaminated soil excavations, Site 28 sediment/soil characterization, debris cleanup and natural attenuation monitoring will be conducted from July to October 2011.
- All fieldwork for 2011 will be completed by mid October 2011. The camp, equipment, and supplies will be overwintered on a concrete pad at the MOC. Only the bulk bags filled with contaminated soil, some equipment, and empty ISO tanks will be demobilized in 2011.
- The technical memorandum for the sediment/soil sampling at Site 28 will be submitted in October 2011.
- The 2012 mobilization and fieldwork will occur in June 2012. RI activities in 2012, will be completed by September 2012 and demobilization will occur by the end of September 2012.
- The final HTRW Report will be submitted to the USACE In March 2013.
- Contract closeout will be completed by April 30, 2013.

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8.0 APPLICABLE LAWS AND REGULATIONS

The following laws, regulations, and permits are potentially applicable to project activities.

8.1 LIST OF APPLICABLE LAWS AND REGULATIONS

8.1.1 Federal Laws and Regulations

- Safe Drinking Water Act
  - EPA Drinking Water Standards and Health Advisories, EPA 822-B-00-001, summer 2000
- Clean Water Act, Title 33 U.S. Code (U.S.C.), Sections 1251-1376 (33 U.S.C. 1251-1376)
  - Criteria and Standards for the National Pollutant Discharge Elimination System (NPDES), 40 CFR 125
  - Water Quality Standards, 40 CFR 131
  - EPA-administered Permit Program for the NPDES, 40 CFR 122
- Resource Conservation and Recovery Act
  - Identification and Listing of Hazardous Waste, 40 CFR 261
  - Release of Hazardous Substances to the Environment, 40 CFR 300 and 302
  - Management of Used Oil, 40 CFR 279
  - Protection of Wetlands, Executive Order (E.O.) 11990
- Toxic Substances Control Act, 40 CFR 761
- Endangered Species Act
- Fish and Wildlife Coordination Act
- National Historic Preservation Act
- Coastal Zone Management Act
- Marine Mammal Protection Act
- Migratory Bird Treaty Act
- St. Lawrence Island FUDS, E.O. 12088, PL No. 98-212
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- National Oil and Hazardous Substance Pollution Contingency Plan
- U.S. Department of Transportation, Transportation of Hazardous Materials, 49 CFR 171-178

- Disposal of Waste Material, Including Asbestos-Containing Material and PCB, 40 CFR 60, 257, 261, 262, 263, 268, 279, 761, and 763
- Magnuson-Stevens Fishery Conservation and Management Act, 16 U.S.C. 1801 et seq., and Essential Fish Habitat, 50 CFR 600.920
- National Environmental Policy Act

8.1.2 State Laws and Regulations

- Alaska Regulations for Storage, Labeling, Containerizing, and Disposal of Hazardous Waste, Title 18 Alaska Administrative Code, Chapter 62 (18 AAC 62)
- Alaska Water Quality Standards, 18 AAC 70, Alaska Drinking Water Regulations, 18 AAC 80Underground Storage Tanks Procedures Manual, Oil and Hazardous Substances Pollution Control, 18 AAC 75
- Alaska Department of Fish and Game (ADF&G), 5 AAC 95, Fish and Game Habitat
- Alaska Department of Natural Resources, 11 AAC 62.720, Tideland Permit
- Alaska Historic Preservation Act, Alaska Statute (AS) 41.35, January 1992
- Alaska Coastal Management Regulations, 11 AAC 110,
- ADF&G Fish Habitat Permits, AS 16.05.841
- Temporary Water Use, 11 AAC 93.210-220

8.1.3 Camp Regulations

- Alaska Food Code, 18 AAC 31
- Temporary Water Use, 11 AAC 93.210-220

9.0 REFERENCES

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FIGURES

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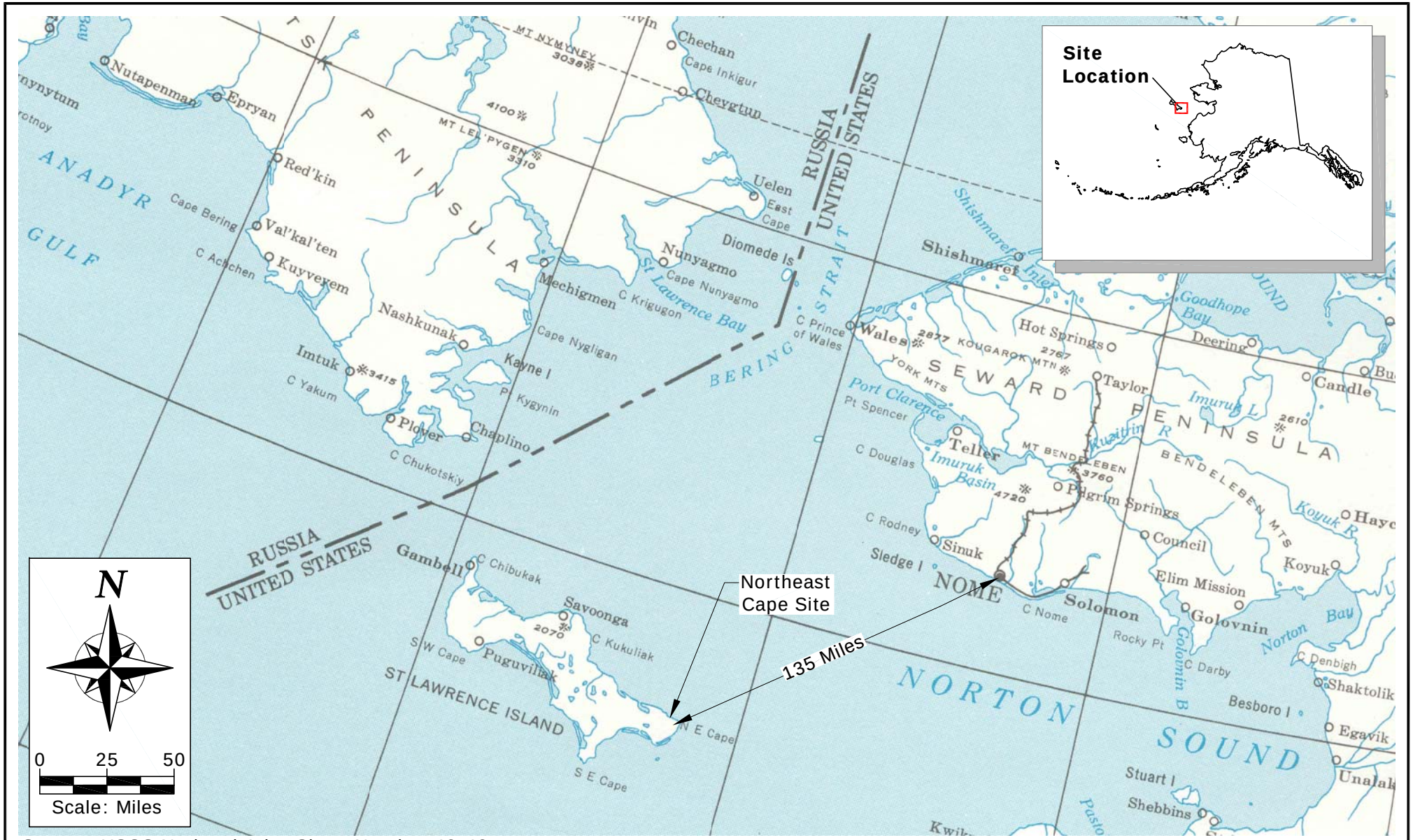

Source: USGS National Atlas Sheet Number 42-43

FIGURE 1
NORTHEAST CAPE, ST. LAWRENCE ISLAND, ALASKA
NORTHEAST CAPE HTRW REMEDIAL ACTIONS
VICINITY MAP

Bristol
ENVIRONMENTAL REMEDIATION SERVICES, LLC
Phone (907) 563-0013 Fax (907) 563-6713

DATUM:	NA
PROJECTION:	NA
PROJECT NO.	34110008
DATE	07/18/11
DWN.	MTG
SCALE	SHOWN
APPRVD.	MW

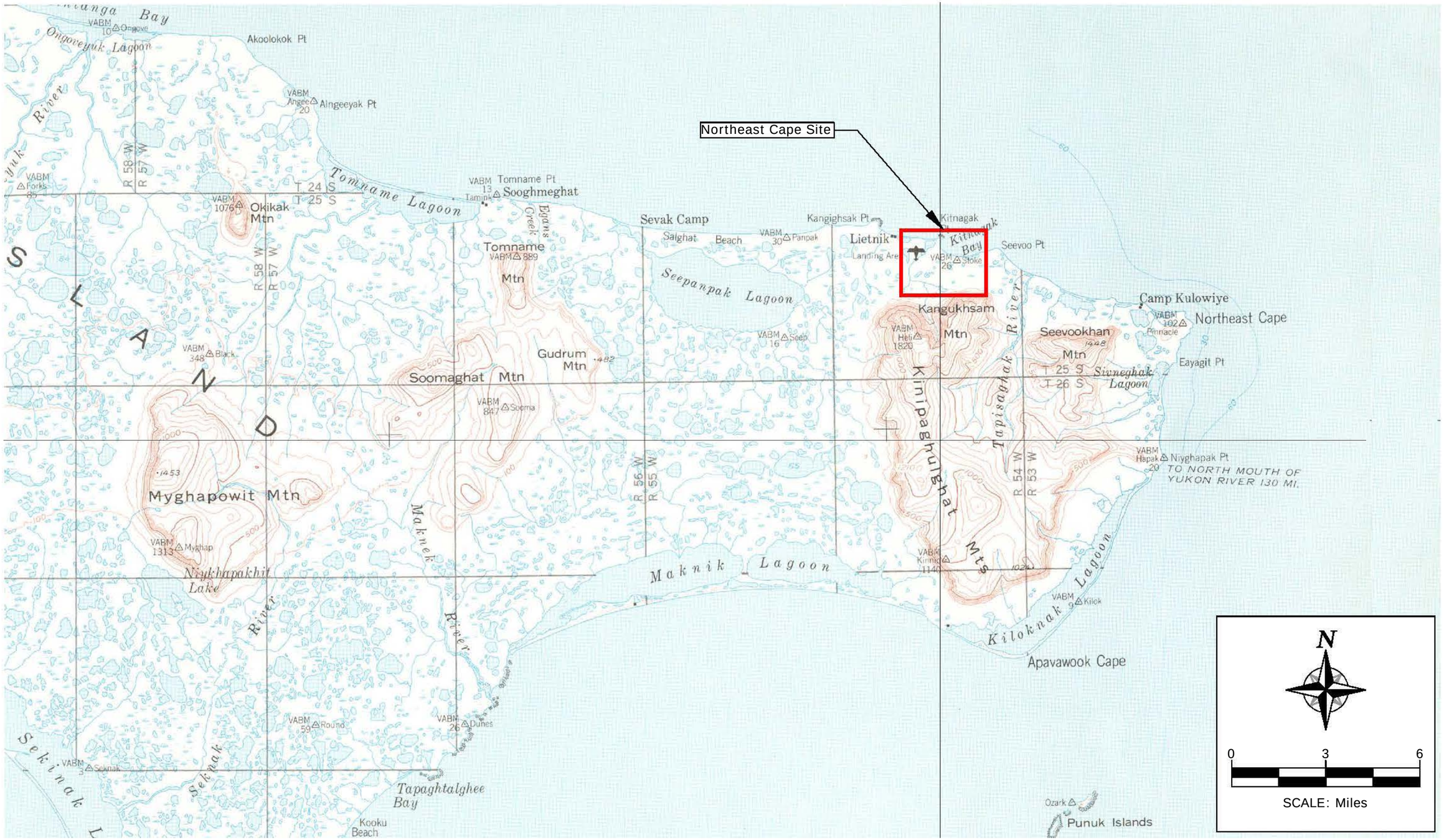

FIGURE 2
NORTHEAST CAPE, ST. LAWRENCE ISLAND, ALASKA
NORTHEAST CAPE HTRW REMEDIAL ACTIONS
LOCATION MAP

Bristol
ENVIRONMENTAL REMEDIATION SERVICES, LLC
Phone (907) 563-0013 Fax (907) 563-6713

DATUM:	NA
PROJECTION:	NA
PROJECT NO.	34110008
DATE	07/18/11
DWN.	MTG
SCALE	SHOWN
APPRVD.	MW

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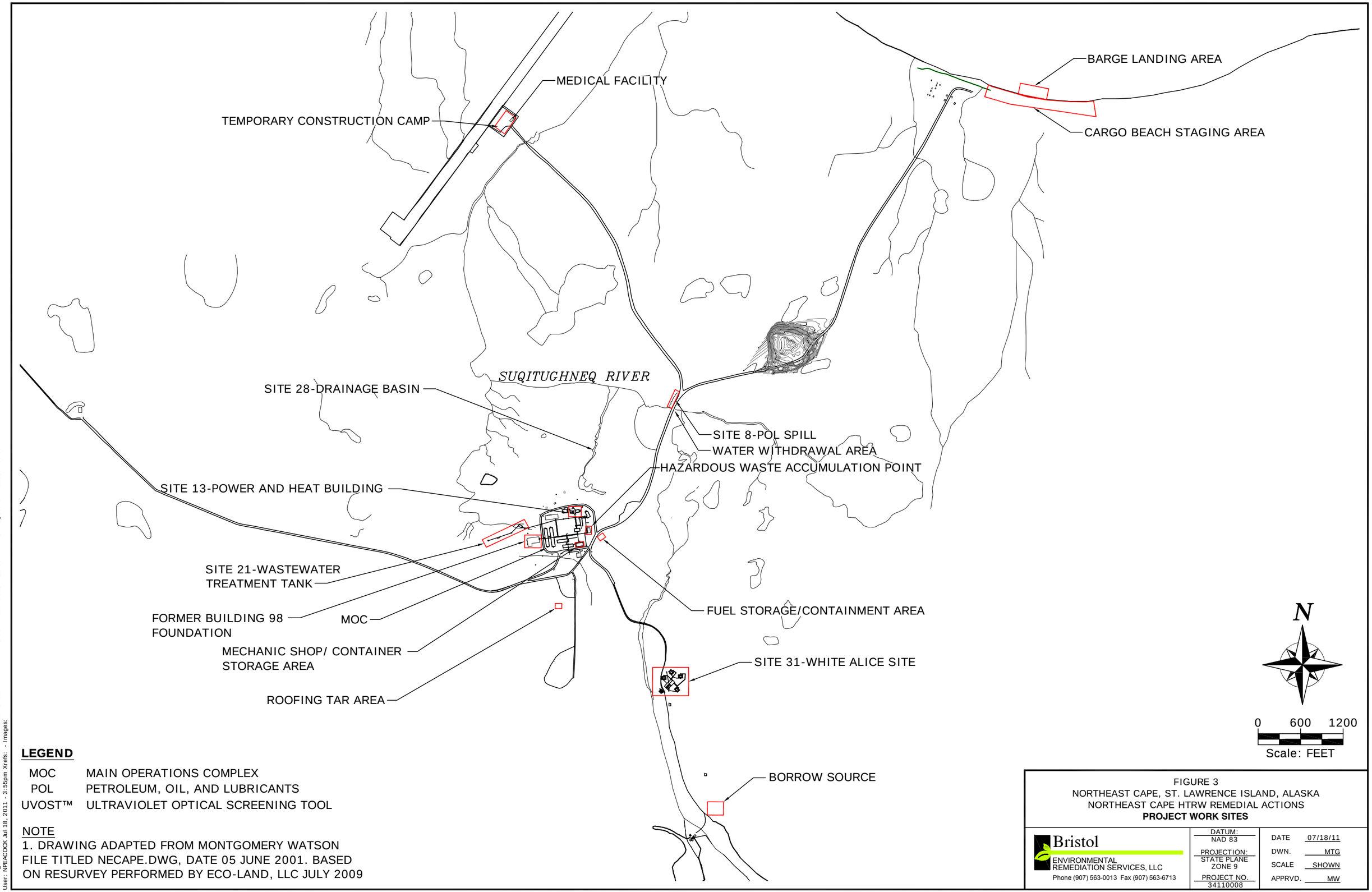

LEGEND

MOC	MAIN OPERATIONS COMPLEX
POL	PETROLEUM, OIL, AND LUBRICANTS
UVOST™	ULTRAVIOLET OPTICAL SCREENING TOOL

NOTE

1. DRAWING ADAPTED FROM MONTGOMERY WATSON FILE TITLED NECAPE.DWG, DATE 05 JUNE 2001. BASED ON RESURVEY PERFORMED BY ECO-LAND, LLC JULY 2009

FIGURE 3
NORTHEAST CAPE, ST. LAWRENCE ISLAND, ALASKA
NORTHEAST CAPE HTRW REMEDIAL ACTIONS
PROJECT WORK SITES

Bristol
ENVIRONMENTAL REMEDIATION SERVICES, LLC
Phone (907) 563-0013 Fax (907) 563-6713

DATUM:	NAD 83
PROJECTION:	STATE PLANE ZONE 9
PROJECT NO.	34110008
DATE	07/18/11
DWN.	MTG
SCALE	SHOWN
APPRVD.	MW

Drawing: O:\JOBS\34110008 2011 NE CAPE\ACAD-ENVIRO\AUTOCAD-NATIVE-FILES-JUL11\34110008-FIG3-JUL11.DWG - Layout: 34110008-FIG3-JUL11
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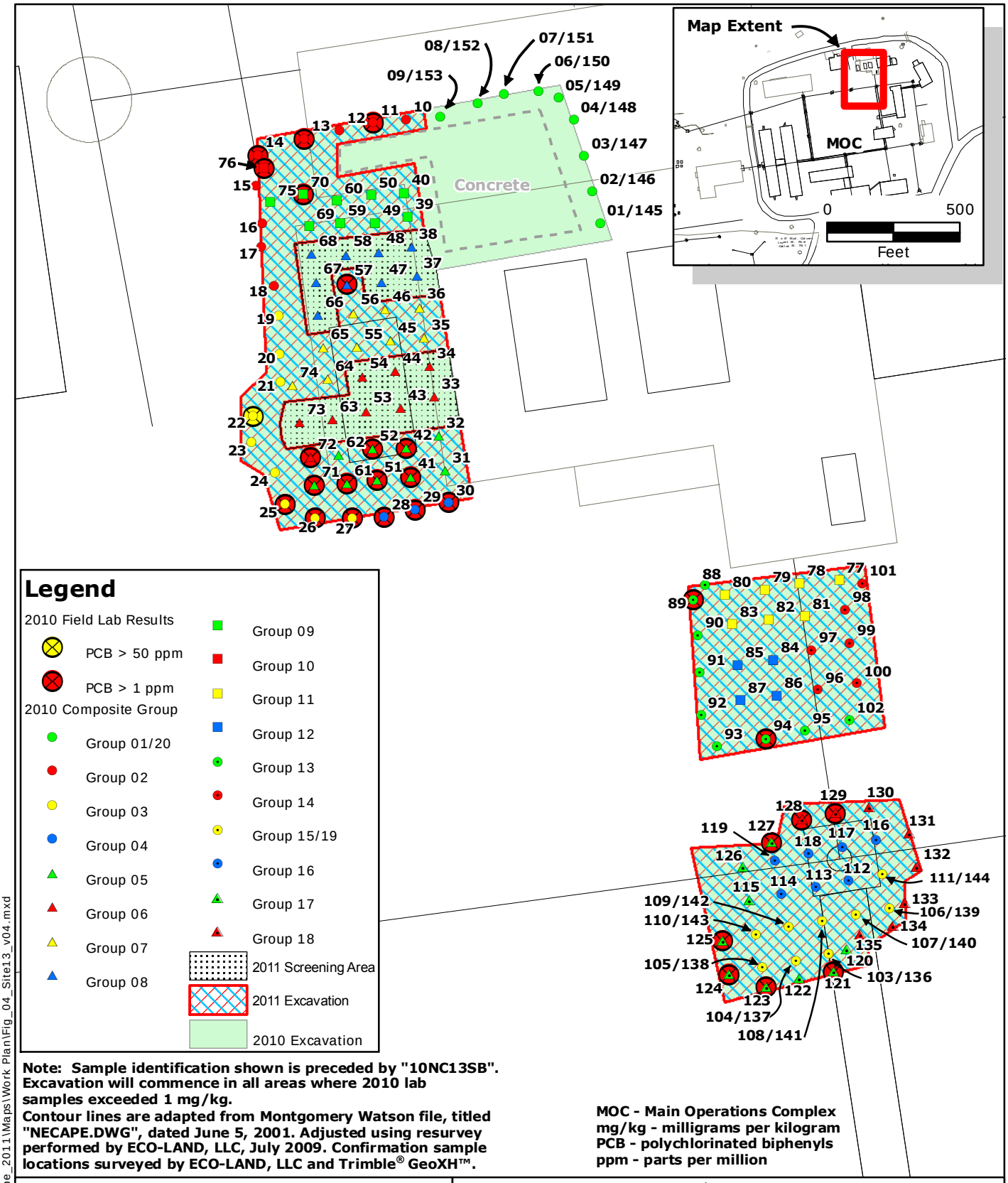


Note: Sample identification shown is preceded by "10NC13SB". Excavation will commence in all areas where 2010 lab samples exceeded 1 mg/kg.
Contour lines are adapted from Montgomery Watson file, titled "NECAPE.DWG", dated June 5, 2001. Adjusted using resurvey performed by ECO-LAND, LLC, July 2009. Confirmation sample locations surveyed by ECO-LAND, LLC and Trimble® GeoXH™.

MOC - Main Operations Complex
mg/kg - milligrams per kilogram
PCB - polychlorinated biphenyls
ppm - parts per million

N W E S

0 12.5 25 50
Feet

Figure 4
Northeast Cape, St. Lawrence Island, Alaska
Northeast Cape HTRW Remedial Actions
Site 13 Former Power and Heat Building

Bristol ENVIRONMENTAL REMEDIATION SERVICES, LLC
Phone (907)563-0013 Fax (907)563-6713
Project No. 34110008

DATUM:	DATE	05-04-11	SHEET
NAD83	DWN.	BI-ME	1
PROJECTION:	SCALE	1:240	of
Alaska State Plane Zone 9	APPRVD.	BERS-MW	1

File: G:\Jobs\34110008_NE_Cape_2011\Maps\Work Plan\Fig_04_Site13_v04.mxd

Figure 4a - 2010 Site 13 PCB Soil Composite Sample Results from Fixed-based Analytical Laboratory

Sample ID	Lab ID	Date Collected	EPA method 8082 Results (mg/Kg)						
			Analyte (Aroclor)						
			PCB-1016	PCB-1221	PCB-1232	PCB-1242	PCB-1248	PCB-1254	PCB-1260
Composite # 1	21440-154	9/2/2010	0.0082 U	0.01 U	0.01 U	0.0061 U	0.0031 U	0.0061 U	0.35
Composite # 20[D]	21440-173	9/2/2010	0.0084 U	0.011 U	0.011 U	0.0063 U	0.0032 U	0.0063 U	0.42 QH
Composite # 2	21440-155	9/2/2010	0.0083 U	0.01 U	0.01 U	0.0062 U	0.0031 U	0.0062 U	**1.6**
Composite # 3	21440-156	9/2/2010	0.0091 U	0.011 U	0.011 U	0.0068 U	0.0034 U	0.0068 U	**5.9**
Composite # 4	21440-157	9/2/2010	0.0088 U	0.011 U	0.011 U	0.0066 U	0.0033 U	0.0066 U	**39**
Composite # 5	21440-158	9/2/2010	0.0089 U	0.011 U	0.011 U	0.0066 U	0.0033 U	0.0066 U	**80**
Composite # 6	21440-159	9/2/2010	0.0087 U	0.011 U	0.011 U	0.0065 U	0.0033 U	0.0065 U	0.89
Composite # 7	21440-160	9/2/2010	0.0083 U	0.01 U	0.01 U	0.0062 U	0.0031 U	0.0062 U	**1.7**
Composite # 8	21440-161	9/2/2010	0.0083 U	0.01 U	0.01 U	0.0062 U	0.0031 U	0.0062 U	0.59 J
Composite # 9	21440-162	9/2/2010	0.0083 U	0.01 U	0.01 U	0.0063 U	0.0031 U	0.0063 U	**12**
Composite # 10	21440-163	9/2/2010	0.0086 U	0.011 U	0.011 U	0.0064 U	0.0032 U	0.0064 U	**8.7**
Composite # 11	21440-164	9/2/2010	0.0089 U	0.011 U	0.011 U	0.0066 U	0.0033 U	0.0066 U	**48**
Composite # 12	21440-165	9/2/2010	0.0088 U	0.011 U	0.011 U	0.0066 U	0.0033 U	0.0066 U	**4.4**
Composite # 13	21440-166	9/2/2010	0.0082 U	0.01 U	0.01 U	0.0062 U	0.0031 U	0.0062 U	**3.3**
Composite # 14	21440-167	9/2/2010	0.0084 U	0.011 U	0.011 U	0.0063 U	0.0032 U	0.0063 U	**3**
Composite # 15	21440-168	9/2/2010	0.0084 U	0.011 U	0.011 U	0.0063 U	0.0032 U	0.0063 U	**8.2 J**
Composite # 19[D]	21440-172	9/2/2010	0.0087 U	0.011 U	0.011 U	0.0065 U	0.0033 U	0.0065 U	**15 J**
Composite # 16	21440-169	9/2/2010	0.0087 U	0.011 U	0.011 U	0.0065 U	0.0033 U	0.0065 U	**3**
Composite # 17	21440-170	9/2/2010	0.0088 U	0.011 U	0.011 U	0.0066 U	0.0033 U	0.0066 U	**35**
Composite # 18	21440-171	9/2/2010	0.0084 U	0.011 U	0.011 U	0.0063 U	0.0032 U	0.0063 U	**2.5**
Cleanup Level (mg/Kg)			1	1	1	1	1	1	1

Notes:

[D] Indicates duplicate of previous sample

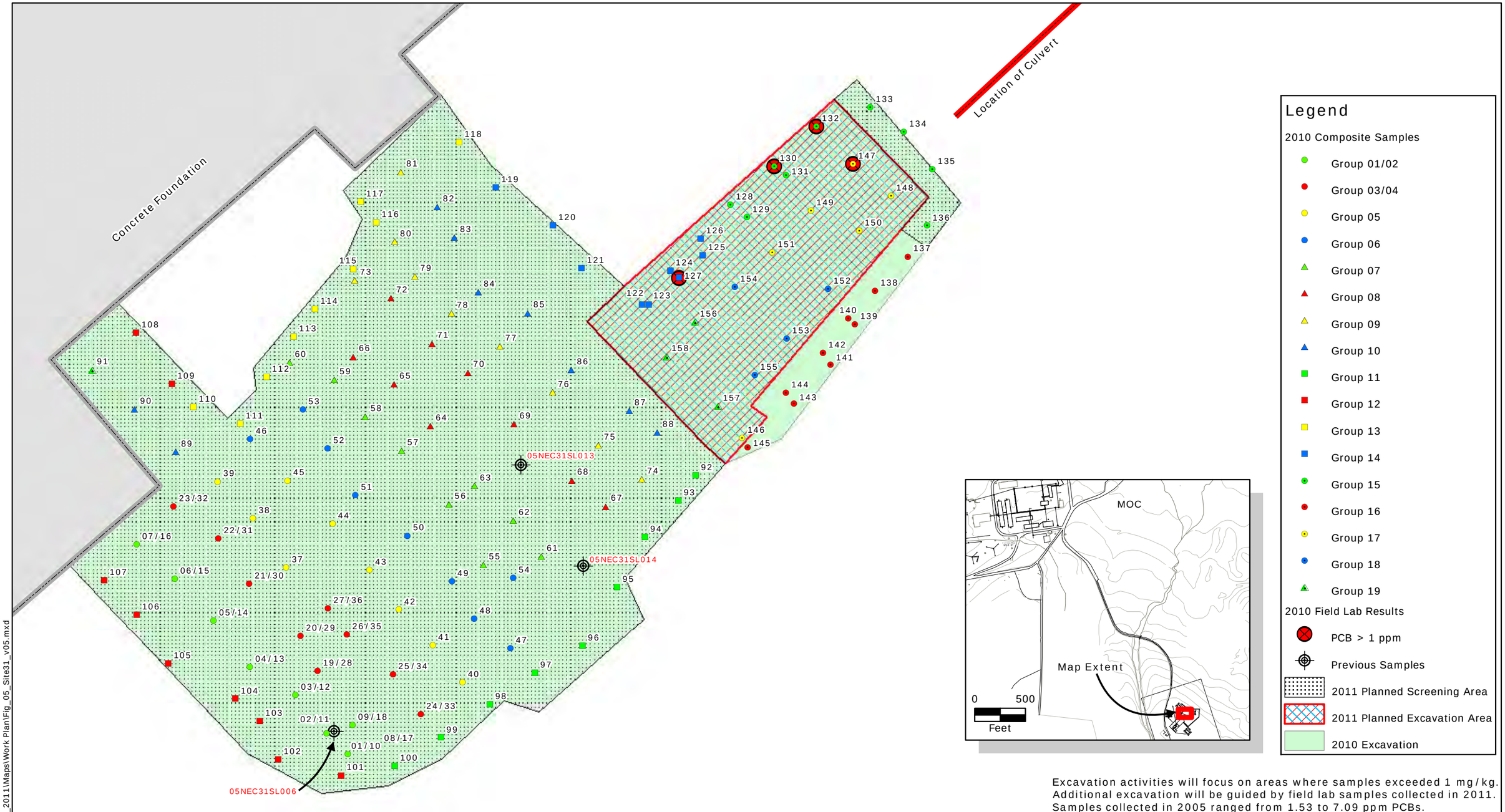
Bold indicates sample result is above site cleanup level.

QH-Estimated with a high bias.

U-Result is non-detect, the limit of detection (LOD) precedes the U.

J The analyte was positively identified; the quantitation is an estimate.

The Location IDs are provided on the chain of custody. Samples were composited at the lab.



Excavation activities will focus on areas where samples exceeded 1 mg/kg. Additional excavation will be guided by field lab samples collected in 2011. Samples collected in 2005 ranged from 1.53 to 7.09 ppm PCBs.

Note: Sample identification shown is preceded by "10NC31SB". Points labeled with two numbers show the primary ID followed by the duplicate ID. Confirmation sample locations and site features surveyed by ECO-LAND, LLC, 2010.

MOC - Main Operations Complex
PCB - polychlorinated biphenyls
ppm - parts per million

N W E S

0 5 10 20
Feet

Figure 5
Northeast Cape, St. Lawrence Island, Alaska
Northeast Cape HTRW Remedial Actions
Site 31 Former White Alice Site

Bristol ENVIRONMENTAL REMEDIATION SERVICES, LLC
Phone (907)563-0013 Fax (907)563-6713
Project No. 34110008

DATUM: NAD83	DATE 06-29-11	SHEET
PROJECTION: Alaska State Plane Zone 9	DWN. BERS-RJ	1
	SCALE 1:100	of
	APPRVD. BERS-MW	1

File: G:\Jobs\34110008_NE_Cape_2011\Maps\Work Plan\Fig_05_Site31_v05.mxd

Table 12 - Site 31 PCB Soil Composite Sample Results

Sample ID	Lab ID	Date Collected	EPA method 8082 Soil Results (mg/Kg)						
			Analyte (Aroclor)						
			PCB-1016	PCB-1221	PCB-1232	PCB-1242	PCB-1248	PCB-1254	PCB-1260
Composite #1	21449-159	9/4/2010	0.0085 U	0.011 U	0.011 U	0.0064 U	0.0032 U	0.0064 U	0.68 J
Composite #2[D]	21449-160	9/4/2010	0.0085 U	0.011 U	0.011 U	0.0064 U	0.0032 U	0.0064 U	0.33 J
Composite #3	21449-161	9/4/2010	0.009 U	0.011 U	0.011 U	0.0067 U	0.0034 U	0.0067 U	0.56 J
Composite #4[D]	21449-162	9/4/2010	0.0091 U	0.011 U	0.011 U	0.0068 U	0.0034 U	0.0068 U	0.31 J
Composite #5	21449-163	9/4/2010	0.0084 U	0.01 U	0.01 U	0.0063 U	0.0031 U	0.0063 U	0.34 J
Composite #6	21449-164	9/4/2010	0.0085 U	0.011 U	0.011 U	0.0064 U	0.0032 U	0.0064 U	0.19 J
Composite #7	21449-165	9/4/2010	0.0087 U	0.011 U	0.011 U	0.0065 U	0.0033 U	0.0065 U	0.34 J
Composite #8	21449-166	9/4/2010	0.0089 U	0.011 U	0.011 U	0.0067 U	0.0033 U	0.0067 U	0.18 J
Composite #9	21449-167	9/4/2010	0.0095 U	0.012 U	0.012 U	0.0071 U	0.0036 U	0.0071 U	0.29 J
Composite #10	21449-168	9/4/2010	0.0092 U	0.011 U	0.011 U	0.0069 U	0.0034 U	0.0069 U	**5 J**
Composite #11	21449-169	9/4/2010	0.009 U	0.011 U	0.011 U	0.0068 U	0.0034 U	0.0068 U	0.7 J
Composite #12	21449-170	9/4/2010	0.0087 U	0.011 U	0.011 U	0.0065 U	0.0033 U	0.0065 U	**1.6 J**
Composite #13	21449-171	9/4/2010	0.0083 U	0.01 U	0.01 U	0.0062 U	0.0031 U	0.0062 U	0.37 J
Composite #14	21449-172	9/4/2010	0.0088 U	0.011 U	0.011 U	0.0066 U	0.0033 U	0.0066 U	**1.9 J**
Composite #15	21449-173	9/4/2010	0.0086 U	0.011 U	0.011 U	0.0065 U	0.0032 U	0.0065 U	**2.7 J**
Composite #16	21449-174	9/4/2010	0.0082 U	0.01 U	0.01 U	0.0061 U	0.0031 U	0.0061 U	0.08 J
Composite #17	21449-175	9/4/2010	0.009 U	0.011 U	0.011 U	0.0067 U	0.0034 U	0.0067 U	**4.3 J**
Composite #18	21449-176	9/4/2010	0.017 U Q	0.021 U	0.021 U	0.013 U	0.0064 U	0.013 U	**1.3 J**
Composite #19	21449-177	9/4/2010	0.0086 U	0.011 U	0.011 U	0.0065 U	0.0032 U	0.0065 U	**3.6 J**
Cleanup Level			1	1	1	1	1	1	1

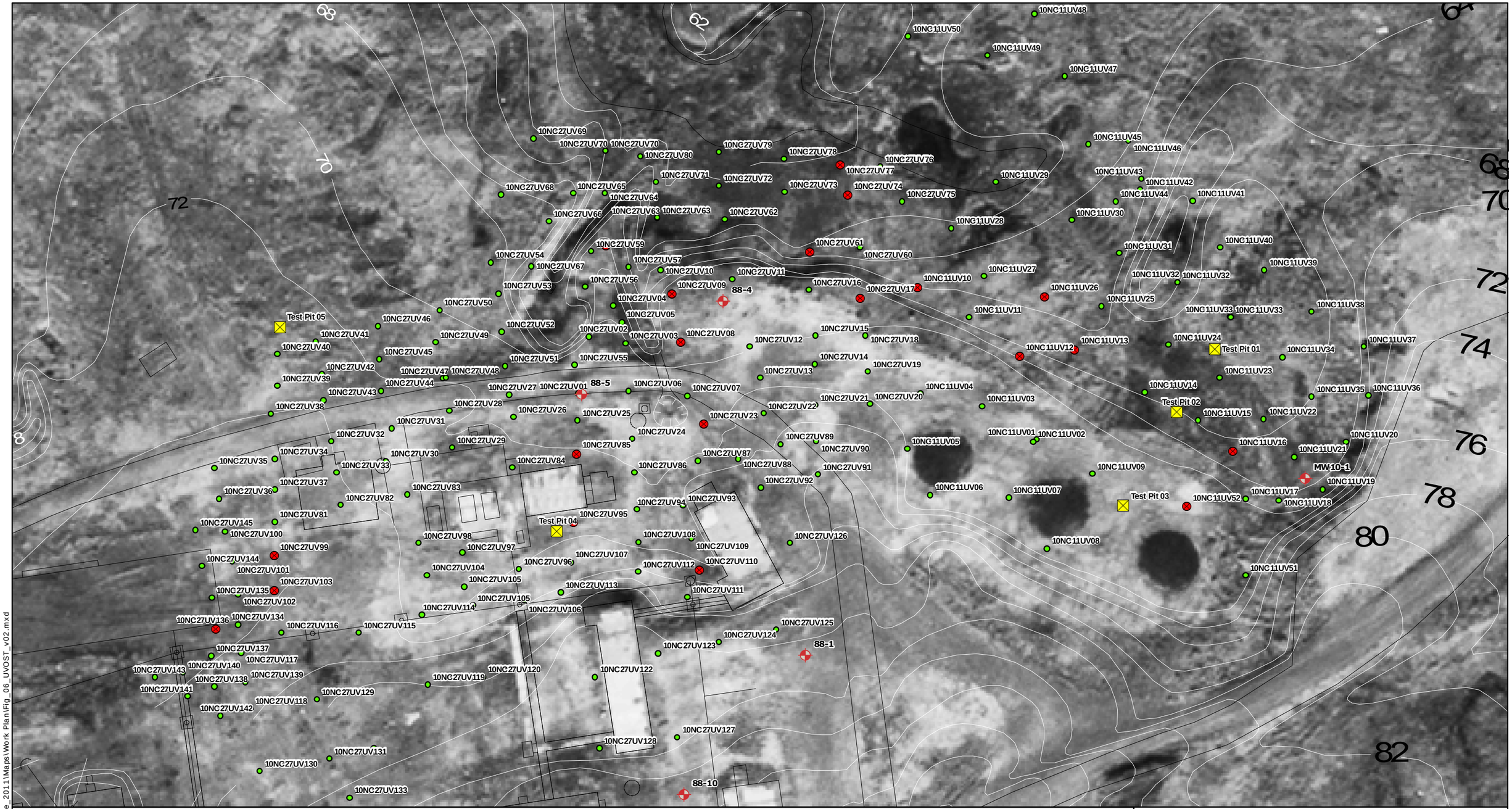
Notes:

[D] Indicates duplicate of previous sample

U-Result is non-detect, the limit of detection (LOD) precedes the U.

J-Result is an estimate due to field duplicate imprecision.

mg/kg = milligrams per kilogram



Legend

- MOC Monitoring Well
- Correlation Location
- Test Pit
- UVOST Probe

MOC - Main Operations Complex
UVOST - UltraViolet Optical Screening Tool

Note: Feature and contour lines are adapted from Montgomery Watson file, titled "NECAPE.DWG", dated June 5, 2001. Adjusted using resurvey performed by ECO-LAND, LLC, July 2009. UVOST probe locations surveyed by ECO-LAND, LLC and Trimble® GeoXH™.

N W E S

0 50 100
Feet

Figure 6
Northeast Cape, St. Lawrence Island, Alaska
Northeast Cape HTRW Remedial Actions
MOC UVOST™ Probe Locations

Bristol ENVIRONMENTAL REMEDIATION SERVICES, LLC
Phone (907)563-0013 Fax (907)563-6713
Project No. 34110008

DATUM:	DATE 05-03-11	SHEET
NAD 83	DWN. BI-ME	1
PROJECTION:	SCALE 1:900	of
Alaska State Plane Zone 9	APPRVD. BERS-MW	1

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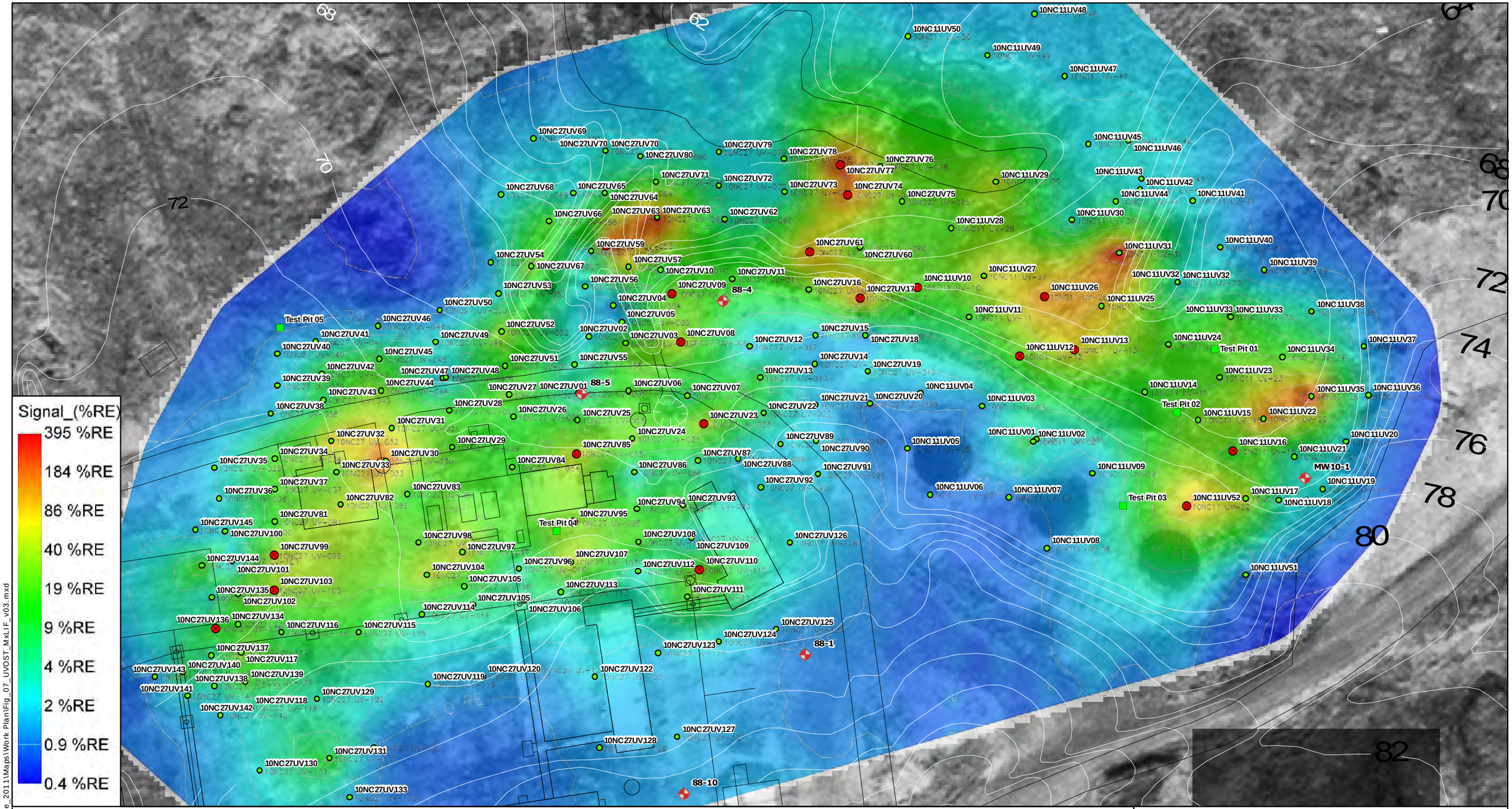


Legend

- MOC Monitoring Well
- Correlation Location
- Test Pit
- UVOST Probe

MOC - Main Operations Complex
UVOST - UltraVioletOptical Screening Tool
%RE - Percent relative emittance

Note: Feature and contour lines are adapted from Montgomery Watson file, titled "NECAPE.DWG", dated June 5, 2001. Adjusted using resurvey performed by ECO-LAND, LLC, July 2009. UVOST probe locations surveyed by ECO-LAND, LLC and Trimble® GeoXH™.

N W E S

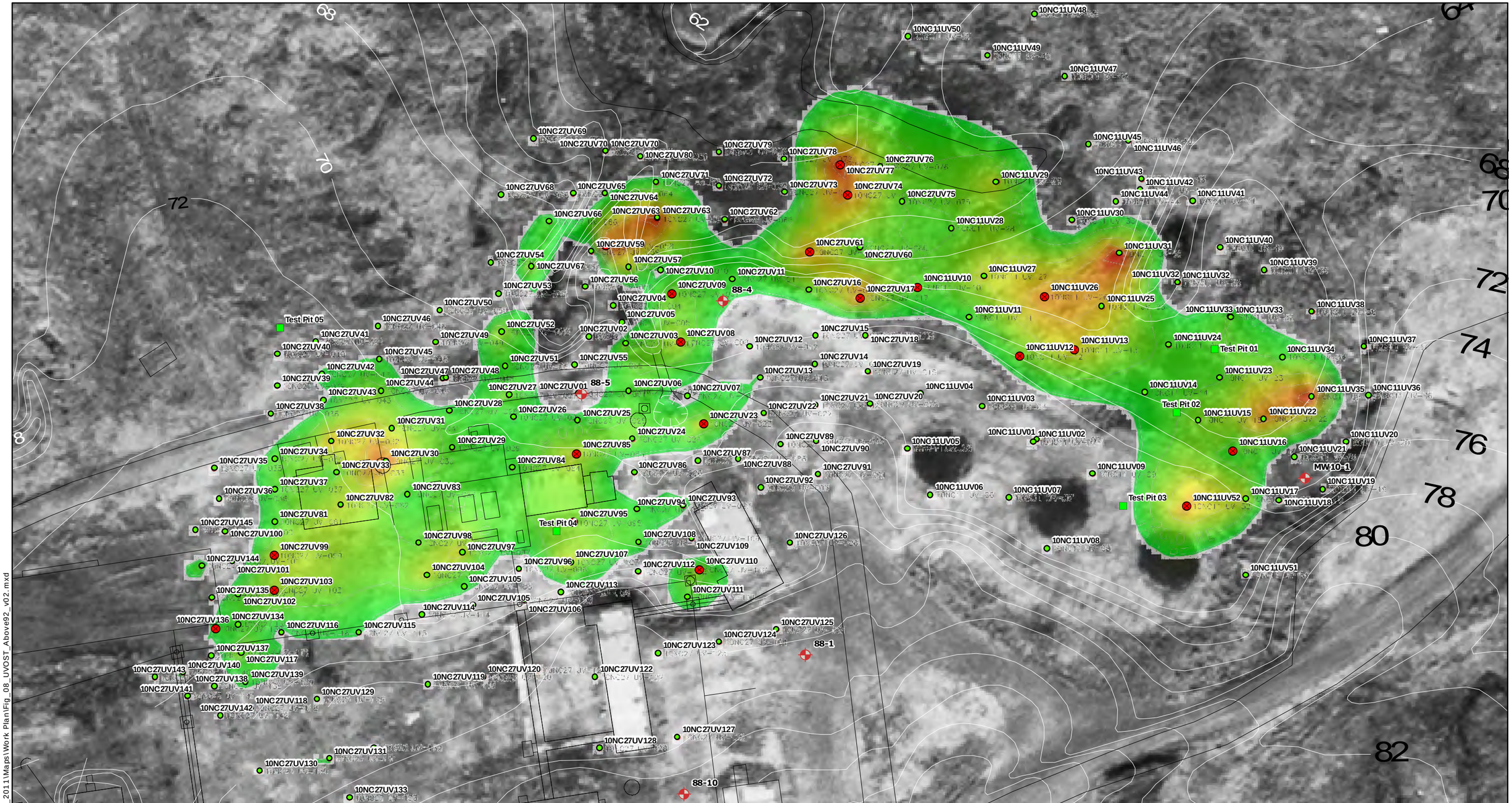
0 50 100
Feet

Figure 7
Northeast Cape, St. Lawrence Island, Alaska
Northeast Cape HTRW Remedial Actions
MOC UVOST™ Maximum LIF Response

Bristol
ENVIRONMENTAL REMEDIATION SERVICES, LLC
Phone (907)563-0013 Fax (907)563-6713
Project No. 34110008

DATUM:	DATE 05-04-11	SHEET
NAD 83	DWN. BI-ME	1
PROJECTION:	SCALE 1:900	of
Alaska State Plane Zone 9	APPRVD. BERS-MW	1

File: G:\Jobs\34110008_NE_Cape_2011\Maps\Work Plan\Fig_07_UVOST_MxLIF_v03.mxd



Legend

- MOC Monitoring Well
- Correlation Location
- Test Pit
- UVOST Probe

MOC - Main Operations Complex

Note: Feature and contour lines are adapted from Montgomery Watson file, titled "NECAPE.DWG", dated June 5, 2001. Adjusted using resurvey performed by ECO-LAND, LLC, July 2009. UVOST probe locations surveyed by ECO-LAND, LLC and Trimble® GeoXH™.

N W E S

0 50 100
Feet

Figure 8
Northeast Cape, St. Lawrence Island, Alaska
Northeast Cape HTRW Remedial Actions
MOC UVOST™ LIF Response Above 9.2%

Bristol
ENVIRONMENTAL REMEDIATION SERVICES, LLC
Phone (907)563-0013 Fax (907)563-6713
Project No. 34110008

DATUM:	DATE 05-03-11	SHEET
NAD 83	DWN. BI-ME	1
PROJECTION:	SCALE 1:900	of
Alaska State Plane Zone 9	APPRVD. BERS-MW	1

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Xrefs: None - Images: EASTCAPE-STLAWRENCE_ORTHO_MOSAIC_Ak83-9F.TIF TEST PITS.JPG TESTPIT2.JPG

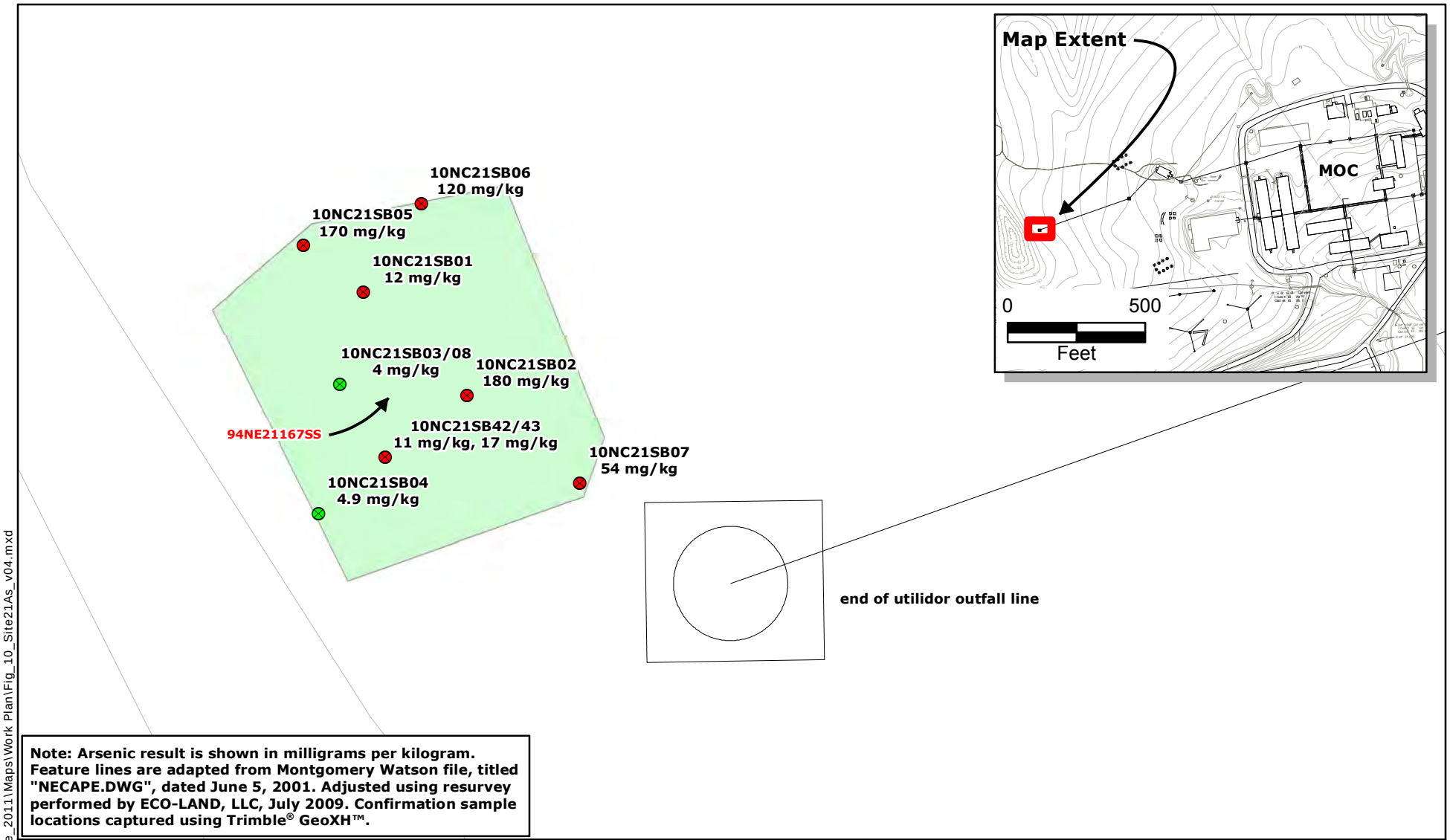
REVISIONS				REVISIONS			
NO.	DATE	BY	DESCRIPTION	NO.	DATE	BY	DESCRIPTION

Bristol
ENVIRONMENTAL REMEDIATION SERVICES, LLC
Phone (907) 563-0013 Fax (907) 563-6713
Project No. 410050

FIGURE 9
NORTHEAST CAPE, ST. LAWRENCE ISLAND, ALASKA
NE CAPE HTRW REMEDIAL ACTIONS
NORTHEAST CAPE MOC POL EXCAVATION PLAN

FIGURE NO.
9

SCALE: 1" = 50' | DESIGNED: | CHECKED: MW | DRAWN: NAP | DATE: 07/18/11



Note: Arsenic result is shown in milligrams per kilogram. Feature lines are adapted from Montgomery Watson file, titled "NECAPE.DWG", dated June 5, 2001. Adjusted using resurvey performed by ECO-LAND, LLC, July 2009. Confirmation sample locations captured using Trimble® GeoXH™.

Legend

- 2010 Arsenic Result Above Cleanup Level
- 2010 Arsenic Result Below Cleanup Level
- 2010 Excavation

MOC - Main Operations Complex

N W E S

0 5 10
Feet

Figure 10
Northeast Cape, St. Lawrence Island, Alaska
Northeast Cape HTRW Removal Actions
Site 21 Arsenic Excavation Area

Bristol ENVIRONMENTAL REMEDIATION SERVICES, LLC
Phone (907)563-0013 Fax (907)563-6713
Project No. 34110008

DATUM:	DATE	07-15-11	SHEET
NAD83	DWN.	BI-ME	1
PROJECTION:	SCALE	1:100	of
Alaska State Plane Zone 9	APPRVD.	BERS-MW	1

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File: G:\Jobs\34110008_NE_Cape_2011\Maps\Work Plan\Fig_11_Site21_BG_v04.mxd

Legend

Potential Background Sample Areas

N
W E
S

0 125 250 500
Feet

Figure 11
Northeast Cape, St. Lawrence Island, Alaska
Northeast Cape HTRW Removal Actions
Site 21 Arsenic Background Sampling Area

Bristol
ENVIRONMENTAL REMEDIATION SERVICES, LLC
Phone (907)563-0013 Fax (907)563-6713
Project No. 34110008

DATUM:	DATE	07-20-11	SHEET
NAD83	DWN.	BI-ME	1
PROJECTION:	SCALE	1:3,000	of
Alaska State Plane Zone 9	APPRVD.	BERS-MW	1

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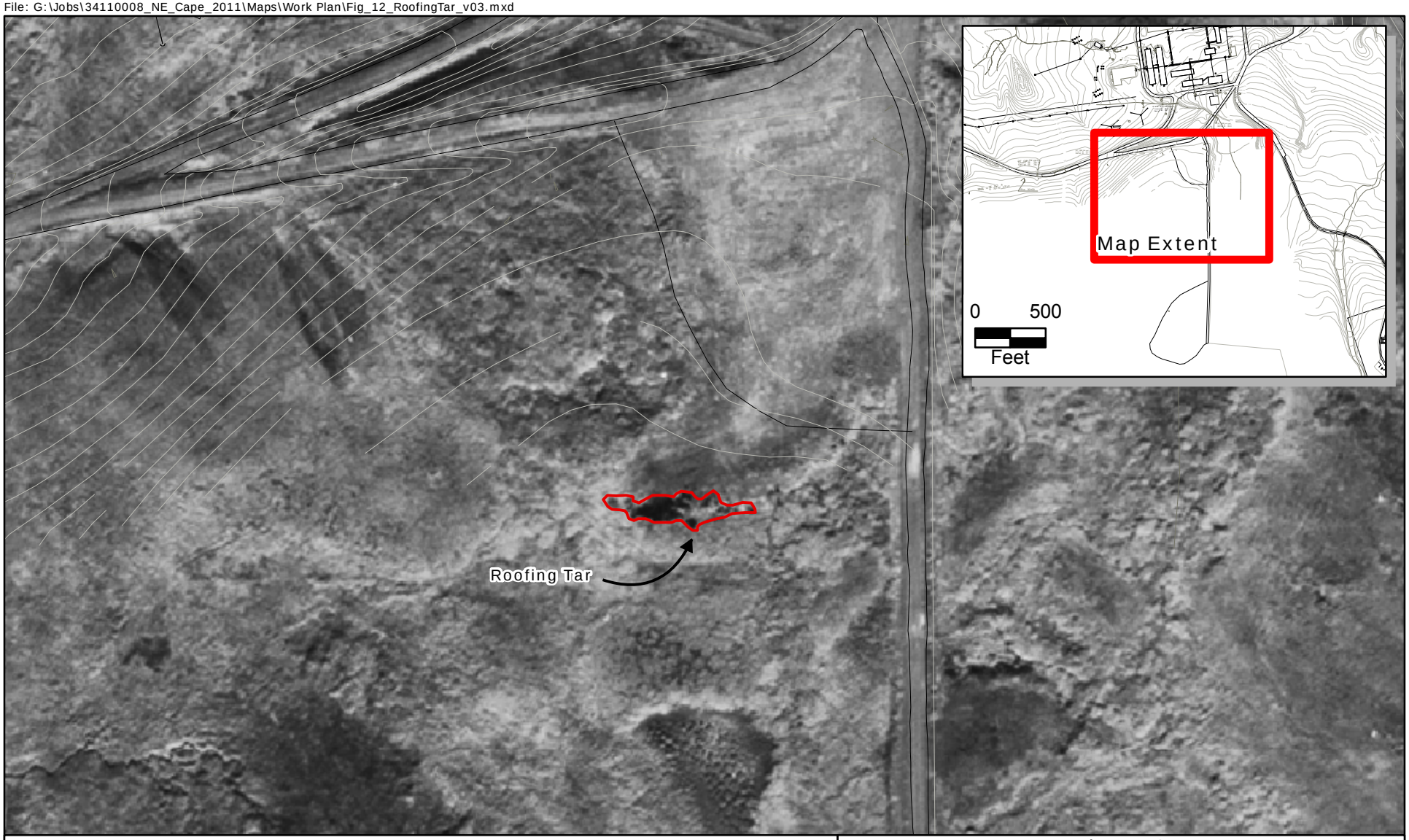

N
W
E
S

0 50 100 200
Feet

Figure 12
Northeast Cape, St. Lawrence Island, Alaska
Northeast Cape HTRW Removal Actions
Roofing Tar Area

Bristol
ENVIRONMENTAL REMEDIATION SERVICES, LLC
Phone (907)563-0013 Fax (907)563-6713
Project No. 410026

DATUM:	DATE	04-20-11	SHEET
NAD83	DWN.	BERS-RJ	1
PROJECTION:	SCALE	1:1,500	of
Alaska State Plane Zone 9	APPRVD.	BERS-MW	1

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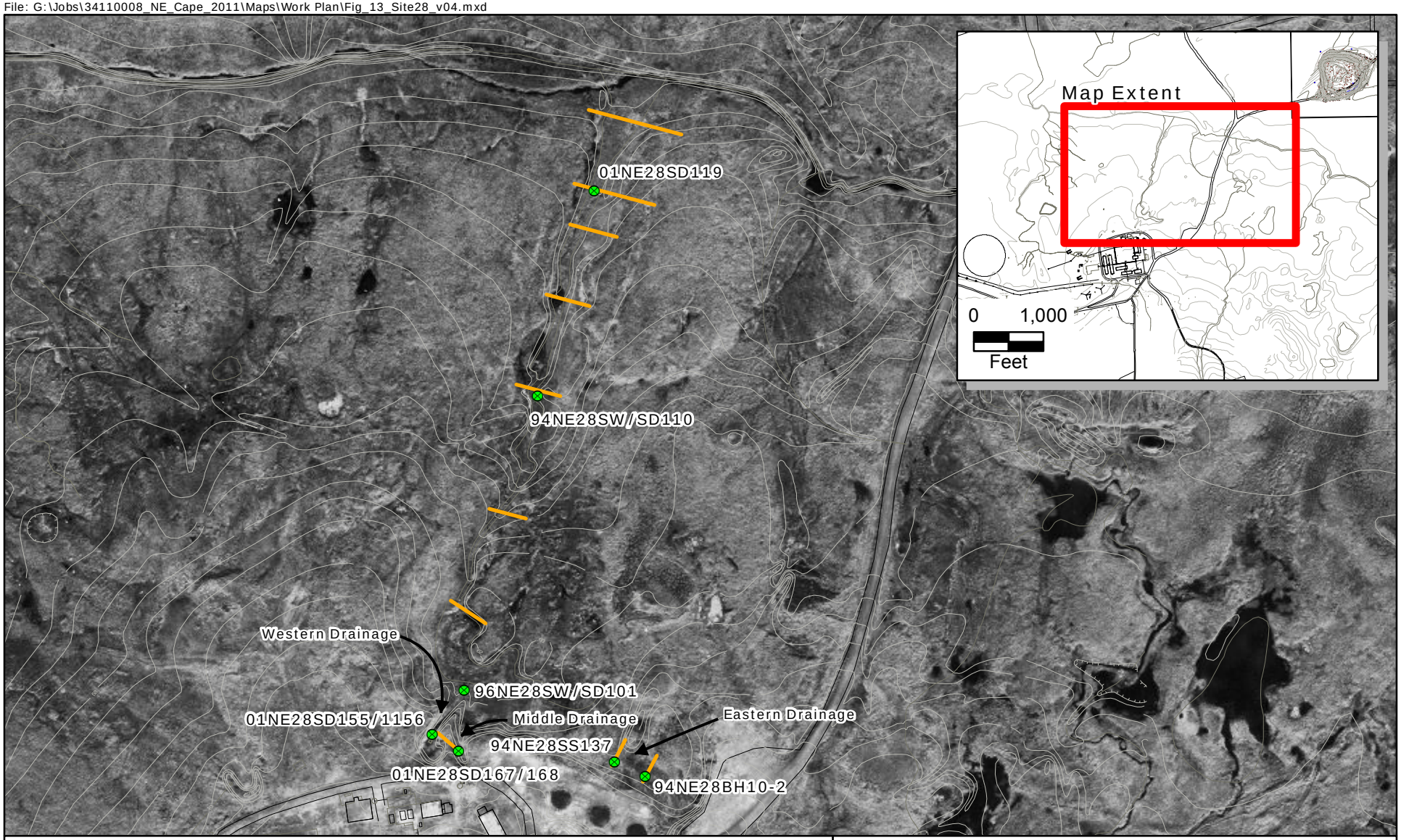

Legend

- Site 28 Historical Samples
- Site 28 Proposed Transects

N W E S

0 100 200 400
Feet

Figure 13
Northeast Cape, St. Lawrence Island, Alaska
Northeast Cape HTRW Removal Actions
Site 28 Drainage Area

Bristol ENVIRONMENTAL REMEDIATION SERVICES, LLC
Phone (907)563-0013 Fax (907)563-6713
Project No. 34110008

DATUM:	DATE	06-29-11	SHEET
NAD83	DWN.	BI-ME	1
PROJECTION:	SCALE	1:4,000	of
Alaska State Plane Zone 9	APPRVD.	BERS-MW	1

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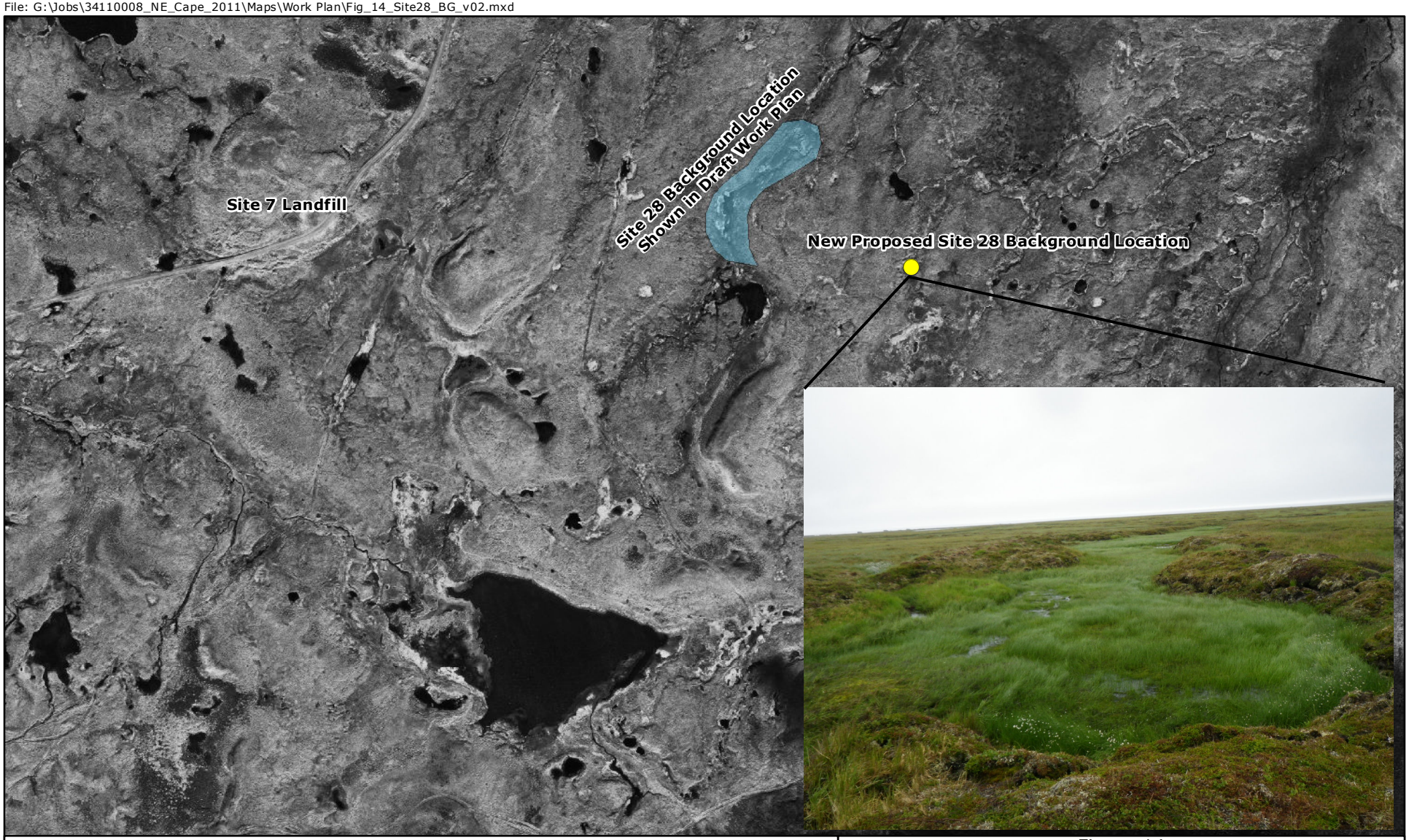


Legend

Background Sample Areas

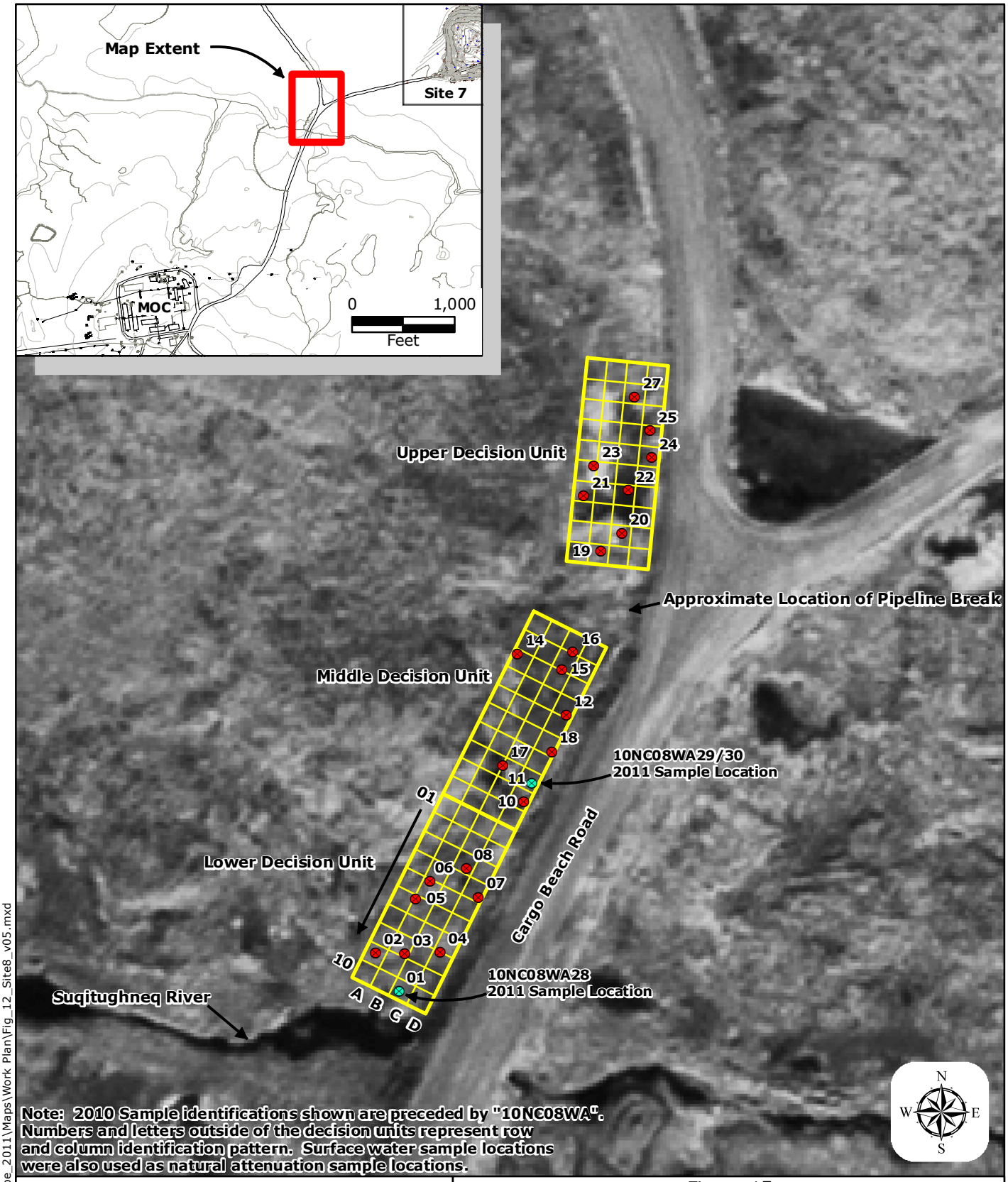
N
W E
S

0 250 500 1,000
Feet

Figure 14
Northeast Cape, St. Lawrence Island, Alaska
Northeast Cape HTRW Removal Actions
Site 28 Background Sample Areas

Bristol
ENVIRONMENTAL REMEDIATION SERVICES, LLC
Phone (907)563-0013 Fax (907)563-6713
Project No. 34110008

DATUM:	DATE 07-24-11	SHEET
NAD83	DWN. BI-ME	1
PROJECTION:	SCALE 1:12,000	of
Alaska State Plane Zone 9	APPRVD. BERS-MW	1



Note: 2010 Sample identifications shown are preceded by "10NC08WA". Numbers and letters outside of the decision units represent row and column identification pattern. Surface water sample locations were also used as natural attenuation sample locations.

Legend

- 2010 Natural Attenuation Water & Soil Sample
- 2010 Surface Water Sample
- Decision Unit

0 25 50
Feet

MOC - Main Operations Complex

Figure 15
Northeast Cape, St. Lawrence Island, Alaska
Northeast Cape HTRW Removal Actions
Site 8 Natural Attenuation Monitoring Area

Bristol
ENVIRONMENTAL REMEDIATION SERVICES, LLC
Phone (907)563-0013 Fax (907)563-6713
Project No. 34110008

DATUM:	DATE	05-05-11	SHEET
NAD83	DWN.	BI-ME	1
PROJECTION:	SCALE	1:800	of
Alaska State Plane Zone 9	APPRVD.	BERS-MW	1

File: G:\Jobs\34110008_NE_Cape_2011\Maps\Work Plan\Fig_12_Site8_v05.mxd

Legend

MOC Monitoring Well

MOC - Main Operations Complex

Note: Feature and contour lines are adapted from Montgomery Watson file, titled "NECAPE.DWG", dated June 5, 2001. Adjusted using resurvey performed by ECO-LAND, LLC, July 2009. UVOST probe locations surveyed by ECO-LAND, LLC and Trimble® GeoXH™.

N W E S

0 100 200
Feet

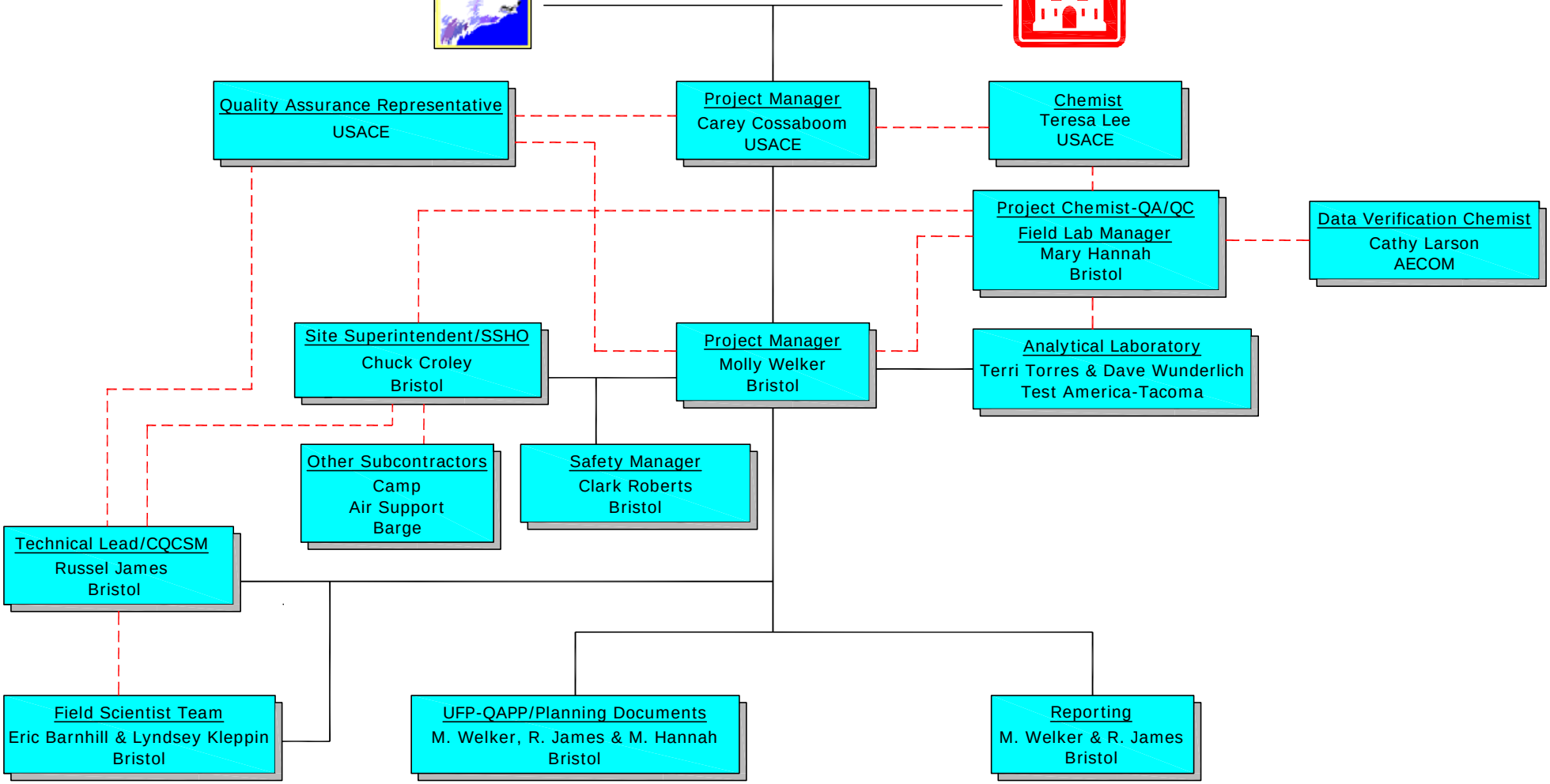
Figure 16
Northeast Cape, St. Lawrence Island, Alaska
Northeast Cape HTRW Remedial Actions
MOC Monitoring Well Locations

Bristol
ENVIRONMENTAL REMEDIATION SERVICES, LLC
Phone (907)563-0013 Fax (907)563-6713
Project No. 34110008

DATUM: NAD 83	DATE 05-03-11	SHEET
PROJECTION: Alaska State Plane Zone 9	DWN. BI-ME	1
	SCALE 1:1,200	of
	APPRVD. BERS-MW	1

File: G:\Jobs\34110008_NE_Cape_2011\Maps\Work Plan\Fig_16_MOCWells_v03.mxd

U. S. Army Corps of Engineers, Alaska District



Legend

CQCSM: Contractor Quality Control Sytems Manager

QA/QC: Quality Assurance / Quality Control

QAPP: Quality Assurance Project Plan

USACE: United States Army Corps of Engineers

Direct Reporting

Lines of Communication

FIGURE 17
NORTHEAST CAPE, ST. LAWRENCE ISLAND, ALASKA
NORTHEAST CAPE HTRW REMOVAL ACTIONS
MANAGEMENT AND SUPPORT ORGANIZATION

Bristol
ENVIRONMENTAL REMEDIATION SERVICES, LLC
Phone (907) 563-0013 Fax (907) 563-6713
PROJECT NO. 34110008

DATUM:	NA
PROJECTION:	NA
PROJECT NO.	34110008
DATE	07/27/11
DWN.	MTG
SCALE	SHOWN
APPRVD.	MW

APPENDIX A

Waste Management Plan

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1.3.1 Laboratory Derived Waste 1
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ATTACHMENT

Attachment 1 Waste Management Forms

ACRONYMS AND ABBREVIATIONS

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CESQG	Conditionally Exempt Small Quantity Generation
CFR	Code of Federal Regulations
CO	Contracting Officer
CON-HTW	containerized hazardous and toxic waste
DOT	U.S. Department of Transportation
EPA	U.S. Environmental Protection Agency
HTRW	hazardous, toxic, and radioactive waste
HWAP	hazardous waste accumulation point
ID	identification
LDR	land disposal restriction
NE Cape	Northeast Cape
QAR	Quality Assurance Representative
RCRA	Resource Conservation and Recovery Act
TDC	Transportation and Disposal Coordinator
TSDF	treatment, storage, and disposal facility
UN	United Nations
USACE	US Army Corps of Engineers, Alaska District
WTSS	Waste Tracking Summary Spreadsheet

1.0 WASTE MANAGEMENT PLAN

1.1 REGULATORY REQUIREMENTS

The handling of wastes will be performed in accordance with the following regulations:

- Title 18 Alaska Administrative Code, Chapters 60, 61, 62, 75, and 78 – Solid and Hazardous Waste Management, Oil and Hazardous Substance Control, and Underground Storage Tank Regulations;
- Title 29 Code of Federal Regulations, Parts 1910 and 1926 (29 CFR 1910 and 1926) – Health and Safety for General Industry and Construction;
- 33 CFR 130 – Financial Responsibility for Water Pollution;
- 40 CFR 60, 61, 260-270, 279, 300-303, and 761 – U.S. Environmental Protection Agency (EPA) – Resource Conservation and Recovery Act (RCRA); Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA); and Toxic Substances Control Act;
- 46 CFR 150, 151, and 153 – U.S. Coast Guard, U.S. Department of Transportation (DOT);
- 49 CFR 171-178 – Hazardous Materials Transportation.

1.2 WASTE MINIMIZATION

Bristol will take all precautions to avoid mixing clean and contaminated material, and will not mix waste streams. When possible, items will be recycled or reclaimed per the requirements of 40 CFR 266, 40 CFR 279, and applicable state requirements.

1.3 ANTICIPATED WASTE STREAMS

Estimates of waste types, estimates of respective waste quantities, and associated shipping container types to be used during the removal project are listed in Table 1-1. Contaminated personal protective equipment generated during waste-handling activities will be added to the appropriate waste stream for disposal.

1.3.1 Laboratory Derived Waste

The field-screening laboratory will generate small quantities of waste that require proper handling and disposal. Anticipated wastes and their estimated volumes are listed in Table 1-1. Soil samples will be extracted using hexane, acetone, and methylene chloride solvents. The solvent streams will be segregated as chlorinated and non-chlorinated solvents in United

Nations (UN)-approved drums and disposed of. Extracted and unextracted soil samples will be added to the appropriate containerized waste soil for disposal. Spent diatomaceous earth, sodium sulfate, and silica gel, will be disposed of with the soil samples. Used disposable glassware will be included in the camp waste stream.

Table 1-1 Estimated Waste Types, Quantities, and Containers

Waste Stream Item No.	Waste Type	Estimated Waste Quantities	Unit/Container Types
1	POL-Contaminated Soil, Non-RCRA	4,500	tons, 8 cy bulk bags
2	PCB-Contaminated Soil, < 50 ppm PCBs	1,000	tons, 8 cy bulk bags
3	PCB-Contaminated Soil, >50 ppm PCBs	500	tons, 8 cy bulk bags
4	Arsenic-Contaminated Soil	10	tons, 8 cy bulk bags
5	Roofing Tar-Contaminated Soil	40	tons, 8 cy bulk bags
6	POL Liquids < 1000 ppm	1	gallons, 55-gallon drum
7	Pure POL Liquids	1	gallons, 55-gallon drum
8	Antifreeze, from equipment, non-RCRA	1	55-gallon drum
9	Antifreeze, from equipment, RCRA	1	55-gallon drum
10	Water Scrubbing Pillows, Absorbents, spent, Non-RCRA	2	55-gallon drum
11	Water Scrubbing Pillows, spent, RCRA, Benzene	1	55-gallon drum
12	Oily PPE/Absorbents, non-RCRA	1	55-gallon drum
13	Ash, Smart Ash Burner, non-RCRA	2	55-gallon drum
14	Miscellaneous Metal Drums	0.25	tons, 20’ intermodal
15	Miscellaneous Metal Debris	10	tons, 20’ intermodal
16	Wooden Poles	15	poles, 20’ intermodal
17	Used Acetone and Hexane Solvent	1	55-gallon drum
18	Used Sulfuric Acid	1	5-gallon drum
19	Methylene Chloride	1	55-gallon drum

Notes:

‘	=	foot	POL	=	petroleum, oil, and lubricants
<	=	less than	PPE	=	personal protective equipment
cy	=	cubic yard	ppm	=	parts per million
lbs	=	pounds	RCRA	=	Resource Conservation Recovery Act
PCB	=	polychlorinated biphenyls	TSCA	=	Toxic Substances Control Act

1.4 HAZARDOUS WASTE MANAGEMENT AND TRANSPORTATION

1.4.1 Waste Classification

To ensure proper disposal, wastes will be classified in accordance with 40 CFR 261; 40 CFR 761; and 40 CFR 61, Subpart M. Each hazardous waste will be evaluated to identify all applicable treatment standards in 40 CFR 268, Land Disposal Restrictions. This site is currently listed as a Conditionally Exempt Small Quantity Generator (CESQG) for RCRA purposes. If sufficient quantities of RCRA waste are generated to warrant a change in generator status, the Quality Assurance Representative (QAR) will be notified, and this should not impact the work schedule.

1.4.2 Accumulation

The containerized hazardous and toxic waste (CON-HTW) items (if necessary) will be collected and consolidated at a hazardous waste accumulation point (HWAP) that will be located on a Main Operations Complex concrete foundation pad. The waste materials will be segregated and consolidated into drums with like materials. The CON-HTW and nonhazardous waste materials will be packaged, labeled, and manifested in accordance with DOT (49 CFR 172-178) and RCRA (40 CFR 260-268) requirements.

For each container stored at the HWAP, a record will be maintained in the field notebook or the appropriate HWAP record sheet. The HTW Waste Tracking Summary Spreadsheet (Attachment 1) will include a running tally of the waste received by date, volume, and type. The HTW Accumulation Summary Sheet will also document field-screening results and any additional comments pertaining to each waste type accumulated and stored at the HWAP.

Bulk solid waste will be placed directly into containers and stored at a container storage area. All containers to be shipped off site will be weighed, marked, and labeled for transportation off site.

1.4.3 Packaging

Hazardous waste liquids will be stored in liquid-tight containers, and incompatibles will be separated. Containers will be compatible to wastes (49 CFR 100-177); will be in good condition; and will be marked in accordance with 40 CFR 262. If used oil is collected, it will be marked in accordance with 40 CFR 279.

1.4.4 Marking and Labeling

Waste containers will be marked and labeled depending on waste composition and hazard class. Unknowns will be marked, "Potential Hazardous Waste Pending Analysis," with date of sampling and suspected hazards. Labels will be added as required by the Hazardous Materials Table in 49 CFR 172.101. All containers of hazardous waste will be marked with the following label and include the information listed below:

- U.S. Army USACE Northeast Cape, Kangukhsam Mt 52.25 Mi ESE of Savoonga, Savoonga, AK 99769, 907-753-2689;
- EPA identification (ID) number (AK0000228395);
- Manifest document number;
- Accumulation start date;
- EPA waste number; and
- Proper shipping name, as determined in 49 CFR 172.101.

Containers of PCB wastes will be marked with the following label and include the information listed below:

- Chemtrac (800) 424-9300

If applicable, containers of nonhazardous waste will be marked with the following label and include the information listed below:

- U.S. Army USACE Northeast Cape, Kangukhsam Mt 52.25 Mi ESE of Savoonga, Savoonga, AK 99769, 907-753-2689;
- Proper shipping name, as determined in 49 CFR 172.101;
- UN or North American number; and
- Contents.

1.4.5 Off-site Materials Management

All hazardous wastes will be transported in accordance with DOT regulations (49 CFR) and Environment Canada regulations for transit of hazardous wastes. All forms discussed in this section may be reviewed in Attachment 1.

1.4.5.1 <u>Placarding</u>

Hazardous materials and wastes shipped off-island will be placarded in accordance with 49 CFR 172, Subpart F. Any quantity of material listed in Table 1-2 (below) must be placarded. If a placard is required, it will be affixed on each of the four sides of the container.

Table 1-2 Placard Required for Any Quantity

Category of Material (Hazard Class or Division Number and Additional Description, as Appropriate)	Placard Name	Placard Design Section Reference (Section)
4.3	Dangerous When Wet	172.548
2.1	Flammable Gas	172.532
2.2	Non-Flammable Gas	172.528
3	Flammable Liquid	172.542
Combustible liquid	Combustible	172.544
4.1	Flammable Solid	172.546
4.2	Spontaneously Combustible	172.547
6.2	None	--
8	Corrosive	172.558
9	Class 9 [see Section 172.504(f)(9)]	172.560
ORM-D	None	--

Notes:
ORM-D = Other Regulated Materials-Domestic

1.4.5.2 United States Documentation

Bristol, in accordance with the requirements of 40 CFR 262, will prepare a Uniform Hazardous Waste Manifest, EPA Form 8700-22, for all hazardous wastes (as defined in 40 CFR 262) that are transported for off-site treatment, storage, or disposal. For each waste type, the following information will be provided:

- Proper shipping names, as determined by 49 CFR 172, Section 101;
- Hazard class or division;
- ID number;
- Packaging group;
- Total quantity;
- Technical and chemical group names;
- Emergency Response Guidebook numbers.

Also included on each manifest will be the following:

- The Generator's EPA ID number,
- Transporter names and associated transporter EPA ID numbers,
- A 24-hour emergency response number (Chemtrac at 800-424-9300),
- Generator and transporter signatures,
- Shipper's certification.

A US Army Corps of Engineers® (USACE) government representative will sign the manifests.

Bristol will prepare chain of custodies and shipper's declarations, if required, for laboratory samples.

Bills of lading will be prepared documenting shipping containers to be shipped off site. Hazardous and nonhazardous manifest numbers will be referenced on the bills of lading. Bills of lading requiring shipper's certifications will be signed by the QAR or, if not available, the Transportation and Disposal Coordinator (TDC).

Nonhazardous waste items scheduled for disposal at a permitted landfill or recycling center will be tracked with a nonhazardous waste manifest. For each waste type, the following information will be provided:

- Proper shipping names, as determined by 49 CFR 172, Section 101;
- Hazard class or division;
- ID number;
- Packaging group;
- Total quantity;
- Technical and chemical group names;
- Emergency Response Guidebook numbers.

Also included on each manifest will be the following:

- The proper EPA ID number,
- Transporters,
- A 24-hour emergency response number (Chemtrec at 800-424-9300),

- Generator and transporter signatures,
- Shipper's certification.

A land disposal restriction (LDR) notification will be prepared as required by 40 CFR 268. A USACE government representative will sign the LDR notification.

1.4.5.3 Canadian Documentation

The Basel Convention, which Canada ratified in August 1992, prohibits the shipment of hazardous wastes across international borders without prior notification and approval. International shipments of hazardous waste that pass into, through, or out of Canada are subject to the requirements of the Export and Import of Hazardous Wastes regulations.

Hazardous wastes shipped from Northeast Cape (NE Cape) to Washington by barge will pass in transit through Canadian waters. A Canadian Transit Notice will be completed and sent to the appropriate Canadian authority before shipment of hazardous waste through Canadian waters. The Canadian Confirmation Letter will be provided to the Contracting Officer (CO) upon its receipt. In addition, Canadian manifest forms will be completed for all hazardous waste streams, in the event that these wastes may land on Canadian soil.

The contractor will sign the Canadian manifests.

1.4.5.4 Manifest Document Review

A complete manifest packet for the off-site shipment at the end of the field season will be generated prior to shipment. The packet will include all of the following:

- Hazardous waste manifests;
- Nonhazardous waste manifests;
- Canadian documentation;
- Waste profiles;
- Waste Shipment Records and LDRs;
- Analytical results, where applicable;
- Material Safety Data Sheets, when available;
- Generator's Certification Statement regarding packaging, marking, labeling, and placarding;

- A certification signed by the TDC that the packet is correct.

Disapproved documents will be returned for revision. Approved documents will be provided to the TDC prior to shipment.

1.4.5.5 Manifest Copy Distribution

Final copies of the manifests and transportation documents will be included as an appendix in the final Hazardous, Toxic, and Radioactive Waste (HTRW) Report.

1.5 TRANSPORTATION

Wastes scheduled for off-island disposal will be sent as one waste shipment at the end of the 2011 field season. Wastes will be transported by barge from NE Cape to Seattle, Washington, (intermediate stops are anticipated) and then sent by truck and/or rail to their respective disposal/recycling facilities.

1.6 TREATMENT, RECYCLING, AND DISPOSAL

Hazardous materials, hazardous wastes, and solid wastes removed from the site and generated during removal activities will be treated, recycled, or disposed of as listed in Table 1-3.

Table 1-3 Waste Types and Disposition

Waste Stream Code	Waste Type	Final Treatment/ Disposal	Treatment Facility/ Location
1	POL-Contaminated Soil, non-RCRA	Disposal in Subtitle D Landfill	Columbia Ridge Recycling & Landfill - Arlington, OR
2	PCB-Contaminated Soil, < 50 ppm PCBs	Disposal in Subtitle D Landfill	Columbia Ridge Recycling & Landfill - Arlington, OR
3	Arsenic-Contaminated Soil, non-RCRA	Disposal in Subtitle D Landfill	U.S. Ecology Idaho, Inc. Grand View, Idaho
4	Miscellaneous Metal Debris	Disposal in Subtitle D Landfill	Emerald Services, Inc. Tacoma, Washington
5	Roofing tar-Contaminated Soil, non-RCRA	Disposal in Subtitle D Landfill	Columbia Ridge Recycling & Landfill - Arlington, OR
6	Wooden Poles	Disposal in Subtitle D Landfill	Columbia Ridge Recycling & Landfill - Arlington, OR

Table 1-3 Waste Types and Disposition (continued)

Waste Stream Code	Waste Type	Final Treatment/ Disposal	Treatment Facility/ Location
7	PCB Contaminated Soil, TSCA, > 50 ppm PCBs	Disposal in Subtitle C Landfill	Chemical Waste Management of the Northwest - Arlington, OR
8	Hazardous Soil, RCRA	Disposal in Subtitle C Landfill	Chemical Waste Management of the Northwest - Arlington, OR
9	Water Scrubbing Pillows, spent, non-RCRA	Disposal in Subtitle C Landfill	Chemical Waste Management of the Northwest - Arlington, OR
10	Off-Spec used Oil, non-RCRA	Energy Recovery/ Fuel Blending	Chemical Waste Management of the Northwest - Arlington, OR
11	Oily PPE/Absorbents, non-RCRA	Disposal in Subtitle C Landfill	Chemical Waste Management of the Northwest - Arlington, OR
12	Antifreeze, from equipment, non-RCRA	Recycling	Chemical Waste Management of the Northwest - Arlington, OR
13	Antifreeze, from equipment, RCRA	Recycling	Chemical Waste Management of the Northwest - Arlington, OR
14	Water Scrubbing Pillows, spent, RCRA, Benzene	Disposal in Subtitle C Landfill	Chemical Waste Management of the Northwest - Arlington, OR
15	Ash, Smart Ash Burner, non-RCRA	Disposal in Subtitle C Landfill	U.S. Ecology Idaho, Inc. Grand View, Idaho
16	Used Acetone and Hexane Solvent	Fuel Blending	U.S. Ecology Idaho, Inc. Grand View, Idaho
17	Used Sulfuric Acid	Disposal in Subtitle C Landfill	U.S. Ecology Idaho, Inc. Grand View, Idaho
18	Methylene Chloride	Recycling/Incineration	U.S. Ecology Idaho, Inc. Grand View, Idaho

Notes:

<	=	less than	ppm	=	parts per million
>	=	greater than	RCRA	=	Resource Conservation Recovery Act
PCBs	=	polychlorinated biphenyls	Off-Spec	=	off-specification
POL	=	petroleum, oil, and lubricants	OR	=	Oregon
PPE	=	personal protective equipment	TSCA	=	Toxic Substances Control Act

All facilities used for off-site disposal have been reviewed and are approved by the Defense Reutilization Marketing Service. Proposed recycling/disposal facility information is listed in Table 1-4.

Table 1-4 Proposed Recycling and Waste Disposal Facilities

Facility Name:	Chemical Waste Management of the Northwest				
Facility Address:	17629 Cedar Springs Lane				
City:	Arlington	State:	OR	Zip Code:	97812
Phone:	(541) 454-2030				
EPA I.D. #:	ORD089452353				
Facility Name:	Columbia Ridge Recycling and Landfill				
Facility Address:	18177 Cedar Springs Lane				
City:	Arlington	State:	OR	Zip Code:	97812
Phone:	(541) 454-2030				
EPA I.D. #:	ORD987173457				
Facility Name:	U.S. Ecology, Inc.				
Facility Address:	20400 Lemley Road				
City:	Grand View, ID 83624				
Phone:	(800) 274-1516				
EPA I.D. #:	IDD073114654				
Facility Name:	Emerald Services, Inc.				
Facility Address:	1825 Alexander Avenue				
City:	Tacoma, WA 98421				
Phone:	(206) 832-3100				
EPA I.D. #:	WAD981769110				

1.7 DOCUMENTATION AND REPORTING

1.7.1 Waste Tracking Requirements

Bristol's TDC will track all off-site shipments on a Waste Tracking Summary Spreadsheet (WTSS), as shown in Attachment 1. A copy of the final WTSS will be included in the final Remedial Action Report.

1.7.2 Packaging Certifications and Exception Reporting

For any Uniform Hazardous Waste Manifests that are shipped, Bristol will verify that the generator has received a copy of the signed manifest from the treatment, storage, and disposal facility (TSDF) on or before the 35th day after transport from NE Cape. If the generator has not received a signed copy on or before the 35th day after transportation from NE Cape, Bristol will contact the transporter/facility owner to locate where in the transportation process the waste is currently located.

On the 40th day, Bristol will again verify whether the generator has received a copy of the signed manifest from the TSDF. If the generator has not received a copy of the signed manifest, Bristol will prepare an exception report to be filed with EPA Region 10 in accordance with 40 CFR 262.42. A copy of the report will be provided to the CO no later than the 42nd day after the transportation ship date for approval prior to submittal to EPA Region 10.

1.7.3 Violations and Discrepancies

In the event that notices of noncompliance or notices of violations are issued to the contractor, they will be submitted to the CO immediately. All relevant documentation regarding the incident will be provided to the CO, and any response shall be coordinated through the CO. Bristol will provide all documentation related to this issue to the CO until the matter is resolved.

When the amount of hazardous waste designated on a manifest and the quantity of hazardous waste received at the disposal facility do not agree, a discrepancy report will be filed as required by 40 CFR 264.72. If required, Bristol will submit this report to the CO five days before it is required by the EPA.

1.7.4 Transportation and Disposal Appendix

To document all wastes generated and managed during this project, a Transportation and Disposal Appendix will be included in the final HTRW Report. The appendix will include a summary of all wastes generated, quantities, and final disposition of the wastes. The appendix will include copies of the following documentation:

- United States Uniform Hazardous Waste Manifests;
- Land Disposal Restriction Forms;
- Nonhazardous Waste Manifests;
- Material Safety Data Sheets;
- Laboratory Results;
- Canadian Manifests and Transit Notices;
- Bills of Lading;
- Certificates of Weight;
- Certificates of Disposal;
- Exception Reports and Discrepancy Reports, if applicable;
- Waste Photographs;

A waste tracking log listing all wastes, container numbers, weights, manifest and profile numbers, and dates for shipping and receiving.

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ATTACHMENT 1

Waste Management Forms

Certification Statement Form

Exception Report

Canadian Movement Document

Canadian Transit Notice Form

Container Tracking Spreadsheet

Land Disposal Restriction Notification

Non-Hazardous Waste Manifest

PCB Control Sheet

Uniform Hazardous Waste Manifest

Waste Tracking Summary Spreadsheet

Bristol
ENVIRONMENTAL
REMEDIATION SERVICES, LLC

111 W. 16th Avenue, Third Floor
Anchorage, Alaska 99501
(907) 563-0013 Phone
(907) 563-6713 fax

CERTIFICATION STATEMENT

This is to certify that the NE Cape generated wastes to be shipped from NE Cape, St. Lawrence Island, Alaska during the month of September 2010 under the Uniform Hazardous Waste Manifest Documents No. _____, _____, and _____ were properly classified, described, packaged, marked, and labeled and were in proper condition for transportation according to the applicable regulations of DOT, EPA, and Washington State laws and regulations.

_____

Printed Name/Title

_____

Signature/Date

EXAMPLE

Bristol
ENVIRONMENTAL
REMEDIATION SERVICES, LLC

111 W. 16th Avenue, Third Floor
Anchorage, Alaska 99501
(907) 563-0013 Phone
(907) 563-6713 fax

October 21, 2010

Xiang-Yu Ge
U.S. Environmental Protection Agency
Region 10
1200 Sixth Avenue (S.O. 141)
Seattle, Washington 98101

Subject: Exception Report for NE Cape, St. Lawrence Island, Alaska
Uniform Hazardous Waste Manifest

Xiang-Yu Ge,

Attached is a copy of uniform hazardous waste manifest _____, for hazardous wastes shipped from the NE Cape location on St. Lawrence Island, Alaska. The Treatment, Storage, and Disposal Facility (TSDF) signed copy has not been received by the generator as of _____. It has been determined that the materials are currently in transit from _____ to _____. The wastes are estimated to arrive on _____.

If you need further information or have questions relating to this issue, please contact me.

Sincerely,

Bristol Environmental
Remediation Services, LLC

Tyler Ellingboe
Project Manager/Sr. Waste Specialist

EXAMPLE

MOVEMENT DOCUMENT / MANIFEST
DOCUMENT DE MOUVEMENT / MANIFESTE

This Movement document/manifest conforms to all federal and provincial transport and environmental legislation.
Ce document de mouvement/manifeste est conforme aux législations fédérale et provinciale sur l'environnement et le transport.

EXAMPLE ONLY

~~9223060-6~~

Movement Document / Manifest Reference No.
N° de référence du document de mouvement/manifeste

A Generator / consignor / Producteur / expéditeur

Registration No. / Provincial ID No. / N° d'immatriculation - d'id. provincial 1

Company name / Nom de l'entreprise

Mailing address / Adresse postale | City / Ville | Province | Postal code / Code postal

E-mail / Courrier électronique | Tel. No. / N° de tél. ( )

Shipping site address / Adresse de lieu de l'expédition

City / Ville | Province | Postal code / Code postal

Intended Receiver / consignee / Réceptionnaire / destinataire prévu 2

Registration No. / Provincial ID No. / N° d'immatriculation - d'id. provincial

Mailing address / Adresse postale | City / Ville | Province | Postal code / Code postal

E-mail / Courrier électronique | Tel. No. / N° de tél. ( )

Receiving site address / Addresse de lieu de l'expédition

City / Ville | Province | Postal code / Code postal

B Carrier / Transporteur

Registration No. / Provincial ID No. / N° d'immatriculation - d'id. provincial 23

Company name / Nom de l'entreprise

Mailing address / Adresse postale | City / Ville | Province | Postal code / Code postal

E-mail / Courrier électronique | Tel. No. / N° de tél. ( )

Vehicle / Véhicule	Registration No. / N° d'immatriculation	Prov. 24
Trailer - Rail car No. 1 / 1re remorque - wagon		
Trailer - Rail car No. 2 / 2e remorque - wagon		

Port of entry / Point d'entrée — International use only | Port of exit / Point de sortie — International use only 25

Carrier Certification : *I certify that I have received waste or recyclable material from the generator / consignor for delivery to the receiver / consignee as set out in Part A and that the information contained in Part B is complete and correct.* ***Attestation du transporteur :*** *J'atteste avoir reçu les déchets ou matières recyclables du producteur / expéditeur en vue de leur livraison au réceptionnaire / destinataire, tels qu'ils figurent à la partie A et que les renseignements inscrits à la partie B sont exacts et complets.* 26

Name of authorized person (print): / Nom de l'agent autoriré (caractères d'imprimerie) : | Tel. No. / N° de tél. ( )

Year / Année | Month / Mois | Day / Jour | Signature :

Reference Nos. of other movement document(s)/manifest(s) used / N° de référence des autres documents de mouvement/manifestes utilisés

C Receiver / consignee / Réceptionnaire / destinataire

Registration No. / Provincial ID No. / N° d'immatriculation - d'id. provincial

Receiver / consignee information same as in Part A
Les renseignments du réceptionnaire / destinataire est la même qu'à la Partie A

☐ Yes / Oui ☐ No, complete the box below / Non, remplir la case ci-dessous

Company name / Nom de l'entreprise

Mailing address / Adresse postale

City / Ville | Province | Postal code / Code postal

E-mail / Courrier électronique | Tel. No. / N° de tél. ( )

Receiving site address / Addresse de lieu de destination

Date received / Date de réception: Year / Année | Month / Mois | Day / Jour

Time / Heure 29 ☐ A.M. ☐ P.M.

If waste or recyclable material to be transferred, specify intended company name/ Si les dechets ou matières recyclables doivent être transférés, préciser le nom du destinataire 30

Registration No./Provincial ID No. / N° d'immatriculation/d'id provincial

	Prov. code / Code prov. 3	Shipping name / Appellation réglementaire 4	Class / Classe 5 Sub. class(es) / Classe(s) sub.	UN No. / N° NU 6	Packing / risk gr. / Gr. d'emballage/ de risque 7	Quantity shipped / Quantité expédiée	Units 8 L or / ou Kg / Unités	Packaging/Contenant 9 No. / N°	Codes Int.– ext.	Phys. state / État phys. 10
(i)										
(ii)										
(iii)										
(iv)										

Quantity received / Quantité reçue	Units 31 L or / ou kg / Unités	Comments / Commentaires 32	Handling Code / Code de manutention 33	Shipment / Envoi 34 Accepted / Accepté	Refused / Refusé	Decont. Pack. / Cont.	Vel / Vé

	Notice No. / N° de notification 11	Notice Line No / N° de ligne de la notification	Shipment / Envoi 12	Of / De	D or R code / Code E ou R 13	C code / Code C 14	Basel Annex VIII or OECD Code / Annexe VIII de Bâle ou Code OCDE 15	H code / Code H 16	Y code / Code Y 17	National code in country of / Code du pays 18 Export / Exportation	Import / Importation	Customs code(s) / Code(s) de douanes 19
(i)												
(ii)												
(iii)												
(iv)												

International use only

If handling code "Other" (specify) / Si code de manutention « autre » (spécifier) 3

Receiver / consignee certification : *I certify that the information contained in Part C is correct and complete. /* ***Attestation du réceptionnaire / destinataire :*** *J'atteste que tous les renseignements à la partie C sont exacts et complets.*

Name of authorized person (print) / Nom de l'agent autorisé (caractère d'imprimerie)

Signature | Tel. No. / N° de tél. ( )

Generator / consignor certification: *I certify that the information contained in Part A is correct and complete.*
Attestation du producteur / expéditeur: *J'atteste que tous les renseignements à la partie A sont exacts et complets.*

Name of authorized person (print) / Nom de l'agent autorisé (caractère d'imprimerie) | Signature | Tel. No. / N° de tél. ( ) 20

Special handling / Manutention spéciale 2

☐ Attached /Ci-joint: ☐ As follows/ Ci-contre :

21 Date shipped / Date d'expédition: Year / Année | Month / Mois | Day / Jour

Time / Heure ☐ A.M. ☐ P.M

Scheduled arrival date / Date d'arrivée prévue: Year / Année | Month / Mois | Day / Jour

MOE 04-1917 (06/05)

Instructions for completion and distribution on reverse / Instructions pour compléter et distribuer au verso

Copy / Copie 1 (white / blanche

Environment Canada / Environnement Canada

NOTICE – NOTIFICATION

Notice Reference No.: / N° de référence de la notification :	Page : ____ of / de : ____

Administrative form for proposed movements of hazardous wastes or hazardous recyclable materials
Formulaire administratif en vue de projets d'envois de déchets dangereux et de matières recyclables dangereuses

1 OPTION Indicate the option that applies to this notice. / Indiquez l'option qui s'applique à cette notification.
☐ Disposal / Élimination ☐ Recycling / Recyclage ☐ Recycling, Pre-approved Facility / Recyclage, Installation approuvée au préalable

2 EXPORTER OR FOREIGN EXPORTER EXPORTATEUR OU EXPÉDITEUR ÉTRANGER		3 FOREIGN RECEIVER OR IMPORTER DESTINAIRE ÉTRANGER OU IMPORTATEUR	
Registration Number: / N° d'immatriculation :		Registration Number: / N° d'immatriculation :	
Name: / Nom : Address: / Adresse :	Shipping Site Address: / Adresse du site d'envoi :	Name: / Nom : Address: / Adresse :	Receiving Site Address: / Adresse du site de réception :
Tel. No.: / N° de tél. : ( )	Fax No.: / N° de téléc. : ( )	Tel. No.: / N° de tél. : ( )	Fax No.: / N° de téléc. : ( )
E-mail address: / Adresse électronique :	Contact person: / Personne ressource :	E-mail address: / Adresse électronique :	Contact Person: / Personne ressource :
Name of Insurance Company: / Nom de l'assureur :	Policy No.: / N° de Police :	Name of Insurance Company: / Nom de l'assureur :	Policy No.: / N° de Police :

4 AUTHORIZED CARRIER TRANSPORTEUR AGRÉÉ		5 AUTHORIZED FACILITY (IF OPERATION D13, D14, D17, R12 R13, R16) INSTALLATION AGRÉÉE (DANS LE CAS DES OPÉRATIONS D13, D14, D17, R12, R13 OU R16)	
Registration Number: / N° d'immatriculation :		Registration Number: / N° d'immatriculation :	
Name: / Nom : Address: / Addresse :	Modes of Transport: Moyens de transport : ☐ Road/Route ☐ Rail/Rail ☐ Marine/Mer ☐ Air/Air If other authorized carriers used, attach a list. S'il y a d'autres transporteurs agréés, annexez une liste. ☐ Attached / ci-joint	Name: / Nom : Address: / Adresse :	Receiving Site Address: / Adresse du site de réception : ☐ Attached / ci-joint
Tel. No.: / N° de tél. : ( )	Fax No.: / N° de téléc. : ( )	Line No.: / N° de la ligne. :	D/R code: / Code D/R :
E-mail address: / Adresse électronique :	Contact person: / Personne ressource :	Tel. No.: / N° de tél. : ( )	Fax No.: / N° de téléc. : ( )
Name of Insurance Company: / Nom de l'assureur :	Policy No.: / N° de Police :	E-mail address: / Adresse électronique :	Contact person: / Personne ressource :

SHIPPING DETAILS – DÉTAILS SUR LES ENVOIS

6 NUMBER OF SHIPMENTS:
NOMBRE D'ENVOIS :

7 PORT OF EXIT / ENTRY OR CUSTOMS OFFICE(S):
BUREAU(X) DE DOUANE OU POINT DE SORTIE/D'ENTRÉE : ☐ Attached / ci-joint

8 FIRST AND LAST SHIPMENTS :
PREMIER ET DERNIER ENVOIS :

	Y - A	M - M	D - J		Y - A	M - M	D - J
First / Premier				Last / Dernier			

9 TRANSIT COUNTRY(IES) / PAYS DE TRANSIT
Country: / Pays :
Length of Stay: / Durée du transit :
☐ Attached / ci-joint

10 HAZARDOUS INFORMATION / RENSEIGNEMENTS DANGEREUX - (For additional hazardous information please see Appendix to the Notice. / Veuillez consulter l'annexe à la notification pour des renseignements dangereux supplémentaires.)

International Waste Identification Code (IWIC) Code international d'identification des déchets (CIID)	Basel Annex VIII or OECD App. 4 Code / Annexe VIII de Bâle ou App. 4 Code OCDE	TDGR PIN NIP du RTMD	Class Classe	Quantity Quantité	Packing / Risk Group Groupe d'emballage/ risque
1)				☐ kg ☐ L	

Customs Code Code de douane	ID No & Description of Sch. 3-7 N° d'id. et description de l'Ann. 3 à 7	POP name, quant. & conc. POP nom, quant. et conc.	Description(s) of the D/R process(es) to be used Description(s) du (des) processus D/R mis en oeuvre

11 EXPORTS OF HAZARDOUS WASTE: Options considered for reducing or phasing out of the waste and the reason the disposal is happening outside of Canada
EXPORTATION DE DÉCHETS DANGEREUX : Solutions envisagées pour réduire ou pour supprimer les déchets et les raisons pour l'élimination en lieu étranger

12 STATEMENT OF PERSON SUBMITTING THE NOTICE: In the case of an export or import, the contract(s) referred to in paragraphs 9(f) or 16(e) is/are in force and if the waste or material cannot be disposed of or recycled in accordance with the export or import permit, the exporter or importer will undertake alternative arrangements required under the Regulations or will return the waste or material to the facility from which it was imported in accordance with s. 34 or 35. In the case of an export, import or transit, the insurance policy will cover the period specified by the Regulations and the information in the notice is complete and correct.

DÉCLARATION PAR L'AUTEUR DE LA NOTIFICATION : Dans le cas d'une exportation ou d'une importation, le(s) contrat(s) visé(s) aux alinéas 9f) ou 16e) est (sont) en vigueur et si les déchets ou les matières ne peuvent être éliminés ou recyclés conformément au permis d'exportation ou d'importation, l'exportateur ou l'importateur mettra en oeuvre les mesures d'arrangements alternatifs prévues au Règlement ou à les ramener à l'installation d'origine conformément aux articles 34 ou 35. Dans le cas d'une exportation, d'une importation ou d'un transit, la police d'assurance sera en vigueur pour la période visée par le Règlement, et les renseignements figurant à la notification sont complets et exacts.

Name: / Nom :	Signature:	Date:	Tel. No.: / N° de tél. :

Bristol
ENVIRONMENTAL
REMEDIATION SERVICES, LLC

Container Tracking Spreadsheet

Date:

Container Number	Container Type	Container ID	Gross/ Tare/ Net Masses	Manifest/ Bill of Lading Code	Contents	Transportation Start Date	TSDF Destination	Current Location	Date Received at TSDF

U.S. Army Corps of Engineers, Alaska District
NE Cape HTRW Remedial Actions
NE Cape, St. Lawrence Island, Alaska
Contract No. W911KB-06-D-0007
BERS Project No. 34110008

Emerald Services RCRA Land Disposal Restriction Notification Form EZ

(This form is applicable to characteristic (D codes), listed waste (F, K, U and P codes), Contaminated Soil and Hazardous Debris)

Generator: U.S. E.P.A. I.D. #:
Profile #: Manifest #:

The wastes identified in this form are subject to the land disposal restrictions of 40CFR Part 268. The wastes do not meet the treatment standards specified in Part 268 , Subpart D or do not meet the applicable prohibition levels specified in 268.32 or RCRA Section 3004(d). Pursuant to 40CFR 256.7(a), the required information applicable to each waste is identified below *(check all boxes that apply):*

Treatability Group: ☐ Wastewater ■ Non-Wastewater

(Wastewaters containing less than 1% filterable solids and less than 1% Total Organic Carbon)

- ☐ **D001 Ignitable (except for high TOC) managed in non-CWA/non-CWA equivalent non-Class I SDWA systems** *(Complete Form U.C. Underlying hazardous constituents need not be addressed if the waste is to be combusted or recovered.)*
- ☐ D001 Ignitable (except for high TOC) managed in CWA/CWA-equivalent /Class I SDWA systems
- ☐ D001 High TOC Ignitable (Greater than 10% organic carbon)
- ☐ **D002 Corrosive managed in non-CWA/non-CWA-equivalent/non Class I SDWA systems** *(Complete Form U.C.)*
- ☐ D002 Corrosive managed in CWA/CWA-equivalent /Class I systems
- ☐ D003 Reactive Sulfides based on 261.23(a)(5)
- ☐ D003 Reactive Cyanides based on 261.23(a)(5)
- ☐ **D003 Water Reactives based on 261.23(a)(2), (3), and (4) managed in non-CWA/non-CWA-equivalent/non-Class I SDWA systems** *(Complete Form U.C.)*
- ☐ D003 Water Reactives based on 261.23(a)(2), (3) and (4) managed in CWA/CWA-equivalent /Class I SDWA systems
- ☐ D003 Other Reactives based on 261.23(a)(1)

If D004 – D043 boxes are checked, complete and attach Form U.C. to address underlying hazardous constituents (unless these wastes are to be managed in a CWA/CWA-equivalent/Class I SDWA system):

- ☐ D004 Arsenic
- ☐ D005 Barium
- ☐ D006 Cadmium
- ☐ D007 Chromium
- ☐ D008 Lead
- ☐ D009 Mercury
- ☐ D010 Selenium
- ☐ D011 Silver
- ☐ D012 Endrin
- ☐ D013 Lindane
- ☐ D014 Methoxychlor
- ☐ D015 Toxaphene
- ☐ D016 2,4-D
- ☐ D017 2,4,5-TP (Silvex)
- ☐ D018 Benzene
- ☐ D019 Carbon Tetrachloride
- ☐ D020 Chlordane
- ☐ D021 Chlorobenzene
- ☐ D022 Chloroform
- ☐ D023 *o*-Cresol
- ☐ D024 *m*-Cresol
- ☐ D025 *p*-Cresol
- ☐ D026 Cresols (Total)
- ☐ D027 *p*-Dichlorobenzene
- ☐ D028 1,2-Dichloroethane
- ☐ D029 1,1-Dichloroethylene
- ☐ D030 2,4-Dinitrotoluene
- ☐ D031 Heptachlor
- ☐ D032 Hexachlorobenzene
- ☐ D033 Hexachlorobutadiene
- ☐ D034 Hexachloroethane
- ☐ D035 Methyl Ethyl Ketone
- ☐ D036 Nitrobenzene
- ☐ D037 Pentachlorophenol
- ☐ D038 Pyridine
- ☐ D039 Tetrachloroethylene
- ☐ D040 Trichloroethylene
- ☐ D041 2,4,5-Trichlorophenol
- ☐ D042 2,4,6-Trichlorophenol
- ☐ D043 Vinyl Chloride

<u>In addition, the following wastes are included in this shipment:</u>

- ☐ F001 – F005 Spent Solvents. (If this box is checked, complete F001-F005 section on the back of this form. Check the hazardous number(s) that apply and identify the constituents likely to be present in the waste.)
- ☐ **F039 Multisource Leachate. If this box is checked, complete and attach Form U.C. to identify the individual constituents**.
- ☐ Contaminated Soil that meets the LDR standard found in 268 Subpart D (If this box is checked, complete the Contaminated Soil section on the back of this form.)
- ☐ Hazardous Debris (If this box is checked, complete the Hazardous Debris section on the back of this form.)

If this shipment carries additional waste codes that are not addressed above, identify them here:

EPA Waste Code	Subcategory (if any)	EPA Waste Code	Subcategory (if any)	EPA Waste Code	Subcategory (if any)
_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____

F001 – F005 Spent Solvents (Form EZ Page 2)

Check the box (es) that apply. Identify the individual constituents likely to be present.

Hazardous Waste Description	Regulated Hazardous Constituents	
☐ F001 Spent Halogenated Solvents used in Degreasing	☐ Carbon Tetrachloride ☐ Tetrachloroethylene ☐ Trichloroethylene ☐ Trichloromonofluoromethane	☐ Methylene Chloride ☐ 1,1,1-Trichloroethane ☐ 1,1,2-Trichloro-1,2,2-trifluoroethane
☐ F002 Spent Halogenated Solvents	☐ Carbon Tetrachloride ☐ Tetrachloroethylene ☐ Trichloroethylene ☐ Trichloromonofluoromethane	☐ Methylene Chloride ☐ 1,1,1-Trichloroethane ☐ 1,1,2-Trichloro-1,2,2-trifluoroethane
☐ F003 Spent Non-Halogenated Solvents	☐ Acetone ☐ Cyclohexanone * ☐ Ethyl Benzene ☐ Methanol * ☐ Xylenes (Total)	☐ *n*-Butyl Alcohol ☐ Ethyl Acetate ☐ Ethyl Ether ☐ Methyl Isobutyl Ketone
☐ F004 Spent Non-Halogenated Solvents	☐ *m*-Cresol ☐ *p*-Cresol ☐ Nitrobenzene	☐ *o*-Cresol ☐ Cresol Mixed Isomers (Cresylic Acid)
☐ F005 Spent Non-Halogenated Solvents	☐ Benzene ☐ 2-Ethoxyethanol ☐ Methyl Ethyl Ketone ☐ Pyridine	☐ Carbon Disulfide * ☐ Isobutyl Alcohol ☐ 2-Nitropropane ☐ Toluene

** The treatment standards for carbon disulfide, cyclohexanone and methanol non-wastewaters are based on the TCLP and apply to spent solvent non-wastewaters containing only one, two or all three of these constituents. The treatment standards for these three constituents do no apply when any of the other F001-F005 constituents are present in the waste.*

Contaminated Soil Waste

- ☐ This shipment contain contaminated soil with listed hazardous waste and does not exhibit a characteristic of hazardous waste and is subject to the soil treatment standards as provided by 268.49(c) of the universal treatment standards.
- ☐ This shipment contains contaminated soil which does not contain hazardous waste and does not exhibit a characteristic of hazardous waste and complies with the soil treatment standards as provided by 268.49(c) of the universal treatment standards.

Hazardous Debris

The definition of "debris" and "hazardous debris" are in 40CFR 268.2. Per 268.45, hazardous debris must be treated for each "contaminant subject to treatment." To determine these, look up the waste code in 268.40 and list the regulated hazardous constituents for each code. Check the box that applies.

- ☐ This shipment contains hazardous debris that will be treated to comply with the alternative treatment standards of 268.45 (e.g. macroencapsulation or abrasive blasting).
- ☐ This shipment contains hazardous debris that will be treated to meet the 258.40 treatment standards for the waste(s) contaminating the debris.

The contaminants subject to treatment for this debris are identified below:

EPA Waste Code	Subcategory (if any)	Contaminants Subject to Treatment
_____	_____	_____
_____	_____	_____
_____	_____	_____

Emerald Services RCRA Land Disposal Restriction Notification Form UC

Generator: U.S. E.P.A. I.D. #:
Profile #: Manifest #:

In accordance with 40CFR 268.7(a), the underlying hazardous constituents must be addressed in the waste Per 268.2(l), "underlying hazardous constituents means any constituent listed in 268.48, Table UTS Universal Treatment Standards, except zinc, which can reasonably be expected to be present at the point of generation of the hazardous waste, at a concentration above the constituent-specific UTS treatment standard." Refer to Form EZ (attached) for the waste code(s), Treatability group, and Subcategory applicable to this waste. This form may also be used to identify F039 constituents.

Please check the appropriate box:

☐ This waste includes F039 multisource leachate. The individual constituents likely to be present are identified below:

_____ _____
_____ _____
_____ _____

☐ This shipment includes D001[other than (1) High TOC ignitables or (2) other ignitables that will be combusted or recovered], D002, D003 [other than (1) Reactive Sulfides or (2) Reactive Cyanides or (3) Other Reactives] and/or D004-D043 Characteristic Wastes. The wastes will not be managed in CWA/CWA-equivalent/Class I SDWA Systems. The underlying hazardous constituents must be addressed for this waste.

In order to address underlying hazardous constituents in characteristic wastes, please check the appropriate box:

☐ I have reviewed the UTS list of 268.48 and 268.7(a), and I have determined that there are no underlying hazardous constituents reasonably expected to be present in this waste.

☐ I have reviewed the UTS list of 268.48 and 268.7(a), and I have determined that underlying hazardous constituents are present in this waste. The underlying hazardous constituents are identified as:

The determination of underlying hazardous constituents was based on:

☐ Generators Knowledge of the waste

☐ Analysis

Generator's Certification:

I certify that I have personally examined and am familiar with the waste through analysis and testing, or through knowledge of the waste to support this certification. I certify that as an authorized representative of the generator named above, all the information submitted in this notification is true and correct to the best of my knowledge.

Printed Name: _____ Title _____

Signature: _____ Date _____

Underlying Hazardous Waste Constituents (Form UC Page 2)

Circle or otherwise identify the underlying hazardous constituents (or F039 constituents) present in the waste:

Acenapthene
Acenaphthylene
Acetone
Acetonitrile
Acetophenone
2-Acetylaminofluorene
Acrolein
Acrylamide
Acrylonitrile
Aldrin
4-Aminobiphenyl
Aniline
Anthracene
Aramite
Alpha-BHC
Beta-BHC
Delta-BHC
Benz(a)anthracene
Benzal Chloride*
Benzene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Benzo(p,h,I)perylene
Bis(2-chloroethoxy)methane
Bis(2-chloroethyl)ether
Bis(2-chloroisopropyl)ether
Bis(2-ethylhexyl)phthalate
Bromodichloromethane
Bromomethane (Methyl Bromide)
4-Bromophenol Phenyl Ether
n-Butyl Alcohol
Butyl Benzyl Phthalate
2-*sec*-Butyl-4,6-dinitrophenol (Dinoseb)
Carbon Disulfide
Carbon Tetrachloride
Chlordane (alpha and gamma isomers)
p-Chloroaniline
Chlorobenzene
Chlorobenzilate
2-Chloro-1,3-butadiene
Chlorodibromomethane
Chloroethane
Chloroform
p-Chloro-*m*-cresol
2-Chloro Vinyl Ether
Chloromethane (Methyl Chloride)
2-Chloronaphthylene
2-Chlorophenol
3-Chloropropylene

Chrysene
o-Cresol
m-Cresol
p-Cresol
Cyclohexanone
o,p'-DDD
p,p'-DDD
o,p'-DDE
p,p'-DDE
o,p'-DDT
p,p'-DDT
Dibenz(a,b)anthracene
Dibenz(a,e) pyrene
1,2-Dibromo-3-chloropropane
1,2-Dibromoehtane (Ethylene Dibromide)
Dibromomethane
m-Dichlorobenzene
o-Dichlorobenzene
p-Dichlorobenzene
Dichlorodifluoromethane
1,1-Dichloroethane
1,2-Dichloroethane
1,1-Dichloroethylene
trans-1,2-Dichloroethylene
2,4-Dichlorophenol
2,6-Dichlorophenol
2,4-Dichlorophenoxyacetic Acid (2,4-D)
1,2-Dichloropropane
cis-1,3-Dichloropropylene
trans-1,3-Dichloropropylene
Dieldrin
Diethyl Phthalate
p-Dimethylaminoazaobenzene*
2,4-Dimethyl Phenol
Dimethyl Phthalate
Di-*n*-butyl Phthalate
1,4-Dinitrobenzene
2.4.6-Dinitro-*o*-cresol
2,4-Dinitrophenol
2,4-Dinitrotoluene
2,6-Dinitrotoluene
Di-*n*-octyl Phthalate
Di-*n*-propylnitrosamine
1,4-Dioxane
Diphenlyamine
Diphenylnitrosamine
1,2-Diphenly Hydrazine
Disulfoton
Endosulfan I
Endosulfan II

Endosulfan Sulfate
Endrin
Endrin Aldehyde
Ethyl Acetate
Ethyl Benzene
Ethyl Ether
Ethyl Methacrylate
Ethylene Oxide
Famphur
Fluoranthene
Fluorene
Heptachlor
Heptachlor Epoxide
Hexachlorobenzene
Hexachlorobutadiene
Hexachlorocyclopentadiene
Hexachlorodibenzo-*p*-dioxins
Hexachlorodibenzofurans
Hexachloroethane
Hexachloropropylene
Indeno(1,2,3-c,d)pyrene
Indomethane
Isobutyl Alcohol
Isodrin
Isosafrole
Kepone
Methacrylonitrile
Methanol
Methapyrilene
Methoxychlor
3-Methylcholanithrene
4,4-Methylene-bis(2-chloroaniline)
Methylene Chloride
Methyl Ethyl Ketone
Methyl Isobutyl Ketone
Methyl Methacrylate
Methyl Methansulfonate
Methyl Parathion
Naphthalene
2-Naphthylamine
o-Nitroaniline*
p-Nitroaniline
Nitrobenzene
5-Nitro-*o*-toluidine
o-Nitrophenol
p-Nitrophenol
N-Nitrosodiethylamine
N-Nitrosodimethylamine
N-Nitrosodi-*n*-butylamine
N-Nitrosomethylethylamine
N-Nitrosmorpholine
N-Nitrosopiperidine

N-Nitrosopyrrolidine
Parathion
PCBs (Total)
Pentachlorobenzene
Pentachlorodibenzo-*p*-dioxins
Pentachlorodibenzofurans
Pentachloroethane*
Pentachloronitrobenzene
Pentacholorphenol
Phenacetin
Phenanthrene
Phenol
Phorate
Phthalic Acid*
Phthalic Anhydrice
Pronamide
Propanenitrile (Ethyl Cyanide)
Pyrene
Pyridine
Safrole
Silvex (2,4,5-TP)
1,2,4,5-Tetrachlorobenzene
Tetrachlorodibenzo-*p*-dioxins
Tetrachlorodibenzofurans
1,1,1,2-Tetrachloroethane
1,1,2,2-Tetrachloroehtane
Tetrachloroethylene
2,3,4,6-Tetrachlorophenol
Toluene
Toxaphene
Tribromomethane (Bromoform)
1,2,4-Trichlorobenzene
1,1,1-Trichloroethane
1,1,2-Trichloroethane
Trichloroethylene
Trichloromonofluoromethane
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,4,5-Trichlorophenoxyacetic Acid (2,4,5-T)
1,2,3-Trichloropropane
1,1,2-Trichloro-1,2,2-trifluoro-ethane
Tris(2,3-dibromopropyl) Phosphate
Vinyl Chloride
Xylenes (Total)

Antimony
Arsenic
Barium
Beryllium

Cadmium
Chromium (total)
Cyanide (total)
Cyanide (amenable)

Mercury (retort residues)*
Mercury (all others)
Fluoride
Lead

Nickel
Selenium
Silver
Sulfide

Thallium
Vanadium

NON-HAZARDOUS WASTE MANIFEST

Please print or type (Form designed for use on elite (12 pitch) typewriter)

NON-HAZARDOUS WASTE

GENERATOR

NON-HAZARDOUS WASTE MANIFEST	1. Generator's US EPA ID No.	Manifest Document No.	2. Page 1 of
3. Generator's Name and Mailing Address			
4. Generator's Phone ( )			
5. Transporter 1 Company Name	6. US EPA ID Number	A. State Transporter's ID	
		B. Transporter 1 Phone	
7. Transporter 2 Company Name	8. US EPA ID Number	C. State Transporter's ID	
		D. Transporter 2 Phone	
9. Designated Facility Name and Site Address	10. US EPA ID Number	E. State Facility's ID	
		F. Facility's Phone	

11. WASTE DESCRIPTION	12. Containers No.	Type	13. Total Quantity	14. Unit Wt./Vol.
a.				
b.				
c.				
d.				

G. Additional Descriptions for Materials Listed Above	H. Handling Codes for Wastes Listed Above

15. Special Handling Instructions and Additional Information

16. GENERATOR'S CERTIFICATION: I hereby certify that the contents of this shipment are fully and accurately described and are in all respects in proper condition for transport. The materials described on this manifest are not subject to federal hazardous waste regulations.

Printed/Typed Name	Signature	Date: Month	Day	Year

TRANSPORTER

17. Transporter 1 Acknowledgement of Receipt of Materials		Date: Month	Day	Year
Printed/Typed Name	Signature			
18. Transporter 2 Acknowledgement of Receipt of Materials		Date: Month	Day	Year
Printed/Typed Name	Signature			

FACILITY

19. Discrepancy Indication Space

20. Facility Owner or Operator; Certification of receipt of the waste materials covered by this manifest, except as noted in item 19.		Date: Month	Day	Year
Printed/Typed Name	Signature			

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039.

~~UNIFORM~~ HAZARDOUS WASTE MANIFEST *(Continuation Sheet)*	21. Generator's US EPA ID No.	Manifest Document No.	22. Page	Information in the shaded areas is not required by Federal law.

23. Generator's Name	L. State Manifest Document Number
	M. State Generator's ID
24. Transporter ___ Company Name / 25. US EPA ID Number	N. State Transporter's ID
	O. Transporter's Phone
26. Transporter ___ Company Name / 27. US EPA ID Number	P. State Transporter's ID
	Q. Transporter's Phone

	28. US DOT Description *(Including Proper Shipping Name, Hazard Class, and ID Number)*	HM	29. Containers No.	Type	30. Total Quantity	31. Unit Wt/Vol	R. Waste No.
a.							
b.							
c.							
d.							
e.							
f.							
g.							
h.							
i.							

GENERATOR

S. Additional Descriptions for Materials Listed Above	T. Handling Codes for Wastes Listed Above

32. Special Handling Instructions and Additional Information

TRANSPORTER

33. Transporter ____ Acknowledgement of Receipt of Materials		Date
Printed/Typed Name	Signature	*Month Day Year*
34. Transporter ____ Acknowledgement of Receipt of Materials		Date
Printed/Typed Name	Signature	*Month Day Year*

FACILITY

35. Discrepancy Indication Space

American Ecology Corporation

PCB Control Sheet

Generator: _____

Site Address: _____

City, State: _____

EPA ID #: _____

Page: _____ of _____

Manifest #: _____

For American Ecology Use-Only

Load #: _____

Received: _____

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
WSID#	Qty	Pkg	Type of Material	D/F	Manuf	Manifest Line#	Serial# / Unique#/ Drum#	KVA	Weight K	Dielect Vol	PPM	OSD	Category	Absorbents added

Explanation:

1. **WSID#:** US Ecology approved waste stream ID#.
2. **Qty:** Enter quantity. **(Idaho Only)**
3. **PKG:** Enter Packaging type-same as container type on manifest.
4. **Type of Material:** Enter description of material. Be specific.
5. **D/F:** Specify if the transformer or article is full (F), drained (D), or drained and flushed (D/F).
6. **Manuf:** Enter the manufacturer. **(Idaho Only)**
7. **Manifest Line#**: For each item, indicate which line # of the manifest it is shipped on.
8. **Serial#/Unique#:** Enter the nameplate serial number for transformers or articles or a unique number for each container.

8. (Note: If there is no nameplate serial#, you must assign a unique number to each container.)
9. **KVA:** Enter the nameplate KVA rating of the transformer or article.
10. **Weight K:** Enter the weight in kilograms.
11. **Dielect Vol:** Enter the nameplate dielectric volume of the transformer or article.
12. **PPM:** Enter the parts per million PCB contained in the material.
13. **OSD:** Enter the date the material was removed from service and designated for disposal [761.65(a), 761.180(a), 761.207(a)].
14. **Category**: Specify US Ecology Beatty Category (see attachment). **(Beatty Only)**
15. **Absorbents Added:** Specify non-biodegradable absorbents added. **(Beatty Only)**

Certification: In order for US Ecology to accept the waste material specified at the US Ecology-Grand View, Idaho or Beatty, Nevada facility the undersigned as an authorized employee of the generating company hereby warrants and certifies to US Ecology that the waste material listed above, delivered to and accepted for disposal by US Ecology shall conform to the above description and that all waste material and packaging shall comply with all current state and federal regulations.

Signature: _____ Title: _____ Date: _____

Note: A completed PCB Control Sheet, including generator's signature, must accompany each shipment of regulated PCB waste.

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST

1. Generator ID Number | 2. Page 1 of | 3. Emergency Response Phone | 4. Manifest Tracking Number 000297665 FLE

GENERATOR

5. Generator's Name and Mailing Address

Generator's Site Address (if different than mailing address)

Generator's Phone:

6. Transporter 1 Company Name | U.S. EPA ID Number

7. Transporter 2 Company Name | U.S. EPA ID Number

8. Designated Facility Name and Site Address | U.S. EPA ID Number

Facility's Phone:

9a. HM	9b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	10. Containers No.	10. Containers Type	11. Total Quantity	12. Unit Wt./Vol.	13. Waste Codes		
	1.							
	2.							
	3.							
	4.							

14. Special Handling Instructions and Additional Information

15. GENERATOR'S/OFFEROR'S CERTIFICATION: I hereby declare that the contents of this consignment are fully and accurately described above by the proper shipping name, and are classified, packaged, marked and labeled/placarded, and are in all respects in proper condition for transport according to applicable international and national governmental regulations. If export shipment and I am the Primary Exporter, I certify that the contents of this consignment conform to the terms of the attached EPA Acknowledgment of Consent.
I certify that the waste minimization statement identified in 40 CFR 262.27(a) (if I am a large quantity generator) or (b) (if I am a small quantity generator) is true.

Generator's/Offeror's Printed/Typed Name | Signature | Month | Day | Year

INT'L

16. International Shipments ☐ Import to U.S. ☐ Export from U.S. Port of entry/exit:

Transporter signature (for exports only): Date leaving U.S.:

TRANSPORTER

17. Transporter Acknowledgment of Receipt of Materials

Transporter 1 Printed/Typed Name | Signature | Month | Day | Year

Transporter 2 Printed/Typed Name | Signature | Month | Day | Year

DESIGNATED FACILITY

18. Discrepancy

18a. Discrepancy Indication Space ☐ Quantity ☐ Type ☐ Residue ☐ Partial Rejection ☐ Full Rejection

Manifest Reference Number:

18b. Alternate Facility (or Generator) | U.S. EPA ID Number

Facility's Phone:

18c. Signature of Alternate Facility (or Generator) | Month | Day | Year

19. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

1.	2.	3.	4.

20. Designated Facility Owner or Operator: Certification of receipt of hazardous materials covered by the manifest except as noted in Item 18a

Printed/Typed Name | Signature | Month | Day | Year

Please print or type. (Form designed for use on elite (12-pitch) typewriter.)

Form Approved. OMB No. 2050-0039

UNIFORM HAZARDOUS WASTE MANIFEST (Continuation Sheet)

21. Generator ID Number

22. Page

23. Manifest Tracking Number

GENERATOR

24. Generator's Name

25. Transporter _____ Company Name

U.S. EPA ID Number

26. Transporter _____ Company Name

U.S. EPA ID Number

27a. HM	27b. U.S. DOT Description (including Proper Shipping Name, Hazard Class, ID Number, and Packing Group (if any))	28. Containers No.	28. Containers Type	29. Total Quantity	30. Unit Wt./Vol.	31. Waste Codes		

32. Special Handling Instructions and Additional Information

TRANSPORTER

33. Transporter _____ Acknowledgment of Receipt of Materials

Printed/Typed Name | Signature | Month | Day | Year

34. Transporter _____ Acknowledgment of Receipt of Materials

Printed/Typed Name | Signature | Month | Day | Year

DESIGNATED FACILITY

35. Discrepancy

36. Hazardous Waste Report Management Method Codes (i.e., codes for hazardous waste treatment, disposal, and recycling systems)

Bristol
ENVIRONMENTAL
REMEDIATION SERVICES, LLC

2011 Waste Tracking Summary Spreadsheet

Waste Package No.	Waste Name	Contract Cost Item No.	Generation Start Date	Waste Package Contents	Waste Package ID Code	Waste Package Quantity (cy, gal, etc.)	Waste Package Gross Weight (lb)	Waste Package Tare Weight (lb)	Waste Package Net Weight (lb)	Waste Profile No.	Manifest/ Bill of Lading No.	Consolidated Container Type	Consolidated Container ID	Current Location	Date In	Date Out	TSDF Destination	ETA Seattle	Treatment Category	Date Received at TSDF	Receipt of Return Manifest from TSDF	Receipt of Certificate of Disposal

APPENDIX B

Contractor Quality Control Plan

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ACRONYMS AND ABBREVIATIONS

CO	Contracting Officer
CQCP	Contractor Quality Control Plan
CQCSM	Contractor Quality Control System Manager
DFW	definable feature of work
DQCR	Daily Quality Control Report
NE Cape	Northeast Cape
QAR	Quality Assurance Representative
QC	quality control
SS	Site Superintendent
USACE	US Army Corps of Engineers
AHA	Activity Hazard Analysis

1.0 CONTRACTOR QUALITY CONTROL PLAN

This Contractor Quality Control Plan (CQCP) has been developed for approval by the US Army Corps of Engineers®, Alaska District (USACE), as a control mechanism for the work to be performed for the Northeast Cape (NE Cape) Hazardous, Toxic, and Radioactive Waste Remedial Actions Project at Northeast Cape, St. Lawrence Island, Alaska, under Contract No. W911KB-06-D-0007. This plan outlines the personnel, procedures, tracking controls, records, and forms necessary to maintain quality control (QC) during the project.

1.1 THREE-PHASE QUALITY CONTROL

Bristol implements a three-phase QC system as Standard Operating Procedure. The primary purposes of this system are to plan and schedule work to ensure adequate preparation by Bristol for the initiation of each definable feature of work (DFW) and to ensure adequate coordination and communication between Bristol and the USACE.

The Contractor Quality Control System Manager (CQCSM) is responsible for implementing the three-phase QC system. This system incorporates preparatory, initial, and follow-up phases for each DFW (listed in Section 1.4 of this CQCP). Additional preparatory and initial phases may be added if the quality of work becomes unacceptable, the CQCSM or Site Superintendent (SS) changes, the work on a DFW resumes after a substantial hiatus, other problems develop, or if the USACE requests it. An overview of each phase is provided below.

1.1.1 Preparatory Phase

The preparatory phase is performed before beginning fieldwork on each DFW. This phase occurs after all required plans, documents, and materials are approved and accepted, and after copies of documentation are made available at the work site.

The USACE will be notified at least 48 hours in advance of the beginning of the preparatory phase for each DFW. The CQCSM will conduct a preparatory phase meeting to be attended by the SS, the Crew Foreman, and the USACE Quality Assurance Representative (QAR). The preparatory phase meeting for each DFW will be documented on the Preparatory Phase Meeting Checklist (Attachment 1).

The CQCSM is responsible for ensuring that all preparatory phase items are accomplished. The CQCSM letter of authority is provided in Attachment 2. The preparatory phase includes the following items that will be discussed during the preparatory phase meeting:

- Review the general procedures of the applicable DFW. An overview of the work to be performed will be discussed with pertinent personnel.
- Review the drawings and figures (if applicable).
- Check that all materials and/or equipment have been tested, submitted (if applicable), and approved.
- Review the provisions that have been made to provide required QC inspection and testing.
- Examine the work area to ensure that all required preliminary work has been completed and is in compliance with the contract.
- Examine required materials and equipment, and sample work to ensure that they are on hand, conform to approved shop drawings or submitted data, and are properly stored.
- Review the appropriate activity hazard analyses to ensure safety requirements are met.
- Discuss procedures for controlling quality of the work, including repetitive deficiencies. Document construction tolerances and workmanship standards for that DFW (if applicable).
- Check that the USACE Contracting Officer (CO) has accepted the portion of the appropriate plan for the work to be performed.
- Discuss the initial control phase.

Work will not begin until all action items identified on the Preparatory Phase Meeting Checklist are completed and signed off by the CQCSM.

1.1.2 Initial Phase

The initial phase occurs when the fieldwork begins for each DFW. The CQCSM will document the initial phase of each DFW on the Initial Phase Inspection Checklist (Attachment 1). The USACE will be notified at least 24 hours in advance of beginning the initial phase for each DFW. The exact field location of the initial phase will be indicated on the checklist for future reference and comparison with the follow-up phase. The initial phase will be repeated if work crews are significantly altered or any time acceptable specified quality standards are not met.

The CQCSM is responsible for ensuring that all initial phase items are accomplished. These include the following:

- Check work to ensure that it is in full compliance with contract requirements. The CQCSM will review the Preparatory Phase Meeting Checklist and any other documentation from the preparatory phase.
- Verify adequacy of controls to ensure full contract compliance. Verify required control inspection and testing (if applicable).
- Establish with the SS and the Crew Foreman (or other appropriate personnel) the level of workmanship expected for each DFW, and verify that the level meets minimum acceptable standards.
- Resolve differences as discovered or discussed.
- Check that field activities comply with the Site Safety and Health Plan and Activity Hazard Analysis (AHA). Ensure that the Site Safety and Health Officer reviews the AHAs with each worker.

1.1.3 Follow-up Phase

After the initial phase has been completed and work for a DFW has begun, the CQCSM will perform the follow-up phase. This phase consists of a site visit and completion of the Follow-up Phase Inspection Checklist (Attachment 1), which will be attached to the Daily Quality Control Report (DQCR).

1.1.4 Additional Preparatory and Initial Phases

The CQCSM will conduct additional preparatory and initial phases on the same DFW if the quality of work becomes unacceptable, the CQCSM or SS changes, the work on a DFW resumes after a substantial period of inactivity, other problems develop, or if the USACE requests it.

1.2 COMPLETION INSPECTIONS

1.2.1 Punch-out Inspection

At the completion of work, or at a milestone established in the project schedule, the CQCSM will conduct an inspection of the work and develop a “punch list” of items that do not conform to the approved plans and specifications. The punch list will be included in the DQCR (Attachment 1), and will contain the estimated dates when the deficiencies will be

corrected. After being notified by the SS that any deficiencies have been corrected, the CQCSM will make a second inspection to verify that the deficiencies have been corrected. The results of the second inspection will be included in the DQCR. After the second inspection is accomplished, the CQCSM will notify the USACE that the project site is ready for the USACE's pre-final inspection.

1.2.2 Pre-Final Inspection

The USACE QAR will perform the pre-final inspection to verify that all Contract Line Item Number work tasks are complete. A USACE Pre-final punch list may be developed by the QAR as a result of this inspection. The CQCSM will ensure that all items on this list have been corrected before notifying the QAR, so that a final inspection by the USACE can be scheduled. Bristol will correct any items noted on the Pre-final punch list in a timely manner to stay within the project's planned schedule.

1.2.3 Final Acceptance Inspection

The CQCSM, the SS, or the Project Manager, and the USACE QAR or Contracting Officer's Representative will attend the final acceptance inspection. Additional government personnel and/or other representatives may also attend. On the basis of results of the pre-final inspection, the CO will formally schedule the final acceptance inspection.

Bristol will give notice to the CO as soon as possible following the pre-final inspection date with assurance that all specific items previously identified as unacceptable, along with all remaining work, will be acceptable and complete by the date of the final acceptance inspection.

1.3 PROCEDURES FOR MEASUREMENT AND PAYMENT

Measurement of work accomplished for payment on this firm-fixed price contract will be achieved in two primary ways. One method will track tasks that are lump sum items, such as the mobilization/demobilization and landfill cap. The second method will track and measure unit-price quantities for any of the options that will be approved by the USACE, such as the disposal cost of additional contaminated soil and miscellaneous debris, drums, and wooden

poles. Bristol has submitted a schedule of values to the USACE for the services provided under this contract.

1.4 DEFINABLE FEATURES OF FIELDWORK

A DFW is a uniquely defined field task for the project. The CQCSM will monitor and inspect all DFWs to ensure completion in accordance with the specifications and applicable regulations. DFWs are presented in Table 1-4 in the anticipated progression of work. The actual progression of work may differ from that indicated in the table. Work progression and sequencing will be decided in the field by the SS.

Table 1-4 Definable Features of Work for Base Items

Definable Feature of Work
POL Soil Removal at MOC (Sites 10, 11, 13, 15, 19 and 27), PCB Soil Removal (Sites 13 and 31), and As Soil Removal (Site 21)
Miscellaneous Metal Debris, Wires, Poles and Drums (Sitewide)
Monitored Natural Attenuation Sampling (Site 8) and groundwater monitoring (MOC)
Transport and dispose of 21 bulk bags containing PCB soil staged at Building 98
Site 28 soil/sediment contamination delineation
Removal of spilled roofing tar south of MOC

Note:

As	=	arsenic	PCB	=	polychlorinated biphenyls
MOC	=	Main Operations Complex	POL	=	petroleum, oil, and lubricants

1.5 DOCUMENTATION

The CQCSM will ensure that current and up-to-date records, documented daily in the DQCR, are maintained to provide factual evidence that required QC activities and/or tests have been performed. The DQCR will contain the following information:

- Contractor/subcontractor and area of responsibility;
- Operating equipment with hours worked, idle, or down for repairs;
- Work performed each day, including location, description, and subcontractors/work crew involved;
- Percent progress for work performed each day;

- Job safety evaluations stating what was checked, results, and instructions or corrective actions;
- Instructions given or received and conflicts in written plans and/or specifications;
- Bristol's verification statement of completion of work tasks (by activity number).

The DQCR will also provide a description of the weather conditions encountered and any delays experienced. In addition, the DQCR will cover both conforming and deficient information.

The signed original and one copy of the DQCR will be furnished to the USACE QAR and USACE Distribution List daily within 24 hours after the date covered by the report. The DQCRs will not be submitted for days when no work is performed. However, one DQCR, at a minimum, will be prepared and submitted for every seven days of no work, on the last day of the no-work period. All calendar days will be accounted for throughout the field period of the project. The first DQCR following a day of no work will be for the day worked only.

The DQCRs will be signed and dated by the CQCSM. Each DQCR will include other reports prepared by subcontractors and any subordinate QC personnel, should they be assigned that task. The CQCSM will forward each DQCR daily to the Project Manager in Anchorage for review.

ATTACHMENT 1

Contractor Quality Control Forms

Daily Quality Control Report

Follow-up Phase Inspection Checklist

Initial Phase Inspection Checklist

Preparatory Phase Meeting Checklist

Punch-Out Inspection Checklist

EXAMPLE

DAILY QUALITY CONTROL REPORT
ENVIRONMENTAL QUALITY CONTROL/QUALITY ASSURANCE REPORT

(ER 415-1-302)

Contract No. / Delivery Order No.	UPC/Project Title and Location of Work
W911KB-06-D-0007 –Task Order 0007	Northeast Cape HTRW Remedial Actions. Northeast Cape, St. Lawrence Island, Alaska.

CQC Report Number: NEC 2011-01
Date or Time Period: Date ##, 2011
Client: USACE, Alaska District

Weather Conditions: Clear.

Temp 7:00 am: ##°F Temp 5:00 pm: ##°F

Winds were calm out of the south.

Quality Control Inspections Performed This Date (Include inspections, results, deficiencies, and corrective action.)

Preparatory: No
Initial: No
Follow-up: No

Environmental Field Sampling and Testing

Has field testing been performed this date? Yes ☐ No ☐ N/A ☐

Type of Test	Method/Matrix	Quantity of Samples	Total
		0	0
		0	0
		0	0
		0	0

Have Data Quality Objectives been achieved? Yes ☐ No ☐ N/A ☒

Have Samples Been Collected for Laboratory Analysis? Yes ☐ No ☐ N/A ☐

Type of Test	EPA Test Method/Matrix	Daily Samples	Total Samples
DRO – Soil	AK102		
RRO - Soil	AK103		
PCBs	EPA8082		

Notes:

Have QA and QC samples been collected in the specified quantity?	Yes ☐	No ☐	N/A ☐
Have samples been properly labeled and packaged?	Yes ☐	No ☐	N/A ☐
Have appropriate QC laboratory tests been ordered? (matrix spikes, method blanks, surrogates, reference standards, etc.)	Yes ☐	No ☐	N/A ☐
Have required amount of QC trip blanks and rinsates been achieved?	Yes ☐	No ☐	N/A ☐

Health and Safety

Worker protection levels this date:	Level C ☐	Level D ☐	
Was any work activity conducted within a confined space?	Yes ☐	No ☐	N/A ☐
Was any work activity conducted within an area determined to be immediately dangerous to life and health?	Yes ☐	No ☐	N/A ☐
Were approved decontamination procedures used on workers and equipment as required?	Yes ☐	No ☐	N/A ☐
Was a Job Safety Meeting held this day?	Yes ☐	No ☐	N/A ☐
Were there any "Lost Time" accidents this day? (If YES, attach copy of completed accident report)	Yes ☐	No ☐	N/A ☐
Was hazardous waste/material released into the environment?	Yes ☐	No ☐	N/A ☐

Safety Comments: (include any infractions of approved safety plan, and include instructions from government personnel. Specify corrective action taken.)

A Health and Safety Meeting was held today. The following topics were discussed:

Safety signature sheet attached to DQCR.

Work Activities Performed This Date

Specification or Contract Reference	Activity and Location
	1.

Manpower and Equipment

Labor Classification	Number	Hours	Equipment Type	Number	Hours Used
Proj. Mgr.—Molly Welker	1		White GMC Crewcab, Gas, Long Box w/gas Service Tank	50-115	1 Day
C.I.H.—Clark Roberts			White Chevy, Duramax Diesel, Crewcab, Short Box w/cover.	50-134	1 Day
Site Supt./SSHO—Chuck Croley	1		White Chevy 2500, Extended Cab, Gas, Short Box w/diesel Service Tank.	50-137	1 Day
CQCSM—Russell James	1		White Chevy, Extended Cab, Gas, Long Box, w/black rack	50-142	1 Day
Op./Foreman—Maze Thompson	1		White Chevy Blazer. Gas	50-166	1 Day

Labor Classification	Number	Hours	Equipment Type	Number	Hours Used
Mechanic—	1		White GMC Diesel, (BDBL) Crewcab, Longbed w/white rack	50-169	1 Day
Oiler—	1		Red GMC, Crewcab, Long Box Diesel	50-171	Down
Admin Assistant—	1		Ottawa Yard Goat, 5th wheel tractor	50-320	1 Day
Bear-guard/Laborer—	1		International S4700 Fuel/Lube Truck	50-205	1 Day
Operator -Allen Dennis	1		Ford F700 Mechanic Truck w/compressor, Welder, & Hyd Boom	50-206	1 Day
Laborer -	1		Kaiser Jeep 6X6 Cargo Truck w/water Tank	50-322	1 Day
Laborer -	1		Cat 988B Loader w/bucket & Forks	50-505	1 Day
Laborer -	1		Cat 160H Motor Grader	50-702	1 Day
Landfill Cap Operator-	1		Cat 460TH Extended Boom Forklift	50-806A	1 Day
Landfill Cap Operator-	1		Cat D6T Dozer	NC 27A16095	1 Day
Landfill Cap Operator-	1		Cat D8N Dozer	51-107	1 Day
Operator-	1		Arctic Cat Side by Side	50-923	1 Day
Landfill Driver-	1		Arctic Cat Side by Side	50-924	1 Day
Replacement Mechanic-			Cat 322BL Excavator	51-207	1 Day
Environ. Sampler-Eric Barnhill	1		IR Light Tower	52-128	1 Day
Hazardous Waste Specialist-Tyler Ellingboe			IR Light Tower	52-130	1 Day
			Frost Fighter Heater	52-206	1 Day
			IR 60KW Generator	52-210	1 Day
			Volvo 330L Loader/Forklift		1 Day
			Volvo A40D Rock Truck	DTO 552	1 Day
			Volvo A40D Rock Truck	DTO 553	1 Day
			287B Skid Steer	26A15295	1 Day
			287B Skid Steer	25W52289	1 Day
			Compressor w/engine (Mechanics Truck)		1 Day
			Welder (Mechanics Truck)		1 Day
			Compressor w/engine (Fuel/Lube Truck)		1 Day
			DeWalt Compressor w/engine		1 Day
			DeWalt electric compressor		1 Day
			DeWalt electric compressor		1 Day
			DeWalt Generator	Environ #1	1 Day
			DeWalt Generator	Environ #2	1 Day
			Generac Generator 6KW		1 Day
			Zaxis 120 Excavator	CMI-HE1262	1 Day
Totals			***Totals***		

Labor Classification	Number	Hours	Equipment Type	Number	Hours Used
Subcontractor			**Equipment**		
Totals	4				

Subcontractor			**Equipment**		
Totals					

Fairweather			**Equipment**		
Medic-			Medical Clinic	1	1 Day
Medic-					
Medic-					
Totals					

Global Services			**Equipment**		
Cook-			75 KW Generator		1 Day
Baker-			Camp Facility		1 Day
Bull Cook-					
Totals					

Subcontractor			**Equipment**		
Totals					

Materials Received to be Used on or Incorporated into Site

Instructions Given by QAR to Bristol (include names, reactions, and remarks.)

Instructions Given by Bristol to Subcontractors (include names, reactions, and remarks.)

Work Progress

Are there any Contractor-caused delays or potential finding of fact? Yes ☐ No ☒

Are there any Government-caused delays or potential finding of fact? Yes ☐ No ☒

Are there any unforeseeable or weather-related delays? Yes ☐ No ☒

Progress Tracking Table

PROJECT SUMMARY TO DATE			
Item	**Today's Total (Units)**	**Previous Total**	**Project Total**
Material Hauling - Volvo A40D Rock Trucks – (DTO 552)			
Material Hauling - Volvo A40D Rock Trucks – (DTO 553)			
MOC POL Soil Excavated			
Site 13 PCB Soil Excavated			
Site 21 Arsenic Soil Excavated			
Site 31 PCB Soil Excavated			
Wooden Poles Recovered			
Wire and Miscellaneous Debris Recovered			
Loads of Water Hauled			
Surveying Completion Percentage			
Intact Batteries			
Broken Batteries			

Site 8 Monitored Natural Attenuation Progress/Remarks:

Definable Feature of Work	Progress
POL, PCB, & As Soil Removal	
Miscellaneous Metal Debris, Wires, Poles and Drums	
Sediment Characterization and Monitored Natural Attenuation Sampling	
Soil Excavations Investigation, Locating, Processing, Screening and Confirmation Sampling	

Comments/Remarks (include any visitors to project and miscellaneous remarks pertinent to work):

Contractor's Verification: On behalf of the Contractor, I certify that the above report is complete and correct and that all materials and equipment used, work performed, and tests conducted during this period were in strict compliance with the contract plans and specifications, to the best of my knowledge, except as noted above.

CQCSM Signature _____ Date _____

Site Superintendent Signature _____ Date _____

Government Quality Assurance Comments

Was QA testing performed this day? Yes ☐ No ☐ N/A ☐

Concurs with the QC report? Yes ☐ No ☐ N/A ☐

Additional comments or exceptions:

QAR Signature	**Date**	**Supervisor's Initials**	**Date**

Follow-up Phase Inspection Checklist

Contract No.: W911KB-06-D-0007_____ Date: _____

Contract Title: 2011 Northeast Cape HTRW Remedial Actions

Definable Feature of Work: _____

Specification Section: _____ Review Completed: _____ Approval Obtained: _____

Location of Inspection: _____

Deficiencies Noted:

Corrective Action Taken:

_____

CQCSM Date

_____

_____ QAR Date

Original and one copy to _____ QAR.

Retain copy in Bristol field project file.

Forward completed copy to Bristol QC Manager.

Initial Phase Inspection Checklist

Contract No.: W911KB-06-D-0007_____ Date: _____

Contract Title: 2011 NE Cape HTRW Remedial Actions

Definable Feature of Work: _____

Specification Section: _____ Review Completed: _____ Approval Obtained: _____

Personnel Present		
Name	**Position**	**Organization**
1.		
2.		
3.		
4.		
5.		
6.		
7.		

(List additional personnel on reverse side)

B. Are materials being used in compliance with the contract plans and specifications?

Yes _____ No _____ If not, explain: _____

C. Are procedures and/or work methods in compliance with approved shop drawings, plans and specifications?

Yes _____ No _____ If not, explain: _____

D. Is workmanship acceptable?

Yes _____ No _____ Indicate areas of needed improvement (attach extra sheet).

E. Safety violations and corrective action taken:

_____
CQCSM Date

_____
QAR Date

Original and one copy to _____, QAR.

Retain copy in Bristol field project file.

Forward completed copy to Bristol QC Manager.

Preparatory Phase Meeting Checklist

Contract No.: W911-KB-06-D-0007 Date: _____

Contract Title: 2011 NE Cape HTRW Remedial Actions

Definable Feature of Work: _____

Specification Section: _____ Review Completed: _____ Approval Obtained: _____

Personnel Present		
Name	**Position**	**Organization**
1.		
2.		
3.		
4.		
5.		
6.		
7.		
8.		
9.		
10.		

(List additional personnel on reverse side)

Submittals Involved		
Number and Item	**Reviewed**	**Approval Code/Remarks**
1.		
2.		
3.		
4.		
5.		

(List additional items on reverse side)

Have all items been approved? Yes _____ No _____

Are all materials on hand? Yes _____ No _____

Tested? Yes _____ No _____

Reviewed? Yes _____ No _____

Properly Stored? Yes _____ No _____

Preparatory Phase Meeting Checklist

Items not on hand in accordance with submittals	
1.	4.
2.	5.
3.	6.

Tests required in accordance with contract requirements	
Test	**Paragraph**
1.	
2.	
3.	

Has all preliminary work been completed in accordance with the specifications?

Yes _____ No _____

Accident prevention pre-planning topics:

1. _____
2. _____
3. _____

Equipment safety checklists:

Attached for:

1. _____
2. _____
3. _____

On-file for:

1. _____
2. _____
3. _____

Required Workmanship Levels:

1. _____
2. _____
3. _____

Remarks (attach extra sheet if needed):

Preparatory Phase Meeting Checklist

Sequence of Work			
Control Point	**Project Plan Reference**	**Type of Inspection**	**Acceptance Criteria**

CQCSM Date

USACE QAR Date

Original and one copy to USACE QAR.
Retain copy in Bristol field project file.
Forward completed copy to Bristol QC Manager.

Punch-Out Inspection Checklist

Contract No.: W911KB-06-D-0007 Date: _____

Contract Title: 2011 NE Cape HTRW Remedial Actions

Definable Feature of Work: _____

Specification Section: _____ Review Completed: _____ Approval Obtained: _____

Location of Inspection: _____

Deficiencies Noted:

Corrective Action Taken:

_____

CQCSM Date

_____

QAR Date

Original and one copy to _____, QAR.

Retain copy in Bristol field project file.

Forward completed copy to Bristol QC Manager.

ATTACHMENT 2

CQCSM Letter of Authority

Bristol
ENVIRONMENTAL & ENGINEERING
SERVICES CORPORATION

111 W. 16th Avenue, Third Floor
Anchorage, Alaska 99501-5109
907-563-0013 Phone
907-563-6713 Fax

April 7, 2011

Mr. Russell James
Bristol Environmental Remediation Services, LLC
111 W. 16th Avenue, Third Floor
Anchorage, Alaska 99501

RE: Contractor Quality Control System Manager Letter of Direction
Northeast Cape HTRW Remedial Actions
Northeast Cape, St. Lawrence Island, Alaska
U.S. Army Corps of Engineers Contract No. W911KB-06-D-0007

Dear Mr. James:

This letter outlines your responsibilities as the Contractor Quality Control System Manager (CQCSM) for the above-referenced project. As the CQCSM, you have the authority and responsibility to implement and maintain the project Contractor Quality Control Plan and supervise quality control personnel who may be assigned to assist you. Your presence is required at the project site during all fieldwork activities.

You have the authority, responsibility, and organizational freedom to identify quality problems in the project; to initiate, recommend, and provide solutions; and to verify implementation of those solutions. In addition, you have the authority and responsibility to reject and stop all work that does not conform to the project specifications and contract requirements.

Should you have any questions concerning these duties, please contact me immediately.

Sincerely,

Bristol Environmental Remediation Services, LLC

Molly Welker
Project Manager

Acknowledged,

Russell James

APPENDIX C

Site Safety and Health Plan/
Accident Prevention Plan

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Attachment 3 Physical Agent Data Sheets
Attachment 4 OSHA Sloping and Benching Standard
Attachment 5 Site Safety Forms
Attachment 6 Bloodborne Pathogen Program
Attachment 7 Respiratory Program

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ACRONYMS AND ABBREVIATIONS

ACGIH	American Conference of Governmental Industrial Hygienists
AHA	Activity Hazard Analysis
ANSI	American National Standards Institute
CFR	Code of Federal Regulations
CO	Contracting Officer
COCs	contaminants of concern
CPR	cardiopulmonary resuscitation
DART	Days Away, Restricted, or Transferred
dBA	decibels A-weighted
DOT	U.S. Department of Transportation
DQCR	Daily Quality Control Report
EM	Engineer Manual
EMT	Emergency Medical Technician
FEV1	forced expiratory volume one second
GFCI	ground fault circuit interrupter
HAZWOPER	Hazardous Waste Operations and Emergency Response
HSM	Health and Safety Manager
mg/m^3	milligrams per cubic meter
mph	miles per hour
MSDSs	Material Safety Data Sheets
NE Cape	Northeast Cape
NEC	National Electrical Code
NIOSH	National Institute for Occupational Safety and Health
OP	Occupational Physician
PADS	Physical Agent Data Sheet
PCBs	polychlorinated biphenyls
PELs	Permissible Exposure Limits
PID	photoionization detector
PPE	personal protective equipment
QAR	Quality Assurance Representative

ACRONYMS AND ABBREVIATIONS (continued)

SEC	Site Emergency Coordinator
SPCC	Spill Prevention, Control, and Countermeasures Plan
SS	Site Superintendent
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
TCIR	Total Case Incidence Rate
TLVs	Threshold Limit Values
TWA	time-weighted average
USACE	US Army Corps of Engineers, Alaska District
UV	ultraviolet

PLAN PREPARATON

Mr. Clark Roberts, Certified Industrial Hygienist (CIH), has reviewed this plan in accordance with the guidance and requirements of the US Army Corps of Engineers® Engineer Manual (EM) 385-1-1, 2008 edition.

Clark Roberts, CIH
Health and Safety Manager, 210-863-9445

July 27, 2011
Date

APPROVALS

By their signatures, the undersigned approve this Site Safety and Health Plan and the attached Accident Prevention Plan.

Clark Roberts, CIH
Health and Safety Manager

July 27, 2011
Date

Steve Johnson
CEO

7/27/11
Date

CONCURRENCE

By their signatures, the undersigned concur with this Accident Prevention Plan and the attached Site Safety and Health Plan.

Molly Welker
Project Manager

7/27/11
Date

Chuck Croley
Site Superintendent/Site Safety and Health Officer

July 27, 2011
Date

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1.0 SITE SAFETY AND HEALTH PLAN

1.1 BRISTOL'S SAFETY AND HEALTH PERFORMANCE

Working safely is a condition of employment at all Bristol work sites and facilities. Bristol values the good health and safety of all workers and maintains a goal of "zero" accidents for all projects. This goal is routinely achieved. Bristol has never had a lost time accident.

The Bristol rate for 2010 "Days Away from Work, Restricted Work Activity, and/or Job Transfer", or DART rate, is 0.00. For 2009, the most recent year for which data are available, the Bureau of Labor Statistics reported that the average DART rate for construction and remediation firms was 1.58 cases per 100 workers. Bristol's 2010 Total Case Incidence Rate (TCIR) (all recordable injuries/illnesses) was also 0.00.

1.2 ACCIDENT PREVENTION PLAN

An Accident Prevention Plan is included as Attachment 1 to this Site Safety and Health Plan (SSHP).

1.3 HAZARD ANALYSIS

This section describes the general chemical, physical, and biological hazards that are associated with many of the activities that will be conducted at the Northeast Cape (NE Cape) site in 2011. This section also discusses task-specific hazards and the control measures that will be instituted to manage them. To support this discussion, Activity Hazard Analysis (AHA) tables have been prepared for each task in accordance with the US Army Corps of Engineers (USACE) EM 385-1-1, and are included in Attachment 2. At a minimum, each AHA includes the following:

- Task description,
- Potential hazards,
- Chemical,
- Physical,
- Safety,
- Hazard control measures,
- Necessary equipment,

- Inspection requirements, and
- Training requirements.

If new activities not discussed in this section occur during the course of work, and/or some presently described activities change, the AHA tables will be amended to account for these changes at that time. All significant AHA changes will be reviewed by the Site Safety and Health Officer (SSHO) and Health and Safety Manager (HSM) and, subsequently, will be communicated to affected employees.

1.3.1 General Chemical Hazards

Previous remedial investigations conducted at the NE Cape site identified several contaminants of concern (COCs) that may present an exposure hazard to site personnel performing a variety of activities at the site. The COCs are polychlorinated biphenyls (PCBs), metals, and weathered petroleum products: diesel fuel and lubrication oils. The contaminants are in the soil and water matrices and pose minimal inhalation hazard at the ambient temperatures of the arctic summer.

Bristol will collect miscellaneous debris, wood poles, and drums that are littered across the tundra. It is unknown how many of the drums contain product or sludge. When handling drums with unknown contents, care will be taken to minimize dermal and inhalation contact by having the disposal crews wear chemical-protective clothing. Caution will be taken when identifying whether or not drums are empty or full; if found, personal protective controls will be applied to all situations involving the handling of unknown materials.

The OSHA Permissible Exposure Limits (PELs) and Threshold Limit Values (TLVs) established by the American Conference of Governmental Industrial Hygienists (ACGIH) have been identified in this SSHP for COC that could present industrial hygiene hazards to workers at the NE Cape site. Differences between exposure limits set by these two entities will result in Bristol complying with the more restrictive limit(s).

Petroleum, oil, and lubricants used for support of the operation will consist of fuels, diesel and gasoline, lubricating oils, and solvents. The Material Safety Data Sheets (MSDSs) will be on

site for all of the products used on the project. All fuels will be stored and dispensed in approved containers.

1.3.1.1 Polychlorinated Biphenyls

The acronym PCB is a generic term for a range of polychlorinated biphenyl compounds used commercially in heat transfer media and in the chemical/coatings industry. PCBs have been marketed commercially under the trade names Askarel® and Aroclor®, with a designation referring to the percent weight of chlorine. Prolonged skin contact with PCBs may cause acne-like symptoms, known as chloracne. Irritation to eyes, nose, and throat may also occur. Acute and chronic exposure can cause liver damage and symptoms of edema, jaundice, anorexia, nausea, abdominal pain, and fatigue. PCBs are a suspect carcinogen. Skin exposure may contribute to uptake of these chemicals; therefore, skin exposure potential will be evaluated and controlled. The likelihood of exposure should be minimal because of the extremely low vapor pressure of PCBs, which prevents evaporation (and inhalation) of these compounds and the fact that these compounds are insoluble in water. The primary route of potential exposure for workers is anticipated to be through skin contact. Therefore, personal protective equipment (PPE) will be in frequent use to prevent contact with PCBs. At a minimum, workers are required to wear appropriate gloves (nitrile) when handling soil/materials suspected of being contaminated with PCBs. The PEL and TLV time-weighted average (TWA) for PCBs with 54 percent chlorine content is 0.5 milligram per cubic meter (mg/m^3), while the PEL and TLV TWA for PCBs with 42 percent chlorine is 1 mg/m^3. Potential sources of PCBs during this project are drums and contaminated soil.

The PELs, TLVs, and physical properties of the hazardous site contaminants discussed above are summarized in Table 1-1 for all COCs that could result in worker exposure.

Table 1-1 Project Chemical Exposure Limits

Chemical	OSHA Exposure Limit (PEL)	ACGIH Exposure Limit (TLV)
POL	5 mg/m^3 (TWA) (oil mist)	5 mg/m^3 (TWA)
PCB (42%)	1 mg/m^3 (TWA)	1 mg/m^3 (TWA)
PCB (54%)	0.5 mg/m^3 (TWA)	0.5 mg/m^3 (TWA)
Arsenic	10 µg/m^3 (TWA)	10 µg/m^3

Notes:

ACGIH = American Conference of Governmental Industrial Hygienists
µg/m^3 micrograms per cubic meter
mg/m^3 = milligrams per cubic meter
OSHA = Occupational Safety & Health Administration
PCB = polychlorinated biphenyl
PEL = permissible exposure level
POL = petroleum, oil, and lubricants
TLV = threshold limit value
TWA = 8-hour time-weighted average

1.3.2 General Physical Hazards

1.3.2.1 Aircraft Operation

Chartered aircraft operations will be required in all phases of this project. Pilot and passengers must wear seat belts at all times. The pilot is responsible for ensuring that passengers are seated and properly secured before moving the aircraft.

The propeller of the aircraft will be avoided at all times, even when the engine is not running. Personnel will stay to the aft of the wing struts at all times. Personnel needing to approach an aircraft will make eye contact with the pilot and approach only when the pilot gives permission. There is no formal charter aircraft training program for contractor employees.

1.3.2.2 Heavy Equipment and Vehicle Operation

Excavators, front-end loaders, haul trucks, graders, and other heavy equipment will be used on this project to excavate contaminated soil, repair roads, grade work areas, and remove debris. There is a potential for workers to be struck by these vehicles or to be injured by contact with exposed mechanical parts (i.e., gears and pulleys). In addition, there is a risk of vehicle accidents and of fire during refueling. Activity Hazard Analysis 5 provides specific guidance for refueling of vehicles and equipment. The majority of the fuels at the site will be diesel, which has a low vapor pressure and is a relatively low fire risk. To control these hazards, regulated work areas will be established around each job site, and safe distances will

be maintained between workers and mechanical equipment. Mobile equipment will be equipped with backup alarms, and spotters may be used to direct equipment operators, particularly when dumping soil and rock, operating cranes, and loading haul trucks. In addition, all exposed gears and pulleys on mechanical equipment will be guarded to eliminate pinch and grab hazards. Vehicles will be equipped with fire extinguishers, and spill-control equipment will be available during refueling operations in case a fuel, hydraulic fluid, or lubricant release occurs.

1.3.2.3 Slips, Trips, and Falls

Workers are anticipated to encounter unstable footing conditions (slipping, tripping, or falling) during all site work activities to the site and while working. The potential hazards related to slipping, tripping, or falling associated with this site include the following:

- Uneven terrain;
- Slippery soil and rocks; and
- Standing water.

There is a potential for site personnel to fall off heavy equipment and other structures, and to fall into open excavations. In addition, debris within the work area (i.e., drums, containers, building debris, and abandoned equipment, etc.) could present a trip hazard for site personnel. The entire project site is subject to wet weather that makes most walking surfaces slick and increases the potential for slips and falls.

These slip, trip, and fall hazards will be addressed by keeping the work area as free as possible of debris and other litter. Before beginning site activities, the site will be inspected for hazards. Removable objects that present hazards will be marked, and holes (if any) will be covered or marked. Site workers will wear high-traction, hard-toe safety boots, and will pay careful attention to surface conditions to prevent slip, trip, and fall injuries. The work area will be inspected before the start of each workday to identify any hazards that could cause injury. The results of these inspections will be communicated to site personnel during the daily toolbox safety meetings.

1.3.2.4 Excavations and Earthwork

Contaminated soils will be excavated at numerous locations across the site. Open excavations present a fall hazard to personnel and equipment working near them. They can also collapse on and bury workers who enter them. To control these hazards, soil conditions, excavation methods, and site entry/control will be closely monitored by the Site Superintendent (SS)/SSHO.

Excavated soils will not be placed closer than 2 feet to the edge of an excavation. Under no circumstances will workers be allowed to enter excavations deeper than 4 feet, unless the excavations have been sloped to 1.5 horizontal to 1 vertical. If at all possible, work will be conducted in a manner that precludes the need for workers to enter excavations. When sampling is necessary, only trained workers will be used, and the SSHO will monitor the sampling activity.

An AHA for excavations less than 4 feet is available in Attachment 2.

1.3.2.5 Material Handling

On-site fieldwork often involves handling heavy objects which may also be bulky or awkward to carry. This labor-intensive work poses the risk of back injury from heavy lifting and lacerations from contact with sharp objects.

To control these hazards, workers will be instructed to use proper lifting techniques when moving heavy loads. These techniques will include using mechanical lifting devices (forklifts, etc.) whenever feasible and having others help to lift heavy loads if mechanical lifting devices cannot be used. Workers will also wear leather or abrasive-proof gloves when handling sharp objects.

1.3.2.6 Noise and Hearing Conservation Program

All heavy equipment can produce hazardous noise levels in excess of 85 decibels A-weighted (dBA). The SSHO will determine when potential noise exposure is hazardous and protective measures are required. The primary hazard associated with noise exposure is hearing loss. A Physical Agent Data Sheet (PADS) is available in Attachment 3.

High noise levels may occur during heavy equipment use and tool operations. A copy of OSHA noise standard, Title 29 Code of Federal Regulations, Part 1910.95 (CFR 1910.95) will be posted at the job site. It is assumed that all workers will be exposed to above 85 dBA at least part of the time they are on NE Cape. Therefore, use of hearing protection is mandatory around heavy equipment and noise sources. All personnel with exposure to noise will be provided with appropriate hearing protection. Noise monitoring shall be available and used as directed by the SSHO to determine appropriate posting and noise controls. Areas with frequent noise levels that exceed 85 dBA will be posted to warn individuals of the need for hearing protection. Engineering controls will be evaluated for all high noise operations, including ensuring noise reduction devices are used and maintained in heavy equipment.

1.3.2.7 Weather Hazards and Thermal Stress

St. Lawrence Island is subject to high winds, rain, and snow. On occasion, weather conditions can become severe enough to present a danger to those working outdoors. In these situations, work will stop, and the control measures discussed in Emergency Procedures (Section 1.13 of this SSHP) will be followed.

Because all planned work activities will be conducted outside where environmental conditions are typically wet, cold, and windy, there is a significant risk that site workers could develop cold stress. In addition, for those workers required to wear chemical-protective clothing, there is a possibility that they could develop heat stress, depending on their work activities. A PADS on heat stress is available in Attachment 3. The likelihood of such thermal illnesses occurring is dependent on environmental conditions, the level of work activity, and the personal control measures that are used to manage heat loads (work/rest cycles, use of clothing and/or cooling devices, hydration, etc.). Appropriate control measures will be taken to manage these thermal stress concerns. These include use of “warm-up sheds” as necessary. The SSHO, for example, will monitor ambient temperatures in the work area, track thermal workloads, and determine the need for personal protective and administrative controls. In addition, all site workers will be instructed in the recognition and control of thermal stress symptoms and in treatment procedures. To guard against cold injury, appropriate clothing and warm shelters for rest periods will be provided. ACGIH practices for cold stress will be

implemented. A summary of the cold stress prevention guidelines is provided in Attachment 3. A copy of the ACGIH TLV handbook will be available on site.

1.3.2.8 Ultraviolet Radiation

Ultraviolet (UV) radiation from the sun causes sunburns and skin cancer. Ultraviolet radiation from other sources can also cause skin burns varying in degree from mild reddening of the skin (first-degree burns) to more severe and painful blistering (second-degree burns). Long-term skin exposure to UV radiation can cause actinic skin (a dry, brown, inelastic wrinkled skin) and skin cancer. Fair-skinned individuals are more susceptible to developing both sunburns and skin cancer. A PADS on UV radiation is available in Attachment 3.

Some drugs, such as the antibiotic tetracycline, can cause skin burns from UV radiation to happen faster and to be more severe. Products containing coal tar can also cause this reaction. These substances are called photosensitizers. Ultraviolet radiation exposure may also trigger cold sores (herpes simplex) in some individuals.

Under sunny conditions on water, snow, and ice, extra precautions will be taken to protect against reflected sunlight. Safety glasses with tinted lenses (with side shields) will be worn. When applying protective ointments or lotions, special attention will be paid to the nose, lips, underside of the chin, and tops of the ears.

1.3.3 High Wind Hazards

The Northeast Cape of St. Lawrence Island is a windy landscape. The wind can lift and transport debris that can be a hazard to site workers. Site workers will wear protective head gear and eyewear while on site.

Vehicle doors being blown open can cause damage to the door of the vehicle, and the door being ripped from a person's grip can cause serious hand, arm, or shoulder injuries, as well as vehicle damage. Vehicles will be parked facing into the wind to prevent the wind from forcing doors open and causing damage to vehicles. Vehicle safety will be covered in the daily safety meetings. All building and container doors will have latches or tie-downs to prevent injuries that could result from doors being opened violently from the wind.

All loose scrap lumber, waste material, tools, equipment and rubbish, which could become missile hazards in high winds, will be collected for removal/disposal at the close of the workday.

1.3.4 Biological Hazards

The primary biological hazards of concern at the NE Cape site are polar bears and foxes.

1.3.4.1 Polar Bears

Polar bears may be found on St. Lawrence Island year-round. Their presence on the island is relatively common when the ice pack is near shore. Some may become stranded on the island from late spring to fall when the ice pack retreats from the shore. Polar bears are protected under the Marine Mammal Protection Act of 1972. It is illegal to disturb a polar bear in any way without a permit. Polar bears are the largest land carnivores in the world. Adult males can weigh more than 1,500 pounds and reach a height of more than 4 feet at the shoulder. Females are usually smaller.

Polar bears can cover hundreds of miles in a few days and cross steep slopes and rough ice at speeds of 25 miles per hour (mph) for short periods of time. They can swim at speeds of 6 mph. Polar bears have an excellent sense of smell and will hone in on a possible food source from many miles away. Their eyesight is equal to humans.

Polar bear tracks look like human footprints, although the bear's are larger. Polar bear droppings look like loose puddles of black tar. Polar bears are carnivores and are also curious. They have been known to eat things that are distinctly inedible, such as rubber, plastic, rope, engine oil, and antifreeze.

All polar bears should be treated as unpredictable. In general, they are tolerant of humans and will steer clear of people if given the opportunity. However, polar bears tend to be more curious than brown or black bears and often approach closely to investigate people or objects. Bluff charges occur very rarely, and a charging bear should be treated as a direct attack. A worker should play dead if attacked by a female bear with cubs. The body position to take on the ground should minimize the exposure of vital areas. Hands should be placed behind the neck with fingers interlocked, forearms and elbows should be drawn up to protect the face,

and knees should be raised to a fetal position. The female bear views people as a threat to her cubs, and she will probably leave once the worker is immobilized. He or she should remain completely passive until the bears have left the area. If a lone bear attacks, the motive is probably predation, and the worker should get away or fight for his or her life. While the odds are against an unarmed person, fighting back is something the bear is unlikely to expect. Fighting back may gain the worker valuable time, and a nearby worker may be able to help. Field workers should always work in pairs.

Polar bears will investigate anything that could potentially turn up food. They will follow roads and snowmobile trails and have been attracted by sounds and odors to industrial activity. A bear watch should be maintained when people are working outside. If people are prepared and are able to detect a bear when it is at least 500 feet away, there is ample time to move to a safe location. Running or making sudden movements may cause the bear to attack, while backing away slowly is more likely to result in the bear leaving the area. The best response during any bear encounter is to move to a safe location as quickly as possible, but without running, if the bear is near.

To minimize the risk from polar bears, practice the following:

- Locate storage areas away from any cooking, food, or sleeping quarters. Remember that only early detection and avoidance of polar bears guarantee your safety.
- Be vigilant.
- Always check outside before leaving a building. If working outside, post a lookout.
- Always carry a radio.
- Have quick access to a safe place, such as a truck or trailer. Never carry food.
- Do not feed wildlife.
- If you see a bear, bear tracks, or droppings, notify the SSHO immediately.
- Avoid bloodstains seen on ice or snow, which probably indicate the location of a polar bear kill. Notify the SSHO immediately.
- Know where the bears are and how many there are.
- Minimize potential bear hiding places (e.g., unskirted structures).
- Dispose of garbage and waste materials correctly. Keep food in a secured area in bear-proof containers. Trucks and other vehicles cannot be considered secure because polar bears looking for food have been known to break into vehicles.

Bristol will have a local bear guard in the field and all garbage will be securely contained in a 20-foot container and incinerated daily.

1.3.4.2 Foxes

Rabid cross foxes may also be encountered at the NE Cape site. Extreme caution should be exercised to avoid any work activities in close proximity to a cross fox. Work in areas that cross foxes may inhabit should always be performed in pairs.

1.3.5 Control Measures

Various institutional control measures and safety procedures/standards will be upheld by applicable personnel in order to maintain a safe working environment.

1.3.5.1 Vehicle Inspections

All equipment and vehicles brought to the job site will be inspected in accordance with the EM 385-1-1 requirements before being put into service. Equipment not conforming to operational and safety requirements will be repaired and re-inspected. Daily inspections of vehicles and heavy equipment will follow the requirements of the equipment manufacturers and EM 385-1-1, Section 16. Inspection forms are included in Appendix C.

Industrial vehicles will have backup alarms, seat belts, brakes, and lights. The operator will take out of service any equipment that does not comply with the manufacturer's specifications. Deficiencies will be noted and referred to the SS, who, in turn, will ensure that all repairs are made before the vehicle is returned to service.

1.3.5.2 Operator Qualifications

Equipment operators must be qualified to operate the specific type of equipment or vehicle to which each has been assigned. In addition, each operator must be proficient in the type of equipment he/she will be using. The SS will ensure that a proficiency test is administered to each operator for each type of equipment operated. The SS will maintain a list of each operator and the equipment the operator is qualified to operate.

1.3.5.3 Equipment and Vehicle Safe Work Practices

Operators, drivers, and passengers must wear seat belts at all times. Drivers and operators must comply with state regulations governing the safe and legal operation of vehicles. Each driver is responsible for ensuring that passengers are seated and properly secured before moving the vehicle. Under no circumstance will personnel ride on fenders, running boards, or vehicle tops; in buckets; on the lift forks of a forklift; on beds of dump trucks or pickup trucks; or in any other area where a passenger cannot be secured by a properly installed seat belt. Operators of heavy equipment must follow the regulations specific for the type of equipment they are operating. Operators and drivers will obey signs, postings, and instructions.

Those personnel directly involved with spotting for an operator are typically the personnel allowed on the ground in the vicinity of the heavy equipment. Other personnel will remain a safe distance away from operations. Personnel needing to approach heavy equipment while the equipment is operating will observe the following protocols:

- Make eye contact with the operator (and spotter),
- Signal the operator to cease heavy equipment activity, if applicable, and
- Approach the equipment operator and inform the operator of intentions.

Before moving parked heavy equipment, the operator will visually inspect and walk around the vehicle to ensure that the equipment is in good condition and that there are no personnel or objects on the ground that could be damaged by vehicle movement. Operators will use handrails and footholds for mounting and dismounting equipment (three points of contact). Operators will follow equipment start-up procedures described in the appropriate operating manual. Each operator will keep hauling equipment under positive control at all times. In case of malfunction that impairs an operator's ability to control a piece of equipment, the operator will use hydraulic systems such as blades, ripper, belly pan lowered to the ground, and brakes, and shut down the equipment until help arrives and repairs are made. Heavy equipment must have booms, forks, buckets, blades, belly pans, and any other similar part lowered to the ground when the equipment is shut off. Heavy equipment has the right-of-way over other traffic.

When temporarily parked, the keys are to remain in the ignition switch, except when the vehicle is being used as a fall protection anchor. When the vehicle is used as a fall protection anchor, the keys are to be removed and in the possession of the person using the fall protection. Vehicle chocks are required to be used to reduce the potential for rolling when parked.

1.3.5.4 Traffic Control

The speed limit for traffic is 15 mph in all areas of the site except the main roads (identified by the SSHO), where the speed limit is 25 mph. Special caution should be taken near the personnel living area where the speed limit is 10 mph. The SSHO and SS may temporarily change speed limits if required for safe operations. Speed limits apply to heavy equipment, as well as other vehicles. To minimize traffic hazards, specific traffic flow patterns may be established at individual work sites. These flow patterns will be implemented through portable traffic signs, by informing personnel in the daily toolbox safety meetings, or over the radio. Flagmen may be used for traffic control wherever there is heavy traffic, where there are “blind spots,” and where there are road hazards. The SSHO may require flagmen for any unsafe road condition.

1.3.5.5 Site Roads and Slopes

The SS/SSHO and/or alternate will regularly inspect site roads. The SS/SSHO or designee will discuss current site road hazards and the status of site roads (e.g., closed, under repair, one way, etc.) at the daily toolbox safety meetings. Personnel will report unsafe road conditions, if observed, to their supervisor or the SSHO.

Operators will operate equipment with booms, blades, buckets, beds, etc., lowered or in a stable position while on slopes.

1.3.5.6 Control of Hazardous Energy

Hazardous energy can come from mechanical sources, as well as electrical sources. Mechanical sources may be from machinery and from individual components of machinery, such as, hydraulic lines or water lines that are still under pressure even though the primary

energy source may be turned off. All mechanical maintenance will be performed by a qualified mechanic or personnel under direct supervision of the qualified mechanic.

Portable electrical generators are used to supply power to the base camp and for various demolition equipment and environmental activities. The generators will be maintained by site personnel, including a qualified operator, as directed by the SS. There are no other sources of electrical energy at the job site, besides the portable generators, that would require lockout/tagout. When it becomes necessary to install or repair portable electrical power systems, the appropriate systems will be shut down.

Implementation of procedures for control of hazardous energy will be administered by the SS/SSHO, in accordance with EM 385-1-1, Section 12, and the Bristol Safety and Health Program Manual.

1.3.5.7 Confined Space Entry

A confined space is defined as a space that meets all of the fol1owing criteria:

- Is large enough and so configured that an employee can bodily enter and perform assigned work,
- Has limited or restricted means for entry or exit. (For example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry.), and
- Is not designed for continuous employee occupancy.

No confined space entry operations are anticipated at the NE Cape site. If it becomes necessary to perform confined space entries all provisions of the Bristol Confined Space Entry Program will be followed.

1.3.5.8 Electrical Safety

For most workers, electrical safety is limited to the proper use of electrical portable tools and equipment (including lighting). All electrical portable tools and equipment will be inspected before use. In addition, these tools and equipment will be used with ground fault circuit interrupters (GFCIs), or in conjunction with power sources that are GFCI protected or vehicle-mounted generators. When using a portable or vehicle-mounted generator, the

generator is not required to be grounded, in accordance with National Electrical Code (NEC) 250-6, as long as the following conditions from the USACE's EM 385-1-1 are met:

Portable Generators. Under the following conditions, the frame of a portable generator is not required to be grounded and shall be permitted to serve as the grounding electrode for a system supplied by the generator:

- The generator supplies only equipment mounted on the generator and/or cord- and plug-connected equipment through receptacles mounted on the generator.
- The noncurrent-carrying metal parts of equipment and the equipment-grounding conductor terminals of the receptacles are bonded to the generator frame.

Vehicle-mounted Generators. Under the following conditions, the frame of a vehicle is permitted to serve as the grounding electrode for a system supplied by a generator located on the vehicle (all conditions must be satisfied):

- The frame of the generator is bonded to the vehicle frame.
- The generator supplies only equipment located on the vehicle and/or cord- and plug-connected equipment through receptacles mounted on the vehicle or on the generator.
- The noncurrent-carrying metal parts of equipment and the equipment-grounding conductor terminals of the receptacles are bonded to the generator frame.
- The system complies with all other NEC grounding requirements.

Additionally, the following provisions will be followed for electrical cords:

- Cords, connections, and outlets will be inspected before each use. Damaged cords, connections, or outlets will not be used. This includes cords with damaged or loose insulation.
- Only extension cords with three-prong grounding plugs will be used.
- Cords placed on the ground must be visible, must not interfere with normal foot traffic, and must not present a tripping hazard.
- Cords cannot cross any roads or traffic areas where they could be run over by vehicles.

1.4 TASK-SPECIFIC HAZARDS

The following sections describe in greater detail the hazards associated with each specific task. Attachment 2 contains AHA tables, completed in accordance with the USACE's EM

385-1-1, identifying the activity, potential hazards, controls and inspections, training, PPE, and monitoring required for each task.

1.4.1 Contaminated Soils, Poles, Drums, and Wire Removal and Disposal

Petroleum, oil, and lubricant-contaminated and other contaminated soil, and miscellaneous debris, including poles, wires, and drums will be disposed of in accordance with the Waste Management Plan in the WP (Appendix A). Discovered drums will be removed by personnel wearing proper PPE. Collected drums and other containers containing potentially hazardous liquids will be staged on a lined concrete pad at the Main Operations Complex, which will have secondary containment to control runoff.

The poles, drums, and the wire will be placed into intermodal shipping containers for transportation and disposal off site and staged at Cargo Beach until the demobilization. Soil will be loaded into U.S. Department of Transportation (DOT) approved bulk bags for transport and off-site disposal and will be staged on flats at Cargo Beach.

Workers who will help handle the removal of debris from this site will be trained about the operator's visibility limitations. Operators will be informed daily and as often as necessary of the workers' whereabouts. A designated transportation route will be established to isolate the area of vehicular traffic. This route will be communicated to the site workers. Site workers will also wear reflective vests to increase their visibility.

1.4.1.1 <u>Soil Removal</u>

Contaminated soil will be excavated using heavy equipment. Bristol will be excavating and sampling tons of soil. Soil excavations have the potential to grow to cover large areas and to great depths. Excavations will keep in accordance with OSHA Sloping and Benching Standard 1926 Subpart P, Attachment 4, which outlines the specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins.

When excavation depths exceed four feet, sampling will be accomplished by excavated soil being lifted from the excavation floor and sidewalls, and samples will be taken from the excavator bucket at ground surface level.

A rock-screening plant will be used for some sites. The soil will be excavated using an excavator and then sorted through the rock-screening plant to remove particles greater than 2 inches. After the soil is sorted, the minus 2-inch material will be loaded into bulk bags.

Workers involved with soil excavation will wear proper PPE at all times. Operators and workers will be in constant communication, and workers will be instructed on proper conduct around heavy equipment and excavations.

1.4.1.2 Pole Removal

One of the hazards associated with the removal of the wood poles concerns the use of the chain saw required to cut the poles down. Chain saws can "kick" back if they strike a piece of metal or a knot in the wood or if they strike the ground. Workers using chain saws will inspect each pole before cutting to look for signs of metal or knots that may cause the chain saw to "kick" back. The angle of cut will be one that does not bring the saw in contact with the ground. Workers using chain saws will wear PPE (including chaps) protection as specified in EM 385-1-1, Section 13F.

1.4.1.3 Wire Removal

Whenever possible mechanical means will be used to move and dispose of wire. Wire removal may necessitate workers to manipulate wire by hand. If mechanical devices cannot be used, workers will wear leather or cut-resistant gloves for moving wires. The wire removal may include the use of a large spool or spools to remove and store smaller diameter wire. The spool would be connected to a large piece of mobile equipment. The spool and heavy equipment may represent a safety hazard. Workers will wear appropriate PPE, will be aware of the position of moving equipment, and will wear highly visible clothing such as reflective vest.

If larger diameter wire that cannot be spooled is found, it will be cut and placed in intermodal containers for transportation. Larger diameter wires will be cut into manageable pieces using portable cutting equipment and placed into intermodal containers. Workers will use proper PPE during cutting operations.

1.4.1.4 Drum Removal

Bristol will remove drums that currently litter the job site. Almost all of these containers are empty or may contain rainwater. When handling drums with unknown contents, care will be taken to minimize dermal and inhalation contact by having the disposal crews wear chemical-protective clothing. If structurally sound, drums will be hoisted with lifting straps or wire rope. Chains and/or fiber rope will not be used. Free rigging using equipment forks will not be allowed. These personal protective controls will be applied to all situations involving the handling of unknown materials.

Workers who will help handle the removal of debris from this site will be trained about the operator's visibility limitations. Operators will be informed daily and as often as necessary of the workers' whereabouts. A designated transportation route will be established to isolate the area of vehicular traffic. This route will be communicated to the site workers. Site workers will also wear reflective vests to increase their visibility. Soil removed will be dug and placed in DOT-approved bulk bags for off-site disposal.

1.4.2 Barge Loading and Unloading

Contaminated soil will be taken off site in DOT-approved bulk bags. Wooden poles, drums, wires, and other miscellaneous debris from the surrounding areas will be taken off site in intermodal containers. Physical hazards associated with this task include being struck by heavy equipment or becoming pinned or crushed underneath heavy loads. Workers will be trained about the operator's visibility limitations. Operators will be informed daily and as often as necessary of the workers' whereabouts. Unloading and loading activities will be performed by a combination of Bristol personnel and Northland Services personnel. Communications and co-ordination between the two groups will be conducted by the SS. Only essential personnel will be allowed in the loading areas. Some spotter activity may be necessary during the loading and unloading operations. The spotter will be on the ground and will be in the line of sight of the operator for communication.

1.4.3 Sampling

Sampling activities will be performed in accordance with the UFP-QAPP. Environmental samples will be collected from different matrices. Hazards associated with sampling are

primarily chemical in nature and are discussed in Section 8.2.1 of this SSHP. The level of PPE used will depend on the type and location of samples being collected. The physical hazards include sprains and strains from improper lifting or overexertion and cuts from sharp objects, as well as slips, trips, and falls. Sampling crews may be required to walk on uneven or slick surfaces. Samples will be retrieved via backhoe and delivered to the sampler on the surface if excavations prove unsafe for personnel entry.

1.4.4 Site Restoration Operations

Site restoration and revegetation will include the use of heavy equipment to blade out excavated terrain and landfill areas. Physical hazards associated with this activity are posed by the use of heavy equipment in areas where workers are performing specific tasks. All site workers will wear reflective vests to increase visibility while working around heavy equipment. Workers will be trained about the operator's visibility limitations. Operators will be informed daily and as often as necessary of the workers' whereabouts. Manual lifting may be required during remediation activities. Site workers wil1 be trained in proper lifting techniques to minimize the potential for injury.

1.4.5 Air Field Operations

Bristol will use the existing airstrip at NE Cape, but improvements will be required. Bristol personnel will function as the ground contact and observation person for aviation activities at the NE Cape. The SS/SSHO or administrative assistant will contact Bering Air about weather conditions at NE Cape anytime a charter flight is due to land at NE Cape. The Bristol personnel will observe and report weather conditions, such as visibility, wind direction, wind velocity (including gusts), and temperature. A large, heavy-duty wind sock will be installed on the east end of the runway.

When the airstrip is in use, a safe setback from the airstrip centerline will be maintained so that materials and equipment movement does not interfere with aircraft operations. Airstrip shoulders will not be used as roadways during airfield operations. No materials will be stored within this area, except with USACE-specific approval.

Before daily flight operations, an inspection and maintenance of the airstrip surface will be performed and any debris discovered will be removed. Due to weather conditions, inspections of the airstrip surface may be conducted on a more frequent basis.

Heavy equipment will not be used on any part of the airstrip surface for aircraft loading or unloading. Loading/unloading operations will be performed on the airstrip aprons.

1.5 TRAINING REQUIREMENTS

All Bristol personnel assigned to the NE Cape project will have some degree of training. The type of training will depend on the location of the workers and the activities they will perform. Safety awareness will be implemented through daily safety meetings, stand-up training, and one-on-one discussions. Training requirements anticipated for the project are summarized in Table 1-2.

All site personnel working on the excavation and landfill cap activities will have received Hazardous Waste Operations and Emergency Response (HAZWOPER) training. All training documentation will be reviewed by the SS/SSHO. Individuals not providing evidence of 40-hour HAZWOPER training, 8-hour refresher training (when necessary), 8-hour supervisory training (when necessary), or 3 days of on-the-job supervision, will not be allowed to enter an excavation area or Site 9. This requirement will also pertain to all site visitors.

Table 1-2 Training Requirements Summary

Activity/Personnel	Training Requirement
All site personnel	Task- and site-specific training, including Hazard Communication
All personnel who enter work zones	40-hour HAZWOPER, 8-hr Refresher, 3 days of on-the-job supervision
Supervisors in work zones	8-hour HAZWOPER Supervisor
Arsenic awareness (1926.1118)	Workers excavating arsenic-contaminated soils
At least two personnel at all times	Certified in First Aid/CPR
Users of personal protective equipment	Specifics and physical limitations of use

Notes:
CPR = cardiopulmonary resuscitation
HAZWOPER = hazardous waste operations and emergency response

1.5.1 Site-specific Training

The SSHO will provide and document site-specific training during the project site kickoff meeting and whenever new workers arrive on site. The site kickoff meeting will cover all aspects of this SSHP. No site workers will be allowed to begin work on site until the site-specific training is completed and documented by the SSHO. As part of the site-specific training, the following topics will be covered:

- Project introduction and orientation;
- Requirements and responsibilities for accident prevention and maintaining safe and healthful work environments;
- General safety and health policies and procedures and pertinent provisions of EM 385-1-1;
- Chemical, physical, and toxicological properties of site contaminants;
- Spill containment procedures and notifications;
- Job hazards and the means to control/eliminate those hazards, including applicable position and/or AHAs;
- Selection, use, and limitation of PPE;
- Employee and supervisor responsibilities for reporting all accidents;
- Decontamination emergency response procedures and medical facilities;
- Confined space entry (if applicable); and
- Procedures for reporting and correcting unsafe conditions or practices.

1.5.2 Safety Briefings

Site workers will be given toolbox safety meetings by the SSHO daily and/or before the start of new work activities. A copy of the daily Toolbox Safety Meeting Record form that will be used to document these meetings is included in Attachment 5. The daily meetings will be conducted under supervision of the SS/SSHO but may be conducted by other professional personnel, topic depending. Updates in work practices and hazards, emergency evacuation routes, and emergency procedures, will be addressed. At each toolbox meeting, safety will be reviewed for all operations planned for that workday.

1.5.3 First Aid and CPR

All Bristol full-time employees who perform fieldwork have received first-aid and cardiopulmonary resuscitation (CPR) training that has been taught by a certified instructor. All first aid/CPR provider certifications will be reviewed and updated before deployment to the NE Cape. Persons trained in first aid and CPR will have received instruction on bloodborne pathogens in accordance with 29 CFR 1910.1030. Although the risk of bloodborne pathogen contact is considered remote, bloodborne pathogen contact during administration of first aid could occur. Any employee involved in an exposure incident will be offered a post-exposure evaluation consisting of prophylaxis and hepatitis-B virus immunization within 24 hours of exposure. A copy of the Bristol corporate Bloodborne Pathogen Protection program is included under Attachment 6. There will be an Emergency Medical Technician (EMT)-III on site at all times during regular field activities, but not during field mobilization or demobilization activities.

1.5.4 Hazard Communication

As part of the site-specific training, the SSHO will provide hazard communication training for all hazardous materials brought on site. The purpose of a hazard communication or employee right-to-know program is to ensure that the hazards of chemicals located at the site are communicated to site personnel and visitors in accordance with 29 CFR 1926.59.

Site hazard communication includes the following:

Container Labeling. Personnel will ensure that drums and containers are labeled according to contents. These drums and containers will include those from manufacturers and those produced on site by operations. Incoming and outgoing labels will be checked for identity, hazard warning, and name and address of responsible party.

Material Safety Data Sheets. An MSDS will be on site for each hazardous chemical used or known to be on site.

At a minimum, site personnel will be instructed on the following:

- Chemicals and their hazards in the work area,
- How to prevent exposure to these hazardous chemicals,
- Controls in place to prevent worker exposure to these chemicals,
- Procedures to follow if workers are exposed to these chemicals,
- How to read and interpret labels and MSDSs for hazardous substances found on site,
- Emergency spill procedures,
- Proper storage and labeling, and
- Location of MSDSs.

When new hazardous material is introduced or discovered on site, site personnel will be given information about this material at the daily toolbox safety meeting. The SS/SSHO is responsible for ensuring that the MSDS for the new chemical or material is available on site. The SSHO will ensure that site personnel have access to MSDSs at all times. At a minimum, MSDSs will be located at the Bristol field office on site.

1.5.5 Site Visitors

During the course of field activities, visitors will come to the site. All visitors will be required to comply with applicable portions of this SSHP, check in with the SS and SSHO, and sign the Site Control Log before going to a specific site. The SSHO will conduct a brief safety and health training session to communicate the general hazards associated with the site and emergency procedures. All visitors must sign the Certificate of Worker/Visitor Acknowledgment form after the briefing.

1.6 PERSONAL PROTECTIVE EQUIPMENT

Personal protective equipment will be provided when hazard control methods are determined to be impractical or inadequate to protect the worker. By providing for the proper selection, training, use, and maintenance of PPE, worker exposure to hazardous agents can be minimized. The PPE program will be monitored by the SSHO to determine its effectiveness. The site hazards, or potential hazards, specific to this project regarding PPE are those associated with the following:

- Heavy equipment and hand-tool operation,
- Noise,
- Dust/asbestos dust (in soil),
- Dust/arsenic in soil,
- Slips, trips, and falls,
- Drum handling
- PCB-contaminated dust,
- Heat stress and cold stress,
- Oils and solvents,
- Antifreeze solutions, and
- Petroleum-contaminated water.

The level of PPE selected and used will protect employees from the hazards and potential hazards they are likely to encounter, as identified in the AHA tables (Attachment 2). Because of the nature of the tasks involved in the project and the size of the NE Cape site, the SSHO will choose PPE on a daily basis, depending on the operation, location of the work, and the hazards involved in each task. The level of PPE protection will be upgraded or downgraded based on changes in site conditions.

Some factors that may indicate the need to reevaluate site conditions and PPE selections follow:

- Encountering or handling contaminants other than those previously identified,
- Commencing a new work phase,
- Changing job tasks during a work phase,
- A change of season or weather,
- A change in a work activity that increases or decreases contact with contaminants, and
- A change in ambient levels of contaminants.

All PPE changes must be approved by the SSHO. Any changes in PPE for specific tasks will be communicated as soon as possible to the field crew by the SSHO and during the daily periodic training sessions conducted by the SSHO. At a minimum, all changes will be

documented in the field logbook and on the daily Toolbox Safety Meeting Record form (Attachment 5).

The types of protective equipment that will be worn for each specific work activity will be selected, used, inspected, and maintained in accordance with 29 CFR 1910.120(g)(5), 29 CFR 1926.65(g)(5), and 29 CFR 1910.134.

Personal protective equipment Levels C and D will be available for use during the planned project activities. The general PPE components that make up these levels are listed below. Anticipated PPE levels associated with site-specific tasks are summarized in Table 1-3.

Each worker will be responsible for inspecting his or her equipment for cracks, holes, and proper fitting. If any abnormalities are found, the worker will report the defect to the SSHO.

1.6.1 Optional Inner Coveralls, Boot Covers, and Face Shield (or Safety Glasses) - Level D

Level D PPE includes the following:

- Hard hats at all times: Hard hats will comply with American National Standards Institute (ANSI) Z89.1-1969, Safety Requirements for Industrial Head Protection;
- Hard-toe boots are required, and steel shank boots are recommended. Safety-toe footwear will comply with ANSI Z41.1-1967 for Men's Safety-toe Footwear;
- Safety glasses at all times: Safety glasses will comply with ANSI Z87.1-1968, Practice for Occupational and Educational Eye and Face Protection;
- Hearing protection as required;
- Chemical gloves or apron as required;
- Leather gloves as required; and
- Rain gear as required.

1.6.2 Level C

Level C PPE includes the following:

- National Institute for Occupational Safety and Health (NIOSH)-approved full-face or half-mask air-purifying respirator, with appropriate cartridges;
- Chemical-resistant coveralls, with head coverings as required;
- Chemical-resistant outer and inner gloves;

- Hard hats at all times: Hard hats will comply with ANSI Z89.1-1969, Safety Requirements for Industrial Head Protection;
- Safety glasses at all times: Safety glasses will comply with ANSI Z87.1-1968, Practice for Occupational and Educational Eye and Face Protection; and
- Hearing protection as required.

Table 1-3 Anticipated PPE Requirements

Site-specific Task or Activity	Anticipated PPE Level
Runway repairs	Level D
Stream crossing construction/repair	Level D
Removal of liquids, sludges, residues, and sediments	Level D, Level C if exposure action levels could be exceeded
Removal of POL- or PCB-contaminated soil	Level D, Level C if exposure action levels could be exceeded
Removal of arsenic-contaminated soil	Level D, Level C if exposure action levels could be exceeded
Sampling and analysis	Level D, Level C if exposure action levels could be exceeded
Packaging of debris and materials	Level D, Level C if exposure action levels could be exceeded
Transportation of debris and materials	Level D

Notes:
PCB = polychlorinated biphenyl
POL = petroleum, oil, and lubricants
PPE = personal protective equipment

1.6.3 Limitations of Personal Protective Equipment

Workers should be aware of PPE limitations and their effects on working conditions. These limitations are presented in Table 1-4.

Regular work clothing will be worn only in areas where site contaminants do not pose a significant dermal contact hazard. Because clothing is porous and, as such, does not provide liquid contact protection, chemical-resistant clothing will be worn during activities involving the handling of contaminated liquids. Leather boots and gloves that inadvertently become contaminated with these materials will be discarded because they cannot be adequately decontaminated.

Chemical-protective goggles are required when handling liquids that may be corrosive or irritating to the eyes. If such liquids also pose a splash hazard to the face, then face shields will be worn in addition to protective goggles. Under no circumstances will safety glasses or face shields be worn as a substitute for chemical-protective goggles.

Table 1-4 PPE Limitations

PPE Items	Limitations
Hard hat	Hard hats should not be painted or have holes drilled into them. These are considered damaged, and damaged hard hats cannot protect properly.
Safety-toe footwear	Hard-toe footwear can cause cold feet in cool weather. Heavy wool socks are helpful.
Safety glasses	Glasses that fit snugly and have peripheral protection are best, as most injuries occur from the side or top. Damaged or scratched glasses will impair vision and could fail under impact. Polycarbonate lenses are preferred.
Hearing protection	Earplugs and muffs have to be inserted or cover the ears as specified by the manufacturers, or they will not protect to their maximum capability.
Gloves	Gloves wear out and/or get ripped and torn. Daily inspections should be done. Gloves should be replaced if they are not in good condition. Gloves also reduce finger dexterity.
Overalls/coveralls	Overalls/coveralls cannot be used as a chemical barrier and cannot prevent all punctures or cuts.
Rain gear and other outerwear	Rain gear and other outerwear may cause workers to be off-balance or awkward, and will limit peripheral vision. Body heat will be difficult to dissipate. Chemical clothing must be selected according to the contaminant of concern and its physical and chemical properties.

Note: PPE = personal protective equipment

For this project, all standard chemical-resistant gloves are acceptable for the primary COC at the concentrations anticipated. This means that the SSHO may identify locally any available chemical-resistant glove (e.g., neoprene, nitrile, polyvinyl chloride, or natural rubber) for use in any conditions where there is either contact with contaminated soil or the contact is incidental (e.g., pressure washing tank interiors).

1.7 INSPECTION OF PPE

Before donning protective clothing, workers will visually inspect each garment to identify defects, such as tears, cracks, holes, and delaminations, which may allow chemicals to penetrate the clothing. This inspection procedure will involve holding the clothing in the light to illuminate penetration points and stretching the fabric along stitched or bonded seams to

confirm the structural integrity of the garment. The surface of the clothing will also be inspected for any signs of wearing, cracking, or degradation. Personal protective equipment that displays tears, perforations, or chemical degradation will be replaced.

Clothing that is contaminated or discolored will be discarded. Protective clothing ensembles will also be evaluated for proper fit before being worn.

Other protective equipment, such as safety glasses, chemical-protective goggles, and face shields, will be inspected for structural integrity and cleanliness. Goggles and glasses that are severely scratched will be discarded.

1.7.1 Monitoring PPE Effectiveness

The SSHO will make frequent checks on PPE being worn by workers to ensure effectiveness. Workers will be instructed and encouraged to report PPE deficiencies and relay suggestions for improvements to the SSHO. Results of PPE checks and reports from workers will be documented in the daily logs.

1.8 MEDICAL SURVEILLANCE PROGRAM

Bristol will comply fully with 29 CFR 1910.120(f)(6) and 29 CFR 1926.65(f)(6) at all times.

1.8.1 Medical Program

The medical program administered by Bristol includes provisions and procedures for the following:

- Pre-employment physicals as required,
- Drug testing,
- Respirator fit-testing,
- Ongoing medical surveillance (see below),
- Hearing tests, and
- Vision tests.

The specific requirements for this project include all of the above. These physicals and tests will be completed before the workers begin working on site. The Occupational Physician (OP) performing the physical examinations will be given a list of known site hazards and

contaminants before performing fit-for-work examinations and testing. This list will include arsenic, as well as a copy of the OSHA arsenic standard, 29 CFR 1910.1018. A board-certified medical physician, Dr. Alexander Baskous, will provide the examinations.

Because of limitations on medical treatment available at the NE Cape site, employees with certain manageable health conditions requiring special prescriptions or other needs may be medically restricted from working at the site. The OP will determine factors for employee disqualification under the medical program.

The following elements will be included in the medical surveillance program. Additional elements may be included at the discretion of the OP (Dr. Baskous):

- Complete medical and occupational history (initial examination only);
- General physical examination of major organ systems;
- Pulmonary function testing, including functional vital capacity and forced expiratory volume one second (FEV 1);
- Comprehensive blood count with differential;
- Blood chemistry screening profile;
- Urinalysis with microscopic examination;
- Audiometric testing (as required by the Hearing Conservation Program);
- Visual acuity;
- Chest x-ray (This test will be performed no more frequently than every four years, unless directed by the OP.); and
- Electrocardiogram (as directed by the OP).

1.8.2 Frequency of Examinations

In addition to initial, annual, and exit medical examinations, workers must also receive medical examinations and be provided with emergency medical surveillance within 72 hours of the following:

- A worker being exposed to hazardous material(s) during a spill or emergency,
- A worker exhibiting signs and symptoms of exposure, and
- A worker developing a lost-time injury or illness while involved in NE Cape site activity.

- Additional surveillance may also be required whenever the OP determines that examinations need to be conducted more frequently than once each year.

In most cases, the emergency surveillance will be conducted by the on-island EMT III/Paramedic (EMT). Any worker who receives emergency medical surveillance on site will not be allowed to resume work at the site until the EMT issues a certificate of medical fitness.

A certificate of medical fitness will also be required before any worker who sustains a lost-time injury or illness on site will be permitted to resume work activities. The certificate will be issued to the worker by the EMT and must be received by the SS before the worker will be permitted to return to work.

1.8.3 Medical Data Sheet

A Medical Data Sheet will be completed by all on-site personnel and will be kept in Bristol's NE Cape field office by the EMT during site operations. Completion of this data sheet is required in addition to compliance with the medical surveillance program requirements. This data sheet will accompany any personnel when medical assistance is needed, or if transportation to hospital facilities is required.

1.8.4 Information Provided to the Occupational Physician

The OP will be furnished with the following information:

- Site information from Section 2.0 in the WP, Site Description and Project Overview;
- Information about each employee's anticipated or measured exposures;
- A description of any PPE used or to be used;
- A description of each employee's duties as they relate to the employee's exposures (including physical demands and heat/cold stress);
- A copy of 29 CFR 1910.120 or 29 CFR 1926.65;
- Information from previous examinations not readily available to the examining OP;
- A copy of Section 5.0 of NIOSH Publication No. 85-115, *Occupational Safety and Health Guidance Manual for Hazardous Waste Site Activities*; and
- Information required by 29 CFR 1910.134, Respiratory Protection.

1.8.5 Physician's Written Opinion

Before the fieldwork begins, a copy of the OP's written opinion for each employee will be obtained and furnished to the HSM and the employee. The opinion will address the employee's ability to perform fieldwork and will contain the following:

- The OP's recommended limitations on the employee's work and/or PPE usage,
- The OP's opinion about increased risk to the employee resulting from work, and
- A statement that the employee has been informed and advised about the results of the examination.

Medical records will be maintained in accordance with 29 CFR 1910.120, 29 CFR 1926.65, and 29 CFR 1910.1020.

1.9 AIR MONITORING

This section describes the air monitoring that may be performed at the NE Cape site. Airborne exposures to COC may be assessed using both direct and indirect monitoring methods. Direct methods provide "real-time" measurements that can be used to make decisions in the field in regard to hazard control methods, levels of PPE, and work practice controls. Indirect methods involve more standard types of exposure assessment, such as collecting samples from workers' breathing zones and submitting the samples to a laboratory for chemical analysis. Indirect methods generally provide greater analytical precision than direct methods, but do not provide data in real-time for on-site decision making. This type of sampling and analysis provides historical data for use in planning future activities.

All field instruments will be calibrated and maintained in accordance with the manufacturers' specifications. Field personnel may perform routine maintenance of field equipment. Air monitoring activities will be documented on the DQCR.

1.9.1 Direct Methods

Real-time monitoring equipment that may be used at the NE Cape site includes a photoionization detector (PID). The PID provides the capability to detect a wide variety of organic and inorganic vapors and gases, particularly POL, solvents, and fuels. The PID will be the instrument used most often for initial characterization (screening) of soils and

excavations activities, and it will be used periodically as work progresses to ensure that levels of PPE selected for operations remain appropriate.

Exposure limits that will be observed at the NE Cape site are those enforced by OSHA and recommended by the ACGIH. Where exposure limits differ between these two authorities, the lower exposure limit will be observed. Exposure limits for all contaminants discussed above were presented in Table 1-1.

1.10 NOISE MONITORING

Certain operations may exhibit a noise level exceeding the 85-decibel OSHA action level. As part of the medical surveillance program, all site personnel will have baseline audiometric tests before flying to NE Cape. Noise monitoring may be conducted by the SSHO, and personnel will wear hearing protection as directed by the SSHO. As a general rule, hearing protection will be worn when noise levels prevent conversation in a normal voice at a distance of 3 feet, or when work is conducted within 5 feet of heavy construction equipment. A PADS on heat stress is in Attachment 3.

Noise monitoring and calibration will be recorded in the field logbook, or on the Air Monitoring Data Record.

1.11 SITE CONTROL MEASURES

1.11.1 Work Zones

Work zones will be established daily. The configuration of the work zones will depend on the type of activity being performed (e.g., landfill capping, excavating, or sampling).

Excavations and other hazards will be demarcated to prevent people and vehicles from entering work zones.

1.11.2 Buddy System

The buddy system will be employed during most site activities. Employees will be required to be within the visual or oral presence of at least one other person when in a designated work zone. Certain field tasks can be done independently such as the bear guard activities during

fueling and mechanic activities, and the SS often will travel alone between sites during site reconnaissance and survey activities.

1.11.3 Communications

A variety of communications systems will be used for on-site and off-site communication. These include handheld radios, vehicle-mounted radios, telephones, air horns, hand signals, and posting of information. Bristol will establish and maintain a bulletin board at the construction camp where written off-site communications will be posted.

1.11.4 Handheld Radios and Telephones

In case of a site emergency, workers should immediately leave a dangerous situation, inform fellow workers, and report to their immediate supervisors. The SS will contact the emergency personnel required to handle the emergency condition.

1.12 GENERAL SITE RULES

1.12.1 General Safety Rules

The following general safety rules will be strictly followed on site:

- Bristol will maintain a safety and health bulletin board in an area commonly accessed by workers. The bulletin board shall be maintained current, in clear view of on-site workers, and protected against the elements and unauthorized removal. The board will contain at a minimum, the following safety and health information:
  - Map denoting the route to the nearest emergency care facility (EMT trailer);
  - Emergency radio contact numbers and phone numbers (for satellite phone);
  - A copy of the most up-to-date SSHP, with AHAs, shall be mounted on or adjacent to the bulletin board and be accessible on the site by all workers;
  - A copy of the Safety and Occupational Health deficiency tracking log shall be mounted on or adjacent to the bulletin board, or state the location where it will be accessible by all workers upon request;
  - OSHA Form 300A shall be posted in accordance with OSHA requirements and mounted on or adjacent to the bulletin board or state the location, which will be accessible on the site by all workers.
  - Alaska Safety and Health promotional posters;
  - Date of last lost work injury, including number of consecutive days without a lost work injury; and

  - Federal OSHA Safety and Health poster.

- All Bristol and subcontractor personnel must attend the daily safety meeting.
- All site personnel will wear the PPE specified by this SSHP. This includes hard hats and safety glasses, which must be worn at all times in active work areas. Hard-toe shoes will also be worn in all construction areas.
- Facial hair (beards, long sideburns, or mustaches) that may interfere with a satisfactory fit of a respirator mask is not allowed on any person who may be required to wear a respirator.
- Personnel must follow proper decontamination procedures.
- Eating, drinking, chewing tobacco or gum, smoking, and any other practices that may increase the possibility of hand-to-mouth contact are prohibited in the exclusion zones and the contamination reduction zones.
- All signs and demarcations will be followed. Such signs and demarcations will not be removed, except as authorized by the SSHO.
- All personnel must follow the work-rest regimens and other practices required by the heat stress program.
- All personnel must follow lockout/tagout procedures when working on equipment involving moving parts or hazardous energy sources.
- No person will operate equipment unless trained and authorized to do so.
- Ladders will be solidly constructed, in good working condition, and inspected before use. No one may use defective ladders.
- Hand and portable power tools must be inspected before use. Defective tools and equipment will not be used.
- GFCIs will be used for cord and plug equipment used outdoors or in damp locations. Electrical cords will be kept out of walkways and puddles, unless protected and rated for the service.
- Eye wash stations will be positioned in work areas where hazards exist from corrosive liquids or other eye-damaging activities. The eye wash will be capable of providing a 10-minute flow/supply of water, and extra eye wash fluids will be readily available.
- Improper use, mishandling, or tampering with safety and health equipment and samples is prohibited.
- Horseplay of any kind is prohibited.
- Possession or use of alcoholic beverages or controlled substances on any site is forbidden.
- All accidents, no matter how minor, must be reported immediately to the SS.
- All personnel will be familiar with the site Emergency Response Plan.

1.12.2 Prevention of Alcohol and Drug Use

The use of alcohol or illicit drugs at the NE Cape site or camp is prohibited. The SS will immediately terminate, from the site, personnel who are involved in such activities. Terminated personnel will be transported off site by the most expeditious manner possible.

1.12.3 Housekeeping

All work areas will be kept clean and orderly. The accumulation of rags and other combustible materials in uncontrolled areas is prohibited. Flammable liquids will only be stored in approved containers and locations. Access routes, particularly emergency access routes, will be free of all obstructions. Failure to comply with the combustible and flammable storage and emergency access requirements of this section will be considered an imminent danger, resulting in immediate cessation of affected operations until acceptable conditions are met.

1.13 EMERGENCY PROCEDURES

In case of a site emergency, immediate action will be taken to protect life, property, and the environment. The following sections describe the response systems and the line of communications required.

1.13.1 Medical Emergencies

Medical assistance will be limited at the NE Cape site. A medical clinic with a full-time EMT-III/Paramedic (EMT) will be established at the site. The EMT will be available at all times during site work. First-aid kits will be available in trucks on site and at other site locations.

If a medical emergency is beyond the capability of Bristol and island personnel, a medevac will be initiated by the EMT and coordinated with hospital services in Nome.

Workers will be instructed to contact emergency assistance through company radios and satellite phones. The EMT will be given information about the COC on site before the beginning of work. Emergency evacuation routes will be discussed in the daily safety meetings.

1.13.2 Fire Response

Fire fighting services are not available at the NE Cape site. Bristol personnel will attempt to put out small fires with fire extinguishers or water hoses available on site. However, Bristol personnel are not trained in fire fighting techniques. Under no circumstances will personnel be allowed to enter burning buildings or potentially endanger themselves during fire responses. Any fire conditions that appear to be beyond the limited capabilities of Bristol personnel will result in an evacuation of the immediate area, as discussed in Section 1.13.6 of this SSHP. The SS will be in command of all personnel during an emergency.

1.13.3 Environmental Emergencies

The SS will assess environmental emergencies, such as leaks or spills. Spill response and notification will be conducted in accordance with the SPCC Plan.

1.13.4 Site Security During Emergencies

Site security during emergencies and other unexpected events will be the responsibility of the SS. His primary responsibility will be to ensure the safe evacuation, treatment, and transport of site personnel, as warranted by the emergency. Under no circumstances will persons be allowed to enter evacuated areas or work areas during an emergency.

1.13.5 Lines of Authority

The SS will serve as the Site Emergency Coordinator (SEC), or may designate a qualified alternate. The function of the SEC follows:

- In an emergency, notify the USACE;
- Maintain effective emergency plans for the site;
- Follow directions from the USACE regarding response actions;
- Make all regulatory agency contact through the USACE CO; and
- Contact the Bristol HSM, Project Manager, and Chief Executive Officer.

1.13.6 Evacuation and Safe Refuge

Evacuation routes on site will be clearly identified for all personnel and visitors, and will remain accessible during the duration of the project. All areas used for response operations,

emergency evacuation, and safe refuge will be contingent on the approval and authorization of the USACE. Bristol employees, USACE personnel, and visitors will be briefed on the general Emergency Response Plan, fire plan, and evacuation plan during initial site briefings. Specific evacuation routes, safe distances, and places of refuge will be established by the SS upon arrival on the island and before the commencement of site activities. For emergencies that occur within the construction camp, a general rally point has been established at the Old Airport Terminal pad. This location is across the prevailing wind direction and is also a safe distance from the runway. Under the Emergency Response Plan, each work team lead/foreman will be responsible for immediately performing a "head count" and conveying the results to the SS/SEC.

1.13.7 Communications

In the event of an emergency, the following means of communication will be used:

- Radios and satellite telephones, hand signals, and the line-of-sight buddy system;
- Air horns (three short blasts) will be used to alert workers that an emergency requires evacuation. The SEC will communicate information about the emergency to personnel after everyone has arrived at the designated safe refuge area; and
- If an evacuation is necessary, all equipment, activities, and operations will be shut down.

1.13.8 Emergency Contact Information

Emergency information will be posted in each vehicle on site and will include the following:

Emergency Contact Information

Organization/Personnel	Phone Number
Physician's Assistant	Available by radio
USACE Project Manager – Carey Cossaboom	907-753-2689
Northeast Cape Medical Clinic	Available by radio
Bering Air	Available by telephone
Bristol Project Manager – Molly Welker	907-244-7784
Site Superintendent – Chuck Croley	Radio contact
Alternate Site Superintendent – Maze Thompson	Radio contact

Emergency Contact Information (continued)

Organization/Personnel	Phone Number
Bristol Chief Executive Officer – Steve Johnson	907-250-4955
Corporate Safety and Health Manager – Clark Roberts	210-863-9445
Site Safety and Health Officer – Chuck Croley	Radio contact
Alternate Site Safety and Health Officer – Russell James	Radio contact

Note:
USACE = US Army Corps of Engineers

1.13.9 Spill Prevention Program

The spill prevention program is outlined in the Spill Prevention, Control, and Countermeasures Plan (SPCC) (Appendix E). If a spill occurs, the steps and procedures listed below must be taken to protect the health and safety of nearby persons. Workers will be expected to do the following:

- Evacuate the area and contact the SS,
- Follow the Emergency Response Plan initiated by the response team, and
- Swiftly transport any victims to the nearest medical facility for observation.

1.13.10 Evaluating Emergency Preparedness

The SS will contact the USACE in case of an emergency. Debriefings after an incident will include summaries from participants about changes needed and an overall critique of this SSHP. Changes, reviews, and updates to the SSHP may result from actual field conditions or changing conditions. No changes will be made without written approval from the USACE Project Manager and CO.

1.13.11 Emergency Response Contacts

Emergency contacts listed in this SSHP may change. The SS will inform workers of any change in emergency procedures or contact information once the information is made available.

1.13.12 Adverse Weather or Other Environmental Conditions

In case of adverse weather or other environmental conditions, the SSHO, in consultation with the SS, will determine if work can continue without compromising worker health and safety. The following adverse conditions could prompt a safety review:

- High winds,
- Extreme cold,
- Heavy precipitation,
- Fog,
- Volcanic action, and
- Earthquakes.

1.14 RECORDKEEPING REQUIREMENTS

All safety and health record-keeping requirements mandated by 29 CFR 1910.120, 29 CFR 1926, and 29 CFR 1904, will be followed. These records include injury and illness logs, accident/incident reports, site inspection reports, daily toolbox safety meetings, monitoring reports, SSHO logs, and MSDSs.

Health and safety records will be maintained on site at the Bristol field office to fulfill all OSHA, Workers' Compensation, and insurance record-keeping requirements. These include the following:

- OSHA's Form 300, "Log of Work-related Injuries and Illnesses": This log is maintained at the project site. Each recorded injury or illness is entered in the log within six days after notice that a recorded case has occurred (29 CFR 1904.2).
- Bristol Industries Incident Report Form: A copy of this report (or insurance claim report) must be available within seven days after receiving notice that a recorded case has occurred (29 CFR 1904.4).

Copies of these OSHA forms are included in Attachment 5.

The nearest OSHA office must be contacted within eight hours of being notified of an occupational fatality or multiple injuries (29 CFR 1904.8). The contact phone number is: (907) 269-4957.

1.14.1 Site Safety Inspection Documentation

Site safety inspections will be documented in the DQCRs and submitted to the USACE. This documentation will include safety inspections, work summaries, safety meetings, incident investigations, and other required documentation. An example of the SSHO Daily Inspection Log is included in Attachment 5.

The SSHO's daily inspection documentation will contain the following, at a minimum:

- Date,
- Work area(s) visited,
- Number of employees in the work area(s),
- PPE and work equipment in use,
- Special safety or health precautions (excavations, etc.), and
- SSHO signature.

A safety meeting will be held each morning before beginning work at a site. The daily meeting will be documented on the Toolbox Safety Meeting Record form (Attachment 5). The daily meeting will be used to review the hazards associated with the activities planned for the day and measures to reduce the potential for incidents. The Toolbox Safety Meeting Record form will be included in the DQCR.

1.14.2 Personnel Sampling/Monitoring Reports

During the course of the field activities, some of the personnel may use personal air sampling pumps, or passive badge samplers or dosimeters. These types of equipment will be used to monitor exposures for workers involved in specific activities at work sites. These sampling activities will be documented in the field logbook and on the Daily Inspection Log maintained by the SSHO and the Air Monitoring Data Record, as necessary.

1.14.3 Accident/Incident Reports

An incident is defined as follows:

- A fatality,
- Hospitalization of three or more workers,

- An injury or illness that meets the OSHA recordability criteria,
- A property/vehicle/equipment incident that results in damage greater than $2,000, and
- Cases involving first aid treatment.

Accidents that result in minor first-aid treatment should be reported verbally to the SSHO and recorded in the first-aid log maintained at the infirmary.

If an accident or incident should occur, the SSHO is responsible for making sure all reports are completed.

Accidents resulting in treatment beyond first aid, and/or property damage less than $2,000, will be reported verbally and in writing on POD Form 265-R (Attachment 5) to the Quality Assurance Representative (QAR).

Any accident resulting in a lost workday and/or property damage exceeding $2,000 will be reported both verbally and in writing. Verbal reporting will be provided immediately – regardless of the time of day. The POD Form 265-R will be submitted to the USACE within 24 hours and the ENG 3394 (Attachment 5) will be completed and submitted to the USACE within 72 hours of the accident.

Any accident resulting in a fatality, hospitalization of three or more workers, and/or property damage exceeding $2,000, will be reported immediately to the USACE QAR, regardless of the time of day. The ENG Form 3394 (Attachment 5) will be completed and submitted to the USACE within 7 calendar days of the accident.

For accident reporting purposes, the SS will be responsible for notifying the USACE Contracting Officer's Representative or the on-site QAR of the incident before, or simultaneously with, notifying Bristol management personnel. In the event of an accident, the following personnel will be notified:

Telephone Contacts for Accident Reports

Title	Name	Work Telephone
Contracting Officer's Representative	Ron Broyles	907-753-5789
Alaska District Safety Officer	Marvin Ballard	907-753-2896
USACE Industrial Hygienist	Thomas Oh	907-753-2699

Note:
USACE = US Army Corps of Engineers

Email Contact for Accident Reports

Title	Name	Email	Telephone
District Safety Officer	Marvin Ballard	marvin.g.ballard@usace.army.mil	907-753-2896

For Bristol corporate reporting requirements:

Reporting of Work-related Fatality. The SS will report a work-related fatality as soon as possible after becoming aware of it, but no later than four hours after the fatality. The SS is required to report the fatality to the Bristol Project Manager and the Corporate HSM. If the SS is unable to report the fatality, the SSHO will report the fatality. If the Project Manager or the Corporate HSM is unavailable, the fatality must be reported to the Bristol Chief Executive Officer.

Reporting of Work-Related Hospitalization. The SS will report a work-related injury requiring hospitalization as soon as possible after becoming aware of it, but no later than four hours after the hospitalization. The SS is required to report the hospitalization to the Bristol Project Manager and the Bristol HSM.

Reporting of Work-related Injury or Illness. The SS will report all lost-time injuries or illnesses to the Bristol Project Manager and the Bristol HSM as soon as possible, but no later than eight hours after becoming aware of the injury or illness.

Bristol personnel will provide notifications to state or federal agencies. As previously indicated, the federal OSHA reporting telephone number is 907-269-4957. Instances involving a single employee hospitalization will be reported to Alaska State OSHA at 907-269-4995.

1.14.4 Safety and Health Information

The SS/SSHO will review safety and health issues daily, and this information will be reported in the DQCR. Safety and health issues will be discussed at the daily toolbox safety meetings. The DQCR will also document all field activities performed at the site.

The DQCR will contain the date, time, field activities performed, names of personnel, weather conditions, visitors to the site, areas where photographs were taken, calibration records for instruments, any air-monitoring results, and start and completion times of activities.

1.14.5 Hazard Communication Program/Material Safety Data Sheets

The SSHO, as part of site-specific training, will provide hazard communication training for all hazardous materials brought on site. The training will include reviewing the hazards of the chemicals, symptoms of exposure, first aid, MSDSs for spill control information, and appropriate labeling requirements. The MSDSs will be required for all hazardous materials used on site. The MSDSs will be maintained on site by the SSHO.

1.14.6 Safety and Health Phase-out Report

At the completion of the project, a Safety and Health Phase-out Report will be prepared, which will include the following information:

- Summary of the overall success of the Safety and Health Program (accidents/incidents, injury/illness cases),
- Final decontamination documentation for equipment, vehicles, or facilities before demobilization,
- Summary of exposure monitoring and air sampling results, and
- Signatures of the SSHO and the HSM.

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ATTACHMENT 1

Accident Prevention Plan

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ACRONYMS AND ABBREVIATIONS

APP	Accident Prevention Plan
CIH	Certified Industrial Hygienist
EM	Engineer Manual
HSM	Health and Safety Manager
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
USACE	US Army Corps of Engineers

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1. BACKGROUND INFORMATION

a. Contractor

Bristol Environmental Remediation Services, LLC (Bristol)

b. Contract Number

W911KB-06-D-0007

c. Project Name

Northeast Cape HTRW Remedial Actions

d. Introduction

This Accident Prevention Plan (APP) will serve, in essence, as a safety and health policy and program document for this project. This plan will address the job-specific hazards associated with this project and also any unusual or unique aspects of the project. To avoid duplication, the US Army Corps of Engineers® (USACE) EM 385-1-1's minimum APP basic requirements that are not specifically addressed in this APP are included in the Site Safety and Health Plan (SSHP) included as Appendix C of the Work Plan.

e. Project Description

Section 2.0 of the Work Plan includes a description of the site, and Section 3.0 of the Work Plan includes a description of site activities.

f. List of Phases of Work and Activity Hazard Analysis

Section 1.3 of the SSHP includes a list of types of hazards, and Activity Hazard Analysis Tables are included.

g. Statement of Safety and Health Policy

Bristol is committed to maintaining a safe environment under all working conditions. Our goal is to achieve zero accidents with every job and with all work conducted for the company. Our commitment to this goal relies on the skills and attitude of every employee to exercise safe working practices. Our company's Occupational Health and Safety Manual presents basic information for conducting business in a safe manner. It is

expected that, on condition of employment, every employee be familiar with the contents of this Manual and apply the information in a practical and competent manner. It is essential to the success of the company that all employees are committed to maintaining their safety and that of their co-workers.

h. Accident Prevention Plan Components

(1) Signature Sheet

The signature sheet is included as page 1 of the SSHP.

2. RESPONSIBILITY AND LINES OF AUTHORITY

a. Personnel Responsible for Safety

Section 5.0 of the Work Plan details the administration for this project, including the SSHP (Section 5.2.1). Key corporate and project personnel resumes are included as Appendix G of the Work Plan.

b. Lines of Authority

Section 1.13.5 of the SSHP details lines of authority.

c. Subcontractors and Suppliers

(1) Identification of Subcontractors

Table 4-1 in the Work Plan lists subcontractors required for completion of this project.

(2) Subcontractor Coordination and Control

Section 4.1.1 of the Work Plan details the Site Safety and Health Officer's (SSHO's) oversight responsibilities for subcontractor coordination and control.

(3) Safety Responsibility of Subcontractors

The SSHP details the safety responsibilities of all laborers, operators, and subcontractors.

d. Training

(1) Safety Training

Section 1.5 of the SSHP details all safety training requirements associated with this project. Appendix G of the Work Plan includes training certifications for key Bristol personnel.

(2) Mandatory Safety Training

Table 1-2 in the SSHP summarizes mandatory safety training for this project.

(3) Emergency Response Training

Section 1.5.3 of the SSHP details first aid and CPR training requirements of this project.

(4) Supervisor and Employee Safety Meetings

Section 1.5.2 of the SSHP details the daily safety briefing requirements of this project.

e. Safety and Health Inspections

(1) Safety Inspection Personnel

The SSHO will have the responsibility of conducting daily site inspections and equipment inspections. Procedures for completing daily site inspection logs are included in Section 1.14.1 of the SSHP, and example equipment inspection logs and daily inspection logs are included in Attachment 5 of the SSHP.

(2) External Inspections/Certifications

The Corporate Health and Safety Manager (HSM) may make announced or unannounced site visits. The HSM also performs a quarterly review of all projects to ensure the proper documentation and follow up of safety meetings, inspections, and briefings.

f. Safety and Health Expectations and Compliance

(1) Safety Goals

Bristol's project safety goal is to complete the project with no recordable accidents or illnesses, and no first-aid incidents.

(2) Policies and Procedures for Noncompliance

Noncompliance with safety and health requirements will be corrected immediately as designated by the SSHO. Documentation will be made in the logbook. The SSHO will report serious, noncompliant personnel to the immediate supervisor. The supervisor shall counsel the employee. All employees are expected to follow safe work practices, to take responsibility for their own safety, and to respect the safety of others. Bristol's safety management approach attempts to motivate employees to work safely, rather than punish them for unsafe behaviors, but there may be instances where disciplinary action may be necessary.

Any personnel not abiding by regulatory or internal safety rules or policies will be subject to progressive discipline. The general approach to progressive discipline includes the following steps:

- **First Offense** – Documented verbal warning
- **Second Offense** – Written warning
- **Third Offense** – Three days suspension without pay
- **Fourth Offense** – Termination

Disciplinary actions will be documented by the supervisor, and a notice will be placed in the individual's personnel record.

Depending on the nature, severity, or frequency of safety violations, and at Bristol's sole discretion, individual or multiple steps in this progressive disciplinary approach may be bypassed, with potential actions up to or including termination on the first offense.

g. Accident Reporting

(1) Exposure/Man-hours

Bristol will provide monthly reporting of man-hours and exposure data to the USACE.

(2) Accident Investigations, Reports, and Logs

Section 1.14.3 of the SSHP details accident reporting procedures for this project. Appendix C of the Work Plan includes accident reporting forms.

(3) Accident Notification

Section 1.14.3 of the SSHP details accident notification procedures for this project.

h. Medical Support

Section 1.8 of the SSHP details Bristol's medical surveillance program. Section 2.13 of the SSHP details medical emergency procedures for the project.

i. Personal Protective Equipment

Section 1.6 of the SSHP details the personal protective equipment requirements, procedures, and limitations for the project.

j. Plans Required by the Safety Manual

(1) Hazard Communication Program

Section 1.5.4 of the SSHP details hazard communications procedures for the project.

(2) Emergency Plans

Section 1.13 of the SSHP details emergency procedures for the project.

(3) Layout Plans

Figure 3 of the Work Plan is a Project Work Site Map.

(4) Respiratory Protection Plan

Appendix C of the Work Plan includes information on Bristol's Respiratory Protection Program. Use of respirators is not anticipated for the project.

(5) Health Hazards Control Programs

Section 1.3 of the SSHP details potential health hazards. Task-specific hazards are identified in Section 1.4 of the SSHP.

(6) Lead Abatement Plan

Not applicable to this project.

(7) Asbestos Abatement Plan

Not applicable to this project.

(8) Abrasive Blasting

Not applicable to this project.

(9) Confined Space

Confined space entry operators are not anticipated for the project.

(10) Hazardous Energy Control Plan

No lockout/tagout activities that would require development of a hazardous energy control plan are anticipated for this project.

(11) Critical Lift Procedures

Not applicable to this project.

(12) Severe Weather

Section 1.3.2.7 of the SSHP discusses weather hazards and thermal stress. Section 1.13.12 of the SSHP discusses adverse weather and other conditions.

(13) Access and Haul Road Plan

Not applicable to this project.

(14) Demolition Plan

Not applicable to this project.

(15) Emergency Response

Section 1.13 of the SSHP describes the emergency response systems and lines of communication required for this project.

(16) Underground Construction Fire Prevention and Protection Plan

Not applicable to this project.

(17) Compressed Air Plan

Not applicable to this project.

(18) Formwork and Shoring Erection and Removal Plans

Not applicable to this project.

(19) Lift Slab Plans

Not applicable to this project.

(20) Safety and Health Programs and Site Safety and Health Plan

Appendix C of the Work Plan contains the SSHP for this project.

(21) Blasting Plan

Not applicable to this project.

(22) Diving Plan

Not applicable to this project.

(23) Alcohol and Drug Abuse Prevention Plan

Illegal use, sale, or possession of narcotics or drugs (except as authorized and prescribed by a physician) while on Bristol property, Bristol time, or in any other circumstance that might adversely affect Bristol's operations, safety, job performance, or corporate image, is prohibited and may result in discipline or discharge. Alcohol is prohibited from Bristol property and operations. Consuming alcohol while on Bristol property, Bristol time, or in other circumstances that might adversely affect Bristol operations, job performance, safety, or corporate image, including consuming such substances prior to reporting to work or during breaks or lunch periods, is prohibited.

If an employee appears to be under the influence of drugs or alcohol, Bristol may require the employee to submit to appropriate tests, including urinalysis or breath tests, to confirm the existence of such alcohol or prohibited drug or substance in his/her system. Failure to promptly permit such tests upon management's request shall be grounds for discipline, including immediate termination.

Bristol may also conduct appropriate pre-employment drug and alcohol tests, and may require periodic drug and alcohol tests on designated projects when such tests are requested or required by the client or by applicable law or regulation.

k. Additional Information

Additional safety and health requirements are included in the SSHP, which is in Appendix C of the Work Plan.

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ATTACHMENT 2

Activity Hazard Analysis

Barge Loading Operations

Barge Unloading Operations

Debris Removal and Staging

Drum Removal

Excavation Less than Four Feet

Excavation Greater than 4 Feet and Backfilling

Fueling of Vehicles and Equipment

POL and PCB Soil Removal Disposal

Pole Removal

Site Restoration

Surface Soil Sampling

Subsurface Soil Sampling

Wire Removal

ACTIVITY HAZARDS ANALYSIS

Overall Risk Assessment Code (RAC)
(Use highest code): M

Date: 20 April 2011 Project: NE Cape HTRW

Activity: Barge Loading Operations

Activity Location: Northeast Cape St. Lawrence Island

Prepared By: Eric Barnhill

Risk Assessment Code Matrix

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Add Identified Hazards

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	General Activity	Slips, trips, falls Back Injury Crushing Injuries Eye Injury / Hearing Los Dropped Objects	• Use care during foot travel, and clear the area of slip and trip hazards • Use barricades • Use guardrails • Cover holes • Use proper lifting technique • Use Buddy System for heavy lifts • Use lifting/transport equipment • Use caution when setting loads • Wear required PPE: o Hard Hat o Hard-toe boots o Safety glasses with side shields o Reflective vest o Hearing protection, as needed. o Personal Flotation Device o Life ring with 75' line • Use caution around equipment lift materials.	L

ACTIVITY HAZARDS ANALYSIS

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	Container Movement	Crushing from Container free movement Struck by equipment/objects Leak/Spill Contact splash or inhalation of hazardous materials	• Blocks/chocks/Barricades • No loads carried over any individuals • No loads suspended over individuals • Use watchman during container movement • Wear required PPE/reflective vests • Use backup alarms on all equipment • Use traffic control and watchman • Use MSDS for guidance • Spill Kits • Use chemical splash PPE/Level C protection as warranted • Limit personnel in area (site control) • Use chemical splash PPE/Level C protection as warranted	M
X	Vehicle Operation	Rollover	• Stay within the speed limit specified • Follow manufacturer's recommended payload • Use trained operators only	L
X	Equipment operations	Equipment Failure	• Inspect equipment prior to daily operation • Ensure all roll cages and guards are in place and backup alarms operate • OEM equipment modifications only • Machine guarding and enclosures	L

Add Items

	EQUIPMENT	TRAINING	INSPECTION
X	Trucks	• Utilize only trained and qualified operators for operation of equipment	Daily inspection of vehicles prior to operation
X	Forklifts	• Utilize only trained and qualified operators for operation of equipment	Daily inspection of equipment prior to operation
X	Hand Tools	• On the job training training Toolbox Talks • 40-hour HAZWOPER • HazCom Training Competent Person: Alt. Competent Person:	Daily inspection of tools prior to operation

Involved Personnel:

ACTIVITY HAZARDS ANALYSIS

Acceptance Authority (digital signature): _____

ACTIVITY HAZARDS ANALYSIS

Overall Risk Assessment Code (RAC)
(Use highest code)

M

Date: 20 April 2011

Project: NE Cape HTRW

Activity: Barge Unloading Operations

Activity Location: Northeast Cape St. Lawrence Island

Prepared By: Eric Barnhill

Risk Assessment Code Matrix

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Add Identified Hazards

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	General Activity	Slips, trips, falls Back Injury Crushing Injuries Eye Injury / Hearing Los Dropped Objects	• Use care during foot travel, and clear the area of slip and trip hazards • Use barricades • Use guardrails • Cover holes • Use proper lifting technique • Use Buddy System for heavy lifts • Use lifting/transport equipment • Use caution when setting loads • Wear required PPE: o Hard Hat o Hard-toe boots o Safety glasses with side shields o Reflective vest o Hearing protection, as needed. o Personal Flotation Device o Life ring with 75' line • Use caution around equipment lift materials.	L

ACTIVITY HAZARDS ANALYSIS

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	Container Movement	Crushing from Container free movement Struck by equipment/objects Leak/Spill Contact splash or inhalation of hazardous materials	• Blocks/chocks/Barricades • No loads carried over any individuals • No loads suspended over individuals • Use watchman during container movement • Wear required PPE/reflective vests • Use backup alarms on all equipment • Use traffic control and watchman • Use MSDS for guidance • Spill Kits • Use chemical splash PPE/Level C protection as warranted • Limit personnel in area (site control) • Use chemical splash PPE/Level C protection as warranted	M
X	Vehicle Operation	Rollover	• Stay within the speed limit specified • Follow manufacturer's recommended payload • Use trained operators only	L
X	Equipment operations	Equipment Failure	• Inspect equipment prior to daily operation • Ensure all roll cages and guards are in place and backup alarms operate • OEM equipment modifications only • Machine guarding and enclosures	L

Add Items

	EQUIPMENT	TRAINING	INSPECTION
X	Trucks	• Utilize only trained and qualified operators for operation of equipment	Daily inspection of vehicles prior to operation
X	Forklifts	• Utilize only trained and qualified operators for operation of equipment	Daily inspection of equipment prior to operation
X	Hand Tools	• On the job training training Toolbox Talks • 40-hour HAZWOPER • HazCom Training Competent Person: Alt. Competent Person:	Daily inspection of tools prior to operation

Involved Personnel:

ACTIVITY HAZARDS ANALYSIS

Acceptance Authority (digital signature): CSP

ACTIVITY HAZARDS ANALYSIS

Overall Risk Assessment Code (RAC) (Use highest code): L

Date: 20 April 2011 Project: NE Cape HTRW

Activity: Debris Removal and staging

Activity Location: Northeast Cape St. Lawrence Island

Prepared By: Troy Tau'a, Site Safety & Health Officer

Risk Assessment Code Matrix

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Add Identified Hazards

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	Removal by Hand and General Site Work	Slips, trips, falls Struck by equipment/objects Crushing Injuries Dropped Objects Eye Injury / Hearing Loss Falls from steep slopes Back Injury	• Use care during foot travel, and clear the area of slip and trip hazards • Use barricades • Use guardrails • Cover holes • Use proper lifting technique • Use Buddy System for heavy lifts • Use lifting/transport equipment • Use caution when setting loads • Machine guards/enclosures • Wear required personal protective equipment (PPE) o Hard Hat o Hard-toe Boots o Safety Glasses with side shields o Reflective Vest o Hearing Protection, as needed. o Gloves • Use caution around equipment lift materials. • Wear required PPE. • Wear required PPE. • Wear D-ring harness with restraint cable system at approved anchor points • Wear required PPE • Backup alarms on all equipment • Use traffic control and watchman	L

ACTIVITY HAZARDS ANALYSIS

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	Vehicle Operation	Rollover	• Stay within the speed limit specified. • Follow manufacturer's recommended payload. • Use Seatbelts/rollover protection system (ROPS). • For all-terrain vehicles, gloves and hardhats are required. • Utilize only licensed and trained operators. • Ensure equipment is not operated on excessive grades to prevent rollovers.	L
X	Equipment operations	Equipment failure	• Inspect equipment prior to daily operation. • Ensure all roll cages and guards are in place and back up alarms operate. • Original equipment manufacturer's (OEM) equipment modifications only. • Use machine guarding and enclosures	L

Add Items

	EQUIPMENT	TRAINING	INSPECTION
X	Trucks	Utilize only trained and qualified operators for vehicles.	Daily inspection of equipment prior to operation
X	Graders, Bulldozers, Backhoe	Utilize only trained and qualified operators for operation of equipment.	Daily inspection of equipment prior to operation
X	Hand tools	Site Specific Training – Toolbox safety meetings Fall Protection System (if applicable) Competent Person: ALT. Competent Person:	Daily inspection of equipment prior to use

Involved Personnel:

Acceptance Authority (digital signature): CSP

ACTIVITY HAZARDS ANALYSIS

Overall Risk Assessment Code (RAC)
(Use highest code): L

Date: 20 April 2011 Project: NE Cape HTRW

Activity: Drum Removal

Activity Location: Northeast Cape St. Lawrence Island

Prepared By: Troy Tau'a, Site Safety & Health Officer

Risk Assessment Code Matrix

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Add Identified Hazards

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	Removal by Hand	Slips, trips, falls Struck by equipment/objects Crushing Injuries Dropped Objects Eye Injury / Hearing Loss Falls from steep slopes Back Injury	• Use care during foot travel, and clear the area of slip and trip hazards • Use barricades • Cover holes • Use proper lifting technique • Use Buddy System for heavy lifts • Use lifting/transport equipment • Use caution when setting loads • Machine guards/enclosures • Wear required personal protective equipment (PPE) o Hard Hat o Hard-toe Boots o Safety Glasses with side shields o Reflective Vest o Hearing Protection, as needed. o Gloves • Use caution around equipment lift materials. • Wear required PPE. • Wear required PPE. • Wear D-ring harness with restraint cable system at approved anchor points • Wear required PPE • Backup alarms on all equipment • Use traffic control and watchman	L

ACTIVITY HAZARDS ANALYSIS

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	Vehicle Operation	Rollover	• Stay within the speed limit specified. • Follow manufacturer's recommended payload. • Use Seatbelts/rollover protection system (ROPS). • For all-terrain vehicles, gloves and hardhats are required. • Utilize only licensed and trained operators. • Ensure equipment is not operated on excessive grades to prevent rollovers.	L
X	Equipment operations	Equipment failure	• Inspect equipment prior to daily operation. • Ensure all roll cages and guards are in place and back up alarms operate. • Original equipment manufacturer's (OEM) equipment modifications only. • Use machine guarding and enclosures	L

Add Items

	EQUIPMENT	TRAINING	INSPECTION
X	Trucks	Utilize only trained and qualified operators for vehicles.	Daily inspection of equipment prior to operation
X	Hand tools	Site Specific Training – Toolbox safety meetings Fall Protection System (if applicable) HAZWOPER 40 hour Competent Person: ALT. Competent Person:	Daily inspection of equipment prior to use

Involved Personnel:

Acceptance Authority (digital signature): CSP

ACTIVITY HAZARDS ANALYSIS

Overall Risk Assessment Code (RAC)
(Use highest code): L

Date: 20 April 2011 Project: NE Cape HTRW

Activity: Excavation - Less than 4 feet in depth

Activity Location: Northeast Cape St. Lawrence Island

Prepared By: Eric Barnhill

Risk Assessment Code Matrix

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Add Identified Hazards

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	Site Prep	Slips, trips, and falls Back injury Crushing injuries Eye injury Hearing loss	Use care during foot travel, and clear the area of slip and trip hazards Use barricades Cover holes Wear required PPE	L
X	Excavation	Slips, trips, and falls Wall collapse	Use care during foot travel, and clear the area of slip and trip hazards Use barricades Use guardrails Appropriate sloping/shoring Soils classification Daily excavation inspection	M
X	Vehicle Operation	Rollover	Stay within the speed limit specified Use seat belt's Ensure equipment is not operated on excessive grades	L
X	Equipment Operations	Equipment failure Caught between/Caught under	Use back up alarms back-up alarms Use spotter when necessary	L

Add Items

	EQUIPMENT	TRAINING	INSPECTION
X	Trucks	Use only trained and qualified operators	Daily inspection of vehicles prior to operation
X	Excavator and backhoe	Utilized only trained and qualified operators	Daily inspection of heavy equipment prior to operation

ACTIVITY HAZARDS ANALYSIS

	EQUIPMENT	TRAINING	INSPECTION
X	Hand tools	Site specific training Toolbox Talks Hazcom training 40 hour HAZWOPER Competent person: ALT. Competent person:	Daily inspection of tools prior to operation

Involved Personnel:

Acceptance Authority (digital signature): CSP

ACTIVITY HAZARDS ANALYSIS

Overall Risk Assessment Code (RAC)
(Use highest code)

L

Date: 20 April 2011 Project: NE Cape HTRW

Activity: Excavation greater than 4 feet and backfilling

Activity Location: Northeast Cape St. Lawrence Island

Prepared By: Eric Barnhill

Risk Assessment Code Matrix

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Add Identified Hazards

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	Site preparation	Slips, trips, falls Back injury Eye injury / hearing loss Wall collapse	• Use care during foot travel, and clear the area of slip and trip hazards • Use barricades • Cover holes • Use Material Safety Data Sheets (MSDS) prior to action • Use appropriate PPE o Hard hat o Safety reinforced boots o Face shield/safety glasses o Reflective vest o Hearing protection, as needed • Use proper lifting technique. • Use Buddy System for heavy lifts • Use lifting/transport equipment • Inspection daily of all trenches and excavations • Follow all OSHA and EM 385 1-1 regulations	L

ACTIVITY HAZARDS ANALYSIS

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	Excavator operation	Rollover Personnel pinch/crushing	• Stay within the speed limit specified • Follow manufacturer's recommended limits • Use seatbelts/roll over protection systems (ROPS) • Use only qualified and trained operators • Ensure equipment is grounded when not in use • Bucket lowered to ground when not in use • Do not approach operator cab until visual contact is made with operator • SS/SSHO will identify swing radius and pinching zone of excavator while operating and mark safe boundary of personnel with cones, barricade tape, etc.	M
X	Loader operation	Rollover	• Stay within the speed limit specified • Follow manufacturer's recommended limits • Use seatbelts/roll over protection systems (ROPS) • Use only licensed and trained operators • Ensure equipment is ground when not in use • Bucket lowered to ground when not in use. Stay within the speed limit • Do not approach operator cab until visual contact is made with operator	M
X	Compaction with tow compactor	Struck by equipment	• Wear specified personal protective equipment (PPE)/reflective vests • Backup alarms on all equipment	M
X	All equipment operations	Contact with personnel of other equipment and all hazards indicated above Mechanical fluid leaks	• Use original equipment manufacturer (OEM) equipment modifications only. • Regulated work areas will be established around each job site and safe distances will be maintained between workers and mechanical equipment using safety fence and signs. Mobile equipment will be equipped with backup alarms. • Personnel will remain a safe distance away from operations. Personnel needing to approach heavy equipment while the equipment is operating will observe the following protocols: • Make eye contact with the operator (and spotter); • Signal the operator to cease heavy equipment activity, if applicable; and • Approach the equipment operator and inform the operator of intentions. • Use spill kits to protect environment.	M

Add Items

EQUIPMENT	TRAINING	INSPECTION

ACTIVITY HAZARDS ANALYSIS

	EQUIPMENT	TRAINING	INSPECTION
X			
X	Excavator, loader, and tow compactor	• Use only trained and qualified operators for operation of equipment. • Site-specific training – Toolbox meetings • Competent Person training • Hazardous communication (HazCom) training 40 hour HAZWOPER COMPETENT PERSON: ALT. COMPETENT PERSON:	Daily inspection of equipment prior to operation

Involved Personnel:

Acceptance Authority (digital signature): CSP

ACTIVITY HAZARDS ANALYSIS

Overall Risk Assessment Code (RAC)
(Use highest code): L

Date: 20 April 2011 Project: NE Cape HTRW

Activity: Fueling of Vehicles and Equipment

Activity Location: Northeast Cape St. Lawrence Island

Prepared By: Troy Tau'a, Site Safety & Health Officer

Risk Assessment Code Matrix

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Add Identified Hazards

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	Maintenance of Equipment	Slips, trips, falls Back Injury Dropped Objects Body Injury/Hearing Loss Cuts Electrical Shock Crushing Injuries	• Use care during foot travel • Housekeeping - clear the area of slip and trip hazards • Use barricades •Use proper lifting technique o Keep back straight during lifts o Use legs – not back/arm muscles for lift o Don't perform lifts on uneven surfaces o Do not walk/carry heavy loads o Use Buddy System for heavy lifts o Use lifting/transport equipment as needed • Use caution around equipment lift materials • Wear required PPE o Hard hat o Hard-toe shoes o Safety glasses with side shields o Reflective vest o Hearing protection (as required) • Wear specified PPE and protective gloves as needed • Use ground fault circuit interrupter (GFCI) • Inspect all cords (remover from service if damaged) • Use machine guards/enclosures	L

ACTIVITY HAZARDS ANALYSIS

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	Fueling	Leak/Spill Fire Splash/Drenching with Fuel	• Use MSDS for guidance • Use spill kits • Fire Extinguisher in Fuels Area • No Smoking in Fuels Area • Use Bonding Clips during fuel transfer to containers • Use chemical splash PPE/eye-face protection as warranted	L

Add Items

	EQUIPMENT	TRAINING	INSPECTION
X	Mechanical Pump	• Utilize only trained and qualified operators for operation of equipment. • Site specific training Toolbox safety meetings • HazCom Training Competent Person: ALT. Competent Person:	Daily inspection of equipment prior to operation

Involved Personnel:

Acceptance Authority (digital signature): CSP

ACTIVITY HAZARDS ANALYSIS

Overall Risk Assessment Code (RAC)
(Use highest code): L

Date: 20 April 2011 Project: NE Cape HTRW

Activity: POL & PCB soil Removal Disposal

Activity Location: Northeast Cape St. Lawrence Island

Prepared By: Troy Tau'a, Site Safety & Health Officer

Risk Assessment Code Matrix

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Add Identified Hazards

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	General Activity	Contact with or inhalation of hazardous materials Back Injury Crushing Injuries Dropped Objects Eye Injury / Hearing Loss Struck by equipment/objects Slips, trips, falls	• Use care during foot travel, and clear the area of slip and trip hazards • Use barricades • Cover holes • Use proper lifting technique • Use Buddy System for heavy lifts • Use lifting/transport equipment • Use caution when setting loads • Machine guards/enclosures • Wear required PPE: o Hard Hat o Hard-toe boots o Safety glasses with side shields o Reflective vest o Hearing protection, as needed. • Use caution around equipment lift materials. • Use backup alarms on all equipment • Use traffic control and watchman • Limit personnel in area (site control) • Use impermeable PPE/Level C protection as warranted	L
X	Equipment Operations	Equipment Failure	Inspect equipment prior to daily operation. • Ensure all roll cages and guards are in place and backup alarms operate. • OEM equipment modifications only. • Machine guarding and enclosures	L

ACTIVITY HAZARDS ANALYSIS

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	Vehicle Operations	Material Spill/Contact Rollover	• Stay within the speed limit specified. • Follow manufacturer's recommended payload. • Inspect containers before transport. • Use spill kits. • Use impermeable PPE/Level C protection as warranted.	L

Add Items

	EQUIPMENT	TRAINING	INSPECTION
X	Trucks	• Utilize only trained and qualified operators for operation of equipment.	Daily inspection of vehicle prior to operation
X	Backhoes	• Utilize only trained and qualified operators for operation of equipment.	Daily inspection of equipment prior to operation
X	Hand Tools	• On the job training Toolbox Talks • 40-hour HAZWOPER • HazCom Training Competent Person: ALT. Competent Person:	Daily inspection of equipment prior to operation

Involved Personnel:

Acceptance Authority (digital signature): CSP

ACTIVITY HAZARDS ANALYSIS

Overall Risk Assessment Code (RAC)
(Use highest code)

L

Date: 20 April 2011 Project: NE Cape HTRW

Activity: Pole Removal

Activity Location: Northeast Cape St. Lawrence Island

Prepared By: Eric Barnhill

Risk Assessment Code Matrix

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Add Identified Hazards

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	Removal by hand, Tracked Vehicle and Boom Truck.	Slips, trips, falls Struck by equipment/objects Crushing Injuries Dropped Objects Eye Injury / Hearing Loss Falls from steep slopes Back Injury Cutting Hazard	• Use care during foot travel, and clear the area of slip and trip hazards • Use proper lifting technique • Use Buddy System for heavy lifts • Use lifting/transport equipment • Use caution when setting loads • Machine guards/enclosures • Wear required personal protective equipment (PPE) o Hard Hat o Hard-toe Boots o Safety Glasses with side shields o Reflective Vest o Hearing Protection, as needed. o Chain saw chaps o Face shield • Use caution around equipment lift materials. • Wear D-ring harness with restraint cable system at approved anchor points • Backup alarms on all equipment • Use traffic control and watchman	L

ACTIVITY HAZARDS ANALYSIS

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	Vehicle Operation	Rollover	• Stay within the speed limit specified. • Follow manufacturer's recommended payload. • Use Seatbelts/rollover protection system (ROPS). • For all-terrain vehicles, gloves and hardhats are required. • Utilize only licensed and trained operators. • Ensure equipment is not operated on excessive grades to prevent rollovers.	L
X	Equipment operations	Equipment failure Cuts/Lacerations	• Inspect equipment prior to daily operation. • Ensure all roll cages and guards are in place and back up alarms operate. • Original equipment manufacturer's (OEM) equipment modifications only. • Use machine guarding and enclosures	L

Add Items

	EQUIPMENT	TRAINING	INSPECTION
X	Trucks	Utilize only trained and qualified operators for vehicles.	Daily inspection of equipment prior to operation
X	Excavator, Boom Truck	Utilize only trained and qualified operators for operation of equipment.	Daily inspection of equipment prior to operation
X	Hand tools - Chain saw	Site Specific Training – Toolbox safety meetings Fall Protection System (if applicable) Competent Person: ALT. Competent Person:	Daily inspection of equipment prior to use

Involved Personnel:

Acceptance Authority (digital signature): CSP

ACTIVITY HAZARDS ANALYSIS

Overall Risk Assessment Code (RAC)
(Use highest code): L

Date: 20 April 2011 Project: NE Cape HTRW

Activity: Site Restoration

Activity Location: Northeast Cape St. Lawrence Island

Prepared By: Eric Barnhill

Risk Assessment Code Matrix

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Add Identified Hazards

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	Site Prep	Struck by equipment/objects Back Injury Crushing Injuries Dropped Objects Eye Injury / Hearing Loss Slips, trips, falls	• Use care during foot travel, and clear the area of slip and trip hazards • Use barricades • Cover holes • Use proper lifting technique • Use Buddy System for heavy lifts • Use lifting/transport equipment • Use caution when setting loads • Wear required PPE: o Hard Hat o Hard-toe boots o Safety Glasses w/ side shields o Reflective Vest o Hearing Protection, as needed. • Use caution around equipment lift materials. • Wear required PPE. • Use backup alarms on all equipment • Use traffic control and watchman	L
X	Equipment Operations	Equipment Failure	• Inspect equipment prior to daily operation. • Ensure all roll cages and guards are in place and backup alarms operate. • OEM equipment modifications only. • Use machine guarding and enclosures.	L
X	Vehicle Operations	Rollover	• Stay within the speed limit specified. • Follow manufacturer's recommended payload.	L

ACTIVITY HAZARDS ANALYSIS

Add Items

	EQUIPMENT	TRAINING	INSPECTION
X	Trucks	• Utilize only trained and qualified operators for vehicles	Daily inspection of vehicle prior to operation
X	Graders, Bulldozers	• Utilize only trained and qualified operators for operation of equipment.	Daily inspection of equipment prior to operation
X	Hand Tools	• On the job training Toolbox Talks • 40-hour HAZWOPER • HazCom Training Competent Person: ALt. Competent Person:	Daily inspection of tools prior to operation

Involved Personnel:

Acceptance Authority (digital signature): CSP

ACTIVITY HAZARDS ANALYSIS

Overall Risk Assessment Code (RAC)
(Use highest code): L

Date: 20 April 2011 Project: NE Cape HTRW

Activity: Surface Soil Sampling

Activity Location: Northeast Cape St. Lawrence Island

Prepared By: Eric Barnhill

Risk Assessment Code Matrix

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Add Identified Hazards

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	General safety requirements for all steps		Minimum personal protective equipment: (a) Long pants (b) Long sleeves (c) Hardhat (d) Safety boots (steel or composite toe) (e) Safety glasses (potential eye injury hazard areas) (f) Reflective vest (g) Hear protection, as needed	L
		(1) Exposure to cold or hot weather	(1a) Wear appropriate clothing for hot or cold weather (1b) Wear sun block	
		(2) Dehydration	(2a) Drink at least 1/2 liter of water an hour (2b) Refer to physical agent data sheet (PADS) for specific details on heat stress and symptoms	
X	Surface soil sampling	(1) Chemical hazards	(1a) Gloves, safety glasses, and other appropriate PPE will be used during soil sampling collection. Ambient monitoring will be conducted with a photoionization detector (PID) to identify any unusual rise or change in petroleum vapors	L
		(2) Unstable footing conditions	(2a) Use care and assure solid footing in the work area. (2b) Note all slip hazards in the work area. (2c) Clear the work area of all potential trip hazards	
		(3) Noise	(3a) Hearing protection will be used as warranted	

ACTIVITY HAZARDS ANALYSIS

Add Items

	EQUIPMENT	TRAINING	INSPECTION
X	PID	Personnel will be trained in PID utilization, calibration, maintenance, and sample collection techniques	Daily calibration and moisture trap or sensor replacement, as needed

Involved Personnel:

Acceptance Authority (digital signature): Clark Roberts

Digitally signed by Clark Roberts
DN: cn=Clark Roberts, o=Bristol, ou=Health & Safety Manager, email=croberts@bristol-companies.com, c=US
Date: 2010.09.24 10:03:43 -05'00'

ACTIVITY HAZARDS ANALYSIS

Overall Risk Assessment Code (RAC)
(Use highest code): L

Date: 20 April 2011 Project: NE Cape HTRW

Activity: Subsurface Soil Sampling

Activity Location: Northeast Cape St. Lawrence Island

Prepared By: Eric Barnhill

Risk Assessment Code Matrix

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Add Identified Hazards

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	General safety requirements for all steps		Minimum personal protective equipment: (a) Long pants (b) Long sleeves (c) Hardhat (d) Safety boots (steel or composite toe) (e) Safety glasses (potential eye injury hazard areas) (f) Reflective vest (g) Hear protection, as needed	L
		(1) Exposure to cold or hot weather	(1a) Wear appropriate clothing for hot or cold weather (1b) Wear sun block	
		(2) Dehydration	(2a) Drink at least 1/2 liter of water an hour (2b) Refer to physical agent data sheet (PADS) for specific details on heat stress and symptoms	

ACTIVITY HAZARDS ANALYSIS

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	General subsurface soil sampling	(1) Chemical hazards (2) Unstable footing conditions (3) Noise	(1a) Gloves, safety glasses, and other appropriate PPE will be used during soil sampling collection. Ambient monitoring will be conducted with a photoionization detector (PID) to identify any unusual rise or change in petroleum vapors (2a) Use care and assure solid footing in the work area. (2b) Note all slip hazards in the work area. (2c) Clear the work area of all potential trip hazards (3a) Hearing protection will be used as warranted	L
X	Sampling using hand auger	(1) Lacerations	(1a) When handling auger, pay attention to sharp edges on the sampling end of the tool (1b) Use proper PPE (gloves)	L

Add Items

	EQUIPMENT	TRAINING	INSPECTION
X	PID	Personnel will be trained in PID utilization, calibration, maintenance, and sample collection techniques	Daily calibration and moisture trap or sensor replacement, as needed
X	Hand Auger, Hand Shovel	Personnel will be appraised of the sharp edges on the sampling end of the auger, and the hazards associated with shovel	None needed

Involved Personnel:

Acceptance Authority (digital signature): Clark Roberts

Digitally signed by Clark Roberts
DN: cn=Clark Roberts, o=Bristol, ou=Health & Safety Manager, email=croberts@bristol-companies.com, c=US
Date: 2010.09.24 10:04:06 -05'00'

ACTIVITY HAZARDS ANALYSIS

Overall Risk Assessment Code (RAC)
(Use highest code): L

Date: 20 April 2011 Project: NE Cape HTRW

Activity: Wire Removal

Activity Location: Northeast Cape St. Lawrence Island

Prepared By: Eric Barnhill

Risk Assessment Code Matrix

E = Extremely High Risk
H = High Risk
M = Moderate Risk
L = Low Risk

Severity	Probability: Frequent	Likely	Occasional	Seldom	Unlikely
Catastrophic	E	E	H	H	M
Critical	E	H	H	M	L
Marginal	H	M	M	L	L
Negligible	M	L	L	L	L

Add Identified Hazards

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	Removal by hand, Tracked Vehicle and Boom Truck	Slips, trips, falls Struck by equipment/objects Crushing Injuries Dropped Objects Eye Injury / Hearing Loss Falls from steep slopes Back Injury Cutting Hazard	• Use care during foot travel, and clear the area of slip and trip hazards • Use barricades • Cover holes • Use proper lifting technique • Use Buddy System for heavy lifts • Use lifting/transport equipment • Use caution when setting loads • Machine guards/enclosures • Wear required personal protective equipment (PPE) o Hard Hat o Hard-toe Boots o Safety Glasses with side shields o Reflective Vest o Hearing Protection, as needed. • Use caution around equipment lift materials. • Wear D-ring harness with restraint cable system at approved anchor points • Backup alarms on all equipment • Use traffic control and watchman	L

ACTIVITY HAZARDS ANALYSIS

	JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE HAZARDS	RAC
X	Vehicle Operation	Rollover	• Stay within the speed limit specified. • Follow manufacturer's recommended payload. • Use Seatbelts/rollover protection system (ROPS). • For all-terrain vehicles, gloves and hardhats are required. • Utilize only licensed and trained operators. • Ensure equipment is not operated on excessive grades to prevent rollovers.	L
X	Equipment operations	Equipment failure Cuts/Lacerations	• Inspect equipment prior to daily operation. • Ensure all roll cages and guards are in place and back up alarms operate. • Original equipment manufacturer's (OEM) equipment modifications only. • Use machine guarding and enclosures	L

Add Items

	EQUIPMENT	TRAINING	INSPECTION
X	Trucks	Utilize only trained and qualified operators for vehicles.	Daily inspection of equipment prior to operation
X	Excavator, Boom Truck	Utilize only trained and qualified operators for operation of equipment.	Daily inspection of equipment prior to operation
X	Hand tools/Wire cutters	Site Specific Training – Toolbox safety meetings Fall Protection System (if applicable) Competent Person: ALT. Competent Person:	Daily inspection of equipment prior to use

Involved Personnel:

Acceptance Authority (digital signature): _____

ATTACHMENT 3

Physical Agent Data Sheets

Cold Stress

Hand-Arm Vibration

Heat Stress

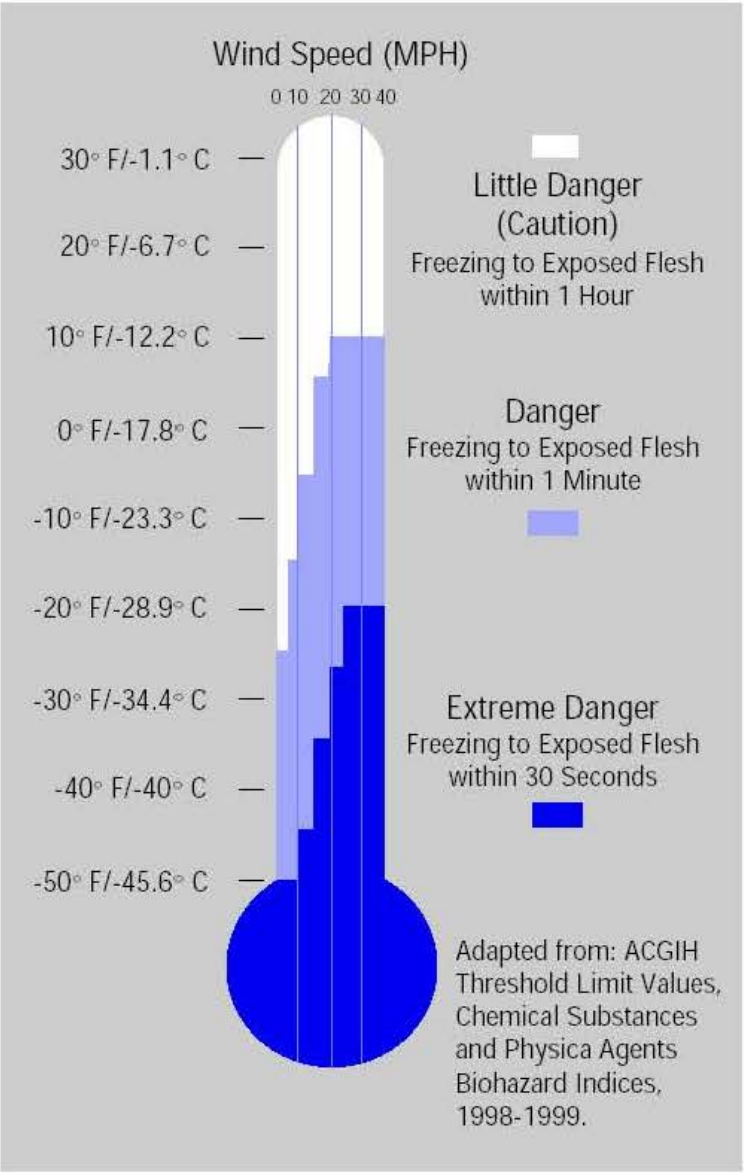
Noise

UV Radiation

THE COLD STRESS EQUATION

LOW TEMPERATURE + WIND SPEED + WETNESS = INJURIES & ILLNESS

When the body is unable to warm itself, serious cold-related illnesses and injuries may occur, and permanent tissue damage and death may result. **Hypothermia** can occur when *land temperatures* are **above** freezing or *water temperatures* are below 98.6°F/ 37°C. Cold-related illnesses can slowly overcome a person who has been chilled by low temperatures, brisk winds, or wet clothing.



OSHA 3156
1998

FROST BITE

What Happens to the Body:

FREEZING IN DEEP LAYERS OF SKIN AND TISSUE; PALE, WAXY-WHITE SKIN COLOR; SKIN BECOMES HARD and NUMB; USUALLY AFFECTS THE FINGERS, HANDS, TOES, FEET, EARS, and NOSE.

What Should Be Done: (land temperatures)

- Move the person to a warm dry area. Don't leave the person alone.
- Remove any wet or tight clothing that may cut off blood flow to the affected area.
- **DO NOT** rub the affected area, because rubbing causes damage to the skin and tissue.
- **Gently** place the affected area in a warm (105°F) water bath and monitor the water temperature to **slowly** warm the tissue. Don't pour warm water directly on the affected area because it will warm the tissue too fast causing tissue damage. Warming takes about 25-40 minutes.
- After the affected area has been warmed, it may become puffy and blister. The affected area may have a burning feeling or numbness. When normal feeling, movement, and skin color have returned, the affected area should be dried and wrapped to keep it warm. **NOTE:** If there is a chance the affected area may get cold again, do not warm the skin. If the skin is warmed and then becomes cold again, it will cause severe tissue damage.
- Seek medical attention as soon as possible.

HYPOTHERMIA - (Medical Emergency)

What Happens to the Body:

NORMAL BODY TEMPERATURE (98.6° F/37°C) DROPS TO OR BELOW 95°F (35° C); FATIGUE OR DROWSINESS; UNCONTROLLED SHIVERING; COOL BLUISH SKIN; SLURRED SPEECH; CLUMSY MOVEMENTS; IRRITABLE, IRRATIONAL OR CONFUSED BEHAVIOR.

What Should Be Done: (land temperatures)

- Call for emergency help (i.e., Ambulance or Call 911).
- Move the person to a warm, dry area. Don't leave the person alone. Remove any wet clothing and replace with warm, dry clothing or wrap the person in blankets.
- Have the person drink warm, sweet drinks (sugar water or sports-type drinks) if they are alert. **Avoid drinks with caffeine** (coffee, tea, or hot chocolate) or alcohol.
- Have the person move their arms and legs to create muscle heat. If they are unable to do this, place warm bottles or hot packs in the arm pits, groin, neck, and head areas. **DO NOT** rub the person's body or place them in warm water bath. This may stop their heart.

What Should Be Done: (water temperatures)

- Call for emergency help (Ambulance or Call 911). Body heat is lost up to 25 times faster in water.
- **DO NOT** remove any clothing. Button, buckle, zip, and tighten any collars, cuffs, shoes, and hoods because the layer of trapped water closest to the body provides a layer of insulation that slows the loss of heat. Keep the head out of the water and put on a hat or hood.
- Get out of the water as quickly as possible or climb on anything floating. **DO NOT** attempt to swim unless a floating object or another person can be reached because swimming or other physical activity uses the body's heat and reduces survival time by about 50 percent.
- If getting out of the water is not possible, wait quietly and conserve body heat by folding arms across the chest, keeping thighs together, bending knees, and crossing ankles. If another person is in the water, huddle together with chests held closely.

How to Protect Workers

- Recognize the environmental and workplace conditions that lead to potential cold-induced illnesses and injuries.
- Learn the signs and symptoms of cold-induced illnesses/injuries and what to do to help the worker.
- Train the workforce about cold-induced illnesses and injuries.
- Select proper clothing for cold, wet, and windy conditions. Layer clothing to adjust to changing environmental temperatures. Wear a hat and gloves, in addition to underwear that will keep water away from the skin (polypropylene).
- Take frequent short breaks in warm dry shelters to allow the body to warm up.
- Perform work during the warmest part of the day.
- Avoid exhaustion or fatigue because energy is needed to keep muscles warm.
- Use the buddy system (work in pairs).
- Drink warm, sweet beverages (sugar water, sports-type drinks). Avoid drinks with caffeine (coffee, tea, or hot chocolate) or alcohol.
- Eat warm, high-calorie foods like hot pasta dishes.

Workers Are at Increased Risk When…

- They have predisposing health conditions such as cardiovascular disease, diabetes, and hypertension.
- They take certain medication (check with your doctor, nurse, or pharmacy and ask if any medicines you are taking affect you while working in cold environments).
- They are in poor physical condition, have a poor diet, or are older.

PHYSICAL AGENT DATA SHEET (PADS)

HAND-ARM VIBRATION

Description

Hand-arm vibration is caused by the use of vibrating hand-held tools, such as pneumatic jack hammers, drills, gas powered chain saws, and electrical tools such as grinders. The nature of these tools involves vibration (a rapid back and forth type of motion) which is transmitted from the tool to the hands and arms of the person holding the tool.

Health Hazards

Vibration Syndrome and Vibration-Induced White Finger (VWF) are the major health hazards related to the use of vibrating tools. Carpal Tunnel Syndrome is another health problem that has been linked in one study to the use of smaller hand-held vibrating tools.

Vibration Syndrome

Vibration Syndrome is a group of symptoms related to the use of vibrating tools and includes -some or all of the following: muscle weakness, muscle fatigue, pain in the arms and shoulders, and vibration-induced white finger. Many researchers believe that other symptoms--headaches, irritability, depression, forgetfulness, and sleeping problems--should also be included in descriptions of Vibration Syndrome.

Vibration-Induced White Finger

Vibration-Induced White Finger (VWF), also known as "Dead Finger" or "Dead Hand" is the result of impaired circulation (poor blood supply in the fingers, caused by the prolonged use of vibrating tools. VWF may appear after only several months on the job, or may not appear until twenty to forty years on the job.

The harmful health effects of vibrating tools are related to the length of time that a worker has been using vibrating tools and to the frequency of the vibration (how fast the tool goes back and forth). The longer a person uses a vibrating tool, and the faster the tool vibrates, the greater the risk of health effects. The length of the initial symptom-free period of vibration exposure (i.e., from first exposure to the first appearance of a white finger) is known as the latent interval. It is related to the intensity of the vibration - the shorter the latent period, the more severe the resulting VWF if vibration exposure continues.

Temporary tingling or numbness during or soon after use of a vibrating hand tool is not considered to be VWF, however tingling and numbness in the fingers lasting more than an hour after finishing work may indicate early stages of VWF. Table 1 lists the stages that Vibration White Finger may progress through if exposure continues.

Table 1 Stages of Vibration White Finger (Taylor-Pelmear System)

Stage	Condition of Fingers	Work & Social Interference
00	No tingling, numbness or blanching of fingers	No complaints
OT	Intermittent tingling	No interference with activities
ON	Intermittent numbness	No interference with activities
TN	Intermittent tingling and numbness	No interference with activities
1	Blanching of a fingertip with or without tingling and/or numbness	No interference with activities
2	Blanching of one or more fingers beyond tips, usually during winter	Possible interference with activities outside work, no interference at work
3	Extensive blanching of fingers; frequent episodes in both summer and winter	Definite interference at work, at home, and with social activities; restriction of hobbies
4	Extensive blanching of most fingers; frequent episodes in both summer and winter	Occupation usually changed because of severity of signs and symptoms

The technical name for VWF is Raynaud's Syndrome of Occupational Origin. Raynaud's Syndrome may also occur in people who do not use vibrating hand-held tools. Several different kinds of medical illnesses can cause Raynaud's Syndrome. Raynaud's Syndrome also appears in some people who are otherwise entirely healthy.

It is important that people with Raynaud's Syndrome avoid the extensive use of vibrating tools because they can develop the most severe complications of VWF very quickly.

Many of the symptoms of Vibration Syndrome will disappear shortly after a worker stops using the types of tools which transmit vibration to the hands and arms. Fatigue and muscular pain in the arms and shoulders will generally disappear. In the early stages, if a worker stops using vibrating tools, VWF will not get any worse and may get slightly better.

Carpal Tunnel Syndrome

Carpal Tunnel Syndrome (CTS) is a group of symptoms in the hand which arise from pressure on one of the nerves which passes through the palm side of the wrist. The early symptoms are similar to the early symptoms of white finger and consist of tingling in the fingers. For the most part only the thumb, index, and middle fingers are affected in CTS.

Later, symptoms can progress to numbness. Pain in the wrist and fingers may also develop. CTS may occur in people using small hand tools like pneumatic screwdrivers. Carpal Tunnel Syndrome also occurs among people having repetitive motion of the wrist or fingers, such as using a cash register, or picking fish from a net; or with forceful motion of the wrist, such as in using a wrench. Pinching or flexing with the wrist bent upwards, downwards, or sideways increases the occurrence of CTS.

The symptoms of CTS are frequently worse at night and a person may be awakened from sleep by pain or the feeling of pins and needles in fingers, hand or wrist.

Carpal Tunnel Syndrome may improve if diagnosed in the early stages and exposure to the type of activity which caused it is stopped. In moderate cases most of the symptoms of CTS can be relieved by a surgical operation which relieves the pressure on the nerve which causes the CTS symptoms. If the surgery is performed too late, only some of the symptoms may be relieved. In very severe cases the symptoms are irreversible and may include weakness of the hand due to loss of muscle function.

Preventing Hand-Arm Vibration Diseases

Job Modification to Reduce Vibration Exposure

Wherever possible, jobs should be redesigned to minimize the use of hand-held vibrating tools. Where job redesign is not feasible, ways to reduce tool vibration should be found. Where practical, substitute a manual tool for a vibrating tool. Whenever possible, high vibration tools should be replaced by improved, low vibration tools designed to absorb vibration before it reaches the handgrip.

Determine vibration exposure times and introduce work breaks to avoid constant, continued vibration exposure. A worker who is using a vibrating tool continuously should take a 10 minute break after each hour of using the tool.

Medical Evaluation

Workers whose occupations place them at risk for developing VWF should have pre-employment physicals and thereafter should be checked at least annually by doctors who know about the diagnosis and treatment of VWF. Diagnostic tests which can be used include plethysmography, arteriography, skin thermography, and sensory tests,, such as two point discrimination depth sense, pinprick touch and temperature sensation. X-rays may also be useful.

Workers that have a past history of abnormalities in blood circulation and especially workers who have Raynaudis Syndrome should not be permitted to use vibrating hand-held tools. Workers who have moderate to severe symptoms of VWF should be reassigned to work which removes them from further direct exposure to vibrating tools.

If workers develop symptoms of tingling or numbness, or if their fingers occasionally become white or blue, or painful especially when cold, they should be examined by a doctor who knows about the diagnosis and treatment of VWF and CTS.

Work Practices

Workers using vibrating hand-held tools should wear multiple layers of warm gloves and should wear anti-vibration gloves whenever possible. Before starting the job, warm the hands. This is especially important when it is cold. workers using vibrating tools should not allow the hands to become chilled. If the hands of a worker using vibrating tools become wet or chilled, he should dry them and put on dry, warm gloves before resuming exposure to vibration. Workers exposed to cold should dress adequately to keep the whole body warm because low body temperature can make a worker more susceptible to VWF.

A worker using a vibrating hand-held tool should let the tool do the work by grasping it as lightly as possible, consistent with safe work practice. The tighter the tool is held, the more vibration is transmitted to the fingers and hand. The tool should rest on a support or on the workpiece as much as possible. The tool should be operated only when necessary and at the minimum speed (and impact force) to reduce vibration exposure.

Tools should be regularly maintained to keep vibration to a minimum. Keeping chisels and chainsaws sharp, for example, will reduce vibration. Using new grinder wheels will also reduce vibration.

Education

Employees who use or will be using vibrating hand-held tools should receive training about the hazards of vibration and they should be taught how to minimize the ill effects of vibration.

Smokers are much more susceptible to VWF that non-smokers, and the VWF in smokers is usually more severe, therefore workers who use vibrating hand-held tools should not smoke.

Recommended Exposure Limits

Table 2 contains the American Conference of Governmental Industrial Hygienists (ACGIH) recommendations on the limits for exposure of the hand to vibration.

Table 2 Threshold Limit Values for Exposure of the Hand to Vibration in Either X_h, Y_h, Z_h, Directions

Total Daily Exposure Duration[a]	Values of the Dominant,[b] Frequency-Weighted, rms, Component Acceleration Which Shall Not be Exceeded a_k, (a_{keg})	
	m/s^2	g[c]
4 hours and less than 8	4	0.40
2 hours and less than 4	6	0.61
1 hour and less than 2	8	0.81
less than 1 hour	12	1.22

[a] The total time vibration enters the hand per day, whether continuously or intermittently.

[b] Usually one axis of vibration is dominant over the remaining two axes. If one or more vibration axes exceeds the Total Daily Exposure then the TLV has been exceeded.

[c] g = 9.81 m/s . d

PHYSICAL AGENT DATA SHEET (PADS)

HEAT STRESS

Description

Heat stress is caused by working in hot environments like laundries, bakeries, or around boilers or incinerators. Four environmental factors affect the amount of heat stress felt by employees in hot work areas: temperature, humidity, radiant heat (such as from the sun or a furnace), and air velocity. How well or how poorly an individual reacts to heat stress is dependent on personal characteristics such as age, weight, fitness, medical condition, and acclimatization.

The body has several methods of maintaining the proper internal body temperature. When internal body temperature increases, the circulatory system reacts by increasing the amount of blood flow to the skin so the extra heat can by given off.

Sweating is another means the body uses to maintain stable internal temperatures. When sweat evaporates, cooling results. However, sweating is effective only if the humidity level is low enough to permit evaporation and if the fluids and salts lost are replaced.

Health Effects—Heat Disorders

Heat stroke, the most serious health problem for workers in hot environments is caused by the failure of the body's internal mechanism to regulate its core temperature. Sweating stops and the body can no longer rid itself of excess heat. Signs include: mental confusion, delirium, loss of consciousness, convulsions or coma; a body temperature of 106 degrees Fahrenheit or higher; and hot dry skin which may be red, mottled or bluish. Victims of heat stroke will die unless treated promptly. While medical help should be called, the victim must be removed immediately to a cool area and his/her clothing soaked with cool water. He/she should be fanned vigorously to increase cooling. Prompt first aid can prevent permanent injury to the brain and other vital organs.

Heat exhaustion develops as a result of loss of fluid through sweating when a worker has failed to drink enough fluids or take in enough salt, or both. The worker with heat exhaustion still sweats, but experiences extreme weakness or fatigue, giddiness, nausea, or headache. The skin is clammy and moist, the complexion pale or flushed, and the body temperature normal or slightly higher. Treatment is usually simple: the victim should rest in a cool place and drink salted liquids. Salt tablets are not recommended. Severe cases involving victims who vomit or lose consciousness may require longer treatment under medical supervision.

Heat cramps, painful spasms of the bone muscles, are caused when workers drink large quantities of water but fail to replace their bodies' salt loss. Tired muscles, those used for performing the work, are usually the ones most susceptible to cramps. Cramps may occur during or after working hours and may be relieved by taking salted liqids by mouth or saline solutions intravenously for quicker relief, if medically determined to be required.

Fainting may be a problem for the worker unacclimatized to a hot environment who simply stands still in the heat. Victims usually recover quickly after a brief period of lying down. Moving around, rather that standing still, will usually reduce the possibility of fainting.

Heat rash, also known as prickly heat, may occur in hot and humid environments where sweat is not easily removed from the surface of the skin by evaporation. When extensive or complicated by infection, heat rash can be so uncomfortable that it inhibits sleep and impairs a worker's performance or even results in temporary total disability. It can be prevented by showering, resting in a cool place, and allowing the skin to dry.

Medical Conditions Aggravated By Exposure to Heat

Persons with heart or circulatory diseases or those who are on "low salt" diets should consult with their physicians prior to working in hot environments.

Preventing Heat Disorders

One of the best ways to reduce heat stress on workers is to minimize heat in the workplace. However, there are some work environments where heat production is difficult to control, such as when furnaces or sources of steam or water are present in the work area, or when the workplace itself is outdoors and exposed to varying warm weather conditions.

Acclimatization

Humans are, to a large extent, capable of adjusting to the heat. This adjustment to heat, under normal circumstances, usually takes about 5 to 7 days, during which time the body will undergo a series of changes that will make continued exposure to heat more endurable.

On the first day of work in a hot environment, the body temperature, pulse rate, and general discomfort will be higher. With each succeeding daily exposure, all of these responses will gradually decrease, while the sweat rate will increase. When the body becomes acclimated to the heat, the worker will find it possible to perform work with less strain and distress.

Gradual exposure to heat gives the body time to become accustomed to higher environmental temperatures. Heat disorders in general are more likely to occur among workers who have not been given time to adjust to working in the heat or among workers who have been away from hot environments and who have gotten accustomed to lower temperatures. Hot weather conditions of the summer are likely to affect the worker who is not acclimatized to heat. Likewise, workers who return to work after a leisurely vacation or extended illness may be affected by the heat in the work environment. Whenever such circumstances occur, the worker should be gradually reacclimatized to the hot environment.

Lessening Stressful Conditions

Many industries have attempted to reduce the hazards of heat stress by introducing engineering controls, training workers in the recognition and prevention of heat stress, and implementing work-rest cycles. Heat stress depends, in part, on the amount of heat the worker's body produces while a job is being performed. The amount of heat produced during hard, steady work is much higher than that produced during intermittent or light work. Therefore, one way of reducing the potential for heat stress is to make the job easier or lessen its duration by providing adequate rest time. Mechanization of work procedures can often make it possible to isolate workers from the heat source (perhaps in an air-conditioned booth) and increase overall productivity by decreasing the time needed for rest. Another approach to reducing the level of heat stress is the use of engineering controls which include ventilation and heat shielding.

Number and Duration of Exposures

Rather than be exposed to heat for extended periods of time during the course of a job, workers should, wherever possible, be permitted to distribute the workload evenly over the day and incorporate work-rest cycles. Work-rest cycles give the body an opportunity to get rid of excess heat, slow down the production of internal body heat, and provide greater blood flow to the skin.

Workers employed outdoors are especially subject to weather changes. A hot spell or a rise in humidity can create overly stressful conditions. The following practices can help to reduce heat stress:

- Postponement of nonessential tasks
- Permit only those workers acclimatized to heat to perform the more strenuous tasks, or
- Provide additional workers to perform the task keeping in mind that all workers should have the physical capacity to perform the task and that they should be accustomed to the heat.

Thermal Conditions in the Workplace

A variety of engineering controls can be introduced to minimize exposure to heat. For instance, improving the insulation on a furnace wall can reduce its surface temperature and the temperature of the area around it. In a laundry room, exhaust hoods installed over those sources releasing moisture will lower the humidity in the work area. In general, the simplest and least expensive methods of reducing heat and humidity can be accomplished by:

- Opening windows in hot work areas,
- Using fans, or
- Using other methods of creating airflow such as exhaust ventilation or air blowers.

Rest Areas

Providing cool rest areas in hot work environments considerably reduces the stress of working in those environments. There is no conclusive information available on the ideal temperature for a rest area. However, a rest area with a temperature near 76 degrees Fahrenheit appears to be adequate and may even feel chilly to a hot, sweating worker, until acclimated to the cooler environment. The rest area should be as close to the workplace as possible. Individual work periods should not be lengthened in favor of prolonged rest periods. Shorter but frequent work-rest cycles are the greatest benefit to the worker.

Drinking Water

In the course of a day's work in the heat, a worker may produce as much as 2 to 3 gallons of sweat. Because so many heat disorders involve excessive dehydration of the body, it is essential that water intake during the workday be about equal to the amount of sweat produced.

Most workers exposed to hot conditions drink less fluids than needed because of an insufficient thirst drive. A worker, therefore, should not depend on thirst to signal when and how much to drink. Instead, the worker should drink 5 to 7 ounces of fluids every 15 or 20 minutes to replenish the necessary fluids in the body. There is no optimum temperature of drinking water, but most people tend not to drink warm or very cold fluids as readily as they will cool ones. whatever the temperature of the water, it must be palatable and readily available to the worker. Individual drinking cups should be provided, never use a common drinking cup.

Heat acclimatized workers lose much less salt in their sweat than do workers who are not adjusted to the heat. The average American diet contains sufficient salt for acclimatized workers even when sweat production is high. If, for some reason, salt replacement is required, the best way to compensate for the loss is to add a little extra salt to the food. Salt tablets <u>should not</u> be used. CAUTION: PERSONS WITH HEART PROBLEMS OR THOSE ON A "LOW SODIUM" DIET WHO WORK IN HOT ENVIRONMENTS SHOULD CONSULT A PHYSICIAN ABOUT WHAT TO DO UNDER THESE CONDITIONS.

Protective Clothing

Clothing inhibits the transfer of heat between the body and the surrounding environment. Therefore, in hot jobs where the air temperature is lower than skin temperature, wearing clothing reduces the body's ability to lose heat into the air.

When air temperature is higher than skin temperature, clothing helps to prevent the transfer of heat from the air to the body. The advantage of wearing clothing, however, may be nullified if the clothes interfere with the evaporation of sweat.

In dry climates, adequate evaporation of sweat is seldom a problem. In a dry work environment with very high air temperatures, the wearing of clothing could be an advantage to the worker. The proper type of clothing depends on the specific circumstance. Certain work in hot environments may require insulated gloves, insulated suits, reflective clothing, or infrared reflecting face shields. For extremely hot conditions, thermally-conditioned clothing is available. One such garment carries a self-contained air conditioner in a backpack, while another is connected to a compressed air source which feeds cool air into the jacket or coveralls through a vortex tube. Another type of garment is a plastic jacket which has pockets that can be filled with dry ice or containers of ice.

Recommended Exposure Limits

These Threshold Limit Values (TLVS) refer to heat stress conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse health effects. The TLVs shown in Table I are based on the assumption that nearly all acclimatized, fully clothed workers with adequate water and salt intake should be able to function effectively under the given working conditions without exceeding a deep body temperature of 38 degrees Celsius (100.4 degrees Fahrenheit).

Since measurement of deep body temperature is impractical for monitoring the workers' heat load, the measurement of environmental factors is required which most nearly correlate with deep body temperature and other physiological responses to heat. At the present time, Wet Bulb Globe Temperature Index (WBGT) is the simplest and most suitable technique to measure the environmental factors. WBGT values are calculated by the following equations:

Outdoors with solar load: $WBGT = 0.7\ NWB + 0.2\ GT + 0.1\ DB$

Indoors or Outdoors with no solar load: $WBGT = 0.7\ NWB + 0.3\ GT$

Where: WBGT = Wet Bulb Globe Temperature Index

NWB = Natural Wet Bulb Temperature

DB = Dry Bulb Temperature

GT = Globe Temperature

The determination of WBGT requires the use of a black globe thermometer, a natural (static) wet-bulb thermometer, and a dry bulb thermometer.

Higher heat exposures that shown in Table I are permissible if the workers have been undergoing medical surveillance and it has been established that they are more tolerant at work in heat than the average worker. Workers should not be permitted to continue their work when their deep body temperature exceeds 38.0 degrees Celsius (100.4 degrees Fahrenheit).

Table 1 Permissible Heat Exposure Threshold Limit Values (Values are given in degrees Centigrade WBGT [Fahrenheit])

	Work Load		
Work- Rest Regimen	**Light**	**Moderate**	**Heavy**
Continuous work	30.0 (86.0)	26.7 (80.1)	25.0 (77.0)
75% Work, 25% Rest/Hour	30.6 (87.1)	28.0 (82.4)	25.9 (78.6)
50% Work, 50% Rest/Hour	31.4 (88.5)	29.4 (85.0)	27.9 (82.2)
25% Work, 75% Rest/Hour	32.2 (90.0)	31.1 (88.0)	30.0 (86.0)

References

"Working in Hot Environments," US Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, 1986.

"Threshold Limit Values and Biological Exposure Indices for 1986 - 1987," American Conference of Governmental Industrial, Hygienists, 6500 Glenway Avenue, Building D-7, Cincinnati, OH 45211-4438.

PHYSICAL AGENT DATA SHEET (PADS)

NOISE

Description

Sound is created when a vibrating source (like a bell, motor or a stereo speaker) sends sound waves through the air to your ear. Every sound has two aspects: its pitch (frequency) and its loudness (intensity). On a stereo, frequency is determined by the bass/treble control. Intensity is determined by the volume control. Noise (unwanted sound) is usually made up of many frequencies. The disturbing and harmful effects of noise depend both on the loudness and the frequency of the tones making up noise.

Loudness is measured in units called decibels (dB). A conversational voice is about 65 dB. A shout is 90 dB or greater.

Frequency is measured in units called Hertz (Hz). The frequency of a locomotive horn is about 250 Hz. The frequency of a table saw is about 4,000 Hz.

Health Effects

Excessive noise can destroy the ability to hear, and may also put stress of other parts of the body, including the heart.

For most effects of noise, there is no cure, so that prevention of excessive noise exposure is the only way to avoid health damage.

Hearing

The damage done by noise depends mainly on how loud it is and on the length of exposure. The frequency or pitch can also have some effect, since high-pitched sounds are more damaging than low-pitched sounds.

Noise may tire out the inner ear, causing temporary hearing loss. After a period of time away from the noise hearing may be restored. Some workers who suffer temporary hearing loss may find that by the time their hearing returns to normal, it is time for another work shift so, in that sense, the problem is "permanent."

With continual noise exposure, the ear will lose its ability to recover from temporary hearing loss, and the damage will become permanent. Permanent hearing loss results from the destruction of cells in the inner ear, cells which can never be replaced or repaired. Such damage can be caused by long-term exposure to loud noise or, in some cases" by brief exposures to very loud noises.

Normally, workplace noise first affects the ability to hear high frequency (high-pitched) sounds. This means that even though a person can still hear some noise, speech or other sounds may be unclear or distorted.

Workers suffering from noise-induced hearing loss may also experience continual ringing in their ears, called "tinnitus." At this time, there is no cure for tinnitus, although some doctors are experimenting with treatment.

Other Effects

Although research on the effects of noise is not complete, it appears that noise can cause quickened pulse rate, increased blood pressure and a narrowing of the blood vessels over a long period of time, these may place an added burden on the heart.

Noise may also put stress on other parts of the body by causing the abnormal secretion of hormones and tensing of the muscles.

Workers exposed to noise sometimes complain of nervousness, sleeplessness and fatigue. Excessive noise exposure also can reduce job performance and may cause high rates of absenteeism.

Permissible Exposure Limit

The Action level for noise is an average noise level of 85 dB for an eight-hour day. When employees are exposed to noise levels, which exceed the Permissible Exposure Limit, the employer must install or use engineering or administrative controls to lower the noise levels. While these controls are being designed or installed employees must wear hearing protection. If the controls still do not reduce noise exposures to below 90 dB, hearing protection must continue to be worn.

Protective Measures

Suitable hearing protectors (earplugs or muffs) must be made available at no cost to employees who are exposed to an average of 85 dB or greater for an eight-hour day. Employees must be given the opportunity to select from three different types of appropriate hearing protectors.

Hearing tests (audiometric exams) must be given to employees who are exposed to an average of 85 dB or greater for an eight-hour day. Hearing tests will show whether employees are experiencing any hearing losses. Hearing tests are also useful in showing how well the earplugs and earmuffs are working. Hearing tests must be given annually.

Employees should also receive training in the effects of noise on hearing, an explanation of the hearing tests, and instruction on the proper fitting and care of earplugs or muffs.

Noise away from work can also cause hearing loss. Hearing protectors should be worn when operating noisy equipment or tools such as chain saws, brush cutters, power lawn mowers, or when using firearms.

Refer to Alaska Administrative Code, Occupational Health and Environmental Control 04.0104 for specific regulations on Noise Exposure and Hearing Conservation Programs.

PHYSICAL AGENT DATA SHEET (PADS)

ULTRAVIOLET RADIATION

Description

Ultraviolet (UV) is the name for a band of energy on the electromagnetic spectrum that lies between visible light and x-rays. UV has some of the properties of visible light and other properties of the x-rays. Like visible light, some UV is actually visible but most is invisible like x-rays. UV, like light, cannot penetrate very far into most solids. Some UV, like x-rays, can ionize atoms or molecules which visible light cannot do.

Common sources of UV include the sun (especially when reflected by water, snow or ice), sun tanning lamps, mercury discharge lamps, welding arcs, plasma torches, and some lasers.

Health Hazards

The nature and seriousness of UV injuries depend on the length of exposure, the intensity of the UV, the type or wavelength of UV, the sensitivity of the individual, and the presence of certain chemicals (photosensitizers).

Skin

UV from the sun causes sunburns and skin cancer. UV from other sources can also cause skin burns varying in degree from mild reddening of the skin (first degree burns) to more severe and painful blistering (second degree burns). Long-term skin exposure to UV can cause actinic skin (a dry, brown, inelastic wrinkled skin) and skin cancer. Fair skinned individuals are more likely to develop both sunburns and skin cancer.

Some drugs, such as the antibiotic tetracycline, can cause skin burns from UV to happen faster and to be more severe. Products containing coal tar can also cause this reaction. These substances are called photosensitizers.

UV exposure may trigger cold sores (Herpes Simplex) in some individuals.

Eyes

When UV is absorbed by the eyes and eyelids, it can cause keratoconjunctivitis or "welders' flash." This is a very painful condition that feels like grit in the eyes and may make the eyes water and very sensitive to light. The condition usually occurs 6-12 hours after exposure and may last 6-24 hours. The painful injury may make a person unwilling or unable to open his/her eyes during this time period, but most discomfort is gone within 48 hours with no lasting injury. The maximum sensitivity of the eye occurs at a UV wavelength of 270 manometers. Cataracts or clouding of the lens of the eye can occur during high exposures to wavelengths in the range of 295-300 nanometers.

Skin Safety and Health Precautions

Skin burns from high, short-term exposure to UV and skin cancer from long-term exposure can be prevented by covering exposed skin with clothing and protective equipment such as gloves and face shields. *Barrier creams or lotions with sun protection factors (SPF) of 15-18 will also help prevent skin burns.

*Welders' helmets should provide protection for the neck area as well as the face and eyes.

Eyes

Tinted goggles and/or face shields should be worn to prevent burns of the cornea and eyelids. Selection of the appropriate degree of tint should be based on the anticipated wavelength and intensity of the UV source. (see Table 1)

Table 1

Shade No. 3.0: is for glare of reflected sunlight from snow, water, sand, etc.; stray light from cutting and welding, metal pouring and work around furnaces and foundries; and soldering (for goggles or spectacles with side shields worn under helmets in arc welding operations, particularly gas-shielded arc welding operations).
Shade Nos. 4.0 and 5.0: are for light acetylene cutting and welding; light electric spot welding.
Shade Nos. 6.0 and 7.0: are for gas cutting, medium gas welding, and non-gas-shielded arc welding using current values up to 30 amperes.
Shade Nos. 8.0 and 9.0: are for heavy gas cutting and nongas-shielded arc welding and cutting using current values from 30 to 75 amperes.
Shade Nos. 10.0 and 11.0: are for arc welding and cutting using current values from 75 to 200 amperes.
Shade Nos. 12.0 and 13.0: are for arc welding and cutting using current values from 200 to 400 amperes.
Shade No. 14.0: is for arc welding and cutting using current values over 400 amperes (including carbon arc welding and cutting), and for atomic hydrogen welding.

NOTE: ordinary window glass, 1/811 in thickness, is sufficient protection for the eyes and skin against the ultraviolet radiation from ordinary sources such as sunlight. In cases of extremely intense sources of ultraviolet and visible radiation, it is not adequate.

In sunny conditions on water, snow and ice, extra precautions should be taken to protect against reflected sunlight. Sunglasses with side shields should be worn. When applying

protective ointments or lotions, special attention should be paid to the nose, lips, underside of the chin, and tops of the ears.

In workplaces, operations such as welding which produce high levels of UV should be performed behind enclosures or barriers to absorb the radiation and shield nearby workers.

UV sources like mercury discharge lamps should be operated only with all safety devices in place and in accordance with manufacturer's instructions.

First Aid Procedures

Skin burns: immediate application of cold (cold water, ice, cold clean cloths) to the affected area will reduce the severity and relieve pain associated with first and second degree burns. Do not apply any burn ointments, creams, or butter to skin burns.

Eyes: place sterile dressings over the eyes of a person suffering from UV burns of the eyes and seek medical attention.

Recommended Exposure Limits[2]

The following section is very technical and is included for the use of safety and health professionals who have the skills and equipment to measure UV levels.

These threshold limit values (TLVS) refer to ultraviolet radiation in the spectral region between 200 and 400 nm and represent conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse effect. These values for exposure of the eye or skin apply to ultraviolet radiation from arcs, gas and vapor discharges, flourescent and incandescent sources, and solar radiation, but do not apply to ultraviolet lasers. These values do not apply to ultraviolet radiation exposure of photosensitive individuals or of individuals concomitantly exposed to photosensitizing agents. These values should be used as guides in the control of exposure to continuous sources where the exposure duration shall not be less that 0.1 sec (Figure 1).

These values should be used as guides in the control of exposure to ultraviolet sources and should not be regarded as a fine line between safe and dangerous levels.

Recommended Values

The threshold limit value for occupational exposure to ultraviolet radiation incident upon skin or eye where irradiance values are known and exposure time is controlled are as follows:

1. For the near ultraviolet spectral region (320 to 400 nm), total radiance incident upon the unprotected skin or eye should not exceed 1 mW/cm for periods greated than 110

seconds (approximately 16 minutes) and for exposure times less than 10 seconds should not exceed one J/cm.

2. For the actinic ultraviolet spectral region (200 to 315 nm), radiant exposure incident upon the unprotected skin or eye should not exceed the values given in Table 2 within an 8-hour period.

Table 2 Relative Spectral Effectiveness by Wavelength*

Wavelength (nm)	TLV (mJ/cm^2)	Relative Special Effectiveness S
200	100	0.03
210	40	0.075
220	25	0.12
230	16	0.19
240	10	0.30
250	7	0.43
254	6	0.5
260	4.6	0.65
270	3.0	1.0
280	3.4	0.88
290	4.7	0.64
300	10	0.30
305	50	0.60
310	200	0.015
315	1000	0.003

*See Laser TLVS.

3. To determine the effective irradiance of a broadband source weighted against the peak of the spectral effectiveness curve (270 nm), the following weighting formula should be used:

$$E_{eff} = \Sigma\ E\lambda\ S\lambda\ \Delta\ \lambda$$

where:

E_{eff} = effective irradinace relative to a monochromatic source at 270 nm in W/cm^2 [J/ (s cm^2)]

$E\lambda$ = spectral irradiance in W/(cm nm)

$S\lambda$ = relative spectral effectiveness (unitless)

$\Delta\lambda$ = band width in manometers

4. Permissible exposure time in seconds for exposure to actinic ultraviolet radiation incident upon the unprotected skin or eye may be computed by dividing 0.003 J/cm^2 by E_{eff} in W/cm^2. The exposure time may also be determined using Table 3 which provides exposure times corresponding to effective irradiances in μ W/cm^2.

Table 3 Permissible Ultraviolet Exposures

Duration of Exposure Per Day	Effective Irradiance E_{eff} (W/cm^2)
8 hrs	0.1
4 hrs	0.2
2 hrs	0.4
1 hr	0.8
30 min	1.7
15 min	3.3
10 min	5.0
5 min	10.0
1 min	50.0
30 sec	100.0
10 sec	300.0
1 sec	3,000.0
0.5 sec	6,000.0
0.1 sec	30,000.0

5. All the preceding TLVs for ultraviolet energy apply to sources which subtend an angle less than 80 degrees. Sources which subtend a greater angle need to be measured only over an angle of 80 degrees.

Conditioned (tanned) individuals can tolerate skin exposure in excess of the TLV without erythemal effects. However, such conditioning may not protect persons against cancer.

Reference

1. Sunlight and Man. Fitzpatrick et all Eds. University of Tokyo Press, Tokyo, Japan (1974).
2. Threshold Limit Values and Biological Exposures Indices for 1986 - 1987. American Conference of Governmental Industrial Hygienists, 6500 Glenway Avenue, Building D-7, Cincinnati, Ohio 45211-4438.

ATTACHMENT 4

OSHA Sloping and Benching Standard

United States Department Labor

Occupational Safety & Health Administration

Part Number:	1926
Part Title:	Safety and Health Regulations for Construction
Subpart:	P
Subpart Title:	Excavations
Standard Number:	1926 Subpart P App B
Title:	Sloping and Benching

(a) ***Scope and application***. This appendix contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in § 1926.652(b)(2).

(b) ***Definitions***.

Actual slope means the slope to which an excavation face is excavated.

Distress means that the soil is in a condition where a cave-in is imminent or is likely to occur. Distress is evidenced by such phenomena as the development of fissures in the face of or adjacent to an open excavation; the subsidence of the edge of an excavation; the slumping of material from the face or the bulging or heaving of material from the bottom of an excavation; the spalling of material from the face of an excavation; and ravelling, i.e., small amounts of material such as pebbles or little clumps of material suddenly separating from the face of an excavation and trickling or rolling down into the excavation.

Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V).

Short term exposure means a period of time less than or equal to 24 hours that an excavation is open.

(c) ***Requirements*** -- (1) ***Soil classification***. Soil and rock deposits shall be classified in accordance with appendix A to subpart P of part 1926.

(2) ***Maximum allowable slope***. The maximum allowable slope for a soil or rock deposit shall be determined from Table B-1 of this appendix.

(3) ***Actual slope***. (i) The actual slope shall not be steeper than the maximum allowable slope.

(ii) The actual slope shall be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope shall be cut back to an actual slope which is at least ½ horizontal to one vertical (½H:1V) less steep than the maximum allowable slope.

(iii) When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. Surcharge loads from adjacent structures shall be evaluated in accordance with § 1926.651(i).

(4) ***Configurations***. Configurations of sloping and benching systems shall be in accordance with Figure B-1.

TABLE B-1
MAXIMUM ALLOWABLE SLOPES

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V)(1) FOR EXCAVATIONS LESS THAN 20 FEET DEEP(3)
STABLE ROCK	VERTICAL (90º)
TYPE A (2)	3/4:1 (53º)
TYPE B	1:1 (45º)
TYPE C	1 ½:1 (34º)

Footnote(1) Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.

Footnote(2) A short-term maximum allowable slope of 1/2H:1V (63º) is allowed in excavations in Type A soil that are 12 feed (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53º).

Footnote(3) Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

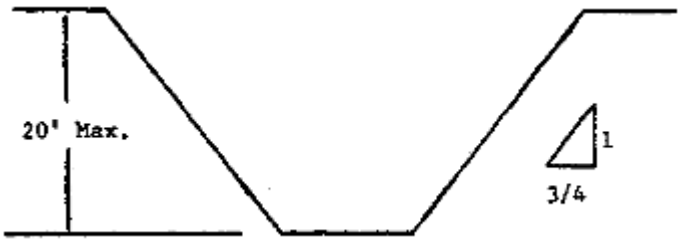
Figure B-1

Slope Configurations

(All slopes stated below are in the horizontal to vertical ratio)

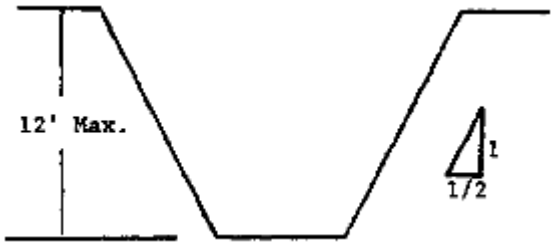
B-1.1 Excavations made in Type A soil.

1. All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of ¾:1.



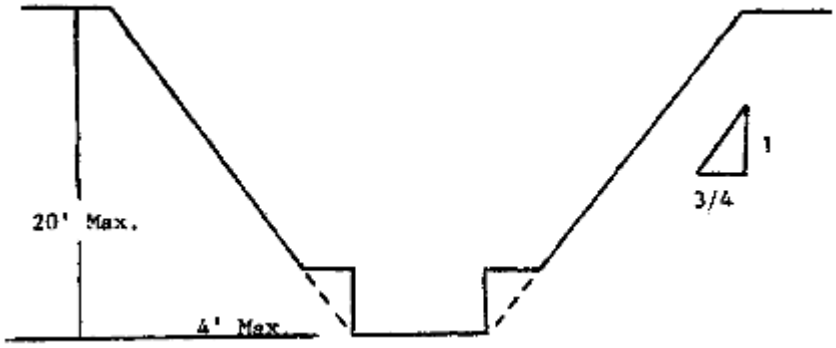
SIMPLE SLOPE -- GENERAL

Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of ½:1.

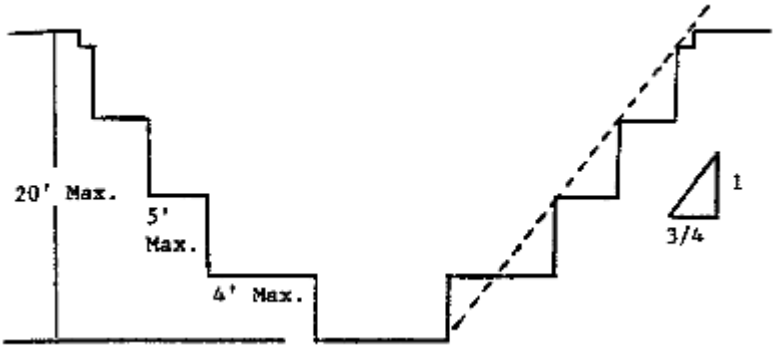


SIMPLE SLOPE -- SHORT TERM

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 3/4 to 1 and maximum bench dimensions as follows:

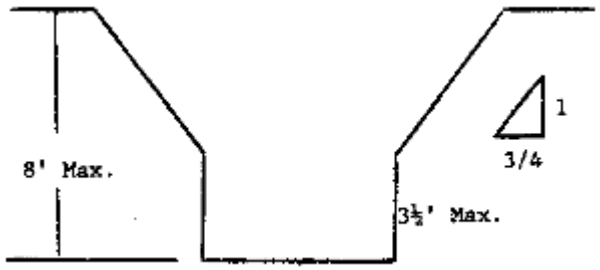


SIMPLE BENCH



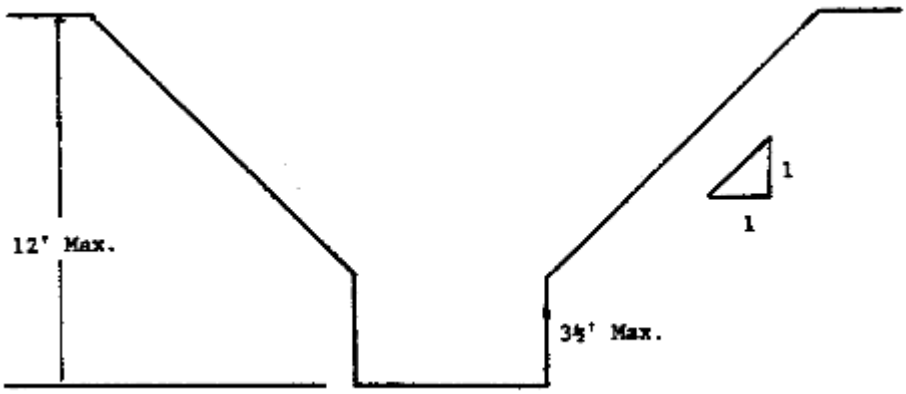
MULTIPLE BENCH

3. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3½ feet.



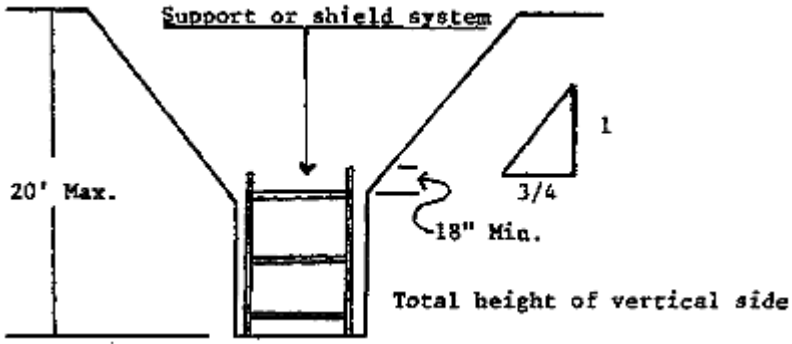
UNSUPPORTED VERTICALLY SIDED LOWER PORTION -- MAXIMUM 8 FEET IN DEPTH)

All excavations more than 8 feet but not more than 12 feet in depth with unsupported vertically sided lower portions shall have a maximum allowable slope of 1:1 and a maximum vertical side of 3½ feet.



UNSUPPORTED VERTICALLY SIDED LOWER PORTION -- MAXIMUM 12 FEET IN DEPTH)

All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded shall have a maximum allowable slope of ¾:1. The support or shield system must extend at least 18 inches above the top of the vertical side.

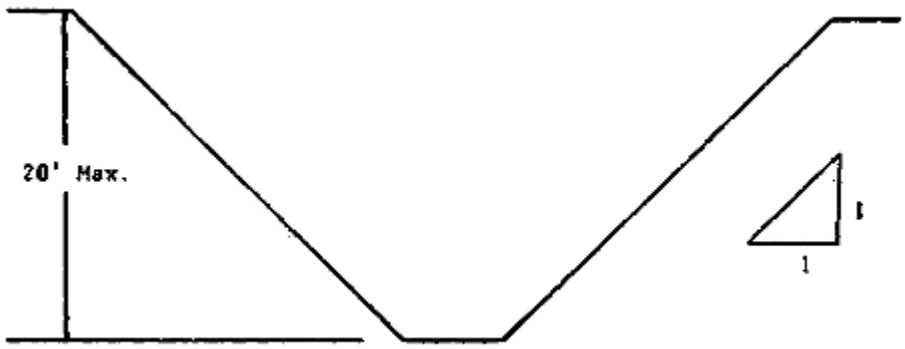


SUPPORTED OR SHIELDED VERTICALLY SIDED LOWER PORTION

4. All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under § 1926.652(b).

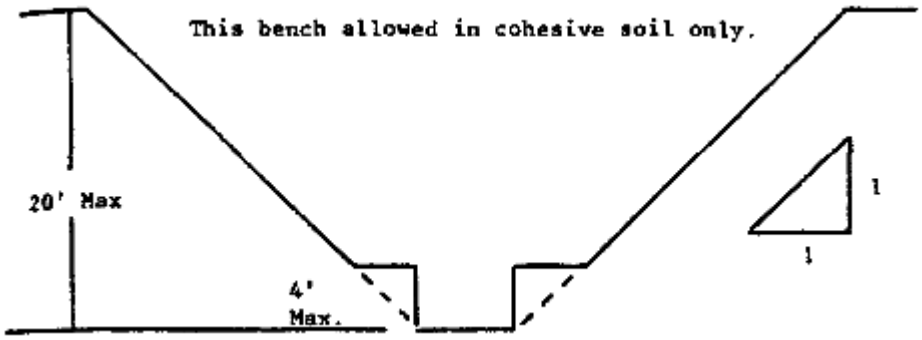
B-1.2 Excavations Made in Type B Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.

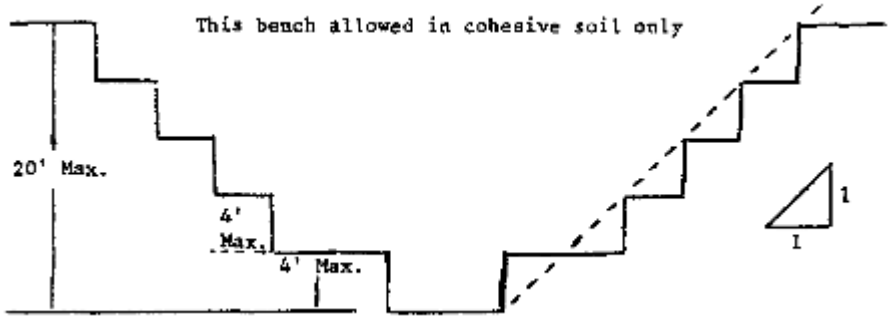


SIMPLE SLOPE

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows:

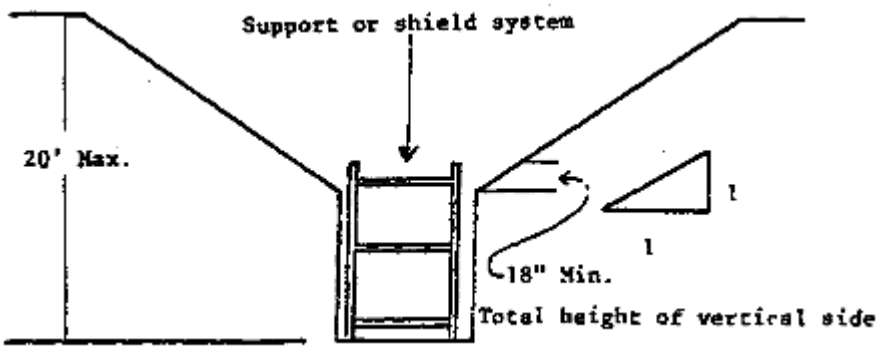


SINGLE BENCH



MULTIPLE BENCH

3. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1.

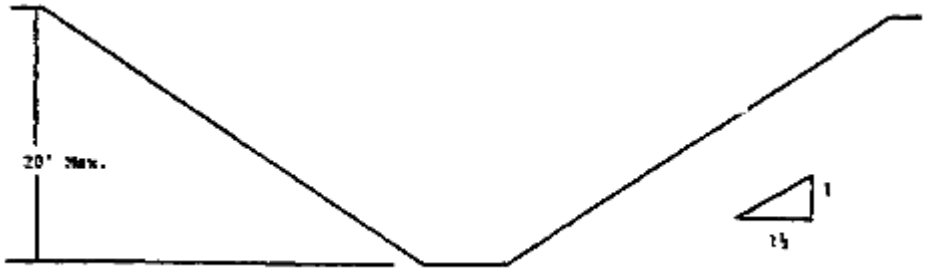


VERTICALLY SIDED LOWER PORTION

4. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

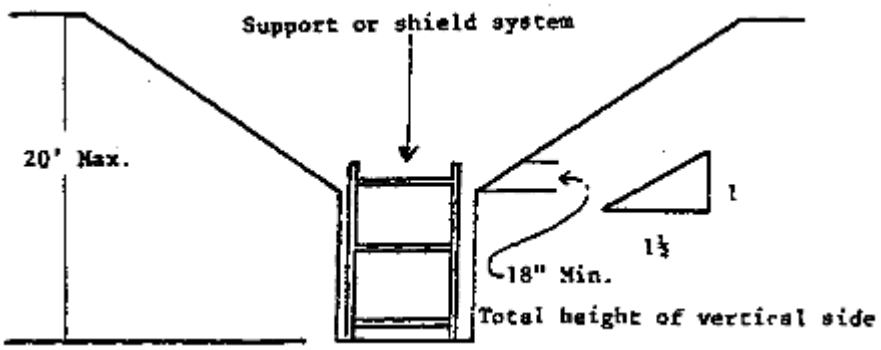
B-1.3 Excavations Made in Type C Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1½:1.



SIMPLE SLOPE

2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1½:1.

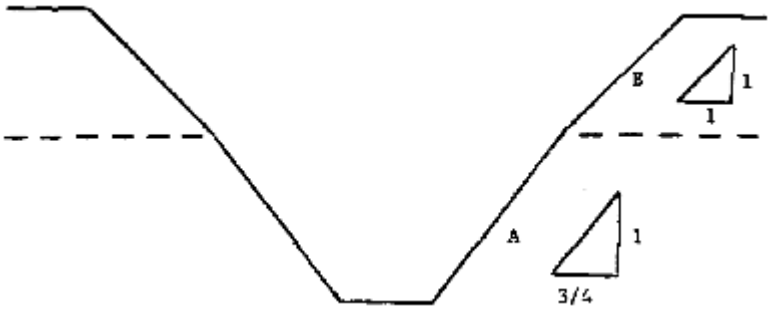


VERTICAL SIDED LOWER PORTION

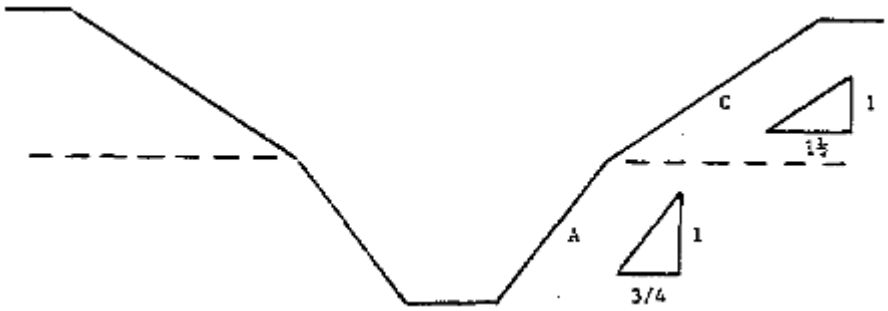
3. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

B-1.4 Excavations Made in Layered Soils

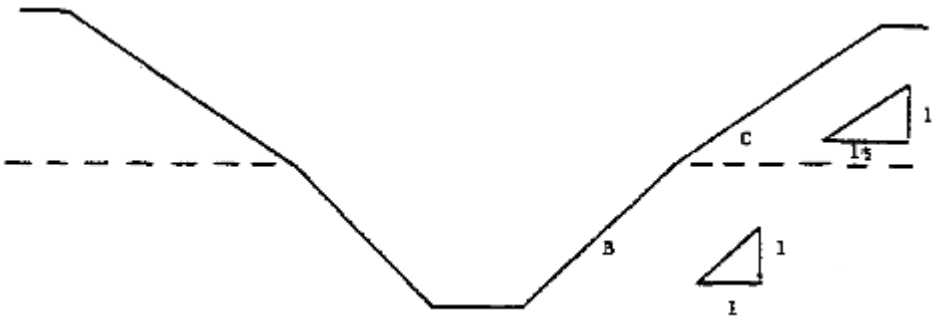
1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.



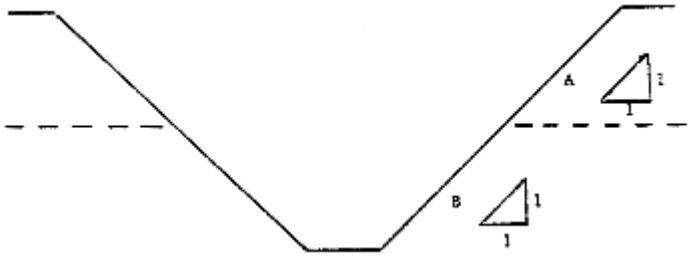
B OVER A



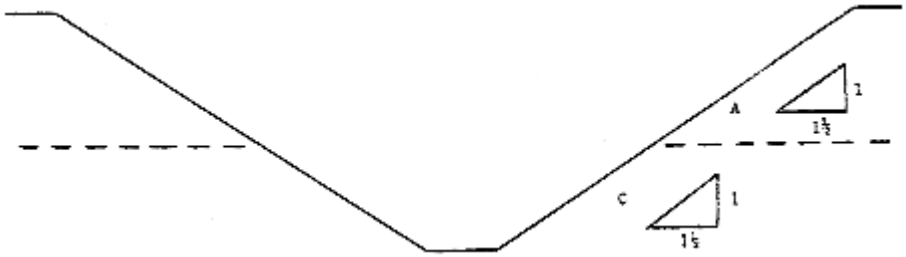
C OVER A



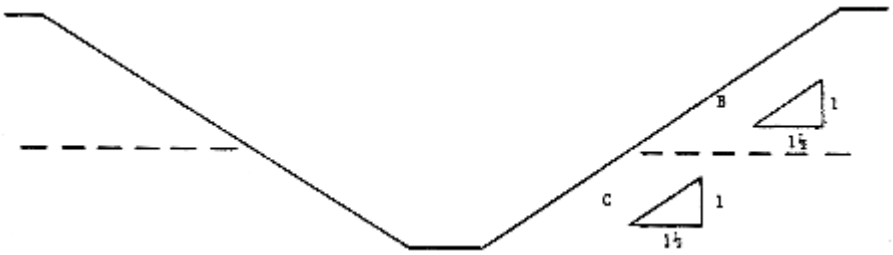
C OVER B



A OVER B



A OVER C



B OVER C

2. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

ATTACHMENT 5

Site Safety Forms

Incident Report Form

Construction Equipment Checklist

Daily Inspection Log

Equipment Inspection Checklist

Noise Dosimetry Form

OSHA Forms 300 & 300A

Immediate Report of Accident Form POD-265-R

Toolbox Safety Meeting Record

USACE Accident Investigation Report ENG 3394

Bristol
INDUSTRIES, LLC

Date _____

INCIDENT REPORT FORM

(Please indicate which of Bristol Industries, employee is working for!)

BI		**BCS**		**BEESC**		**BBKP**		**BFuels**		

Name of manager or supervisor:

EMPLOYEE INFORMATION

Full Name	Last	First	Middle

Job title					
Street		City	State	Zip	
Date of birth		Date hired		Male	Female

PHYSICIAN OR HEALTH CARE PROFESSIONAL INFORMATION

Name of physician or other health care professional			
Location of treatment			
Facility			
Street	City	State	Zip

Was employee treated in an emergency room?		NO	YES

Was employee hospitalized overnight as an in-patient?		NO	YES

(Please attach a release form for return to work if applicable)

Physicians comments or notes	
Indicate if employee refuses medical attention beyond first aid (Explain)	

INCIDENT REPORT

Check if time cannot be determined		explain	
Date of injury/illness or fatality		Time employee began work	
Time of incident			

Pre-incident activity? *Describe the activity, as well as the tools, equipment or material the employee was using. Be specific. Examples: "climbing a ladder while carrying roofing materials"; "spraying chlorine from hand sprayer"; "daily computer key-entry."*

Incident events? *Examples: "When ladder slipped on wet floor, worker fell 20 feet"; "Worker was sprayed with chlorine when gasket broke during replacement"; "Worker developed soreness in wrist over time."*

Physical description of injury or illness.

Type of injury							
Body part							
Extent of injury (from where to where)							
Level of pain (1-10) and pain type							
Additional information							

Physical mechanics of injury? *Examples: "concrete floor"; "chlorine"; "radial arm saw." If this question does not apply to the incident, leave it blank.*

Names of witnesses if applicable

date

Name/Title (Person completing report)

date

Signature (Person completing report)

date

Name (employee)

date

Signature (employee)

SAFETY INSPECTION FOR CONSTRUCTION EQUIPMENT		
CONTRACTOR: Bristol Construction Services		CONTRACT NUMBER:
TYPE OF EQUIPMENT:	EQUIPMENT NUMBER:	DATE OF INSPECTION:

CORPS OF ENGINEERS SAFETY & HEALTH REQUIREMENTS MANUAL. EM 385-1-1. REVISION 92 REFERENCES ARE IN PARENTHESES

CRANES AND DERRICKS

Inspection of cranes & derricks shall be in accordance with the manufacturer's recommendations: at the minimum, inspections shall cover items listed in Appendix H. CRANE & DERRICK INSPECTION and Appendix I CRANE BOOM STOP FIELD TEST of EM 385-1-1 (16.C.11)

INDICATE ANSWERS BY PLACING "X" IN PROPER COLUMN	YES	NO	N/A
GENERAL REQUIREMENTS			
1. Every crane shall have the following documents with them at all times they are to be operated: (16.C.01)			
a. A copy of operating manual developed by the manufacturer for the specific make & model of crane: a copy of the operating manual for any operator aids w/ which the crane is equipped.			
b. The load rating chart for the crane, which includes:			
(1) the crane make & model, serial number, and year of manufacturer			
(2) load rating for all crane operating configurations, including optional equipment			
(3) wire rope type, size, and reeving: line pull, line speed, & drum capacity: and			
(4) operating limits in windy or cold weather conditions			
c. The crane's log book which shall be used to record operating hours & all crane inspections, tests, maintenance & repair. The log shall be updated daily as the crane is used & shall be signed by the operator and supervisor: service mechanic shall sign the log after conducting maintenance or repairs on the crane			
2. Performance Load Tests (16.C.12) (16.D.02a)			
a. Under the following circumstances cranes shall be load tested by a qualified person			
(1) prior to initial use in which load sustaining parts have been altered, replaced, or repaired (excluding replacement of the rope)			
(2) every time it is reconfigured or reassembled after disassembly, and			
(3) every four years.			
b. Performance load tests shall be conducted in accordance with the manufacturer's recommendations. Test loads shall not exceed 100% of the manufacturer's load rating capacity chart at the configuration of the test.			
c. Written reports of the rated load test, showing test procedures & confirming the adequacy of repairs or alterations, shall be maintained w/ the crane/derrick or at the on-site project office			
3. Crawler-, Truck-, and Wheel-Mounted Cranes shall be checked for the following; (16.D.01)			
a. Boom angel indicator and a load indicating device, or a load moment indicator.			
b. A means for the operator to visually determine the levelness of the crane.			
c. Drum rotation indicators located to afford sensing by the operator.			
d. Boom angle or radius indicator within operator's view.			
e. Anti-two block device			
(1) Lattice boom cranes shall have blocking devise to stop the load hoist function before the load block or load contacts the boom tip.			
(2) Telescoping boom cranes shall have a device to stop the load hoisting function before the load block or load contacts the boom tip & to prevent damage to the hoist rope or other machine components when extending the boom.			
(3) Telescoping boom cranes used exclusively for duty cycle operations shall have a two-blocking damage prevention or warning device to prevent damage to the hoist rope or other machine components when extending the boom.			
4. All mobile cranes with cable supported booms hsall be checked for boom stops which, at angle specified by the crane manufacturer, limit the movement of that portion of the boom below the point at which the boom stop acts on the boom: (16.D.02a.b. & c. I)			

REMARKS: (USE REVERSE SIDE IF NECESSARY)

INSPECTED & CERTIFIED BY: (SIGNATURE OF MECHANIC)	APPROVED BY: (SIGNATURE OF COMPANY OFFICIAL)

SAFETY INSPECTION FOR CONSTRUCTION EQUIPMENT		
CONTRACTOR: Bristol Design Build Services		CONTRACT NUMBER:
TYPE OF EQUIPMENT:	EQUIPMENT NUMBER:	DATE OF INSPECTION:

CORPS OF ENGINEERS SAFETY & HEALTH REQUIREMENTS MANUAL. EM 385-1-1. REVISION 92
REFERENCES ARE IN PARENTHESES

MACHINERY & MECHANICAL EQUIPMENT

NO MACHINERY OR MECHANICAL EQUIPMENT SHALL BE PLACED IN SERVICE UNTIL IT HAS BEEN INSPECTED & TESTED BY A COMPETENT PERSON & CERTIFIED TO BE IN SAFE OPERATING CONDITION.

INDICATE ANSWERS BY PLACING "X" IN PROPER COLUMN	YES	NO	N/A
1. Equipment requirements: (16.A.07)			
a. Seats or equal protection provided for each person required to ride equipment			
b. When operated on the highway, headlights, taillights, brake lights, backup lights & turn signals visible from front & rear must be provided			
c. With windshields: shall be equipped with power wiper & defogging/defrosting devices			
d. Service brake system, parking brake system, & emergency (manually operated from driver's position)			
e. At a minimum, one dry chemical or carbon-dioxide fire extinguisher with a rating of 5-B:C (tagged, charged & ready for use)			
2. Reverse signal (BACK-UP) alarms (16.B.01)			
3. Guarding (16.B.03) is required for the following:			
a. All belts, gears, shafts, pulleys, sprockets, spindles, drums, flywheels, chains or other reciprocating, rotating, or moving parts of equipment			
b. Hot surfaces including exhaust pipes or other lines			
c. Charging skip shall be provided with guards on both sides and open ends of skip area			
d. Platforms, catwalks, steps, handholds			
4. Fuel tanks located not allow spills or overflows to run onto engine, exhaust, or electrical equipment (16.B.04)			
5. Exhaust or discharges do not endanger workmen or obstruct view of operator (16. B.05)			
6. Seatbelts comply with 49CFR 571 (16.B.08)			
7. Falling object protective structures (FOPS) (16.B.11) (a through c)			
8. Rollover protective structures (ROPS) (16.B.12) (a through c)			
9. Is glass installed in operator's compartment safety glass? (16.B.10)			
10. Points requiring lubrication during operation shall have fittings so located or guarded to be accessible without hazardous exposure (16.B.13)			
11. Whenever long-bed end-dump trailers are used: (16.B.15) provide a roll-over warning device: the device shall have a continuous monitoring display at the operation station to provide the operator with a quick & easily read indicator & audible warning of an unsafe condition.			

REMARKS: (USE REVERSE SIDE IF NECESSARY)

INSPECTED & CERTIFIED BY: (SIGNATURE OF MECHANIC)	APPROVED BY: (SIGNATURE OF COMPANY OFFICIAL)
N/A	

Crane Test and Inspection Record

Date ____/____/_____

Crane ID _____

Temperature _____

Wind _____

Test #	Site W	Site E
X1		
X2		
L2		
L3		
L4		
L5		
L6		
L7		
L11		
L17		
L18		

Reference ACE EN 385 Table I-2

OPERATORS CERTIFICATION	
PHYSICIAN'S CERTIFICATE	
CRANE INSPECTION CERTIFICATE	
CRANE OPERATING MANUAL	
CRANE LOG BOOK	

Witnessed By _____

DAILY INSPECTION LOG

Date: _____

Worksite ID: _____

SS/Lead and No. of Workers: _____

Activity Description: _____

Equipment/PPE in Use: _____

Work Site Observations/Issues: _____

_____

_____

_____

_____

_____

_____

_____

Corrective Actions Taken: _____

_____

_____

_____

_____

_____

_____

_____

Screening Data Results: _____

Photo: ☐ Yes ☐ No

Name: _____

Signature: _____

Standard Equipment Inspection Form

Equipment No.	Date	Inspector Name	Hours	Location

A. SERVICE CHECKS:

ITEM	*OK*	*AMT NEEDED*	*ITEM*	*OK*	*AMT ADDED*
Radiator & Freeze Protection			Batteries		
Engine			Lubrication Points		
Transmission			Fuel Level		
Hydraulic System			Drain Fuel Sediment		
Differentials			Pivot Shaft		
Planetaries / Final Drives			Air Induction & Filter		

B. EQUIPMENT INSPECTION

	CONDITION Bad/Good/ Excellent	*Attn Needed*	*Explanation*	*Corrected? (Y/N)*
Fan & Shrouds				
Belts Pulleys				
Exhaust & Rain Cap				
Battery & Cables				
Hydraulic Cylinders				
Operators Compartment				
Hoses & Lines				
Fuel / Oil Leaks				
Cracks				
Cutting Edges				
Sprockets				
Rollers & Idlers				
Tracks or Tires				
Trans Operation				
Service Brakes				
Parking Brake				
Gauges Operational				
Backup Alarm				
Wipers & Washer				
Lights				
Horn				
Seat & Seat Belts				
Windows				

Machine Damage:

Standard Equipment Inspection Form

NOTES (continued)**:**

Deficiencies noted: ☐ Yes ☐ No Explain: _____

Deficiencies fixed: ☐ Yes ☐ No Date: _____

Inspection 100% complete ☐ Yes ☐ No

USCOE Rep. Signature _____ Date all items passed inspection: _____

Bristol Representative _____ Date: _____

Bristol INDUSTRIES

Dosimeter Noise Exposure Documentation Form

Person Conducting Survey_____ **Dosimeter Manf & Model**_____ _____**Dosimeter S/N**_____

Dosimeter Pre-Calibration_____ **(If pre-calibration fails, do not continue survey)**

Dosimeter Post-Calibration_____ **(If post-calibration fails, survey results are invalid)**

Person Being Surveyed_____ **Occupation/Work Activity**_____

Equipment Used_____ **Hearing Protection Y / N Manf & Model**_____

Date_____**Wind/Weather/Other Conditions**_____

INSTRUCTIONS:

1. Check dosimeter batteries. Replace if necessary.
2. Choose worker or workers for sampling who are likely to receive the highest noise exposure.
3. Hang dosimeter on belt, pocket, etc. and place microphone on shoulder, centered and pointing upward. If one shoulder is noisier than the other, place on noisier side. Make sure microphone is covered by wind shield.
4. Turn on dosimeter, and record sampling start time.
5. Observe worker periodically throughout sampling period and record time, work activity, equipment operated, source of noise, noise controls used, etc. Verify that person sampled is experiencing a "normal work day."
6. Check dosimeter at regular intervals (hourly, if possible) and record noise dose. Spot check noise levels with SLM.
7. Remove dosimeter at end of sampling period. Record time and final noise dose, and turn off dosimeter.

TIME	Location, Work Activity, Equipment Operated, Sources of Noise Noise Controls Used, General Observations and Comments	Noise Dose (%)

OSHA's Form 300 (Rev. 01/2004)

Log of Work-Related Injuries and Illnesses

Attention: This form contains information relating to employee health and must be used in a manner that protects the confidentiality of employees to the extent possible while the information is being used for occupational safety and health purposes.

Year _____

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

You must record information about every work-related injury or illness that involves loss of consciousness, restricted work activity or job transfer, days away from work, or medical treatment beyond first aid. You must also record significant work-related injuries and illnesses that are diagnosed by a physician or licensed health care professional. You must also record work-related injuries and illnesses that meet any of the specific recording criteria listed in 29 CFR 1904.8 through 1904.12. Feel free to use two lines for a single case if you need to. You must complete an injury and illness incident report (OSHA Form 301) or equivalent form for each injury or illness recorded on this form. If you're not sure whether a case is recordable, call your local OSHA office for help.

Establishment name _____

City _____ State _____

Identify the person			Describe the case			Classify the case											
						CHECK ONLY ONE box for each case based on the most serious outcome for that case:				Enter the number of days the injured or ill worker was:		Check the "injury" column or choose one type of illness:					
(A) Case No.	(B) Employee's Name	(C) Job Title (e.g., Welder)	(D) Date of injury or onset of illness (mo./day)	(E) Where the event occurred (e.g. Loading dock north end)	(F) Describe injury or illness, parts of body affected, and object/substance that directly injured or made person ill (e.g. Second degree burns on right forearm from acetylene torch)	Death	Days away from work	Remained at work		Away From Work (days)	On job transfer or restriction (days)	(M) Injury	Skin Disorder	Respiratory Condition	Poisoning	Hearing Loss	All other illnesses
								Job transfer or restriction	Other record-able cases								
						(G)	(H)	(I)	(J)	(K)	(L)	(1)	(2)	(3)	(4)	(5)	(6)
					Page totals	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*	*0*

Be sure to transfer these totals to the Summary page (Form 300A) before you post it.

Injury	Skin Disorder	Respiratory Condition	Poisoning	Hearing Loss	All other illnesses
(1)	(2)	(3)	(4)	(5)	(6)

Public reporting burden for this collection of information is estimated to average 14 minutes per response, including time to review the instruction, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistics, Room N-3644, 200 Constitution Ave, NW, Washington, DC 20210. Do not send the completed forms to this office.

OSHA's Form 300A (Rev. 01/2004)

Summary of Work-Related Injuries and Illnesses

Year _____

U.S. Department of Labor
Occupational Safety and Health Administration

Form approved OMB no. 1218-0176

All establishments covered by Part 1904 must complete this Summary page, even if no injuries or illnesses occurred during the year. Remember to review the Log to verify that the entries are complete

Using the Log, count the individual entries you made for each category. Then write the totals below, making sure you've added the entries from every page of the log. If you had no cases write "0."

Employees former employees, and their representatives have the right to review the OSHA Form 300 in its entirety. They also have limited access to the OSHA Form 301 or its equivalent. See 29 CFR 1904.35, in OSHA's Recordkeeping rule, for further details on the access provisions for these forms.

Number of Cases

Total number of deaths	Total number of cases with days away from work	Total number of cases with job transfer or restriction	Total number of other recordable cases
0	0	0	0
(G)	(H)	(I)	(J)

Number of Days

Total number of days away from work	Total number of days of job transfer or restriction
0	0
(K)	(L)

Injury and Illness Types

Total number of… (M)			
(1) Injury	0	(4) Poisoning	0
(2) Skin Disorder	0	(5) Hearing Loss	0
(3) Respiratory Condition	0	(6) All Other Illnesses	0

Post this Summary page from February 1 to April 30 of the year following the year covered by the form

Public reporting burden for this collection of information is estimated to average 50 minutes per response, including time to review the instruction, search and gather the data needed, and complete and review the collection of information. Persons are not required to respond to the collection of information unless it displays a currently valid OMB control number. If you have any comments about these estimates or any aspects of this data collection, contact: US Department of Labor, OSHA Office of Statistics, Room N-3644, 200 Constitution Ave. NW, Washington, DC 20210. Do not send the completed forms to this office.

Establishment information

Your establishment name _____

Street _____

City _____ State _____ Zip _____

Industry description (e.g., Manufacture of motor truck trailers)

_____

Standard Industrial Classification (SIC), if known (e.g., SIC 3715)

___ ___ ___ ___

OR North American Industrial Classification (NAICS), if known (e.g., 336212)

___ ___ ___ ___ ___ ___

Employment information

Annual average number of employees _____

Total hours worked by all employees last year _____

Sign here

Knowingly falsifying this document may result in a fine.

I certify that I have examined this document and that to the best of my knowledge the entries are true, accurate, and complete.

_____ Company executive

_____ Title

_____ Phone

_____ Date

IMMEDIATE REPORT OF ACCIDENT

SOHO USE ONLY
Date Recd': _____
Time Recd': _____

TO: _____ (COE Office) FROM: _____ DATE: _____

1. Name of Person Reporting: _____ (Print) Phone No.: _____
2. Location of Accident: _____
3. Date and Time of Accident: _____

   If this accident is being reported late,(24 hrs) Why? _____
4. Name of Injured (if any): _____
5. Nature of Injury: _____
6. Occupation (Injured Person): _____
7. Age (Injured Person): _____
8. Estimated Lost Time (Days): _____

   Was, return to light duty emphasized to the doctor? _____
9. Estimated Property Damage: _____
10. Contractor: _____ 10. Contract No.: _____
11. Board of Investigation Required: YES _____ 1. Fatal

    NO _____ 2. Three or more admitted to a hospital?

    3. Property damage of $200,000 or more?

    If yes, was immediate phone notifications to the Commander, Directorate and safety made? _____
12. Descripton of Accident: (continue on back if needed)Provide a narrative (Where,What,Why,How it Happened) so the Commander can get a understanding of the situation.

Who Investigated This Accident (Name): _____

Signature of Person Making Report: _____ Print Name: _____

Title of Person Making Report: _____ Phone No. to Reach: _____

Location of Person Making Report: _____

EDITION OF 1 JUN 98 IS OBSOLETE

Bristol
ENVIRONMENTAL
REMEDIATION SERVICES, LLC

111 W. 16th Avenue, Third Floor
Anchorage, Alaska 99501-5109
907-563-0013 Phone
907-563-6713 Fax

2011 Northeast Cape HTRW Remedial Actions

TOOLBOX SAFETY MEETING RECORD

DATE: _____

SUBJECTS:

1. _____
2. _____
3. _____
4. _____
5. _____
6. _____
7. _____
8. _____

	PRINTED NAME	SIGNATURE	COMPANY
1.			
2.			
3.			
4.			
5.			
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28.			
29.			
30.			

(For Safety Staff only)	REPORT NO.	EROC CODE	**UNITED STATES ARMY CORPS OF ENGINEERS ACCIDENT INVESTIGATION REPORT** *(For Use of this Form See Help Menu and USACE Suppl to AR 385-40)*	**REQUIREMENT CONTROL SYMBOL: CEEC-S-8(R2)**

1. ACCIDENT CLASSIFICATION

PERSONNEL CLASSIFICATION	INJURY/ILLNESS/FATAL	PROPERTY DAMAGE	MOTOR VEHICLE INVOLVED	DIVING
GOVERNMENT ☐ CIVILIAN ☐ MILITARY	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ CONTRACTOR	☐	☐ FIRE INVOLVED ☐ OTHER	☐	☐
☐ PUBLIC	☐ FATAL ☐ OTHER		☐	

2. PERSONAL DATA

a. Name *(Last, First, MI)*	b. AGE	c. SEX ☐ MALE ☐ FEMALE	d. SOCIAL SECURITY NUMBER	e. GRADE

f. JOB SERIES/TITLE	g. DUTY STATUS AT TIME OF ACCIDENT	h. EMPLOYMENT STATUS AT TIME OF ACCIDENT
	☐ ON DUTY ☐ TDY ☐ OFF DUTY	☐ ARMY ACTIVE ☐ ARMY RESERVE ☐ VOLUNTEER ☐ PERMANENT ☐ FOREIGN NATIONAL ☐ SEASONAL ☐ TEMPORARY ☐ STUDENT ☐ OTHER *(Specify)*

3. GENERAL INFORMATION

a. DATE OF ACCIDENT *(month/day/year)*	b. TIME OF ACCIDENT *(Military time)* hrs	c. EXACT LOCATION OF ACCIDENT	d. CONTRACTOR'S NAME (1) PRIME: (2) SUBCONTRACTOR:

e. CONTRACT NUMBER	f. TYPE OF CONTRACT	g. HAZARDOUS/TOXIC WASTE ACTIVITY
☐ CIVIL WORKS ☐ MILITARY ☐ OTHER *(Specify)*	☐ CONSTRUCTION ☐ SERVICE ☐ A/E ☐ DREDGE ☐ OTHER *(Specify)*	☐ SUPERFUND ☐ DERP ☐ IRP ☐ OTHER *(Specify)*

4. CONSTRUCTION ACTIVITIES ONLY *(Fill in line and corresponding code number in box from list - see help menu)*

a. CONSTRUCTION ACTIVITY	(CODE) #	b. TYPE OF CONSTRUCTION EQUIPMENT	(CODE) #

5. INJURY/ILLNESS INFORMATION *(Include name on line and corresponding code number in box for items e, f & g - see help menu)*

a. SEVERITY OF ILLNESS/INJURY	(CODE) #	b. ESTIMATED DAYS LOST	c. ESTIMATED DAYS HOSPITALIZED	d. ESTIMATED DAYS RESTRICTED DUTY

e. BODY PART AFFECTED	(CODE)	g. TYPE AND SOURCE OF INJURY/ILLNESS	(CODE)
PRIMARY	#	TYPE	#
SECONDARY	#	SOURCE	#
f. NATURE OF ILLNESS/INJURY	#		

6. PUBLIC FATALITY *(Fill in line and correspondence code number in box - see help menu)*

a. ACTIVITY AT TIME OF ACCIDENT	(CODE) #	b. PERSONAL FLOATATION DEVICE USED? ☐ YES ☐ NO ☐ N/A

7. MOTOR VEHICLE ACCIDENT

a. TYPE OF VEHICLE	b. TYPE OF COLLISION	c. SEAT BELTS	USED	NOT USED	NOT AVAILABLE
☐ PICKUP/VAN ☐ AUTOMOBILE ☐ TRUCK ☐ OTHER *(Specify)*	☐ SIDE SWIPE ☐ HEAD ON ☐ REAR END ☐ BROADSIDE ☐ ROLL OVER ☐ BACKING ☐ OTHER *(Specify)*	(1) FRONT SEAT			
		(2) REAR SEAT			

8. PROPERTY/MATERIAL INVOLVED

a. NAME OF ITEM	b. OWNERSHIP	c. $ AMOUNT OF DAMAGE
(1)		
(2)		
(3)		

9. VESSEL/FLOATING PLANT ACCIDENT *(Fill in line and correspondence code number in box from list - see help menu)*

a. TYPE OF VESSEL/FLOATING PLANT	(CODE) #	b. TYPE OF COLLISION/MISHAP	(CODE) #

10. ACCIDENT DESCRIPTION *(Use additional paper, if necessary)*

11. CAUSAL FACTOR(S) *(Read Instruction Before Completing)*

a. (Explain YES answers in item 13)

	YES	NO
DESIGN: Was design of facility, workplace or equipment a factor?	☐	☐
INSPECTION/MAINTENANCE: Were inspection & maintenance procedures a factor?	☐	☐
PERSON'S PHYSICAL CONDITION: In your opinion, was the physical condition of the person a factor?	☐	☐
OPERATING PROCEDURES: Were operating procedures a factor?	☐	☐
JOB PRACTICES: Were any job safety/health practices not followed when the accident occurred?	☐	☐
HUMAN FACTORS: Did any human factors such as, size or strength of person, etc., contribute to accident?	☐	☐
ENVIRONMENTAL FACTORS: Did heat, cold, dust, sun, glare, etc., contribute to the accident?	☐	☐

a. *(CONTINUED)*

	YES	NO
CHEMICAL AND PHYSICAL AGENT FACTORS: Did exposure to chemical agents, such as dust, fumes, mists, vapors or physical agents, such as, noise, radiation, etc., contribute to accident?	☐	☐
OFFICE FACTORS: Did office setting such as, lifting office furniture, carrying, stooping, etc., contribute to the accident?	☐	☐
SUPPORT FACTORS: Were inappropriate tools/resources provided to properly perform the activity/task?	☐	☐
PERSONAL PROTECTIVE EQUIPMENT: Did the improper selection, use or maintenance of personal protective equipment contribute to the accident?	☐	☐
DRUGS/ALCOHOL: In your opinion, was drugs or alcohol a factor to the accident	☐	☐

b. WAS A WRITTEN JOB/ACTIVITY HAZARD ANALYSIS COMPLETED FOR TASK BEING PERFORMED AT TIME OF ACCIDENT?

☐ YES *(If yes, attach a copy.)* ☐ NO

12. TRAINING

a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK?	b. TYPE OF TRAINING.	c. DATE OF MOST RECENT FORMAL TRAINING.
☐ YES ☐ NO	☐ CLASSROOM ☐ ON JOB	(Month) (Day) (Year)

13. FULLY EXPLAIN WHAT ALLOWED OR CAUSED THE ACCIDENT; INCLUDE DIRECT AND INDIRECT CAUSES *(See instruction for definition of direct and indirect causes.) (Use additional paper, if necessary)*

a. DIRECT CAUSE

b. INDIRECT CAUSE(S)

14. ACTION(S) TAKEN, ANTICIPATED OR RECOMMENDED TO ELIMINATE CAUSE(S).

DESCRIBE FULLY:

15. DATES FOR ACTIONS IDENTIFIED IN BLOCK 14.

a. BEGINNING (Month/Day/Year)	b. ANTICIPATED COMPLETION (Month/Day/Year)

c. SIGNATURE AND TITLE OF SUPERVISOR COMPLETING REPORT	d. DATE *(Mo/Da/Yr)*	e. ORGANIZATION IDENTIFIER *(Div, Br, Sect)*	f. OFFICE SYMBOL
CORPS _____ CONTRACTOR _____			

16. MANAGEMENT REVIEW *(1st)*

a. ☐ CONCUR b. ☐ NON CONCUR c. COMMENTS

SIGNATURE	TITLE	DATE

17. MANAGEMENT REVIEW *(2nd - Chief Operations, Construction, Engineering, etc.)*

a. ☐ CONCUR b. ☐ NON CONCUR c. COMMENTS

SIGNATURE	TITLE	DATE

18. SAFETY AND OCCUPATIONAL HEALTH OFFICE REVIEW

a. ☐ CONCUR b. ☐ NON CONCUR c. ADDITIONAL ACTIONS/COMMENTS

SIGNATURE	TITLE	DATE

19. COMMAND APPROVAL

COMMENTS

COMMANDER SIGNATURE	DATE

*U.S. GOVERNMENT PRINTING OFFICE: 1993-0-791-757

10.	ACCIDENT DESCRIPTION *(Continuation)*

13a.	DIRECT CAUSE *(Continuation)*

13b.	INDIRECT CAUSES *(Continuation)*

14.	ACTION(S) TAKEN, ANTICIPATED, OR RECOMMENDED TO ELIMINATE CAUSE(S) *(Continuation)*

GENERAL. Complete a separate report for each person who was injured, caused, or contributed to the accident (excluding uninjured personnel and witnesses). Use of this form for reporting USACE employee first-aid type injuries not submitted to the Office of Workers' Compensation Programs (OWCP) shall be at the descretion of the FOA commander. Please type or print legibly. Appropriate items shall be marked with an "X" in box(es). If additional space is needed, provide the information on a separate sheet and attach to the completed form. Ensure that these instructions are forwarded with the completed report to the designated management reviewers indicated in sections 16 and 17.

INSTRUCTIONS FOR SECTION 1 - ACCIDENT CLASSIFICATION

(Mark All Boxes That Are Applicable)

a. GOVERNMENT. Mark "CIVILIAN" box if accident involved government civilian employee; mark "MILITARY" box if accident involved U.S. military personnel.

(1) INJURY/ILLNESS/FATALITY - Mark if accident resulted in any government civilian employee injury, illness, or fatality that requires the submission of OWCP Forms CA-1 (injury), CA-2 (illness) or CA-6 (fatality) to OWCP; mark if accident resulted in military personnel lost-time or fatal injury or illness.

(2) PROPERTY DAMAGE - Mark the appropriate box if accident resulted in any damage of $1000 or more to government property (including motor vehicles).

(3) VEHICLE INVOLVED - Mark if accident involved a motor vehicle, regardless of whether "INJURY/ILLNESS/FATALITY" or "PROPERTY DAMAGE" are marked.

(4) DIVING ACTIVITY - Mark if the accident involved an in-house USACE diving activity.

b. CONTRACTOR.

(1) INJURY/ILLNESS/FATALITY - Mark if accident resulted in any contractor lost-time injury/illness or fatality.

(2) PROPERTY DAMAGE - Mark the appropriate box if accident resulted in any damage of $1000 or more to contractor property (including motor vehicles).

(3) VEHICLE INVOLVED - Mark if accident involved a motor vehicle, regardless of whether "INJURY/ILLNESS/FATALITY" or "PROPERTY DAMAGE" are marked.

(4) DIVING ACTIVITY - Mark if the accident involved a USACE Contractor diving activity.

c. PUBLIC.

(1) INJURY/ILLNESS/FATALITY - Mark if accident resulted in public fatality or permanent total disability. (The "OTHER" box will be marked when requested by the FOA to report an unusual non-fatal public accident that could result in claims against the government or as otherwise directed by the FOA Commander).

(2) VOID SPACE - Make no entry.

(3) VEHICLE INVOLVED - Mark if accident resulted in a fatality to a member of the public and involved a motor vehicle, regardless of whether "INJURY/ILLNESS/FATALITY" is marked.

(4) VOID SPACE - Make no entry.

INSTRUCTIONS FOR SECTION 2 - PERSONAL DATA

a. NAME - (MANDATORY FOR GOVERNMENT ACCIDENTS. OPTIONAL AT THE DISCRETION OF THE FOA COMMANDER FOR CONTRACTOR AND PUBLIC ACCIDENTS). Enter last name, first name, middle initial of person involved.

b. AGE - Enter age.

c. SEX - Mark appropriate box.

d. SOCIAL SECURITY NUMBER - (FOR GOVERNMENT PERSONNEL ONLY) Enter the social security number (or other personal identification number if no social security number issued).

e. GRADE - (FOR GOVERNMENT PERSONNEL ONLY) Enter pay grade. Example: 0-6; E-7; WG-8; WS-12; GS-11; etc.

f. JOB SERIES/TITLE - For government civilian employees enter the pay plan, full series number, and job title, e.g., GS-O810/Civil Engineer. For military personnel enter the primary military occupational specialty (PMOS), e.g., 15A30 or 11G50. For contractor employees enter the job title assigned to the injured person, e.g., carpenter, laborer, surveyor, etc.

g. DUTY STATUS - Mark the appropriate box.

(1) ON DUTY - Person was at duty station during duty hours or person was away from duty station during duty hours but on official business at time of the accident.

(2) TDY - Person was on official business, away from the duty station and with travel orders at time of accident. Line-of-duty investigation required.

(3) OFF DUTY - Person was not on official business at time of accident.

h. EMPLOYMENT STATUS - (FOR GOVERNMENT PERSONNEL ONLY) Mark the most appropriate box. If "OTHER" is marked, specify the employment status of the person.

INSTRUCTION FOR SECTION 3 - GENERAL INFORMATION

a. DATE OF ACCIDENT - Enter the month, day, and year of accident.

b. TIME OF ACCIDENT - Enter the local time of accident in military time. Example: 1430 hrs (not 2:30 p.m.).

c. EXACT LOCATION OF ACCIDENT - Enter facts needed to locate the accident scene, (installation/project name, building number, street, direction and distance from closest landmark, etc.).

d. CONTRACTOR NAME

(1) PRIME - Enter the exact name (title of firm) of the prime contractor.

(2) SUBCONTRACTOR - Enter the name of any subcontractor involved in the accident.

e. CONTRACT NUMBER - Mark the appropriate box to identify if contract is civil works, military, or other: if "OTHER" is marked, specify contract appropriation on line provided. Enter complete contract number of prime contract, e.g., DACW 09-85-C-0100.

f. TYPE OF CONTRACT - Mark appropriate box. A/E means architect/engineer. If "OTHER" is marked, specify type of contract on line provided.

g. HAZARDOUS/TOXIC WASTE ACTIVITY (HTW) - Mark the box to identify the HTW activity being performed at the time of the accident. For Superfund, DERP, and Installation Restoration Program (IRP) HTW activities include accidents that occurred during inventory, predesign, design, and construction. For the purpose of accident reporting, DERP Formerly Used DoD Site (FUDS) activities and IRP activities will be treated separately. For Civil Works O&M HTW activities mark the "OTHER" box.

INSTRUCTIONS FOR SECTION 4 - CONSTRUCTION ACTIVITIES

a. CONSTRUCTION ACTIVITY - Select the most appropriate construction activity being performed at time of accident from the list below. Enter the activity name and place the corresponding code number identified in the box.

CONSTRUCTION ACTIVITY LIST

1. **MOBILIZATION**
2. **SITE PREPARATION**
3. **EXCAVATION/TRENCHING**
4. **GRADING (EARTHWORK)**
5. **PIPING/UTILITIES**
6. **FOUNDATION**
7. **FORMING**
8. **CONCRETE PLACEMENT**
9. **STEEL ERECTION**
10. **ROOFING**
11. **FRAMING**
12. **MASONRY**
13. **CARPENTRY**
14. **ELECTRICAL**
15. **SCAFFOLDING/ACCESS**
16. **MECHANICAL**
17. **PAINTING**
18. **EOUIPMENT/MAINTENANCE**
19. **TUNNELING**
20. **WAREHOUSING/STORAGE**
21. **PAVING**
22. **FENCING**
23. **SIGNING**
24. **LANDSCAPING/IRRIGATION**
25. **INSULATION**
26. **DEMOLITION**

b. TYPE OF CONSTRUCTION EQUIPMENT - Select the equipment involved in the accident from the list below. Enter the name and place the corresponding code number identified in the box. If equipment is not included below, use code 24, "OTHER", and write in specific type of equipment.

CONSTRUCTION EQUIPMENT

1. GRADER
2. DRAGLINE
3. CRANE (ON VESSEL/BARGE)
4. CRANE (TRACKED)
5. CRANE (RUBBER TIRE)
6. CRANE (VEHICLE MOUNTED)
7. CRANE (TOWER)
8. SHOVEL
9. SCRAPER
10. PUMP TRUCK (CONCRETE)
11. TRUCK (CONCRETE/TRANSIT MIXER)
12. DUMP TRUCK (HIGHWAY)
13. DUMP TRUCK (OFF HIGHWAY)
14. TRUCK (OTHER)
15. FORKLIFT
16. BACKHOE
17. FRONT-END LOADER
18. PILE DRIVER
19. TRACTOR (UTILITY)
20. MANLIFT
21. DOZER
22. DRILL RIG
23. COMPACTOR/VIBRATORY ROLLER
24. OTHER

INSTRUCTIONS FOR SECTION 5 - INJURY/ILLNESS INFORMATION

a. SEVERITY OF INJURY/ILLNESS - Reference para 2-10 of USACE Suppl 1 to AR 385-40 and enter code and description from list below.

NOI	**NO INJURY**
FAT	**FATALITY**
PTL	**PERMANENT TOTAL DISABILITY**
PPR	**ERMANENT PARTIAL DISABILITY**
LWD	**LOST WORKDAY CASE INVOLVING DAYS AWAY FROM WORK**
NLW	**RECORDABLE CASE WITHOUT LOST WORKDAYS**
RFA	**RECORDABLE FIRST AID CASE**

b. ESTIMATED DAYS LOST - Enter the estimated number of workdays the person will lose from work.

c. ESTIMATED DAYS HOSPITALIZED - Enter the estimated number of workdays the person will be hospitalized.

d. ESTIMATED DAYS RESTRICTED DUTY - Enter the estimated number of workdays the person, as a result of the accident, will not be able to perform all of their regular duties.

e. BODY PART AFFECTED - Select the most appropriate primary and when applicable, secondary body part affected from the list below. Enter body part name on line and place the corresponding code letters identifying that body part in the box.

GENERAL BODY AREA	CODE	BODY PART NAME
ARM/WRIST	**AB**	**ARM AND WRIST**
	AS	**ARM OR WRIST**
TRUNK, EXTERNAL MUSCULATURE	**B1**	**SINGLE BREAST**
	B2	**BOTH BREASTS**
	B3	**SINGLE TESTICLE**
	B4	**BOTH TESTICLES**
	BA	**ABDOMEN**
	BC	**CHEST**
	BL	**LOWER BACK**
	BP	**PENIS**
	BS	**SIDE**
	BU	**UPPER BACK**
	BW	**WAIST**
	BZ	**TRUNK OTHER**
HEAD, INTERNAL	**C1**	**SINGLE EAR INTERNAL**
	C2	**BOTH EARS INTERNAL**
	C3	**SINGLE EYE INTERNAL**
	C4	**BOTH EYES INTERNAL**
	CB	**BRAIN**
	CC	**CRANIAL BONES**
	CD	**TEETH**
	CJ	**JAW**
	CL	**THROAT, LARYNX**
	CM	**MOUTH**
	CN	**NOSE**
	CR	**THROAT, OTHER**
	CT	**TONGUE**
	CZ	**HEAD OTHER INTERNAL**
ELBOW	**EB**	**BOTH ELBOWS**
	ES	**SINGLE ELBOW**
FINGER	**F1**	**FIRST FINGER**
	F2	**BOTH FIRST FINGERS**
	F3	**SECOND FINGER**
	F4	**BOTH SECOND FINGERS**
	F5	**THIRD FINGER**
	F6	**BOTH THIRD FINGERS**
	F7	**FOURTH FINGER**
	F8	**BOTH FOURTH FINGERS**
TOE	**G1**	**GREAT TOE**
	G2	**BOTH GREAT TOES**
	G3	**TOE OTHER**
	G4	**TOES OTHER**

GENERAL BODY AREA	CODE	BODY PART NAME
HEAD, EXTERNAL	**H1**	**EYES EXTERNAL**
	H2	**BOTH EYES EXTERNAL**
	H3	**EAR EXTERNAL**
	H4	**BOTH EARS EXTERNAL**
	HC	**CHIN**
	HF	**FACE**
	HK	**NECK/THROAT**
	HM	**MOUTH/LIPS**
	HN	**NOSE**
	HS	**SCALP**
KNEE	**KB**	**BOTH KNEES**
	KS	**KNEE**
LEG, HIP, ANKLE, BUTTOCK	**LB**	**BOTH LEGS/HIPS/ ANKLES/BUTTOCKS**
	LS	**SINGLE LEG/HIP ANKLE/BUTTOCK**
HAND	**MB**	**BOTH HANDS**
	MS	**SINGLE HAND**
FOOT	**PB**	**BOTH FEET**
	PS	**SINGLE FOOT**
TRUNK, BONES	**R1**	**SINGLE COLLAR BONE**
	R2	**BOTH COLLAR BONES**
	R3	**SHOULDER BLADE**
	R4	**BOTH SHOULDER BLADES**
	RB	**RIB**
	RS	**STERNUM (BREAST BONE)**
	RV	**VERTEBRAE (SPINE; DISC)**
	RZ	**TRUNK BONES OTHER**
SHOULDER	**SB**	**BOTH SHOULDERS**
	SS	**SINGLE SHOULDER**
THUMB	**TB**	**BOTH THUMBS**
	TS	**SINGLE THUMB**
TRUNK, INTERNAL ORGANS	**V1**	**LUNG, SINGLE**
	V2	**LUNGS, BOTH**
	V3	**KIDNEY, SINGLE**
	V4	**KIDNEYS, BOTH**
	VH	**HEART**
	VL	**LIVER**
	VR	**REPRODUCTIVE ORGANS**
	VS	**STOMACH**
	VV	**INTESTINES**
	VZ	**TRUNK, INTERNAL; OTHER**

f. NATURE OF INJURY/ILLNESS - Select the most appropriate nature of injury/illness from the list below. This nature of injury/illness shall correspond to the primary body part selected in 5e, above. Enter the nature of injury/illness name on the line and place the corresponding CODE letters in the box provided.

*** The injury or condition selected below must be caused by a specific incident or event <u>which occurred during a single work day or shift.</u>**

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME
***TRAUMATIC INJURY OR DISABILITY**	**TA**	**AMPUTATION**
	TB	**BACK STRAIN**
	TC	**CONTUSION; BRUISE; ABRASION**
	TD	**DISLOCATION**
	TF	**FRACTURE**
	TH	**HERNIA**
	TK	CONCUSSION
	TL	LACERATION, CUT
	TP	PUNCTURE
	TS	STRAIN, MULTIPLE
	TU	BURN, SCALD, SUNBURN
	TI	TRAUMATIC SKIN DISEASES/CONDITIONS INCLUDING DERMATITIS
	TR	TRAUMATIC RESPIRATORY DISEASE
	TQ	TRAUMATIC FOOD POISONING
	TW	TRAUMATIC TUBERCULOSIS
	TX	TRAUMATIC VIROLOGICAL/ INFECTIVE/PARASITIC DISEASE
	T1	TRAUMATIC CEREBRAL VASCULAR CONDITION/STROKE
	T2	TRAUMATIC HEARING LOSS
	T3	TRAUMATIC HEART CONDITION
	T4	TRAUMATIC MENTAL DISORDER, STRESS; NERVOUS CONDITION
	T8	TRAUMATIC INJURY - OTHER (EXCEPT DISEASE, ILLNESS)

** A nontraumatic physiological harm or loss of capacity produced by systemic infection; continued or repeated stress or strain; exposure to toxins, poisons, fumes, etc.; or other continued and <u>repeated exposures to conditions of the work environment over a long period of time</u>. For practical purposes, an occupational illness/disease or disability is any reported condition which does not meet the definition of traumatic injury or disability as described above.

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME
**NON-TRAUMATIC ILLNESS/DISEASE OR DISABILITY		
RESPIRATORY DISEASE	RA	ASBESTOSIS
	RB	BRONCHITIS
	RE	EMPHYSEMA
	RP	PNEUMOCONIOSIS
	RS	SILICOSIS
	R9	RESPIRATORY DISEASE, OTHER
VIROLOGICAL, INFECTIVE & PARASITIC DISEASES	VB	BRUCELLOSIS
	VC	COCCIDIOMYCOSIS
	VF	FOOD POISONING
	VH	HEPATITIS
	VM	MALARIA
	VS	STAPHYLOCOCCUS
	VT	TUBERCULOSIS
	V9	VIROLOGICAL/INFECTIVE/ PARASITIC - OTHER
DISABILITY, OCCU-PATIONAL	DA	ARTHRITIS, BURSITIS
	DB	BACK STRAIN, BACK SPRAIN
	DC	CEREBRAL VASCULAR CONDITION; STROKE

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME
	DD	ENDEMIC DISEASE (OTHER THAN CODE TYPES R&S)
	DE	EFFECT OF ENVIRON-MENTAL CONDITION
	DH	HEARING LOSS
	DK	HEART CONDITION
	DM	MENTAL DISORDER, EMOTIONAL STRESS, NERVOUS
CONDITION		
	DR	RADIATION
	DS	STRAIN, MULTIPLE
	DU	ULCER
	DV	OTHER VASCULAR CONDITIONS
	D9	DISABILITY, OTHER
SKIN DISEASE OR CONDITION	SB	BIOLOGICAL
	SC	CHEMICAL
	S9	DERMATITIS, UNCLASSIFIED

g. TYPE AND SOURCE OF INJURY/ILLNESS (CAUSE) - Type and Source Codes are used to describe what caused the incident. The Type Code stands for an ACTION and the Source Code for an OBJECT or SUBSTANCE. Together, they form a brief description of how the incident occurred. Where there are two different sources, code the initiating source of the incident (see example 1, below). Examples:

(1) An employee tripped on carpet and struck his head on a desk.
TYPE: 210 (fell on same level) SOURCE: 0110 (walking/working surface).

NOTE: This example would NOT be coded 120 (struck against) and 0140 (furniture).

(2) A Park Ranger contracted dermatitis from contact with poison ivy/oak.
TYPE: 510 (contact) SOURCE: 0920 (plant)

(3) A lock and dam mechanic punctured his finger with a metal sliver while grinding a turbine blade.
TYPE: 410 (punctured by) SOURCE: 0830 (metal)

(4) An employee was driving a government vehicle when it was struck by another vehicle.
TYPE: 800 (traveling in) SOURCE: 0421 (government-owned vehicle, as driver)

NOTE: The Type Code 800, "Traveling In" is different from the other type codes in that its function is not to identify factors contributing to the injury or fatality, but rather to collect data on the type of vehicle the employee was operating or traveling in at the time of the incident.

Select the most appropriate TYPE and SOURCE identifier from the list below and enter the name on the line and the corresponding code in the appropriate box.

CODE	TYPE OF INJURY NAME
	STRUCK
0110	STRUCK BY
0111	STRUCK BY FALLING OBJECT
0120	STRUCK AGAINST
0210	FELL, SLIPPED, TRIPPED
0220	FELL ON SAME LEVEL
0230	FELL ON DIFFERENT LEVEL
	SLIPPED, TRIPPED (NO FALL)
	CAUGHT
0310	CAUGHT ON
0320	CAUGHT IN
0330	CAUGHT BETWEEN
	PUNCTURED, LACERATED
0410	PUNCTURED BY
0420	CUT BY
0430	STUNG BY
0440	BITTEN BY
	CONTACTED
0510	CONTACTED WITH (INJURED PERSON MOVING)
0520	CONTACTED BY (OBJECT WAS MOVING)
	EXERTED
0610	LIFTED, STRAINED BY (SINGLE ACTION)
0620	STRESSED BY (REPEATED ACTION)
	EXPOSED
0710	INHALED
0720	INGESTED
0730	ABSORBED
0740	EXPOSED TO
0800	TRAVELING IN

CODE	SOURCE OF INJURY NAME
0100	BUILDING OR WORKING AREA
0110	WALKING/WORKING SURFACE (FLOOR, STREET, SIDEWALKS, ETC.)
0120	STAIRS, STEPS
0130	LADDER
0140	FURNITURE, FURNISHINGS, OFFICE EQUIPMENT
0150	BOILER, PRESSURE VESSEL
0160	EQUIPMENT LAYOUT (ERGONOMIC)
0170	WINDOWS, DOORS
0180	ELECTRICITY
0200	ENVIRONMENTAL CONDITION
0210	TEMPERATURE EXTREME (INDOOR)
0220	WEATHER (ICE, RAIN, HEAT, ETC.)
0230	FIRE, FLAME, SMOKE (NOT TOBACCO)
0240	NOISE
0250	RADIATION
0260	LIGHT
0270	VENTILATION
0271	TOBACCO SMOKE
0280	STRESS (EMOTIONAL)
0290	CONFINED SPACE
0300	MACHINE OR TOOL
0310	HAND TOOL (POWERED; SAW, GRINDER, ETC.)
0320	HAND TOOL (NONPOWERED)
0330	MECHANICAL POWER TRANSMISSION APPARATUS
0340	GUARD, SHIELD (FIXED, MOVEABLE, INTERLOCK)

CODE	TYPE OF INJURY NAME
0350	VIDEO DISPLAY TERMINAL
0360	PUMP, COMPRESSOR, AIR PRESSURE TOOL
0370	HEATING EQUIPMENT
0380	WELDING EQUIPMENT
0400	VEHICLE
0411	AS DRIVER OF PRIVATELY OWNED/RENTAL VEHICLE
0412	AS PASSENGER OF PRIVATELY OWNED/RENTAL VEHICLE
0421	DRIVER OF GOVERNMENT VEHICLE
0422	PASSENGER OF GOVERNMENT VEHICLE
0430	COMMON CARRIER (AIRLINE, BUS, ETC.)
0440	AIRCRAFT (NOT COMMERCIAL)
0450	BOAT, SHIP, BARGE
0500	MATERIAL HANDLING EQUIPMENT
0510	EARTHMOVER (TRACTOR, BACKHOE, ETC.)
0520	CONVEYOR (FOR MATERIAL AND EQUIPMENT)
0530	ELEVATOR, ESCALATOR, PERSONNEL HOIST
0540	HOIST, SLING CHAIN, JACK
0550	CRANE
0551	FORKLIFT
0560	HANDTRUCK, DOLLY
0600	DUST, VAPOR, ETC.
0610	DUST (SILICA, COAL, ETC.)
0620	FIBERS
0621	ASBESTOS
0630	GASES
0631	CARBON MONOXIDE
0640	MIST, STEAM, VAPOR, FUME
0641	WELDING FUMES
0650	PARTICLES (UNIDENTIFIED)
0700	CHEMICAL, PLASTIC, ETC.
0711	DRY CHEMICAL - CORROSIVE
0712	DRY CHEMICAL - TOXIC
0713	DRY CHEMICAL - EXPLOSIVE
0714	DRY CHEMICAL FLAMMABLE
0721	LIQUID CHEMICAL - CORROSIVE
0722	LIQUID CHEMICAL - TOXIC
0723	LIQUID CHEMICAL - EXPLOSIVE
0724	LIQUID CHEMICAL - FLAM-MABLE
0730	PLASTIC
0740	WATER
0750	MEDICINE
0800	INAMINATE OBJECT
0810	BOX, BARREL, ETC.
0820	PAPER
0830	METAL ITEM, MINERAL
0831	NEEDLE
0840	GLASS

CODE	SOURCE OF INJURY NAME
0850	SCRAP, TRASH
0860	WOOD
0870	FOOD
0880	CLOTHING, APPAREL, SHOES
0900	ANIMATE OBJECT
0911	DOG
0912	OTHER ANIMAL
0920	PLANT
0930	INSECT
0940	HUMAN (VIOLENCE)
0950	HUMAN (COMMUNICABLE DISEASE)
0960	BACTERIA, VIRUS (NOT HUMAN CONTACT)
1000	PERSONAL PROTECTIVE EQUIPMENT
1010	PROTECTIVE CLOTHING, SHOES, GLASSES, GOGGLES
1020	RESPIRATOR, MASK
1021	DIVING EQUIPMENT
1030	SAFETY BELT, HARNESS
1040	PARACHUTE

INSTRUCTIONS FOR SECTION 6 - PUBLIC FATALITY

a. ACTIVITY AT TIME OF ACCIDENT - Select the activity being performed at the time of the accident from the list below. Enter the activity name on the line and the corresponding number in the box. If the activity performed is not identified on the list, select from the most appropriate primary activity area (water related, non-water related or other activity), the code number for "Other", and write in the activity being performed at the time of the accident.

WATER RELATED RECREATION

1. Sailing
2. Boating-powered
3. Boating-unpowered
4. Water skiing
5. Fishing from boat
6. Fishing from bank dock or pier
7. Fishing while wading
8. Swimming/supervised area
9. Swimming/designated area
10. Swimming/other area
11. Underwater activities (skin diving, scuba, etc.)
12. Wading
13. Attempted rescue
14. Hunting from boat
15. Other

NON-WATER RELATED RECREATION

16. Hiking and walking
17. Climbing (general)
18. Camping/picnicking authorized area
19. Camping/picnicking unauthorized area
20. Guided tours
21. Hunting
22. Playground equipment
23. Sports/summer (baseball, football, etc.)
24. Sports/winter (skiing, sledding, snowmobiling etc.)
25. Cycling (bicycle, motorcycle, scooter)
26. Gliding
27. Parachuting
28. Other non-water related

OTHER ACTIVITIES

29. Unlawful acts (fights, riots, vandalism, etc.)
30. Food preparation/serving
31. Food consumption
32. Housekeeping
33. Sleeping
34. Pedestrian struck by vehicle
35. Pedestrian other acts
36. Suicide
37. "Other" activities

b. PERSONAL FLOTATION DEVICE USED - If fatality was water-related was the victim wearing a person flotation device? Mark the appropriate box.

INSTRUCTIONS FOR SECTION 7 - MOTOR VEHICLE ACCIDENT

a. TYPE OF VEHICLE - Mark appropriate box for each vehicle involved. If more than one vehicle of the same type is involved, mark both halves of the appropriate box. USACE vehicle(s) involved shall be marked in left half of appropriate box.

b. TYPE OF COLLISION - Mark appropriate box.

c. SEAT BELT - Mark appropriate box.

INSTRUCTIONS FOR SECTION 8 - PROPERTY/MATERIAL INVOLVED

a. NAME OF ITEM - Describe all property involved in accident. Property/material involved means material which is damaged or whose use or misuse contributed to the accident. Include the name, type, model; also include the National Stock Number (NSN) whenever applicable.

b. OWNERSHIP - Enter ownership for each item listed. (Enter one of the following: USACE; OTHER GOVERNMENT; CONTRACTOR; PRIVATE)

c. $ AMOUNT OF DAMAGE - Enter the total estimated dollar amount of damage (parts and labor), if any.

INSTRUCTIONS FOR SECTION 9 - VESSEL/ FLOATING PLANT ACCIDENT

a. TYPE OF VESSEL/FLOATING PLANT - Select the most appropriate vessel/floating plant from list below. Enter name and place corresponding number in box. If item is not listed below, enter item number for "OTHER" and write in specific type of vessel floating plant.

VESSEL/FLOATING PLANTS

1. ROW BOAT
2. SAIL BOAT
3. MOTOR BOAT
4. BARGE
5. DREDGE/HOPPER
6. DREDGE/SIDE CASTING
7. DREDGE/DIPPER
8. DREDGE/CLAMSHELL, BUCKET
9. DREDGE/PIPE LINE
10. DREDGE/DUST PAN
11. TUG BOAT
12. OTHER

b. COLLISION/MISHAP - Select from the list below the object(s) that contributed to the accident or were damaged in the accident.

COLLISION/MISHAP

1. COLLISION W/OTHER VESSEL
2. UPPER GUIDE WALL
3. UPPER LOCK GATES
4. LOCK WALL
5. LOWER LOCK GATES
6. LOWER GUIDE WALL
7. HAULAGE UNIT
8. BREAKING TOW
9. TOW BREAKING UP
10. SWEPT DOWN 0N DAM
11. BUOY/DOLPHIN/CELL
12. WHARF OR DOCK
13. OTHER

INSTRUCTIONS FOR SECTION 10 - ACCIDENT DESCRIPTION

DESCRIBE ACCIDENT - Fully describe the accident. Give the sequence of events that describe what happened leading up to and including the accident. Fully identify personnel and equipment involved and their role(s) in the accident. Ensure that relationships between personnel and equipment are clearly specified. Continue on blank sheets if necessary and attach to this report.

INSTRUCTIONS FOR SECTION 11 - CAUSAL FACTORS

a. Review thoroughly. Answer each question by marking the appropriate block. If any answer is yes, explain in item 13 below. Consider, as a minimum, the following:

(1) DESIGN - Did inadequacies associated with the building or work site play a role? Would an improved design or layout of the equipment or facilities reduce the likelihood of similar accidents? Were the tools or other equipment designed and intended for the task at hand?

(2) INSPECTION/MAINTENANCE - Did inadequately or improperly maintained equipment, tools, workplace, etc. create or worsen any hazards that contributed to the accident? Would better equipment, facility, work site or work activity inspections have helped avoid the accident?

(3) PERSON'S PHYSICAL CONDITION - Do you feel that the accident would probably not have occurred if the employee was in "good" physical condition? If the person involved in the accident had been in better physical condition, would the accident have been less severe or avoided altogether? Was over exertion a factor?

(4) OPERATING PROCEDURES - Did a lack of or inadequacy within established operating procedures contribute to the accident? Did any aspect of the procedures introduce any hazard to, or increase the risk associated with the work process? Would establishment or improvement of operating procedures reduce the likelihood of similar accidents?

(5) JOB PRACTICES - Were any of the provisions of the Safety and Health Requirements Manual (EM 385-1-1) violated? Was the task being accomplished in a manner which was not in compliance with an established job hazard analysis or activity hazard analysis? Did any established job practice (including EM 385-1-1) fail to adequately address the task or work process? Would better job practices improve the safety of the task?

(6) HUMAN FACTORS - Was the person under undue stress (either internal or external to the job)? Did the task tend toward overloading the capabilities of the person; i.e., did the job require tracking and reacting to many external inputs such as displays, alarms, or signals? Did the arrangement of the workplace tend to interfere with efficient task performance? Did the task require reach, strength, endurance, agility, etc., at or beyond the capabilities of the employee? Was the work environment ill-adapted to the person? Did the person need more training, experience, or practice in doing the task? Was the person inadequately rested to perform safely?

(7) ENVIRONMENTAL FACTORS - Did any factors such as moisture, humidity, rain, snow, sleet, hail, ice, fog, cold, heat, sun, temperature changes, wind, tides, floods, currents, dust, mud, glare, pressure changes, lightning, etc., play a part in the accident?

(8) CHEMICAL AND PHYSICAL AGENT FACTORS - Did exposure to chemical agents (either single shift exposure or long-term exposure) such as dusts, fibers (asbestos, etc.), silica, gases (carbon monoxide, chlorine, etc.,), mists, steam, vapors, fumes, smoke, other particulates, liquid or dry chemicals that are corrosive, toxic, explosive or flammable, byproducts of combustion or physical agents such as noise, ionizing radiation, non-ionizing radiation (UV radiation created during welding, etc.) contribute to the accident/incident?

(9) **OFFICE FACTORS -** Did the fact that the accident occurred in an office setting or to an office worker have a bearing on its cause? For example, office workers tend to have less experience and training in performing tasks such as lifting office furniture. Did physical hazards within the office environment contribute to the hazard?

(10) **SUPPORT FACTORS** - Was the person using an improper tool for the job? Was inadequate time available or utilized to safely accomplish the task? Were less than adequate personnel resources (in terms of employee skills, number of workers, and adequate supervision) available to get the job done properly? Was funding available, utilized, and adequate to provide proper tools, equipment, personnel, site preparation, etc.?

(11) **PERSONAL PROTECTIVE EQUIPMENT** - Did the person fail to use appropriate personal protective equipment (gloves, eye protection, hard-toed shoes, respirator, etc.) for the task or environment? Did protective equipment provided or worn fail to provide adequate protection from the hazard(s)? Did lack of or inadequate maintenance of protective gear contribute to the accident?

(12) **DRUGS/ALCOHOL** - Is there any reason to believe the person's mental or physical capabilities, judgment, etc., were impaired or altered by the use of drugs or alcohol? Consider the effects of prescription medicine and over the counter medications as well as illicit drug use. Consider the effect of drug or alcohol induced "hangovers".

b. **WRITTEN JOB/ACTIVITY HAZARD ANALYSIS** - Was a written Job/Activity Hazard Analysis completed for the task being performed at the time of the accident? Mark the appropriate box. If one was performed, attach a copy of the analysis to the report.

INSTRUCTIONS FOR SECTION 12 - TRAINING

a. **WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK?** - For the purpose of this section "trained" means the person has been provided the necessary information (either formal and/or on-the-job (OJT) training) to competently perform the activity/task in a safe and healthful manner.

b. **TYPE OF TRAINING** - Mark the appropriate box that best indicates the type of training; (classroom or on-the-job) that the injured person received before the accident happened.

c. **DATE OF MOST RECENT TRAINING** - Enter the month, day, and year of the last formal training completed that covered the activity task being performed at the time of the accident.

INSTRUCTIONS FOR SECTION 13 - CAUSES

a. DIRECT CAUSES - The direct cause is that single factor which most directly lead to the accident. See examples below.

b. INDIRECT CAUSES - Indirect causes are those factors which contributed to but did not directly initiate the occurrence of the accident.

Examples for section 13:

a. Employee was dismantling scaffold and fell 12 feet from unguarded opening.

Direct cause: failure to provide fall protection at elevation. Indirect causes: failure to enforce USACE safety requirements; improper training/motivation of employee (possibility that employee was not knowledgeable of USACE fall protection requirements or was lax in his attitude towards safety); failure to ensure provision of positive fall protection whenever elevated; failure to address fall protection during scaffold dismantling in phase hazard analysis.

b. Private citizen had stopped his vehicle at intersection for red light when vehicle was struck in rear by USACE vehicle. (Note: USACE vehicle was in proper/safe working condition).

Direct cause: failure of USACE driver to maintain control of and stop USACE vehicle within safe distance.
Indirect cause: failure of employee to pay attention to driving (defensive driving).

INSTRUCTIONS FOR SECTION 14 - ACTION TO ELIMINATE CAUSE(S)

DESCRIPTION - Fully describe all the actions taken, anticipated, and recommended to eliminate the cause(s) and prevent reoccurrence of similar accidents/illnesses. Continue on blank sheets of paper if necessary to fully explain and attach to the completed report form.

INSTRUCTIONS FOR SECTION 15 - DATES FOR ACTION

a. **BEGIN DATE** - Enter the date when the corrective action(s) identified in section 14 will begin.

b. **COMPLETE DATE** - Enter the date when the corrective action(s) identified in section 14 will be completed.

c. **TITLE AND SIGNATURE -** Enter the title and signature of supervisor completing the accident report. For a GOVERNMENT employee accident/illness the immediate supervisor will complete and sign the report. For PUBLIC accidents the USACE Project Manager/Area Engineer responsible for the USACE property where the accident happened shall complete and sign the report. For CONTRACTOR accidents the Contractor's project manager shall complete and sign the report and provide to the USACE supervisor responsible for oversight of that contractor activity. This USACE supervisor shall also sign the report. Upon entering the information required in 15.d, 15.e and 15.f below, the responsible USACE supervisor shall forward the report for mangement review as indicated in section 16.

d. **DATE SIGNED** - Enter the month, day, and year that the report was signed by the responsible supervisor.

e. **ORGANIZATION NAME** - For GOVERNMENT employee accidents enter the USACE organization name (Division, Branch, Section, etc.) of the injured employee. For PUBLIC accidents enter the USACE organization name for the person identified in block 15.c. For CONTRACTOR accidents enter the USACE organization name for the USACE office responsible for providing contract administration oversight.

f. **OFFICE SYMBOL** - Enter the latest complete USACE Office Symbol for the USACE organization identified in block 15.e.

INSTRUCTIONS FOR SECTION 16 - MANAGEMENT REVIEW (1st)

1ST REVIEW - Each USACE FOA shall determine who will provide 1st management review. The responsible USACE supervisor in section 15.c shall forward the completed report to the USACE office designated as the 1st Reviewer by the FOA. Upon receipt, the Chief of the Office shall review the completed report, mark the appropriate box, provide substantive comments, sign, date, and forward to the FOA Staff Chief (2nd review) for review and comment.

INSTRUCTIONS FOR SECTION 17 - MANAGEMENT REVIEW (2nd)

2ND REVIEW - The FOA Staff Chief (i.e., FOA Chief of Construction, Operations, Engineering, Planning, etc.) shall mark the appropriate box, review the completed report, provide substantive comments, sign, date, and return to the FOA Safety and Occupational Health Office.

INSTRUCTIONS FOR SECTION 18 - SAFETY AND OCCUPATIONAL HEALTH REVIEW

3RD REVIEW - The FOA Safety and Occupational Health Office shall review the completed report, mark the appropriate box, ensure that any inadequacies, discrepancies, etc. are rectified by the responsible supervisor and management reviewers, provide substantive comments, sign, date and forward to the FOA Commander for review, comment, and signature.

INSTRUCTION FOR SECTION 19 - COMMAND APPROVAL

4TH REVIEW - The FOA Commander shall (to include the person designated Acting Commander in his absence) review the completed report, comment if required, sign, date, and forward the report to the FOA Safety and Occupational Health Office. Signature authority shall not be delegated.

ATTACHMENT 6

Bloodborne Pathogen Program

SECTION 6
SAFETY AND HEALTH PROGRAMS

Program 6
Bristol Bloodborne Pathogens Program

As required by

The OSHA Bloodborne Pathogens Standard 29 CFR 1910.1030

APPROVAL

_____

Health and Safety Manager

APRIL 2005

Bristol
INDUSTRIES

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ACRONYMS AND ABBREVIATIONS

Bristol	Bristol Industries and all affiliated companies controlled by Bristol
CPR	cardiopulmonary resuscitation
PPE	personal protective equipment

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

The purpose of the Bristol Industries (Bristol) Bloodborne Pathogens Program is to provide the employee with adequate written guidance concerning exposure control and personal protective equipment (PPE).

The scope of the Bristol Bloodborne Pathogens Program dictates requirements for exposure control to include all Bristol employees, regardless of work locations. These work locations include any temporary work sites.

Bristol client's written Bloodborne Pathogens Programs may be used in conjunction with that of Bristol's. However, at no time shall any program be adopted that is less stringent than that of Bristol.

1.2 PROGRAM ADMINISTRATION

Management, oversight and training of the Bristol Bloodborne Pathogens Program are the responsibility of the Health and Safety Manager.

The Bristol Bloodborne Pathogens Program shall be reviewed at least annually. Any changes to the written program shall be relayed to the effected employees.

Employees are responsible to follow the provisions of the Bristol Bloodborne Pathogens Program.

1.3 EMPLOYEE INFORMATION AND TRAINING

All employees with the potential for occupational exposure to blood or other potentially infectious material shall receive Bloodborne Pathogen training initially, then annually. Employees trained in First Aid and cardiopulmonary resuscitation (CPR) shall have Bloodborne Pathogen training. This training shall cover:

- Exposure determination,
- Methods of compliance,
- Hepatitis B vaccination and post-exposure evaluation and follow-up,
- Communication of hazards to employees,
- Recordkeeping,
- Evaluation of circumstances surrounding exposure incidents, and
- Accessibility to the Bloodborne Pathogen Program.

1.4 OCCUPATIONAL EXPOSURE DETERMINATION

Employees that have a primary job function to treat injured workers or others could possibly be occupationally exposed. Those who have a current CPR/First Aid certificate, or are assigned as the supervisor, as described in Chapter 29, Code of Federal Regulations, Part 1910.120 (29 CFR 1910.120), may be incidentally exposed if they choose to render aid to another worker or injured individual. Examples of contacting potentially infectious materials include the following:

- Another person's blood,
- Blood soaked bandages, and
- Improperly bagged potentially infectious materials.

Note: Any contact with another person's blood without observation of universal precautions shall be deemed an exposure incident.

1.5 METHODS OF COMPLIANCE

Precautions and practices include the following:

- Treat all blood and bodily fluids as if they are contaminated.
- Use proper cleanup and decontaminationUse Engineering and Work Practice Controls when feasible:
  - Hand washing facilities or an equivalent system, and
  - Sharps containers for any needles, to include diabetic needles.
- Use Administrative Controls:
  - Labeled sharps containers, and
  - Color code material bags.
- Use PPE – The Site Supervisor shall carry a small Bloodborne Pathogen kit (with first aid supplies) at all times when at the work location. Other suggested PPE for certain conditions include:
  - Bleeding control – latex gloves.
  - Spurting blood – latex gloves, protective clothing (smocks or aprons), respiratory mask, eye/face protection (goggles, glasses, or face shield).
  - Post-accident cleanup – latex gloves.
  - Janitorial work – latex gloves.
- Maintain Safe Work Practices, including:
  - Remove contaminated PPE or clothing as soon as possible,
  - Clean and disinfect contaminated equipment and work surfaces,

- Thoroughly wash up immediately after exposure, and
- Properly dispose of contaminated items.

1.6 HEPATITIS B VACCINATION AND POST-EXPOSURE EVALUATION AND FOLLOW UP

Hepatitis B Vaccination and vaccination series are available to employees at no cost to the employee. Screening will be conducted during the annual Hazardous Waste Operations and Emergency Response physical.

- If a worker declines the vaccination, it should be documented in the medical files. Any worker that declines the vaccination is still eligible to receive the treatment in the future if they desire.
- Post exposure-evaluation and followup are available to any occupationally or incidentally exposed employee.

1.7 COMMUNICATION OF HAZARDS TO EMPLOYEES

Employees will be trained initially and annually on the Bristol Bloodborne Pathogens Program.

1.8 RECORDKEEPING

Bristol will maintain all records of exposure incidents, and record them in the Occupational Safety and Health Administration Form 300, when applicable.

1.9 PERSONAL PROTECTIVE EQUIPMENT

Proper PPE must worn during the administration of any First Aid.

2.0 ACCESSIBILITY TO THE BLOOD BORNE PATHOGENS PROGRAM

A copy of this Bloodborne Pathogens Program is available in the Bristol Anchorage office. Employees are encouraged review this program as often as needed.

2.1 PROGRAM REVIEW

The Bloodborne Pathogens Program shall be reviewed annually.

APPENDIX A

Letter for Hepatitis Vaccination

111 West 16th Ave
Anchorage, AK 99501
907-563-0013 Phone
907-563-6713 Fax

October 25, 2005

Bristol Industries (Bristol) offers each of our employees that may be working in conditions where they might be exposed to the Hepatitis virus the opportunity to receive a vaccination at no cost to the employee. It is the right of the company's employees to determine whether or not they wish to receive the vaccination. If the employee declines the hepatitis vaccination, he or she must acknowledge their refusal by signing the lower portion of this document and returning it to the Bristol Health and Safety Manager. If an employee initially chooses not to receive the vaccination, he/she may receive the vaccination at any later time.

_____ _____

Health and Safety Representative Date

I understand I have the right to receive a Hepatitis B Vaccination at no cost to me, and I decline the vaccination at this time. I also understand that I have a right to receive the vaccination at a later time of employment, and at no cost.

Employee Name: _____ Date: _____

Employee Signature: _____

ATTACHMENT 7

Respiratory Program

SECTION 6
HEALTH AND SAFETY PROGRAMS

Program 2
Bristol Respiratory Protection Program

As required by

The OSHA Hazard Communication Standard 29 CFR 1910.134

APPROVAL

Health and Safety Manager

APRIL 2005

Bristol
INDUSTRIES

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Appendix A Standard Operating Procedures
Appendix B Respirator Medical History Questionnaire

ACRONYMS AND ABBREVIATIONS

APR	Air Purifying Respirators
Bristol	Bristol Industries and all affiliated companies controlled by Bristol
IDLH	Immediately Dangerous to Life or Health
MSHA	Mine Safety and Health Administration
NIOSH	National Institute for Occupational Safety and Health
OSHA	Occupational Safety and Health Administration
QLFT	Qualitative Fit Test
QNFT	Quantitative Fit Test
SOP	Standard Operating Procedures

1.0 PROGRAM ADMINISTRATION

This Respiratory Protection Program (Program) is consistent with federal regulations pertaining to the use of respirators. Respiratory protection will be used when engineering and administrative controls cannot reduce airborne contaminants below the Occupational Safety and Health Administration (OSHA) permissible exposure limit, or other applicable exposure levels; and is required when conditions in the workplace must be used to protect the health of the employee. Any required respiratory protection will be provided at no cost to Bristol Industries (Bristol) employees.

The Bristol Health and Safety Manager, Project Managers, and Site Supervisors will administer this Respiratory Protection Program. Bristol will provide training at least annually to review the contents of this program and to satisfy the training requirements of Part 29, Code of Federal Regulations, Section 1910.134 (29 CFR 1910.134). The Project Manager and other managers of a project will evaluate each feature of that project to determine the respiratory protection requirements and will incorporate measures to meet the requirements into the project work plan. Bristol will provide training in respiratory protection to employees who will work on a project that may require respiratory protection and who have not yet received training in respiratory protection. No employee of Bristol, or its subcontractors, will work in environments where respiratory protection is required without evidence that he or she has received the following:

- A current (within 12 months) occupational physician's certification indicating the worker is fit to wear a respirator,
- Adequate training in respiratory protection, and
- A current (within 12 months) respiratory fit test.

Bristol Employees and subcontractors are responsible for complying with this Bristol *Respiratory Protection Program* and with the Standard Operating Procedures (SOPs) of this program (Appendix A).

This *Respiratory Protection Program* represents the minimum acceptable standards for employees of Bristol and its subcontractors. Generally, Bristol projects will never require respiratory protection above Level C (air purifying respirators). If project conditions require use of air supplying respirators, additional procedures and requirements may be required beyond the practices described here. The Health and Safety Manager will be consulted prior to planning and use of air supplying respirators.

2.0 RESPIRATOR SELECTION

Special training in the selection and use of the appropriate respirators is required for any work requiring respiratory protection that meets the following criteria:

- The work is described as Immediately Dangerous to Life or Health (IDLH); and
- The work could cause irreversible adverse health effects, or could present conditions under which an individual's ability to escape from a dangerous atmosphere would be impaired.

Work that is IDLH must be approved by the Health and Safety Manager. In addition, certification must be provided that any required special training has been completed for the IDLH work condition, before work is performed.

For non-IDLH work, a respirator certified by the National Institute for Occupational Safety and Health (NIOSH) will be selected, based on the following considerations:

- Nature of the known hazards,
- Extent of hazards,
- Best fit of the selected respirator,
- Work requirements, and
- Characteristics and limitations of respirators.

The Bristol Project Manager will consider the following to identify the type of respirator and work conditions requiring respiratory protection:

- Analytical methodologies used to determine respirator selection;
- Exposure assessment method and results;
- Atmospheric testing results;
- On-scene site assessment, as required;
- Regulatory requirements;
- Respiratory protection factors; and
- Selection consistent with the intended use.

Appendix A, Section A-1 contains the SOP for selecting a respirator, and Section A-2 provides a respirator selection checklist.

3.0 EMPLOYEE RESPIRATOR TRAINING REQUIREMENTS

Employee training for respirator protection will include, but is not limited to, the following:

- Location and contents of the written Respiratory Protection Program;
- Government regulations that apply to the use of respirators;
- Responsibilities of various personnel as prescribed by this Respiratory Protection Program;
- Refresher training and surveillance requirements;
- Discussion of atmospheric hazards, including particles (dust, fumes, mist, fibers), oxygen deficiency, vapors, and gases;
- Terminology and expressions for concentrations of harmful airborne contaminants from OSHA, NIOSH, Mine Safety and Health Administration (MSHA), and American

Conference of Governmental Industrial Hygienists;

- Chemical, physical, and toxicological properties of airborne contaminants;
- Rationale and reasons for respirator use;
- Instruction for inspecting, maintaining, cleaning, disinfecting, and storing respirators;
- Instructions for donning, performing self-fit check, and proper techniques for wearing respirators;
- Selection, limitations, and replacement schedules for cartridges;
- Recognition and ways to cope with emergencies;
- Medical approval requirements;
- Fit testing requirements and documentation; and
- Limitations of respirators by type.

Records of training will be maintained in the Bristol training management system.

4.0 RESPIRATOR USE AND LIMITATION GUIDELINES

Air purifying respirators (APRs) are designed to protect workers from inhaling airborne contaminants. Each type of respirator has its own unique protective characteristics. In selecting a particular type of respirator, the following statements are appropriate to any work condition:

- APRs *are not* for use in oxygen-deficient atmospheres.
- APRs *are not* for use in IDLH atmospheres.
- Bristol requires specialized and certified training for work in IDLH conditions.
- Bristol *will not* intentionally subject employees to work in IDLH conditions without specialized training, the appropriate respiratory protection equipment, and explanations of methods for use of that equipment.

5.0 RESPIRATOR CARE AND MAINTENANCE REQUIREMENTS

Bristol employees and subcontractors who are in possession of a respirator for work they are performing must maintain their respirator in accordance with specifications of the manufacturer, NIOSH, MSHA, and OSHA. The following subsections describe cleaning, disinfection, storage, and inspection.

5.1 CLEANING AND DISINFECTING REQUIREMENTS

After using a respirator, the employee is responsible for cleaning and disinfecting the respirator before it is stored. The preferred method for respirator cleaning and disinfecting can vary with the manufacturer. The Bristol preferred method is warm water with a mild soap for cleaning. Disinfecting can be accomplished by using a combination bactericide and fungicide soak,

followed by a fresh water rinse. The SOP for cleaning and disinfecting of respirator is included in Appendix A, Section A-5.

5.2 STORAGE REQUIREMENTS

Respirators must be stored while not in use. After using a respirator, the employee is responsible for cleaning the respirator (as described above), inspecting it (as described below), and storing it in an appropriate condition. The respirator must be stored in a manner that will protect it from dust, sunlight, heat, excessive cold or moisture, and damaging chemicals, and in a manner that will prevent the respirator from deforming. The respirator must be dry and placed into a plastic bag with a zipper-locking closure. Storage of respirators must not damage or compromise the integrity of the face and face piece seal.

5.3 INSPECTION REQUIREMENTS

Bristol will periodically inspect respirators that are available for use and those in use. Respirators that are not serviceable will be turned in for repair or disposal.

Each employee with a respirator is responsible for inspecting the respirator both before and after its use. Any defects must be reported to the Site Supervisor, and repairs or replacements must be made before the respirator is used. Section A-3 of Appendix A provides the SOP for inspecting a respirator.

6.0 MEDICAL REQUIREMENTS AND PHYSICIAN APPROVAL

Any Bristol employee or subcontractor who anticipates use of a respirator as part of his or her job must first have received a favorable opinion from an occupational physician indicating the person is fit to wear a respirator as part of work duties. The physician's opinion will be based on the following:

- Information similar to that found in the Questionnaire included as Appendix B that the employee provides the physician; and
- The results of a pulmonary function test that the physician will evaluate.

Following receipt of a copy of the physician's favorable opinion, the employee is qualified to receive a respiratory fit test. When the following items have been documented, the employee is considered eligible to wear a respirator:

- Physician's signed statement, completed annually, indicating the employee is fit to wear a respirator; and
- Fit test certificate, completed annually, indicating the name and affiliation of the employee tested; date of test; type of test; specific model, style, and size of respirator tested; and passing test results.

7.0 RESPIRATORS FIT TESTING REQUIREMENTS

The Bristol policy allows for the use of either the Quantitative Fit Test (QNFT), which is the fit test of choice, or the Qualitative Fit Test (QLFT), which may be administered in the field when necessary. The fit test must be administered by a qualified person. Bristol does not perform the QNFT, and the employee must make arrangements with the Project Manager to receive the QNFT, at the company's expense.

The QLFT may be administered in the field by the Project Manager, Site Superintendent, or an appointee of the Site Superintendent. When qualified Bristol persons administer the respiratory fit test in the field (the QLFT), the results of testing must be noted in the project's field book.

Appendix A, Section A-4 is the SOP for donning a respirator, and Section A-6 of Appendix A is the SOP for performing a QLFT.

The respiratory fit test is valid for a period of no more than 1 year. If an employee's physical condition is substantially different than when the fit test was taken during the period of 1 year when the fit test is valid, additional fit testing may be deemed to be warranted. On the basis of work conditions, the employee may select the type of respirator from a reasonable selection variety that offers the employee the ability to identify a respirator providing the best fit.

8.0 WORKPLACE SURVEILLANCE

Each workplace will be evaluated periodically by safety personnel. The scope of this evaluation will be to determine whether the selected level of respiratory protection is appropriate. When changes to the work environment that raise the level of respiratory protection have occurred, changes in respiratory protection will be made immediately to reflect a level that protects the worker. When conditions in the work area warrant a lower level of respiratory protection, the Site Manager may make the change at his or her discretion.

9.0 PERIODIC PROGRAM EVALUATION

The Health and Safety Manager will review this Respiratory Protection Program annually, and make any additions or deletions that may be required to maintain its compliance with federal regulations. At any time, any Bristol employee may recommend changes to this program to the Health and Safety Manager.

10.0 SPECIFIC STATE REGULATIONS

Each state may have additional regulations that pertain to respiratory protection. Every Bristol work plan must include any additional regulations or requirements consistent with those of the state where the work will be performed.

11.0 REFERENCES

U. S. Department of Health and Human Services (USDHHS). 1987. NIOSH Respirator Decision Logic. NIOSH, Cincinnati, OH.

U.S. Department of Labor (USDOL). _____. 29 CFR 1910.134, Respiratory Protection. *Code of Federal Regulations*.

APPENDIX A

RESPIRATORY PROTECTION PROGRAM
STANDARD OPERATING PROCEDURES

STANDARD OPERATING PROCEDURE A-1

Respirator Selection

Respirators will be selected by the Project Manager, Site Superintendent, or a qualified appointee of the Site Superintendent in conjunction with the Bristol Project Manager. The following factors must be considered in making this selection:

1. The identity of the substance(s) present in the work environment for which protection is needed.
2. The physical state of the contaminant (gas, vapor, dust, mist, etc., or combination).
3. The permissible exposure limit or toxicity of the substance and cartridge usable life. See the checklist in Section A-2 of this Appendix.
4. Exposure measurements or professional judgment assessing the concentrations likely to be encountered.
5. The assigned protection factor listed for the respirator type.
6. The need for eye and face protection.
7. The possibility of oxygen deficiency.
8. Any limitations or restrictions applicable to the types of respirators being considered that could make them unsafe in the environment involved.
9. At no time will a respirator be selected that offers less protection than required for the particular conditions under which it is to be used. If desired, however, a respirator type offering a greater protection factor than needed may be selected.
10. Measurements to determine or predict the potential exposure concentrations will be made by the Project Manager, Site Superintendent, or a qualified appointee of the Site Superintendent in consultation with the Bristol Project Manager.

STANDARD OPERATING PROCEDURE A-2

Respirator Selection Checklist

FACILITY _____ Date _____

Chemical Substance (MSDS product name)	Physical State	Anticipated Concentration
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Any changes in the operations that might significantly increase anticipated contaminant level?

_____Yes _____No

Is environment potentially immediately dangerous to life to health? _____Yes _____No

Can contaminant be absorbed through skin? _____Yes _____No

Is the contaminant an eye irritant? _____Yes _____No

Cartridge should be replaced at ____ hour intervals.

On the basis of the above information, the following respirator(s) have been selected and approved for the area or operation listed above:

Manufacturer's Name Model Name/Number (incl. filter) Approval No.

_____

_____

Signed _____ Date _____

STANDARD OPERATING PROCEDURE A-3

Respirator User Inspection Guide

A. Check face piece for:

(1) Dirt
(2) Cracks, tears, or deterioration
(3) Distortion
(4) Inflexibility
(5) Cracked or badly scratched lens
(6) Incorrectly mounted lens

B. Check straps for:

(1) Breaks or tears
(2) Loss of elasticity
(3) Broken or missing hardware
(4) Worn serration's or missing tabs on head harness

C. Check exhalation and inhalation valves for:

(1) Presence of valves
(2) Dirt, hairs, holes, tears, or warpage
(3) Exhaust valve cover in place
(4) Exhaust valve seat in good condition

D. Check filters or cartridges for:

(1) Secure attachment with gaskets in place
(2) Absence of damage, rust, or corrosion
(3) Design and labeling for intended use on cartridges
(4) Absence of rattling of agents in charcoal-filled cartridges
(5) Suitable match of cartridges to type of respirator to be used

STANDARD OPERATING PROCEDURE A-4

Respirator User Guide—Donning Procedures

General. The following will *not* be permitted to protrude under the sealing surface of any face-fitting respirator because they interfere with the face-to-face piece seal and cause the respirator to leak:

1. Facial hair, such as long sideburns, mustaches or beards;
2. Temple bars on glasses protruding under full face piece seal; and
3. Head covers, such as hoods, projecting underneath the face piece.

Air Purifying Respirator Donning. Don the respirator and adjust for comfort as described below:

A. Half Mask:

(1) Fasten bottom strap at back of neck.
(2) Position respirator on face with wider portion under the chin.
(3) Fasten top or cradle strap at the crown of the head.
(4) Adjust straps for comfortable fit.

B. Full Face:

(1) Start with straps of head harness fully open.
(2) Place chin in chin cup.
(3) Adjust bottom straps by pulling back (*not* out to the sides). This will reduce friction and help secure chin in chin cup.
(4) Adjust temple straps next.
(5) Adjust top strap(s) last.
(6) Straps should be adjusted snuggly. Overtightening may affect user comfort.

Positive and Negative Pressure Checks. The following user checks test the face seal and the condition of inlet exhaust check valves.

A. Negative Pressure Check:

(1) Cover the inlet of the canister, cartridge(s), or filter (s) with the palms.
(2) Inhale gently so that the face piece collapses slightly.
(3) Hold breath for ten seconds.
(4) If the face piece remains slightly collapsed and no inward leakage is detected, the respirator is properly donned and the exhaust valve is functioning.

B. Positive Pressure Check:

(1) Close off the opening of the exhalation valve by covering with the palm.
(2) Exhale gently into the face piece.
(3) If slight positive pressure can be built up inside the face piece without any evidence of outward leakage, the respirator is properly donned, and the intake valves are functioning.

STANDARD OPERATING PROCEDURE A-5

Respirator Cleaning and Disinfecting

Methods. Respirators may be cleaned by one of the following methods.

A. Manual Cleaning. A generalized cleaning procedure is:

(1) Remove canisters, filters, valves, and speaking diaphragms from the face piece.

(2) Wash the face piece and accessories in warm soapy water. Gently scrub soil off with a soft brush. A mild detergent is acceptable, but do not use petroleum solvents or corrosive substances.

(3) Rinse parts thoroughly in clean water. For sanitizing, use only manufacturer-recommended products and procedures.

(4) Air dry in a clean place or wipe dry with a lintless cloth.

(5) Reassemble.

Alternatively, use a commercially available respirator cleaner, following the manufacturer's instructions.

B. Machine Cleaning. Machines may be used to expedite the cleaning, sanitizing, rinsing, and drying of a large numbers of respirators.

(1) Take care to prevent excessive tumbling and agitation, or exposure to temperatures above those recommended by the manufacturer (usually 120 degrees Fahrenheit).

(2) Ultrasonic cleaners, clothes-washing machines, dishwashers, and clothes dryers have been specially adapted and successfully used for cleaning and drying respirators.

C. Disinfection. Disinfect respirators used by more than one person. Disinfection procedures recommended by National Institute for Occupational Safety and Health (NIOSH) are as follows:

- Immerse the respirator body for 2 minutes in 50 parts per million chlorine solution (about 2 milliliters of bleach to 1 liter of water). Rinse thoroughly in clean water and dry.

OR:

- Immerse the respirator body for 2 minutes in an aqueous solution of iodine (add 0.8 milliliters of tincture iodine to 1 liter of water). The iodine is about 7 percent ammonium and potassium iodine, 45 percent alcohol, and 48 percent water. Rinse thoroughly in clean water and dry.

For either procedure, immersion times must be limited to minimize damage to respirator. The solutions can age rubber and rust metal parts. Rinse thoroughly to prevent dermatitis.

An alternative method is to purchase a commercially prepared solution for cleaning and disinfection and follow the manufacturer's directions.

Lubricants must be applied before disinfecting "rubber" components of the respirator. Food-grade lubricants such as silicon spray should be used.

STANDARD OPERATING PROCEDURE A-6

Respirator Fit Test Procedure—Qualitative Fit Test

The Qualitative Fit Test will only be administered to individuals who have a physician's current (within the past 12 months) written recommendation that the employee's medical status allows the employee to use a respirator. When the employee has passed the respirator fit test, the test administrator will provide the employee with a certification of the test results, indicating the name of the employee, date of test, and type and manufacturer's make of the respirator. In addition, the Site Superintendent will note the test in the field notebook. The following procedure will be used to administer the Qualitative Fit Test. A valid fit test requires that both parts A and B of this procedure be administered.

A. Banana Oil (Isoamyl Acetate) Protocol

1. A fit test chamber consisting of a hood or bag suspended inverted over a frame is used. The top of the hood should be about 6 inches above the test subject's head.
2. In a room separate from the one containing the test chamber, verify that the test subject can detect the odor of the banana oil without a respirator.
3. The respirator used for the fit test must be equipped with organic vapor cartridges.
4. Instruct the test subject to place respirator over his or her face so that the mask fits snugly, but comfortably, touching all points. Have test subject perform positive and negative fit test (SOP A-4).
5. When the test subject has entered the test chamber, hand him or her a piece of paper towel, or other absorbent material, wetted with banana oil. Instruct the test subject to hold the wet towel in front of his or her face.
6. Instruct the test subject to indicate to the test administrator if he or she detects the odor of the banana oil at any point during the test. If the odor is detected, the test has failed.
7. Allow 2 minutes for the banana oil concentration to stabilize before starting the fit test exercises.
8. Test 1: Instruct the test subject to breathe normally for 1 minute.
9. Test 2: Instruct the test subject to breathe deeply for 1 minute.
10. Test 3: Instruct the test subject to move head side to side for 1 minute.
11. Test 4: Instruct the test subject to move head up and down for 1 minute.
12. Test 5: Instruct the test subject to talk for 1 minute.
13. Test 6: Instruct the test subject to smile or frown for 15 seconds.
14. Test 7: Instruct the test subject to jog in place for 1 minute.
15. Test 8: Instruct the test subject to breathe normally for 1 minute.

B. Qualitative Fit Test–Irritant Smoke (Stannic Chloride) Protocol

1. Break both ends of the smoke tube and attach one end to a low-flow air pump. Attach a short length of tubing to the other end to avoid injury.
2. Allow the test subject to smell a weak concentration of the irritant smoke without a respirator to determine whether he or she can detect it.
3. Instruct the test subject to enter the test chamber.
4. The respirator used for the fit test must be equipped with high-efficiency particulate air (HEPA) filters.
5. Instruct the test subject to place the respirator over his or her face so that the mask fits snugly, but comfortably, touching all points. Have test subject perform positive and negative fit test (SOP A-4).
6. Instruct the test subject to keep his or her eyes closed
7. Direct the stream of irritant smoke toward the face of the subject. Start 12 inches away and move the smoke stream around the entire perimeter of the mask, moving to within 6 inches.
8. Continue to direct the smoke stream at the face of the subject for the following tests. If the smoke is detected at any point, the test has failed.
9. Test 1: Instruct the test subject to breathe normally for 1 minute.
10. Test 2: Instruct the test subject to breathe deeply for 1 minute.
11. Test 3: Instruct the test subject to move head side to side for 1 minute.
12. Test 4: Instruct the test subject to move head up and down for 1 minute.
13. Test 5: Instruct the test subject to talk for 1 minute.
14. Test 6: Instruct the test subject to smile or frown for 15 seconds.
15. Test 7: Instruct the test subject to bend over at the waist for 1 minute.
16. Test 8: Instruct the test subject to breathe normally for 1 minute.

APPENDIX B

FORMS

Respirator Medical History Questionnaire
Source: Appendix C, 29 CFR 1910.134: OSHA Respirator Medical Evaluation Questionnaire (Mandatory)

RESPIRATOR MEDICAL HISTORY QUESTIONNAIRE

To the employer:

Answers to questions in Section 1, and to question 9 in Section 2 of Part A, do not require a medical examination.

To the employee:

Can you read (circle one): Yes/No

Your employer must allow you to answer this questionnaire during normal working hours, or at a time and place that is convenient to you. To maintain your confidentiality, your employer or supervisor must not look at or review your answers, and your employer must tell you how to deliver or send this questionnaire to the health care professional who will review it.

Part A. Section 1. (Mandatory) The following information must be provided by every employee who has been selected to use any type of respirator (please print).

1. Today's date:_____
2. Your name:_____
3. Your age (to nearest year):_____
4. Sex (circle one): Male/Female
5. Your height: _____ feet _____ inches
6. Your weight: _____ pounds (lbs.)
7. Your job title:_____
8. A phone number where you can be reached by the health care professional who reviews this questionnaire (include the Area Code): _____
9. The best time to phone you at this number: _____
10. Has your employer told you how to contact the health care professional who will review this questionnaire (circle one): Yes/No
11. Check the type of respirator you will use (you can check more than one category): a. _____ N, R, or P disposable respirator (filter-mask, non-cartridge type only). b. _____ Other type (for example, half- or full-face piece type, powered-air purifying, supplied-air, self-contained breathing apparatus).
12. Have you worn a respirator (circle one): Yes/No

If "yes," what type(s): _____

_____

Part A. Section 2. (Mandatory)

Questions 1 through 9 below must be answered by every employee who has been selected to use any type of respirator. Please circle "yes" or "no."

1. Do you **currently** smoke tobacco, or have you smoked tobacco in the last month? Yes/No
2. Have you **ever had** any of the following conditions?

   Seizures (fits): Yes/No
   Diabetes (sugar disease): Yes/No
   Allergic reactions that interfere with your breathing: Yes/No
   Claustrophobia (fear of closed-in places): Yes/No
   Trouble smelling odors: Yes/No
3. Have you **ever had** any of the following pulmonary or lung problems?
   a. Asbestosis: Yes/No
   b. Asthma: Yes/No
   c. Chronic bronchitis: Yes/No
   d. Emphysema: Yes/No
   e. Pneumonia: Yes/No
   f. Tuberculosis: Yes/No
   g. Silicosis: Yes/No
   h. Pneumothorax (collapsed lung): Yes/No
   i. Lung cancer: Yes/No
   j. Broken ribs: Yes/No
   k. Any chest injuries or surgeries: Yes/No
   l. Any other lung problem that you have been told about: Yes/No
4. Do you **currently** have any of the following symptoms of pulmonary or lung illness?
   a. Shortness of breath: Yes/No
   b. Shortness of breath when walking fast on level ground or walking up a slight hill or incline: Yes/No
   c. Shortness of breath when walking with other people at an ordinary pace on level ground: Yes/No
   d. Have to stop for breath when walking at your own pace on level ground: Yes/No
   e. Shortness of breath when washing or dressing yourself: Yes/No
   f. Shortness of breath that interferes with your job: Yes/No
   g. Coughing that produces phlegm (thick sputum): Yes/No
   h. Coughing that wakes you early in the morning: Yes/No

i. Coughing that occurs mostly when you are lying down: Yes/No
j. Coughing up blood in the last month: Yes/No
k. Wheezing: Yes/No
l. Wheezing that interferes with your job: Yes/No
m. Chest pain when you breathe deeply: Yes/No
n. Any other symptoms that you think may be related to lung problems: Yes/No

5. Have you **ever had** any of the following cardiovascular or heart problems?
   a. Heart attack: Yes/No
   b. Stroke: Yes/No
   c. Angina: Yes/No
   d. Heart failure: Yes/No
   e. Swelling in your legs or feet (not caused by walking): Yes/No
   f. Heart arrhythmia (heart beating irregularly): Yes/No
   g. High blood pressure: Yes/No
   h. Any other heart problem that you have been told about: Yes/No
6. Have you ever had any of the following cardiovascular or heart symptoms?
   a. Frequent pain or tightness in your chest: Yes/No
   b. Pain or tightness in your chest during physical activity: Yes/No
   c. Pain or tightness in your chest that interferes with your job: Yes/No
   d. In the past two years, have you noticed your heart skipping or missing a beat: Yes/No
   e. Heartburn or indigestion that is not related to eating: Yes/ No
   f. Any other symptoms that you think may be related to heart or circulation problems: Yes/No
7. Do you currently take medication for any of the following problems?
   a. Breathing or lung problems: Yes/No
   b. Heart trouble: Yes/No
   c. Blood pressure: Yes/No
   d. Seizures (fits): Yes/No
8. If you have used a respirator, have you ever had any of the following problems? (If you have never used a respirator, check the following space and go to question 9) _____
   a. Eye irritation: Yes/No
   b. Skin allergies or rashes: Yes/No
   c. Anxiety: Yes/No
   d. General weakness or fatigue: Yes/No
   e. Any other problem that interferes with your use of a respirator: Yes/No
9. Would you like to talk to the health care professional who will review this questionnaire about your answers to this questionnaire? Yes/No

Questions 10 to 15 below must be answered by every employee who has been selected to use either a full-face piece respirator or a self-contained breathing apparatus (SCBA). For employees who have been selected to use other types of respirators, answering these questions is voluntary.

10. Have you ever lost vision in either eye (temporarily or permanently)? Yes/No
11. Do you currently have any of the following vision problems?
    a. Wear contact lenses: Yes/No
    b. Wear glasses: Yes/No
    c. Color blind: Yes/No
    d. Any other eye or vision problem: Yes/No
12. Have you ever had an injury to your ears, including a broken ear drum? Yes/No
13. Do you currently have any of the following hearing problems?
    a. Difficulty hearing: Yes/No
    b. Wear a hearing aid: Yes/No
    c. Any other hearing or ear problem: Yes/No
14. Have you ever had a back injury? Yes/No
15. Do you currently have any of the following musculoskeletal problems?
    a. Weakness in any of your arms, hands, legs, or feet: Yes/No
    b. Back pain: Yes/No
    c. Difficulty fully moving your arms and legs: Yes/No
    d. Pain or stiffness when you lean forward or backward at the waist: Yes/No
    e. Difficulty fully moving your head up or down: Yes/No
    f. Difficulty fully moving your head side to side: Yes/No
    g. Difficulty bending at your knees: Yes/No
    h. Difficulty squatting to the ground: Yes/No
    i. Climbing a flight of stairs or a ladder carrying more than 25 lbs: Yes/No
    j. Any other muscle or skeletal problem that interferes with using a respirator: Yes/No

Part B. Any of the following questions, and other questions not listed, may be added to the questionnaire at the discretion of the health care professional who will review the questionnaire.

1. In your present job, are you working at high altitudes (over 5,000 feet) or in a place that has lower than normal amounts of oxygen? Yes/No

   If "yes," do you have feelings of dizziness, shortness of breath, pounding in your chest, or other symptoms when you're working under these conditions? Yes/No
2. At work or at home, have you ever been exposed to hazardous solvents, hazardous airborne chemicals (e.g., gases, fumes, or dust), or have you come into skin contact with hazardous chemicals? Yes/No

If "yes," name the chemicals if you know them: _____

_____

_____

3. Have you ever worked with any of the materials, or under any of the conditions, listed below?

   Asbestos: Yes/No

   Silica (for example, in sandblasting): Yes/No

   Tungsten/cobalt (for example, grinding or welding this material): Yes/No

   Beryllium: Yes/No

   Aluminum: Yes/No

   Coal (for example, mining): Yes/No

   Iron: Yes/No

   Tin: Yes/No

   Dusty environments: Yes/No

   Any other hazardous exposures: Yes/No

   If "yes," describe these exposures: _____

   _____

   _____

4. List any second jobs or side businesses you have: _____

   _____

5. List your previous occupations: _____

   _____

6. List your current and previous hobbies: _____

   _____

7. Have you been in the military services? Yes/No

   If "yes," were you exposed to biological or chemical agents (either in training or combat): Yes/No

8. Have you ever worked on a Hazardous Materials (HAZMAT) team? Yes/No

9. Other than medications for breathing and lung problems, heart trouble, blood pressure, and seizures mentioned earlier in this questionnaire, are you taking any other medications for any reason (including over-the-counter medications)? Yes/No

If "yes," name the medications if you know them: _____

10. Will you be using any of the following items with your respirator(s)?

    a. High-efficiency Particulate Air (HEPA) Filters: Yes/No
    b. Canisters (for example, gas masks): Yes/No
    c. Cartridges: Yes/No

11. How often are you expected to use the respirator(s) (circle "yes" or "no" for all answers that apply to you)?

a. Escape only (no rescue): Yes/No
b. Emergency rescue only: Yes/No
c. Less than 5 hours per week: Yes/No
d. Less than 2 hours per day: Yes/No
e. 2 to 4 hours per day: Yes/No
f. Over 4 hours per day: Yes/No

12. During the period you are using the respirator(s), is your work effort:

a. **Light** (less than 200 kilocalories (kcal) per hour): Yes/No
If "yes," how long does this period last during the average shift: _____ hours _____ minutes
Examples of a light work effort are sitting while writing, typing, drafting, or performing light assembly work; or standing while operating a drill press (1 to 3 lbs.) or controlling machines.

b. **Moderate** (200 to 350 kcal per hour): Yes/No
If "yes," how long does this period last during the average shift: _____ hours _____ minutes.
Examples of moderate work effort are sitting while nailing or filing; driving a truck or bus in urban traffic; standing while drilling, nailing, performing assembly work, or transferring a moderate load (about 35 lbs.) at trunk level; walking on a level surface about 2 miles per hour (mph) or down a 5-degree grade about 3 mph; or pushing a wheelbarrow with a heavy load (about 100 lbs.) on a level surface.

c. **Heavy** (above 350 kcal per hour): Yes/No
If "yes," how long does this period last during the average shift: _____ hours _____minutes.
Examples of heavy work are lifting a heavy load (about 50 lbs.) from the floor to your waist or shoulder; working on a loading dock; shoveling; standing while bricklaying or chipping castings; walking up an 8-degree grade about 2 mph; climbing stairs with a heavy load (about 50 lbs.).

13. Will you be wearing protective clothing and/or equipment (other than the respirator) when you are using your respirator? Yes/No

If "yes," describe this protective clothing and/or equipment: _____
_____

14. Will you be working under hot conditions (temperature exceeding 77 degrees Fahrenheit)? Yes/No

15. Will you be working under humid conditions? Yes/No

16. Describe the work you will be doing while you are using your respirator(s): _____
_____
_____

17. Describe any special or hazardous conditions you might encounter when you are using your respirator(s) (for example, confined spaces, life-threatening gases): _____
_____

18. Provide the following information, if you know it, for each toxic substance that you will be exposed to when you are using your respirator(s):

    Name of the first toxic substance: _____

    Estimated maximum exposure level per shift: _____

    Duration of exposure per shift: _____

    Name of the second toxic substance: _____

    Estimated maximum exposure level per shift: _____

    Duration of exposure per shift: _____

    Name of the third toxic substance: _____

    Estimated maximum exposure level per shift: _____

    Duration of exposure per shift: _____

    The name of any other toxic substances that you'll be exposed to while using your respirator:

    _____

    _____

    _____

19. Describe any special responsibilities you will have while using your respirator(s) that may affect the safety and well-being of others (for example, rescue, security):

    _____

APPENDIX D

UFP-Quality Assurance Project Plan

NORTHEAST CAPE HTRW REMEDIAL ACTIONS
Northeast Cape, St. Lawrence Island, Alaska

Contract No. W911KB-06-D-0007
F10AK096903_07.04_0502_p

QUALITY ASSURANCE PROJECT PLAN

Prepared for

U.S. Army Corps of Engineers, Alaska District
CEPOA-EN-EE
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W911KB-06-D-0007

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Molly Welker
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Date

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Date

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Attachment 4 TestAmerica Laboratories, Inc. Standard Operating Procedures
Attachment 5 Field Laboratory SOPs

ACRONYMS AND ABBREVIATIONS

%D	percent difference
%R	percent recovery
°C	degrees Celsius
′	minutes
°	degrees
µg/kg	micrograms per kilogram
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AK	Alaska Test Method
amu	atomic mass unit
ANCSA	Alaska Natives Claim Settlement Act
ASTs	aboveground storage tanks
BFB	bromo-fluorobenzene
bgs	below ground surface
Bristol	Bristol Environmental Remediation Services, LLC
BTEX	benzene, toluene, ethylbenzene, and xylenes (total)
CCC	calibration check compound
CCV	continuing calibration verification
CESCL	Certified Erosion and Sediment Control Lead
CFR	Code of Federal Regulations
COCs	contaminants of concern
COD	coefficient of determination
COELT	Corps of Engineers Loading Tool
conc.	concentration
CPR	cardiopulmonary resuscitation
CQCP	Contractor Quality Control Plan
CQCSM	Contractor Quality Control System Manager
CVAAS	cold vapor atomic adsorption spectroscopy

ACRONYMS AND ABBREVIATIONS (continued)

DDT	dichlorodiphenyltrichloroethane
DFTPP	decaflourotriphenylphosphine
DL	detection limit
DO	dissolved oxygen
DoD	U.S. Department of Defense
DoD QSM	U.S. Department of Defense Quality Systems Manual
DOT	U.S. Department of Transportation
DQCR	Daily Quality Control Report
DQI	data quality indicator
DQO	data quality objective
DRO	diesel range organics
DUs	decision units
ECD	electron capture detector
EDD	electronic data deliverables
EDQW	Environmental Data Quality Workgroup
ELAP	Environmental Laboratory Accreditation Program
EPA	U.S. Environmental Protection Agency
ESRI	Environmental Systems Research Institute
FID	flame-ionization detector
FPD	flame photometric detector
FUDS	formerly used defense sites
g	gram
GC/FID	gas chromatography/flame-ionization detector
GC/MS	gas chromatography/mass spectrometry
GIS	Geographic Information System
GPS	Global Positioning System
GRO	gasoline range organics

ACRONYMS AND ABBREVIATIONS (continued)

HazMat	hazardous materials
HCL	hydrochloric acid
HDPE	high-density polyethylene
HNO_3	nitric acid
HSM	Health Safety Manager
HTRW	hazardous, toxic, and radioactive waste
IATA	International Air Transport Association
ICP/MS	inductively coupled plasma mass spectrometer
ICS	interference check solution
ICV	initial calibration verification
IDQTF	Intergovernmental Data Quality Task Force
IDW	investigation-derived waste
IS	internal standard
ISCO	in-situ chemical oxidation
LCD	liquid crystal display
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LIF	Laser-Induced Fluorescence
LOD	limit of detection
LOQ	limit of quantitation
MDL	method detection limit
MeOH	methanol
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
mL	milliliter(s)
MNA	monitored natural attenuation
MOC	Main Operations Complex
MS	matrix spike

ACRONYMS AND ABBREVIATIONS (continued)

MSD	matrix spike duplicate
MWH	Montgomery Watson Harza
NA	not applicable
NDAI	No DoD Action Indicated
NE Cape	Northeast Cape
NPDL	North Pacific Division Laboratory
ORP	oxidation reduction potential
OSHA	Occupational Safety & Health Administration
PAHs	polynuclear aromatic hydrocarbons
PCB	polychlorinated biphenyl
PCP	pentachlorophenol
pH	potential hydrogen
PM	Project Manager
POC	point of contact
POL	petroleum, oil, and lubricants
ppm	parts per million
PQO	project quality objective
QA	quality assurance
QAPP	Quality Assurance Project Plan
QAR	Quality Assurance Representative
QC	quality control
QLs	quantitation limits
RA	remedial action
RA	removal action
RAB	Restoration Advisory Board
RCRA	Resource Conservation and Recovery Act
RF	response factor
Rh	rhodium

ACRONYMS AND ABBREVIATIONS (continued)

RIs	remedial investigations
RL	reporting limit
RPD	relative percent difference
RRO	residual range organics
RSD	relative standard deviation
SAP	Sampling and Analysis Plan
SDG	sample delivery group
SDSFIE	Spatial Data Standards for Facilities, Infrastructure, and Environment
SEDD	staged electronic data deliverable
SIM	selected ion monitoring
SOPs	Standard Operating Procedures
SPCC	system performance check compound
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
SVOCs	semivolatile organic compounds
SW	EPA Solid Waste Test Method
TCD	thermal conductivity detector
TCLP	Toxicity Characteristic Leaching Procedure
TCMX	tetra-chloro-meta xylenes
TestAmerica	TestAmerica Laboratories, Inc.
TOC	total organic carbon
TPH	Total petroleum hydrocarbons
TPP	technical project planning
TRPH	total recoverable petroleum hydrocarbons
TSA	technical systems audit
TSCA	Toxic Substances Control Act

ACRONYMS AND ABBREVIATIONS (continued)

UFP	Uniform Federal Policy
USACE	US Army Corps of Engineers
USTs	underground storage tanks
UVOST	UltraViolet Optical Screening Tool
VOA	volatile organic analyte
VOCs	volatile organic compounds
WMP	Waste Management Plan

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1.0 INTRODUCTION

1.1 PURPOSE

This Quality Assurance Project Plan (QAPP) has been developed for acceptance by the US Army Corps of Engineers® (USACE), Alaska District, as a quality control (QC) mechanism for the work to be performed under Contract No. W911KB-06-D-0007 for Hazardous, Toxic, Radioactive Waste (HTRW) remedial action (RA) activities at Northeast Cape (NE Cape), St. Lawrence Island, Alaska. The USACE has contracted with Bristol Engineering Services Corporation and its team of subcontractors to accomplish the proposed work. Bristol Environmental Remediation Services, LLC (Bristol) will be responsible for completing the Scope of Work for this project at various sites located at NE Cape. The objective of this project is to implement selected remedies for the NE Cape site, as detailed in the Final Decision Document for the NE Cape HTRW Project (USACE, 2009).

This QAPP describes the quality assurance (QA) and QC procedures and other technical field sampling and laboratory analytical procedures to be conducted as part of the HTRW RAs selected for NE Cape. This document meets the requirements and elements set forth in the Intergovernmental Data Quality Task Force (IDQTF) Uniform Federal Policy (UFP) for QAPPs (United States Environmental Protection Agency [EPA], 2005) and EPA Requirements for Quality Assurance Project Plans EPA QA/R-5 (EPA, 2001).

The 37 UFP-QAPP worksheets follow this introduction. References used in the preparation of the QAPP are provided following the QAPP worksheets. The figures and tables are provided following the references. Attachment 1 contains Bristol's Standard Operating Procedures (SOPs) for conducting the 2011 RAs. Attachment 2 includes the field forms required to implement the field procedures. Attachment 3 contains the TestAmerica Laboratories, Inc. (TestAmerica) Quality Assurance Manual and current Defense Environmental Laboratory Accreditation Program (ELAP) and ADEC Contaminated Sites Laboratory certifications. The TestAmerica SOPs for analytical methods specified in this QAPP are provided in Attachment 4. The field laboratory SOPs are provided in Attachment 5.

1.2 BACKGROUND

Environmental investigations and cleanup activities at NE Cape began in the mid 1980s with the goal of locating and identifying areas of contamination and gathering enough information to develop a cleanup plan. Remedial investigations (RIs) were initiated at NE Cape during the summer of 1994. Additional sampling was performed during subsequent investigations: Phase II RI (Montgomery

Watson, 1996 and 1999); Phase III RI (Montgomery Watson Harza, 2003); and Phase IV RI (Shannon &Wilson, Inc., 2005). The studies divided the concerns among 34 separate sites. The results of the RI showed that contaminants were present at some, but not all sites. Site-specific historical information is presented in the Work Plan, Section 3.2 "Site Descriptions", for the sites that will be remediated in 2011.

Bristol performed several removal actions at NE Cape in 2003 and 2005, and in 2009 capped the Site 7 Cargo Beach Landfill and conducted a Phase I In-Situ Chemical Oxidation (ISCO) Study at the Main Operations Complex (MOC).

In 2010, Bristol performed the following remedial activities: Constructed a landfill cap at Site 9; excavated and disposed of approximately 2,730 tons of petroleum-contaminated soil at Site 3, Site 6, and Site 32; excavated and disposed of approximately 1,245 tons of polychlorinated biphenyls (PCB)-contaminated soils from Site 13, Site 16, Site 21, and Site 31; excavated and disposed of 16.7 tons of arsenic-contaminated soils from Site 21; removed 12 tons of debris from Site 9 and Site 29; and removed and disposed of 14 tires and battery pieces totaling 300 pounds from these sites. Bristol also removed 43 poles weighing 14.2 tons, 12 tons of wire, 5.1 tons of wooden debris and 7 tons of metal debris from the tundra areas sitewide. Bristol developed and implemented a Sample Analysis Plan (SAP) for monitored natural attenuation (MNA) of petroleum-contaminated soil at Site 8 and collected 2 surface water samples from the stream that drains into the Suqitughneq River from Site 8. Bristol sampled tundra/sediment locations for petroleum hydrocarbons and biogenic interference at Site 3; conducted an UltraViolet Optical Screening Tool (UVOST™) investigation to delineate the extent of diesel range organic (DRO)-contaminated soil at the MOC; and Sampled 9 monitoring wells at the MOC.

Numerous organizations are involved in the RAs for NE Cape including:

- USACE Geographic District Alaska District
- Federal agency (EPA, Region 10)
- State agency (Alaska Department of Environmental Conservation [ADEC])
- Current land owners/users (Village of Savoonga)
- Bristol Engineering Services Corporation

The objectives and the approach of the RAs are discussed below.

1.3 OBJECTIVES AND APPROACH

The 2011 Scope of Work is addressing specific selected remedies described in the Decision Document for the HTRW at NE Cape (USACE, 2009). The HTRW RAs proposed for the site are as follows:

- Excavating, processing, and disposing of petroleum-contaminated soils to a depth of up to 15 feet, where accessible, or 2 feet below the groundwater, whichever comes first at the MOC, specifically Sites 10, 11, 13, 15, 19 and 27;
- Excavating, and disposing of PCB-contaminated soils from Site 13 (Heat and Power Plant) and Site 31 (White Alice Communications Station);
- Collecting and analyzing background arsenic samples near Site 21;
- Excavating, and disposing of arsenic-contaminated soils from Site 21 (Wastewater Treatment Tank), based on the results of background arsenic sampling;
- Conducting MNA sampling of petroleum-contaminated soil and surface water at Site 8 (petroleum, oil, and lubricants [POL] Spill Site);
- Transportation and disposal of 21 bulk bags containing PCB-contaminated soil staged on the concrete pad at Building 98;
- Evaluating groundwater in 9 monitoring wells at the MOC;
- Removing dangerous poles, wires, and other miscellaneous debris from tundra areas sitewide where clearly identified;
- Delineating extent and magnitude of sediment and soil contamination at Site 28 Drainage Basin through the use of new and existing data; and
- Excavation and removal of spilled roofing tar south of the MOC.

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QAPP WORKSHEET #1
TITLE AND APPROVAL PAGE

Site Name/Project Name:	Northeast Cape HTRW Remedial Actions
Site Location:	Northeast Cape, St. Lawrence Island, Alaska
Document Title:	UFP-QAPP for NE Cape HTRW Remedial Actions, NE Cape, St. Lawrence Island, Alaska
Lead Organization:	US Army Corps of Engineers, Alaska District
Preparer's Name and Organizational Affiliation:	Molly Welker, Senior Project Manager Bristol Environmental Remediation Services, LLC (Bristol)
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Preparation Date (Month/Year):	July 2011
Investigative Organization's Project Manager/Date:	Molly Welker
Printed Name/Organization:	Molly Welker/Bristol
Investigative Organization's Project QA/QC Manager/Date:	Marty Hannah
Printed Name/Organization:	Marty Hannah/Bristol
Lead Organization's Project Manager/Date:	
Printed Name/Organization:	Carey Cossaboom/USACE
Other Approval Signatures/Date:	
Printed Name/Title:	Curtis Dunkin/ADEC
Document Control Numbering System:	FUDS Information Improvement Program (FIIP) Numbers

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QAPP WORKSHEET #2
QAPP IDENTIFYING INFORMATION

Site Name/Project Name: Northeast Cape HTRW Remedial Actions

Site Location: Northeast Cape, St. Lawrence Island, Alaska

Title: UFP-QAPP for Northeast Cape HTRW Remedial Actions, Northeast Cape, St. Lawrence Island, Alaska

Site Number/Code: NA **Revision Number:** 0

Operable Unit: NA **Revision Date:** May 2011

Contractor Name: Bristol Engineering Services Corporation

Contract Title: Northeast Cape HTRW Remedial Actions

Contractor Number: W911KB-06-D-0007 **Work Assignment Number:**

1. Identify regulatory program: Defense Environmental Restoration Program, U.S. Code Title 10, Section 2701, et seq. an 18 AAC 75 Article 3

2. Identify acceptance entity: USACE – Alaska District

3. The QAPP is (select one): _____ Generic __X__ Project Specific

4. List dates of scoping sessions that were held: January 18, 2011, March 10, March 30 (RAB meeting), April 13, 2011

5. List dates and titles of QAPP documents written for previous site work, if applicable:

Title	Acceptance Date
2009 In-Situ Chemical Oxidation (Phase I) and Intrusive Drum Removal/Landfill Cap Sampling and Analysis Plan (Revision 1) F10AK096905_07.04_0501_a	July 2009
2010 Northeast Cape HTRW Remedial Actions Sampling and Analysis Plan (Revision 1) F10AK096993_07.04_0503_p	July 2010

6. List organization partners (stakeholders and connection with lead organization):

Partners	Connection
USACE Headquarters	Sponsor organization
USACE Alaska District	Lead organization
USACE Alaska District	Technical oversight organization
USACE Alaska District	Contracting organization
Kukulget, Inc. in Savoonga, AK	Landowner

Partners	Connection
Sivuqaq, Inc. in Gambell, AK	Landowner
U.S. Environmental Protection Agency (EPA) Region 10	Federal regulatory agency
Alaska Department of Environmental Conservation	State regulatory agency

7. List data users: Same as above

8. If any required QAPP elements and required information are not applicable to the project, then circle the omitted QAPP elements and required information on the following QAPP Worksheet #2 table. Provide an explanation for their exclusions below:

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet Number
Project Management and Objectives		
2.1 Title and Approval Page	Title and Approval Page	1
2.2 Document Format and Table of Contents	Table of Contents	Preface
2.2.1 Document Control Format	QAPP Identifying Information	
2.2.2 Document Control Numbering System	Document Control System	Not included
2.2.3 Table of Contents		
2.2.4 QAPP Identifying Information		
2.3 Distribution List and Project Personnel Sign-Off Sheet	Distribution List	3
2.3.1 Distribution List		
2.3.2 Project Personnel Sign-Off Sheet	Project Personnel Sign-Off Sheet	4
2.4 Project Organization	Project Organizational Chart	5
2.4.1 Project Organizational Chart	Communication Pathways	6
2.4.2 Communication Pathways		
2.4.3 Personnel Responsibilities and Qualifications	Personnel Responsibilities and Qualifications Table	7
2.4.4 Special Training Requirements and Certification	Special Personnel Training Requirements Table	8
2.5 Project Planning/Problem Definition	Project Planning Session Documentation (Refer to Work Plan)	
2.5.1 Project Planning (Scoping)	Project Scoping Session Participants Sheet	9
2.5.2 Problem Definition, Site History, and Background	Problem Definition, Site History, and Background	10
	Site Maps (Historical and Present)	Work Plan

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet Number
2.6 Project Quality Objectives and Measurement Performance Criteria 2.6.1 Developing of Project Quality Objectives Using the Systematic Planning Process	Site-Specific Project Quality Objectives (presented as DQOs during the TPP meeting)	11
2.6.2 Measurement Performance Criteria	Measurement Performance Criteria Tables	12
2.7 Secondary Data Evaluation	Sources of Secondary Data and Information	13
	Secondary Data Criteria and Limitations Table	13
2.8 Project Overview and Schedule	Summary of Project Tasks	14
2.8.1 Project Overview 2.8.2 Project Schedule	Reference Limits and Evaluation Table (includes Evaluation Criteria)	15
	Project Schedule/Timeline Table	Work Plan
Measurement/Data Acquisition		
3.1 Sampling Tasks	Sampling Design and Rationale	
3.1.1 Sampling Process Design and Rationale	Sample Location Map	Work Plan
3.1.2 Sampling Procedures and Requirements	Sampling Locations and Methods/ Standard Operating Procedure (SOP) Requirements Table	11, 21
3.1.2.1 Sampling Collection Procedures	Analytical Methods/SOP Requirements Table	19
3.1.2.2 Sample Containers, Volume, and Preservation	Field Quality Control Sample Summary Table	11, 20, 21, 28
3.1.2.3 Equipment/Sample Containers Cleaning and Decontamination Procedures	Sampling SOPs	21
	Project Sampling SOP References Table	11. 20, 28
3.1.2.4 Field Equipment Calibration, Maintenance, Testing, and Inspection Procedures	Field Equipment Calibration, Maintenance, Testing, and Inspection Table	22
3.1.2.5 Supply Inspection and Acceptance Procedures		
3.1.2.6 Field Documentation Procedures		
3.2 Analytical Tasks	Analytical SOPs	
3.2.1 Analytical SOPs	Analytical SOP References Table	23
3.2.2 Analytical Instruction Calibration Procedures	Analytical Instrument Calibration Table	24
3.2.3 Analytical Instrument and Equipment Maintenance, Testing, and Inspection Procedures	Analytical Instrument and Equipment Maintenance, Testing, and Inspection Table	25

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet Number
3.2.4 Analytical Supply Inspection and Acceptance Procedures		
3.3 Sample Collection Documentation, Handling, Tracking, and Custody Procedures	Sample Collection Documentation, Handling, Tracking, and Custody SOPs	26
3.3.1 Sample Collection Documentation	Sample Container Identification	11, 17
3.3.2 Sample Handling and Tracking System		
3.3.3 Sample Custody	Sample custody requirements	27
3.4 Quality Control Samples 3.4.1 Sampling Quality Control Samples 3.4.2 Analytical Quality Control Samples	Quality Control Samples Table Screening/Confirmatory Analysis Decision Tree	11, 28
3.5 Data Management Tasks		
3.5.1 Project Documentation and Records	Project Documents and Records Table	29
3.5.2 Data Package Deliverables	Analytical Services Table	11, 19, 30
3.5.3 Data Reporting Formats		
3.5.4 Data Handling and Management		
3.5.5 Data Tracking and Control		
Assessment/Oversight		
4.1 Assessments and Response Actions		
4.1.1 Planned Assessments	Planned Project Assessments Table	31
4.1.2 Assessment Findings and Corrective Action Responses	Assessment Findings and Corrective Action Responses Table	32
4.2 Quality Assurance Management Reports	Quality Assurance Management Reports Table	33
4.3 Final Project Report		NA
Data Review		
5.1 Overview		NA
5.2 Data Review Steps		
5.2.1 Step I: Verification	Verification (Step I) Process Table	34
5.2.2 Step II: Validation	Validation (Steps IIa and IIb) Process Table	35
5.2.2.1 Step IIa Validation Activities	Validation (Steps IIa and IIb) Summary Table	36
5.2.2.2 Step IIb Validation Activities		
5.2.3 Step III: Usability Assessment	Usability Assessment	37

Required QAPP Element(s) and Corresponding QAPP Section(s)	Required Information	QAPP Worksheet Number
5.2.3.1 Data Limitations and Actions From Usability Assessment 5.2.3.2 Activities		
5.3 Streamlining Data Review 5.3.1 Data Review Steps to be Streamlined 5.3.2 Criteria for Streamlining Data Review 5.3.3 Amounts and Type of Data Appropriate for Streamlining	Verification (Step I) Process Table	34

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QAPP WORKSHEET #3
DISTRIBUTION LIST

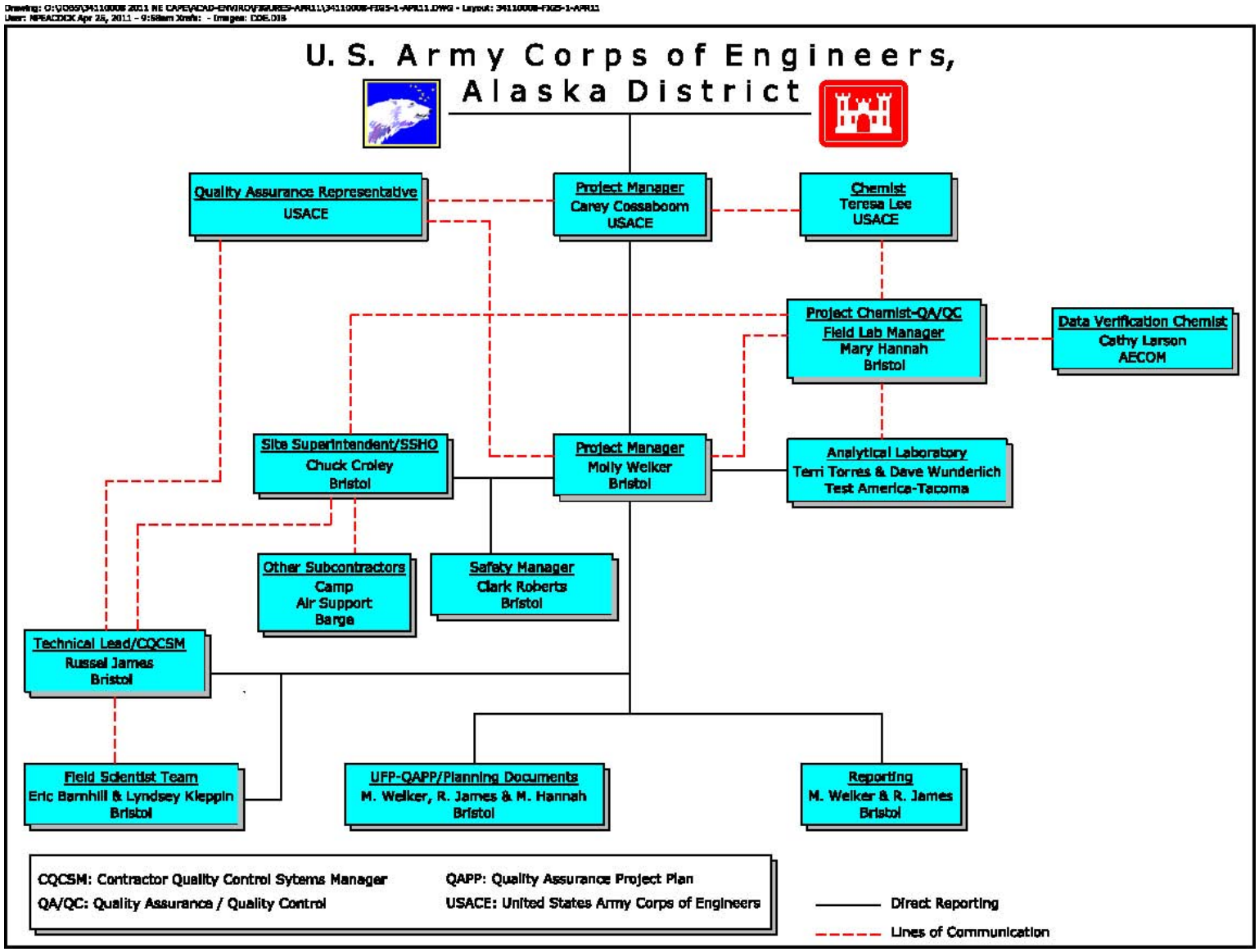
QAPP Recipients	Title	Organization	Telephone Number	Fax Number	E-mail Address
Carey Cossaboom	Project Manager	USACE	(907) 753-2689	(907) 384-7441	Carey.c.cossaboom@usace.army.mil
Ron Broyles	Contracting Officer's Representative	USACE	(907) 753-5789	(907) 384-7441	Ronald.s.broyles@usace.army.mil
Lisa Geist	Project Scientist	USACE	(907) 753-5742	(907) 384-7441	Lisa.k.geist@usace.army.mil
Aaron Shewman	Project Engineer	USACE	(907) 753-5558	(907) 384-7441	Aaron.f.shewman@usace.army.mil
Teresa Lee	Project Chemist	USACE	(907) 753-2788	(907) 384-7441	Teresa.a.lee@usace.army.mil
Curtis Dunkin	ADEC Project Manager	ADEC	(907) 269-3053	(907) 269-7649	Curtis.dunkin@alaska.gov
Steve Johnson	Program Manager	Bristol	(907) 563-0013	(907) 563-6713	sjohnson@bristol-companies.com
Molly Welker	Project Manager	Bristol	(907) 563-0013	(907) 563-6713	mwelker@bristol-companies.com
Martin (Marty) Hannah	Analytical Task Manager/Senior Technical Review Chemist-Project Quality Assurance/Quality Control (QA/QC) Manager	Bristol	(907) 563-0013	(907) 563-6713	mhannah@bristol-companies.com
Clark Roberts	Safety Manager	Bristol	(210) 490-5877	(210) 490-5877	croberts@bristol-companies.com
Chuck Croley	Site Superintendent, Site Safety and Health Officer (SSHO)	Bristol	(907) 563-0013	(907) 563-6713	ccroley@bristol-companies.com
Russell James	Field Team Leader/Contractor Quality Control System Manager (CQCSM)	Bristol	(907) 563-0013	(907) 563-6713	rjames@bristol-companies.com
Terri Torres	Laboratory Project Manager	TestAmerica	(253) 922-2310	(253) 922-5047	Terri.torres@testamericainc.com
Dave Wunderlich	Laboratory Quality Assurance (QA) Manager	TestAmerica	(253) 922-2310	(253)-922-5047	Dave.wunderlich@testamericainc.com

QAPP WORKSHEET #4
PROJECT PERSONNEL SIGN-OFF SHEET

Organization: Bristol Environmental Remediation Services LLC

Project Personnel	Title	Telephone Number	Signature	QAPP Read Date
Molly Welker	Project Manager	(907) 563-0013	Molly Welker	
Russell James	Field Team Leader, CQCSM	(907) 563-0013		
Marty Hannah	Analytical Task Manager/Senior Technical Review Chemist- Project Quality Assurance/Quality Control (QA/QC) Manager	(907) 563-0013	Martin E. Hannah	
Chuck Croley	Site Superintendent, Site Safety Officer	(907) 563-0013	Charles L. Croley	
Terri Torres	TestAmerica Project Manager	(253)-922-2310		
Dave Wunderlich	TestAmerica QA Manager	(253)-922-2310		
Eric Barnhill	Field Team Member	(907) 563- 0013		
Lyndsey Kleppin	Field Team Member	(907) 563-0013		
Carey Cossaboom	USACE Project Manager	(907) 753-2689		
Teresa Lee	USACE Project Chemist	(907) 753-2788		
Ron Broyles	Contracting Officer's Representative	(907) 753-5789		
Lisa Geist	Project Scientist	(907) 753-5742		
Aaron Shewman	Project Engineer	(907) 753-5558		
Curtis Dunkin	ADEC Project Manager	(907) 269-3053		

QAPP WORKSHEET #5
NE CAPE HTRW PROJECT ORGANIZATION CHART



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QAPP WORKSHEET #6
COMMUNICATION PATHWAYS

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Modifications to HTRW Remedial Actions Program	USACE Project Manager	Carey Cossaboom	(907) 753-2689	The USACE Project Manager (PM) will contact the Bristol PM via email or telephone with any programmatic information or coordination issues.
Modifications to contractual responsibilities	USACE Contracting Officer	Roger D. Williams	(907) 753-5571	The USACE Contracting Officer will contact the Bristol PM via email or telephone with any contracting issues.
Proposed modifications to accepted documents	Bristol Project Manager	Molly Welker	(907) 563-0013	Bristol PM will contact all stakeholders and explain proposed modifications to documents. If modifications are deemed acceptable by stakeholders, Bristol will collect approval signatures (if required) and distribute revised documents. Planning documents will have final acceptance prior to start of field activities.
Significant Issues communication between the QAR and COR	USACE QAR	To Be Determined	To be determined	The on-site QAR will contact the COR when significant or undiscovered issues need to be addressed.
Field issues that may result in variations to the Work Plan	Field Team Leader/CQCSM	Russell James	(907) 563-0013	If the field team encounters issues that may result in variations to the Work Plan, the CQCSM will discuss the issue with the Site Superintendent and then inform the on-site Quality Assurance Representative (QAR). The CQCSM will keep the QAR up to date on these issues on a daily basis, through the Daily Quality Control Report (DQCR) system. If the QAR determines that the issue is significant, he or she will contact the USACE PM to discuss the issue, and will pass on any direction from the USACE PM to the Bristol PM.
Cooler Receipt Form	TestAmerica-Bristol	Terri Torres	253-922-2310	A cooler receipt form will be sent by the laboratory within 24 hours to the USACE via email to receipt.cooler@usace.army.mil. Bristol will be copied to ensure that the cooler receipt form was sent. NPDL #11-072 will appear on the Cooler Receipt Form.

Communication Drivers	Responsible Entity	Name	Phone Number	Procedure (Timing, Pathways, etc.)
Laboratory performance issues	Analytical Laboratory Project Manager	Terri Torres	(253)-922-2310	The TestAmerica PM will report all project nonconformance issues to Bristol's Analytical Task Manager in a timely manner. Ms. Torres will communicate with Mr. Hannah regarding any laboratory coordination or issues that arise during the course of the project. Mr. Hannah will communicate any issues with the USACE chemist.
Elevated limits of quantitation (LOQs)	Bristol's Project Chemist	Marty Hannah, Molly Welker	907-563-0013	The Bristol Project Chemist or PM will notify the USACE Chemist (Teresa Lee) when sample LOQs are greater than project stated LOQs listed in Worksheet 15.

QAPP WORKSHEET #7
PERSONNEL RESPONSIBILITIES AND QUALIFICATIONS TABLE

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Carey Cossaboom	Project Manager	USACE	Management of project responsibilities. Reviews and Accepts QAPP and other planning documents, including the Work Plan, Site Safety Health Plan (SSHP), Contractor Quality Control Plan (CQCP), and Waste Management Plan (WMP).	B.S., M.S. Geology 26 Years Experience
Lisa Geist	Project Scientist	USACE	Reviews and accepts QAPP and planning documents.	B.A., Biology and Society. M.E.M. in Environmental Management. Over 15 years experience in environmental investigations and risk assessment.
Teresa Lee	Chemist	USACE	Review of QAPP, review of chemical data, chemistry liaison with regulatory agencies and laboratories.	B.S. Biology Over 10 years experience in the environmental sciences including management of a materials laboratory, management of field operations, wetland delineation, asbestos inspector, SWPPP preparation and compliance, environmental sampling, site assessments, and remediation.
Aaron Shewman	Project Engineer	USACE	Technical Lead. Reviews and accepts QAPP and planning documents.	B.S., Environmental Engineering 19 years experience
Ron Broyles	Contract Officer Representative	USACE	Verifies the contractor performs the technical requirements of the contract, performs inspections, maintains communications with the contractor, evaluates contractor, and is POC for any incident reporting or contract deficiencies.	B.S. Mechanical Engineering 20 years experience.

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Terri Torres	Project Manager/ Client Services Manager	TestAmerica Laboratories, Inc.	Oversees all facets of laboratory services portion of this project as provided by TestAmerica Laboratories, Inc. Responsible for overall implementation of client services such as the development of client relationships, client contracts, preparation of bids and proposals, and management of large-scale client projects/contracts with clients that include the USACE and many environmental engineering firms supplying services to either USACE or U.S. Navy; functions as liaison between clients and the laboratory to achieve client satisfaction through laboratory performance.	B.S. in Biology - Evergreen State College (1993); over 16 years' experience in the analytical services field. This experience includes a wide variety of both organic and inorganic analysis, as well as quality assurance management. Ms. Torres' instrumentation experience includes GS/MS, GC, AA, ICAP, IR, and auto-analyzers. Ms. Torres' diversified experience has provided her with broad-based familiarity with regulatory protocols and methodologies, including WA State DOE, State of CA DOH, NELAP, U.S.Army Corps of Engineers, U.S.Navy and others.
Kathy Kreps	Laboratory Director	TestAmerica Laboratories, Inc.	Responsibilities include technical and administrative management of the analytical laboratory and program management staff of the facility, including approximately 30 chemists, scientists and project managers; functional groups of the facility include sample control, sample preparation, organic chemistry, metals, general inorganic chemistry, project management, customer service management, QA/QC, information technology and report generation; other responsibilities include adherence to budget, staff development, quality assurance and quality control, scheduling, client support/liaison, as well as profit and loss responsibility for the Seattle facility.	B.A. in Chemistry – Whitman College (1978); over 30 years' experience in the fields of analytical and environmental laboratory analyses. Ms. Kreps has held positions as Laboratory Director and Laboratory Manager for over 16 years. In addition to managing daily laboratory operations, she is responsible overseeing budgets and capital expenditures, proposal writing, project management, data validation, method development and evaluation, troubleshooting, consulting, and SOP writing and editing skills. She is well versed in current hazardous waste regulations, including RCRA and TSCA, and their associated analytical requirements. Prior to those positions, Ms. Kreps spent many years as a chemist performing trace organic, environmental, and inorganic analyses, as well as identification techniques and process chemistry. Ms. Kreps has also worked as a senior project manager, responsible for project management of a wide variety of projects involving full laboratory services for private and government contracts, including AFCEE, NFESC, EPA, and USACE.

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Dave Wunderlich	QA Manager	TestAmerica Laboratories, Inc.	Responsible for developing and implementing the quality systems at the TestAmerica laboratory in Seattle and for verifying the laboratory's compliance with those systems with responsibilities including writing, revising, and implementing QA policies and procedures and internal auditing, administering the performance evaluation program, coordinating the laboratory's certification and accreditation activities and associated company website updates, directing the preparation for external audits and the ensuing corrective action process, conducting in-house training, presenting seminars on analytical and regulatory topics, interfacing with clients on QA/QC issues, and summarizing the activities of his department in regular reports to laboratory management.	B.S. in Chemistry and Math - Duquesne University (1984); more than 24 years of environmental laboratory experience, including 14 years as a QA manager and over nine years with TestAmerica. Mr. Wunderlich's past experience also includes roles as laboratory director, project manager, department manager, supervisor, and bench chemist. He has performed many of the EPA methods associated with SDWA, NPDES, RCRA, and CLP programs and has prepared data deliverables for environmental projects governed by various government agencies, including the EPA and the Department of Defense (Army Corps of Engineers, NEESA, and AFCEE).

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Molly Welker	Project Manager	Bristol	Responsible for the following activities: project technical direction; coordination of technical and logistical aspects of the project; resolving issues; development and maintenance of detailed project schedule; review of all reports before submittal to USACE; representation of the project team at meetings; and preparation of the final remedial action reports. Submission of QAPP and any QAPP revisions and amendments to appropriate personnel for review and acceptance. Maintains the official accepted QAPP version with support from the QA/QC Project Officer. Also responsible for ensuring that the documents (QAPP, SSHP, CQCP, and WMP) meet USACE objectives, regulatory requirements, and quality standards.	B.S., Earth Sciences, Montana State University, Bozeman, MT (1982); M.S., Geology, Texas A&M University, College Station TX (1985); over 20 years in the environmental sciences field and over 6 years of experience in managing, coordinating, and performing all aspects of project activities for large environmental projects in Alaska. Her experience includes contracting, budgeting, and directing field activities. Ms. Welker has conducted hazardous materials removal and disposal, site investigations, soil and groundwater remediation, water quality and groundwater studies, and environmental compliance assessments. Ms. Welker has extensive experience in writing environmental planning documents, including remedial action plans, site characterization reports, technical memorandums, and final reports.
Russell James	Construction Quality Control Systems Manager (CQCSM)	Bristol	Responsible for compliance with the CQCP.	Mr. James has 7 years of experience in demonstrating proficiency and expertise in Geographic Information Systems (GIS) and Geographic Positioning Systems (GPS). He has integrated GPS and GIS for a number of projects with government agencies and private organizations, and is adept at combining GIS/GPS with environmental sampling and geologic mapping. He is well versed in databases and skilled in the use of ArcGIS, Geomedia Professional, and Trimble® GPS equipment and software. Mr. James has performed environmental field work in Alaska, Arizona, and New Mexico. He is experienced in collecting soil, sediment, and water samples; soil boring and monitoring well installation; underground storage tank removal; conducting Phase I Site Assessments; and technical writing. Mr. James is an experienced CQCSM for monitoring well drilling, sampling for a variety of media, remedial actions, and HTRW projects.

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Chuck Croley	Site Superintendent, Site Safety Officer	Bristol	Responsible for execution of all HTRW activities and compliance with the SSHP and the CQCP. Responsible for day-to-day field coordination, activities, procedures, and modifications.	Mr. Croley has over 35 years of experience with construction, mining, and environmental projects at remote sites. Mr. Croley is an experienced Site Superintendent, Health and Safety Officer, and CQCSM for projects encompassing construction, aboveground and belowground fuel tank installations and removals, monitoring well drilling, sampling for a variety of media, reserve pit closures, demolition projects, and oil field investigations.
Lyndsey Kleppin	Project Scientist	Bristol	Field sampling duties including guiding the MOC excavation based on the 2010 UVOST data and sampling the MOC groundwater wells.	B.A. in Geology from Carleton College (2004). 5 years of experience in exploration geology and environmental science including geophysical instrumentation, core logging, site assessment, site characterization and risk evaluation, as well as soil, water, and air sampling.
Eric Barnhill	Project Scientist/Certified Erosion and Sediment Control Lead (CESCL)	Bristol	Field sampling duties, including field screening and confirmation samples, MNA samples at Site 8, and Site 28 transect samples. Acts as project CESCL and will coordinate inspections with the Site Superintendent.	B.S. in Biology from Eastern Washington University (1999). Environmental Scientist. Over three years of experience in environmental science, with emphasis on water and soil sampling.

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Martin Hannah	Project Quality Control/Quality Assurance Manager Senior Technical Review Chemist	Bristol	Overall Project Quality Manager. Responsible for auditing and implementation of QA program in conformance with demands of the specific investigations and policies. Specific functions and duties include: Ensuring internal assessments are conducted on the sampling and laboratory processes, as required; preparing, reviewing and/or approving QA plans and procedures; providing QA technical assistance to project staff; reporting on the adequacy, status, and effectiveness of the QA program on a regular basis to the Project Manager. Responsible for data quality in conformance with the QAPP, and interfacing directly with TestAmerica and AECOM for the chemical Data Verification Report. Senior Technical Review Chemist with technical oversight of TestAmerica and AECOM. Field screening laboratory manager/chemist.	M.S. in Environmental Quality Science from University of Alaska Anchorage (2005); B.S. in Biology from Mankato State University (1992); over 12 years of environmental experience, including four years in environmental remediation and 9 years laboratory experience. Expertise includes site assessment and remediation projects, site investigations, QA/QC requirements, and project chemistry, as well as management and transportation of hazardous waste materials at remote arctic project sites; worked on projects for federal and state agencies and is familiar with the standards and procedures for compliance with these agencies.

Name	Title	Organizational Affiliation	Responsibilities	Education and Experience Qualifications
Clark Roberts	Safety Manager	Bristol	Acts as the Project Safety and Health Officer to ensure compliance with internal and federally regulated safety and health procedures.	M.S., Public Health, University of Illinois, Chicago, (1983); B.S., Chemistry and Biology, Heidelberg College, Ohio (1978); Certified Industrial Hygienist, 1988 (#3957); Certified Hazardous Materials Manager, 2007 (#14467); Registered Environmental Assessor, California, 1990 (#3000); Licensed Asbestos Consultant, Texas, 2004 (#105654); more than 23 years of progressive experience in developing solutions to client needs in the areas of regulatory, operational, and liability risk management. He is experienced in developing specifications for hazard abatement and managing technical and professional personnel. Mr. Roberts has developed national policies and programs for the U.S. Navy and DOE in management of occupational health issues. Mr. Roberts has performed over 500 occupational workplace investigations and reviews, including asbestos, lead and chemical exposure investigations, accident/fatality investigations, regulatory compliance assessments, remedial site investigations, and a variety of performance based evaluations. As a former compliance officer for the Occupational Safety & Health Administration (OSHA), Mr. Roberts has significant experience with determining potential exposure to health and safety hazards, setting appropriate exposure limits, recommending controls, and assessing the effectiveness of existing program efforts. Mr. Roberts is also an EPA-Accredited asbestos building inspector, management planner, and abatement designer.

QAPP WORKSHEET #8
SPECIAL PERSONNEL TRAINING REQUIREMENTS TABLE

Project Function	Specialized Training – Title or Description of Course	Training Provider	Training Date	Personnel/Groups Receiving Training	Personnel Titles/Organizational Affiliation	Location of Training Records/Certificates[1]
40-Hour OSHA Training	40-Hour OSHA 8-Hour Refresher	Various	Single Event and Annual Refresher	All field staff	All field staff	Provided in Work Plan Appendix G
8-Hour OSHA Supervisory Training	8-Hour OSHA Supervisory Training	Various	Single Event	Supervisory staff	Project Manager CQCSM, Site Superintendent	Provided in Work Plan Appendix G
30-Hour OSHA Construction Safety	30-Hour OSHA Construction Safety	Various	Single Event	Supervisory and Health and Safety Staff	Site Superintendent and SSHO	Provided in Work Plan Appendix G
CQCSM Training	16 Hour, Construction Quality Management for Contractors	USACE	Every 5 years	CQCSM	Project Manager CQCSM, Site Superintendent	Provided in Work Plan Appendix G
First Aid/CPR	First Aid/Cardiopulmonary Resuscitation	Various	Various	All field staff	All field staff	Provided in Work Plan Appendix G
HAZMAT Shipping	DOT/IATA Hazardous Materials Shipping	Various	Various	All persons involved with shipping materials	All persons involved with shipping materials	Provided in Work Plan Appendix G
Health and Safety Manager (HSM)	Certified Industrial Hygienist	American Board of Industrial Hygiene	July 1988	HSM	HSM	Provided in Work Plan Appendix G

[1]Copies of all current required training certificates (as specified in the Site Safety and Health Plan [Bristol, 2011]) will be available on site during execution of the field project.
All team members will have training updated prior to certificate expiration.

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QAPP WORKSHEET #9
PROJECT SCOPING SESSION PARTICIPANTS SHEET SCOPING SESSION #1

Site Name/Project Name:	NE Cape HTRW Remedial Actions
Site Location:	NE Cape, St. Lawrence Island, Alaska
Projected Date(s) of Sampling:	July - September 2011
Project Manager:	Molly Welker
Date of Session:	January 18, 2011
Scoping Session Purpose:	Kick-off Meeting

Name	Organization	Project Role	Phone	E-mail Address
Carey Cossaboom	USACE	USACE Project Manager	(907)-753-2689	Carey.c.cossaboom@usace.army.mil
Ron Broyles	USACE	Contracting Officer's Representative	(907)-753-5789	Ronald.s.broyles@usace.army.mil
Lisa Geist	USACE	Project Scientist	(907) 753-5742	Lisa.k.geist@usace.army.mil
Aaron Shewman	USACE	Project Engineer	(907) 753-5558	Aaron.f.shewman@usace.army.mil
Steve Johnson	Bristol	Bristol Program Manager	(907) 563-0013	sjohnson@bristol-companies.com
Molly Welker	Bristol	Bristol Project Manager	(907) 563-0013	mwelker@bristol-companies.com
Russell James	Bristol	Field Staff Technical Lead	(907) 563-0013	rjames@bristol-companies.com
Chuck Croley	Bristol	Construction Manager	(907) 563-0013	ccroley@bristol-companies.com

Comments

The Project Kick-Off Meeting was held at the Bristol office to discuss contract requirements, project coordination, and contractor orientation. Discussed field plans and issues related to the MOC petroleum-contaminated soil removal, pole removal, Site 28 survey and sample data, and removal of the arsenic contaminated-soil at Site 21.

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QAPP WORKSHEET #9
PROJECT SCOPING SESSION PARTICIPANTS SHEET SCOPING SESSION #2

Site Name/Project Name:	NE Cape HTRW Remedial Actions
Site Location:	NE Cape, St. Lawrence Island, Alaska
Projected Date(s) of Sampling:	July - September 2011
Project Manager:	Molly Welker
Date of Session:	March 10, 2011
Scoping Session Purpose:	MOC Excavation Plan Meeting

Name	Organization	Project Role	Phone	E-mail Address
Ron Broyles	USACE	Contracting Officer's Representative	(907)-753-5789	Ronald.s.broyles@usace.army.mil
Lisa Geist	USACE	Project Scientist	(907) 753-5742	Lisa.k.geist@usace.army.mil
Aaron Shewman	USACE	Project Engineer	(907) 753-5558	Aaron.f.shewman@usace.army.mil
Steve Johnson	Bristol	Bristol Program Manager	(907) 563-0013	sjohnson@bristol-companies.com
Molly Welker	Bristol	Bristol Project Manager	(907) 563-0013	mwelker@bristol-companies.com
Russell James	Bristol	Field Staff Technical Lead	(907) 563-0013	rjames@bristol-companies.com
Chuck Croley	Bristol	Construction Manager	(907) 563-0013	ccroley@bristol-companies.com
Lyndsey Kleppin	Bristol	Geologist-UVOST Expert	(907) 563-0013	lkleppin@bristol-companies.com
Noyuk Peacock	Bristol	Auto CAD specialist	(907) 563-0013	npeacock@bristol-companies.com

Meeting Objective: Bristol discussed the evaluation of the 2010 UVOST data at the MOC and the estimated tonnage associated with the different plumes that have contamination above the 9.2% Laser-Induced Fluorescence (LIF) response.

Topics-Comments: Dig locations at the MOC will be on pad. Large tank footprints will be excavated and possibly backfilled. Discussed UVOST data and areas of contamination. PCBs will be removed from Site 13 before that area is excavated for POL. Discussed potential for exercising other options under the contract, including over-wintering equipment, QAR staffing TBD, Site 28 sampling scheme, PCB removal – Site 13 first, then Site 31 to present interpretation of MOC POL removal. Use of mobile laboratory for delineating lateral extents of MOC contamination. Survey crews will be on site throughout 2011 fieldwork. Bulk bag sampling protocol – continue with previous bulk bag sampling protocol, Molly Welker will forward RAB meeting PowerPoint presentation to USACE.

QAPP WORKSHEET #9
PROJECT SCOPING SESSION PARTICIPANTS SHEET SCOPING SESSION #3

Site Name/Project Name:	NE Cape HTRW Remedial Actions
Site Location:	NE Cape, St. Lawrence Island, Alaska
Projected Date(s) of Sampling:	July - September 2011
Project Manager:	Molly Welker
Date of Session:	April 13, 2011
Scoping Session Purpose:	MOC Excavation Plan Meeting

Name	Organization	Project Role	Phone	E-mail Address
Ron Broyles	USACE	Contracting Officer's Representative	(907)-753-5789	Ronald.s.broyles@usace.army.mil
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Lyndsey Kleppin	Bristol	Geologist-UVOST Expert	(907) 563-0013	lkleppin@bristol-companies.com

Meeting Topic: Discuss UVOST data at the MOC.

A. Shewman requested that Bristol revise estimates of tonnage to be excavated at the J1 and A1-A2 plumes at the MOC; changes to dig plan will be revised in Draft Work Plan. Shewman estimated 450 tons of soil would be removed at tank footprints to a depth of 18". Bristol has ordered 200 additional bulk bags in case USACE exercises a 2,000-ton option. Shewman suggested collecting 9 background samples near the Site 21 arsenic area to evaluate natural background prior to more soil removal. Discussed landfarm pilot study on MOC soils; Bristol will write addendum to Work Plan if landfarm option is exercised. Bristol will need to know soon, so materials can be placed on barge. Bristol stated they were prepared to over-winter equipment on site if USACE exercises options for 2012.

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QAPP WORKSHEET #10
PROBLEM DEFINITION

PROJECT BACKGROUND

St. Lawrence Island is located in the Bering Sea, near the territorial waters of Russia, approximately 135 air miles southwest of Nome, Alaska (Figure 1 of the Work Plan). The project site, which originally encompassed 4,800 acres located near NE Cape, falls between Kitnagak Bay to the northeast, Kangighsak Point to the northwest, and the Kinipaghulghat Mountains to the south (Figure 2 in Work Plan). The site is located at 63 degrees (°) 20 (′) minutes north latitude, 168° 59′ west longitude, in Township 25 South, Range 54 West, Kateel River Meridian.

In 1982, transfer of the White Alice Station area, south of the MOC, to the U.S. Department of the Navy was initiated. However, this transaction was not formally completed and was superseded by the Alaska Natives Claim Settlement Act (ANCSA). The U.S. Navy conducted a removal action under its Comprehensive Long-Term Environmental Action Navy program. The action included removal of specified hazardous items and containerized HTRW. In 2000, the White Alice Station was reclassified as a Formerly Used Defense Sites (FUDS)-eligible property, and, in response, the USACE, included the area in the ongoing cleanup program for NE Cape (USACE, 2002).

Environmental investigations and cleanup activities at NE Cape began in the mid 1980s with the goal of locating and identifying areas of contamination and gathering enough information to develop a cleanup plan. Remedial investigations were initiated at NE Cape during the summer of 1994. Additional sampling was performed during subsequent investigations: Phase II RI (Montgomery Watson, 1996 and 1999); Phase III RI (Montgomery Watson Harza, 2003); and Phase IV RI (Shannon &Wilson, Inc., 2005). The studies divided the concerns among 34 separate sites. The results of the RI showed that contaminants were present at some, but not all sites. Site-specific historical information is presented in the Work Plan, Section 3.2 “Site Descriptions”.

Bristol performed several removal actions at NE Cape in 2003 and 2005, and in 2009 capped the Site 7 Cargo Beach Landfill and conducted a Phase I In-Situ Chemical Oxidation Study at the MOC. In 2010, Bristol performed the following remedial activities: constructed a landfill cap at Site 9; excavated and disposed of approximately 2,730 tons of petroleum-contaminated soil at Site 3, Site 6, and Site 32; excavated and disposed of approximately 1,245 tons of PCB-contaminated soils from Site 13, Site 16, Site 21, and Site 31; excavated and disposed of 16.7 tons of arsenic-contaminated soils

from Site 21; removed 12 tons of debris from Site 9 and Site 29; and removed and disposed of 14 tires and battery pieces totaling 300 pounds from these sites. Bristol removed 43 poles weighing 14.2 tons, 12 tons of wire, 5.1 tons of wooden debris, and 7 tons of metal debris from the tundra areas sitewide. Bristol developed and implemented an SAP for MNA of petroleum-contaminated soil at Site 8 and collected two surface water samples from the stream that drains into the Suqitughneq River from Site 8; sampled tundra/sediment locations for petroleum hydrocarbons and biogenic interference at Site 3; conducted a (UVOST investigation to delineate the extent of DRO-contaminated soil at the MOC; and sampled 9 monitoring wells at the MOC.

THE PROBLEM TO BE ADDRESSED BY THE PROJECT

The primary contaminants of concern (COCs) in soil at NE Cape are chemicals associated with petroleum hydrocarbon releases, metals (including arsenic), and PCBs. Roofing tar on the ground surface west of the MOC, while not a specific contaminant, is listed in the Scope of Work for removal. Detailed information on the past uses and compounds of concern present at the site have been documented in previous investigation reports [Phase II RI (1996 and 1998); Phase III RI (2001 and 2002); and Phase IV RI (2004)]. The primary sources of contamination at the site were the aboveground storage tanks (ASTs), underground storage tanks (USTs), and associated piping that contained fuel products; the secondary source of contamination was residual subsurface fuel contaminated soil resulting from historic spills and leaks. Other sources of contamination include electrical transformers (PCBs), 55-gallon drums, and other miscellaneous activities during facility operations. The largest documented spill was 30,000 gallons of fuel from POL Tank #2 in 1967.

The following are the objectives for the 2011 project:

- Excavation and disposal of petroleum-contaminated soils at the MOC (Sites 10, 11, 13, 15, 19, and 27).
- Excavation and disposal of PCB-contaminated soils from Site 13 (Heat and Power Plant) and Site 31 (White Alice Communications Station).
- Transportation and disposal of PCB-contaminated soils contained in 21 bulk bags staged at the Building Pad 98.
- Continued MNA of petroleum-contaminated soil and surface water at Site 8 POL Spill Site.
- Continued MNA evaluation and analytical sampling of groundwater from monitoring wells in the vicinity of the MOC.
- Collect samples to determine natural background arsenic concentrations in the vicinity of Site 21.

- Excavation and disposal of arsenic-contaminated soil from Site 21 Wastewater Treatment Tank if arsenic is not attributed to natural occurrence.
- Removal and disposal of dangerous debris, drums, and poles from tundra areas site-wide where clearly identified.
- Review of existing data and collection of sediment/soil samples from Site 28 Drainage Basin to delineate the extent and magnitude of contamination.
- Excavation and disposal of roofing tar from south of the MOC.

THE ENVIRONMENTAL QUESTIONS BEING ASKED

Have all the PCB-contamination in soils above 1.0 milligrams per kilogram (mg/kg) been removed at Site 13 and Site 31? Have all the POL-contaminated soils above the cleanup levels been removed from the MOC? Have all the arsenic-contaminated soils that are not attributable to background conditions at Site 21 been removed? Is the arsenic at Site 21 due to natural occurrence or anthropogenic activities? What is the extent and characterization of sediment and soil contamination at Site 28? Is natural attenuation occurring in surface water and soil at Site 8? Is natural attenuation occurring in groundwater at the MOC?

OBSERVATIONS FROM ANY SITE RECONNAISSANCE REPORTS

The remedies discussed in the Decision Document (USACE, 2009) and the site maps and summary of sample results from previous remedial investigations and removal actions will be reviewed (Phase II RI [Montgomery Watson, 1996 and 1999]; Phase III RI [Montgomery Watson Harza, 2003]; and Phase IV RI [Shannon &Wilson, Inc., 2005]; removal actions performed by Bristol in 2003 and 2005; and the HTRW remedial actions in 2009 and 2010 performed by Bristol).

The POL-contaminated soil has been delineated by the 2010 UVOST investigation at the MOC; PCB contamination above cleanup levels remain at Sites 13 and 31 based on field-screening and confirmation samples analyzed in 2010 by Bristol; two samples, 10NC21SB42 and 10NC21SB43, contained arsenic concentrations of 11 mg/kg and 17 mg/kg, respectively.

A SYNOPSIS OF SECONDARY DATA OR INFORMATION FROM ALL SITE REPORTS

<u>Main Operations Complex (MOC)</u>

The MOC at the NE Cape installation included the majority of the site infrastructure, including buildings, heat and power supply, fuel storage tanks, maintenance, and housing quarters. Individual sites were grouped together to evaluate an overall response action for the known contamination.

These sites are located on the northeast portion of the main complex gravel pad and include Sites 10, 11, 13, 15, 19, and 27. See Figure 3 in the Work Plan for site locations.

All of the MOC structures have been demolished including backfill of utilidors. Tanks and piping have been removed. Contaminated concrete, PCB-contaminated soils, and fuel-stained soils were also excavated and transported off site during removal actions from 2000 to 2005. Only inert concrete foundations and pads remain.

The primary COC in soil at the MOC is DRO. Surface and subsurface soils are contaminated with petroleum to depths exceeding 15 feet below ground surface (bgs).

Shallow groundwater is also contaminated throughout the northeast portion of the MOC, over an area of approximately 175,000 square feet. The primary COC in groundwater are DRO, gasoline range organics (GRO), residual range organics (RRO), benzene, and naphthalene. The depth to groundwater across the northeast portion of the MOC varies significantly. In some areas, a perched aquifer is present, with shallow groundwater encountered between 4 and 7 feet bgs. A potentially confined aquifer is also present, with water encountered from 10 to 25 feet bgs.

Remedial Investigations were conducted in 1994, 1996, 1998, 2001, 2002, and 2004. The sampling results indicate soils and groundwater contain petroleum compounds at elevated levels. The in situ chemical oxidation (ISCO) pilot test was completed at the MOC in 2009. Results indicated ISCO was not an effective means of remediating the petroleum-contaminated, peat-rich soil present at the MOC. As a result, excavation and removal is the preferred alternative. Additional data were collected at the MOC during the 2010 field season. Specifically, UVOST technology was used to evaluate the extent and magnitude of petroleum-contaminated soil. The 2009 ISCO study found that the fuel contamination was most heavily concentrated within a layer of peat and silt near Sites 13 and 27, and may have created a smear zone along the shallow groundwater interface. The 2010 UVOST investigation indicates highest POL concentrations in the low-lying marshy areas north of the Site 11 tank footprints. The UVOST results also indicate the MOC pad area has contamination above cleanup levels in the subsurface. Refer to Figure 8 in the Work Plan for graphical representation of UVOST LIF responses above 9.2 % RE. The tank footprints at Site 11 will be excavated first at the MOC.

Site 8 POL Spill Site

The Pipeline Break Site is located southwest of the intersection of Cargo Beach Road and the Airport Access Road. A fuel pipeline extended from the pump house at Cargo Beach to the bulk storage tanks

at the MOC. A reported break in the pipeline was located on the west side of the main road embankment and north of the Suqitughneq River. The fuel pipeline was drained and removed in 2000.

The site is a wetland with thick surface vegetation, typical of locations along roads and the airstrip where the tundra mat was removed before construction. The roughly 40-foot-wide wetland slopes southward for approximately 300 feet toward the Suqitughneq River. The wetland narrows as it approaches the river and a spring of flowing water is present. The wetland consists of dense, grassy vegetation and roots with little soil or peat development. This vegetation does not appear stressed, though petroleum odor is evident when a person walks across the vegetative mat. Some sand is present between cobbles under the vegetation mat.

Two soil samples and one surface water sample were collected in 2004 to assess possible fuel impacts at the site. Diesel range organics were detected in the soil at concentrations ranging from 6,700 to 19,500 mg/kg. No contaminants were detected in the surface water. The two soil samples were spaced 50 feet apart. The pipeline break was 50 feet upgradient of the first sample, based on field observations.

Baseline MNA sampling of soil and surface water was conducted during 2010. The sampling plan involved creating three decision units (DUs) at Site 8, the upper unit was above gradient of the pipeline break and represented a non-impacted area, the upper boundary of the middle DU started near the pipeline break and represented the most likely impacted area, and the lower DU represented a less impacted area, which terminated at the Suqitughneq River. A random number generator was used to select 8 “cells” for sampling out of 40 possible cells in each DU. The 24 primary locations at Site 8 had water samples field analyzed for MNA parameters, with the exception of methane in water which was analyzed at TestAmerica. Manganese, ferrous iron, sulfate, nitrate, and alkalinity were analyzed with a Hach field spectrometer. Temperature, specific conductivity, pH oxidation-reduction potential (redox), and dissolved oxygen were measured with a YSI 556 multi-parameter water quality meter. The MNA results represent a baseline to determine if natural attenuation is occurring at the site but are inconclusive due to a high influx of rainwater at Site 8, which may have greatly diluted the surface water. The MNA results did not conclusively indicate whether or not natural attenuation is occurring at the site; the results will be used to establish a trend for further evaluation.

Soil samples were also composited from the eight selected cells in each DU for DRO/RRO (with and without silica gel) and polynuclear aromatic hydrocarbons (PAHs) at Site 8. Sample 10NC08SB01

(lower decision unit) contained a 2-Methylnaphthalene concentration of 1,200 micrograms per kilogram (µg/kg). The concentration of 2-Methylnaphthalene exceeded the ADEC cleanup level of 6,100 µg /kg in samples 10NC08SB02 and 10NC08SB03 (duplicate samples from middle DU), with concentrations of 7,500 µg/kg and 7,600 µg/kg, respectively. Sample 10NC08SB03 exceeded the 9,200 mg/kg ADEC soil cleanup level for DRO, with a concentration of 9,300 mg/kg. The DRO concentrations in duplicate samples were decreased by less than 10 percent following a silica gel cleanup method applied to concentrations, which still exceeded cleanup levels. The minor reduction in DRO concentrations following silica gel cleanup suggests the DRO results are likely due to the presence of petrogenic sources, as does the 2-Methylnaphthalene. Samples 10NC08SB03 and 10NC08SB04 contained RRO concentrations of 5,300 mg/kg and 6,300 mg/kg, respectively. Following a silica gel cleanup, the RRO concentrations in these two samples were reduced by greater than 50 percent, to concentrations that were below cleanup levels. Sample 10NC08SB04 was located within the upper, "background", DU and was below cleanup levels for all analyses, except RRO. However, the RRO concentrations were reduced to 3,000 mg/kg, following a silica gel cleanup on the sample extract.

Three surface water samples were collected during 2010 at two locations near the terminus of Site 8 and one surface water sample was collected from a spring-generated stream that flowed into the Suqitughneq River. The samples were submitted to TestAmerica and analyzed for DRO/RRO and PAHs. Concentrations for all analyses were below cleanup levels.

Site 13 – Power and Heat Building

Site 13 consisted of the Heat and Electrical Power Building (Building 110). Several ASTs, USTs, diesel generators, and power transformers were formerly located at this site.

Soil samples collected during the 2003 demolition of the wooden utilidor corridor south of Building 110 also indicated two discrete hits of PCBs ranging from 2.4 to 16.9 mg/kg, at depths of 4 to 5 feet bgs. The utilidor trenches were backfilled with clean fill.

Surface and subsurface soil samples were collected over several years to evaluate the extent of PCB contamination surrounding Building 110 and the transformer pads. During 2005, 141 tons of PCB-contaminated soils were excavated and removed from Site 13. Soil-screening and laboratory confirmation samples following the 2005 removal action indicated residual PCB concentrations up to 37.1 mg/kg at one location (excavation 13B-2). Three excavations (13C, 13D, and 13E) conducted

north of Building 110 during the 2005 field season successfully removed PCB contamination to below 1.0 mg/kg at these locations.

Approximately 590 tons of additional PCB-contaminated soil was removed from Site 13 during 2010 for a total volume removed since 2005 of 731 tons. Soil-screening sample results indicate residual PCB-contaminated soil remains approximately 4 feet bgs. A plastic liner was used to demarcate the boundary between clean backfill and potentially contaminated residual soil.

Site 21 – Wastewater Treatment Tank

Site 21 included the wastewater treatment system for the MOC. The facility was located west of the perimeter road and consisted of a concrete septic settling tank which discharged via an 8" insulated cast iron pipe to the wetland area approximately 450 feet to the west.

Soil, sediment, surface water, and shallow groundwater samples were collected at Site 21 throughout the various phases of remedial investigation. Arsenic and PCBs were identified as primary COC during the investigations. During the 1994 investigation, PCBs were detected in surface soils at one location (SS168) due west of the septic tank. The sample was analyzed in triplicate and the results ranged from 0.93 to 4.2 mg/kg. PCBs were not detected in the other soil or sediment samples. Sludge from within the septic tank was sampled in 1999 and contained total PCBs at a concentration of 120 mg/kg. Additional samples were collected from soils surrounding the tank and outfall pipe in 2001, and PCBs were detected at a maximum concentration of 0.18 mg/kg.

The septic tank compartments were cleaned and decommissioned during the 2003 removal action. The utilidor corridor from the main complex to the septic tank and the wooden utilidor outfall line were also removed in 2003. The concrete sidewalls and floor of the tank were sampled prior to demolition. All PCB sampling results from the concrete were equal to or less than 1.0 mg/kg. The concrete tank was broken up and buried in place. Confirmation soil samples were collected in 2003 after decontamination and decommissioning of the septic tank. The sampling results indicated PCBs had not migrated through the concrete. Confirmation soil samples were collected from underneath the inlet and outfall lines, adjacent to and below the lowest level of the septic tank, and from beneath the wooden utilidor corridor. A total of 17 samples were collected from beneath the concrete tank, beneath the outfall pipe adjacent to the tank, and from the bottom of the wooden utilidor corridor. PCBs were not detected in the samples collected from beneath the concrete tank and the wooden utilidor. PCBs were detected at 1.7 mg/kg in only one sample (03NEC21SB01), which was collected

immediately beneath the outfall piping adjacent to the septic tank. Approximately 10 tons of soil was removed from this location during 2010, which successfully removed the residual PCB contamination.

Arsenic was detected at a single location (SS170) at an anomalous concentration of 170 mg/kg in surface soil downgradient of the septic tank outfall during the 1994 investigation. Other surface soil and subsurface soil samples collected in 1994 at Site 21 contained arsenic at levels ranging from 2.8 to 39 mg/kg. Additional surface soil and sediment samples were collected from the surrounding tundra near the septic tank outfall in 2001, and arsenic concentrations ranged from 4.5 to 14.7 mg/kg and were within the range of ambient levels for the NE Cape site. During the 2003 removal action, arsenic was detected in tundra soil samples collected from immediately beneath the demolished utilidor corridor at concentrations ranging from 11.4 to 35.2 mg/kg. The arsenic detections are likely attributable to naturally occurring minerals in the tundra soils. There is no other known source for the detected arsenic.

Approximately 17 tons of arsenic-contaminated soil was removed from Site 21 during 2010. Residual arsenic-contaminated soil (17 mg/kg arsenic) remains above the site-specific cleanup level of 11 mg/kg.

Additional background sampling will occur in 2011 to determine if the arsenic present at Site 21 is due to natural occurrence, as described in the ADEC *Arsenic in Soil* Technical Memorandum (ADEC, 2009). The background sampling results will help determine if additional arsenic-contaminated soil needs to be removed.

Site 28 – Drainage Basin

The Drainage Basin lies north of the MOC and flows north into the Suqitughneq River. This site has been impacted by fuel releases from the bulk fuel storage tanks, and other spills and releases. Surface water run-off and subsurface water seeps from the MOC gravel pad drain into this tundra/wetland area.

Three discrete drainages originate from the MOC gravel pad and contribute flow to the Drainage Basin (Figure 13 of Work Plan). The western drainage is adjacent to Site 13, the middle drainage originates from where a culvert previously directed flow from the former diesel fuel pump island at Site 27, and the eastern drainage flows from the area adjacent to Sites 10 and 11.

The western drainage originated from a manhole and small concrete supporting structure just north of the perimeter access road, which emptied into an artificially created swale. The manhole likely served as the drain for Building 110 Heat and Electric Power. The drainage swale is approximately 10 feet wide and 40 feet long. The presence of standing surface water is intermittent, depending on seasonal rainfall. Sediments in this area have been noted as stained dark brown and black, and produce a sheen when disturbed. Stained soils have also been observed along the drainage embankment. Grassy vegetation currently grows throughout the drainage. The manhole and small concrete supporting structure were removed and disposed of during 2010.

The middle drainage originates as a small swale south of the perimeter access road. Surface water runoff from the MOC was formerly routed under the road via a culvert to this swale. An area of ponded water periodically existed immediately north of the culvert outlet. Stained soils exist on the banks of this drainage swale. The area is generally heavily vegetated with grasses. The culvert was cut-off and plugged during 2010.

The eastern drainage is a vegetated area north of the former fuel tanks. Soil staining has been observed near the head of this drainage and downgradient of the tank footprints.

The Site 28 drainage basins have been investigated since 1994. Sediment, soil, surface water, and shallow groundwater samples have been collected and analyzed for various constituents. Sampling activities occurred in 1994, 1996, 1998, and 2001.

The most heavily contaminated areas of Site 28 are found immediately below the former locations of two culverts that were previously located at the upper end in the western and middle drainages. The highest concentrations of most COCs are located within this zone.

The primary COCs in sediment are chromium, lead, zinc, PCBs, PAHs, DRO, and RRO. The highest concentrations of these compounds are predominantly located upgradient and closest to the edge of the MOC. Figure 13 in the Work Plan highlights the sampling locations with concentrations of DRO above the cleanup level of 9,200 mg/kg, as well as selected PCB and metals detections. The extent of metals-contaminated sediments is limited to two discrete locations. The maximum concentrations of chromium, lead, and zinc were detected in 2001 in a single sample from the head of the western drainage, near the culvert. Zinc was also elevated at one location (01NE28SD119) approximately 1,450 feet downstream.

Surface water samples were collected in the drainage basin in 1994, 1996, and 2001. Concentrations of DRO, total recoverable petroleum hydrocarbons (TRPH), PCBs, and lead were elevated in 1994. Surface water samples were collected in 2001 and analyzed for DRO, RRO, and PCBs. The samples were not analyzed for lead. DRO was detected at concentrations ranging from 0.39 to 2.3 milligrams per liter (mg/L). PCBs and RRO were not detected.

The shallow groundwater was also investigated during the 1994 investigation. Two monitoring wells were installed within the eastern drainage of Site 28. The 1994 sampling results indicated the potential for DRO and lead contamination. Subsequent sampling in 2001 indicated the levels of DRO and lead were below groundwater cleanup levels. No volatile organic compound (VOC) samples were collecteded from the shallow wells at the MOC.

Site 31 – White Alice Communications Station

The White Alice Complex is located southeast and uphill from the MOC in a glacial valley at the base of Mt. Kangukhsam. The site included four large billboard antennas, a central main electronics building, other supporting structures, and seven ASTs.

Surface water samples were collected in 2001 and no COC were identified.

Surface and subsurface soil samples were collected in 2001, 2003, and 2004 to evaluate the extent of petroleum hydrocarbon contamination associated with former fuel tanks and piping. Specifically, soil samples were collected from beneath fuel pipelines, fuel tanks, and tank impoundments. Samples were also collected to evaluate the extent of PCB contamination near transformer pads and a septic outfall.

The antennas, buildings, and ASTs were demolished and removed during the 2003 field season. A total of 118 tons of PCB-contaminated soil was excavated from three locations: 1) south and west of the former Main Electronics Building (Building 1001); 2) adjacent to a former transformer pad; and 3) at the septic tank outfall during the 2005 field season. PCB-contaminated concrete (79 tons) was removed from portions of the Building 1001 foundation. Confirmation soil samples were collected in 2005 after the removal of PCB-contaminated soil and concrete.

Confirmation soil sample results indicated PCBs remained in subsurface soil at concentrations above 1.0 mg/kg (ranging from 1.53 to 7.09 mg/kg) adjacent to the former transformer pad. Excavations

west of the former Main Electronics Building and at the septic tank outfall successfully removed all PCB-contaminated soil to below 1.0 mg/kg.

As a result of residual contamination present adjacent to the former transformer pad, approximately 640 tons of additional PCB-contaminated soil was removed from Site 31 during 2010, for a total volume removed since 2005 of 758 tons. Residual PCB-contaminated soil remains in the subsurface. A plastic liner was placed in the excavation in 2010 to demarcate the boundary between clean backfill soil and potentially contaminated residual soil.

THE CLASSES OF CONTAMINANTS AND THE AFFECTED MATRICES (SOURCE MATERIAL)

Potential chemical COCs present at the project areas are metals (including arsenic), benzene, toluene, ethylbenzene, and total xylenes (BTEX), GRO, DRO, RRO PAHs and PCBs. The media impacted are groundwater, surface water, sediment, subsurface soil, and concrete.

THE RATIONALE FOR INCLUSION OF CHEMICAL AND NONCHEMICAL ANALYSIS

The chemical contaminants identified for inclusion in this QAPP are based on previous investigation results. Tables 11-1 and 11-2 summarize the analytical groups and locations for soil and groundwater samples at each site. Tables 15-1 and 15-2, soil and groundwater respectively, state the specific analytes and site-specific cleanup levels. For groundwater sampling at the MOC and surface water sampling at Site 8, general water quality indicators will be collected in the field and include conductivity, pH, turbidity, oxidation-reduction potential (ORP), temperature, and dissolved oxygen (DO). Additionally, samples will be collected and field analyzed for MNA parameters except methane, which will be submitted for laboratory analyses. The MNA parameters are: nitrate, sulfate, ferrous iron, alkalinity, and dissolved manganese. Additionally, MOC groundwater samples will be analyzed for BTEX, GRO, DRO, RRO, PCBs, total metals, and dissolved metals. Soil samples at Site 8 will be analyzed for DRO/RRO (with and without silica gel cleanup), total organic carbon (TOC), and PAHs from composite samples collected at each decision unit. The purpose of the TOC analysis is to determine the amount of TOC in the matrix; TOC data will not be utilized to determine an alternative cleanup level. Water samples will also be collected at the outfall of Site 8 before it enters the Suqi River. The water samples will be analyzed for DRO/RRO and PAHs.

Confirmation samples will be collected at Site 13 and Site 31 for PCBs following removal activities to ensure that all PCBs have been removed above site cleanup levels of 1.0 mg/kg.

Concrete PCB wipe samples will be collected at Site 13 to ensure that no PCBs are present in the concrete that will be used as backfill.

Background samples for arsenic will be collected at Site 21 to assess the potential for naturally occurring arsenic (ADEC, 2009). Based on the background arsenic results, confirmation samples may be collected for arsenic at Site 21 if there is a removal of arsenic-contaminated soil.

Soil confirmation samples for PAHs will be collected from an area on the south perimeter of the MOC following removal of tar, which was deposited on approximately 2,500 square feet of soil surface.

Background samples will be collected for DRO/RRO near the MOC at Site 28 to evaluate biogenic interference from naturally occurring materials.

Soil confirmation samples will be collected at the MOC POL site for DRO/RRO analysis following excavation when field screening indicates that soils above cleanup level have been removed. Confirmation samples will be collected from the tank footprint area after it has been excavated, and before the temporary stockpile area is constructed.

Site 28, which is approximately 29 acres, will be characterized in 2011 by sampling 10 transects across the drainages. Seven proposed locations, spaced approximately 10 feet apart, will be sampled along each transect for a total of 70 locations (see Figure 13 in Work Plan). The exact locations will be determined on site following discussions with the on-site USACE QAR. Each location will be sampled at 0.5 feet bgs, 1.0 feet bgs, and 1.5 feet bgs for a total of 210 primary samples. Each sample will be analyzed for BTEX, DRO/RRO (with and without silica gel cleanup), PAHs, PCBs, RCRA 8 metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver) and TOC. The TOC data will be used to determine the amount of TOC in the matrix, and not to determine an alternative cleanup level. The results will be used to determine the extent of contamination and select the appropriate remedial action necessary to meet site cleanup goals. Additionally, 12 background samples will be collected from a nearby, similar, non-impacted drainage to evaluate biogenic interference. A topographic survey will be completed with 1.0-foot primary contours and 0.5-foot secondary contours, along with historic and recent sample locations.

INFORMATION CONCERNING ENVIRONMENTAL INDICATORS (SOURCE-RECEPTOR INTERACTION)

Human receptors are expected to include site visitors, seasonal subsistence users, and future permanent residents. Several potential exposure scenarios were identified in the conceptual site model in the 2009 Decision Document (USACE):

- Incidental ingestion of soil/sediment
- Dermal contact with soil/sediment/surface water
- Inhalation of dust from soil or VOCs from groundwater
- Ingestion of surface water or groundwater
- Consumption of subsistence food items

The potential affected biological resources evaluated included vegetation, birds, fish, shellfish, terrestrial mammals, marine mammals, and special status species. The ecological risk evaluation focused on three selected indicator receptors, the tundra vole, cross fox, and glaucous-winged gull.

PROJECT DECISION CONDITIONS ("IF..., THEN..." STATEMENTS):

If the analytical results for the confirmation samples from the MOC and Sites 13 and 31 are below the evaluation criteria, and the data are found to be usable, the USACE may issue a finding of No DoD Action Indicated (NDAI) for a given site.

If the 2011 characterization activities indicate that contamination remains above the evaluation criteria in a given project area, and the data are found to be usable, then the USACE will develop a remedial plan to discuss further remedial activities that need to be completed to bring a site to closure.

If the analytical results for Site 8 and the MOC groundwater wells indicate that natural attenuation is occurring, then natural attenuation may be the prescribed remedy for achieving cleanup goals for impacted soil and groundwater.

If analytical results are above evaluation criteria for Site 28 Drainage Basin, and the results are found to be usable data, the USACE may consider remedial actions necessary to meet cleanup criteria. The potential COCs identified during this site investigation will be used to develop a future remedial plan, in order to further evaluate risk to human health and the environment.

If background samples collected at Site 21 indicate that arsenic levels in the soil are likely naturally occurring and comparable to concentrations at previously excavated locations, then the ADEC will be consulted and provided with background sample concentrations to determine if any further excavation of arsenic soils is warranted.

QAPP WORKSHEET #11
PROJECT QUALITY OBJECTIVES / SYSTEMATIC PLANNING PROCESS STATEMENTS

An integral part of a UFP-QAPP is the formulation of the project quality objectives (PQOs). The PQOs incorporate the elements of an EPA DQO process, which in turn consists of a series of seven planning steps that are designated to ensure that the type, quantity, and quality of the environmental data used in the decision making are appropriate for their intended application. The DQO process is outlined in the EPA, 2006 guidance document entitled "Guidance on Systematic Planning Using the Data Quality Objectives Process" (EPA/240/B-06/001, February 2006) (EPA, 2006).

The PQOs for this site are defined by covering the following elements: (1) who will use the data, (2) what will the data be used for, (3) what type of data are needed, (4) matrix, (5) how '"good" the data need to be in order to support the environmental decision, (6) how much data are needed, (7) where, when, and how should the data be collected/generated, (8) who will collect and generate the data, (9) how will the data be reported, and (10) how will the data be archived.

The specific QA/QC requirements developed for NE Cape are consistent with those presented in the DoD Quality Systems Manual (QSM), Version 4.1 (DoD, 2009).

WHO WILL USE THE DATA?

The data will be used by the USACE, the ADEC, and the landowners, Kukulget Inc. in Savoonga, Alaska, and Sivuqaq, Inc., in Gambell, Alaska.

WHAT WILL THE DATA BE USED FOR?

The data will be used to determine the following: the remediation goals have been met at excavated areas at Site 13, Site 21, Site 31, and the MOC, and to evaluate MNA at Site 8 and MOC groundwater. Site 28 analytical results and a topographic survey will be used to characterize the site and aid in determining potential RAs for the site.

WHAT TYPE OF DATA ARE NEEDED? (target analytes, analytical groups, field screening, on-site analytical or off-site laboratory techniques, sampling techniques)

The planning team consists of USACE, ADEC, and Bristol. Professional disciplines include project managers (PMs), engineers, hydrogeologists, geologists, chemists, risk assessors, and scientists who determined the data needs for each of the HTRW project areas. Tables 11-1 (soil) and 11-2 (water) summarize the matrices, estimated number of confirmation samples, and analyses for the individual

sites at NE Cape. Tables 15-1 and 15-2 summarize specific analytes, empirical reporting limits (limit of detection [LOD], limit of quantitation [LOQ]) and site-specific cleanup levels. The tables do not address the number of samples that will be submitted to the field-screening laboratory. Discrete samples for PCBs from Site 13 and Site 31 will be submitted to the field-screening laboratory to support excavation activities. Field-screening results will be used to direct the removal actions at these sites. Discrete samples for DRO from the MOC will be submitted to the field-screening laboratory, and results will be used to direct the removal action at the MOC. Field-screening laboratory results will not be used to confirm that site cleanup goals have been achieved. The same sample collection criteria are used for the field laboratory samples and confirmation samples for consistency. The field-screening laboratory is not certified, but does employ similar extraction and analytical techniques as the certified confirmation laboratory (TestAmerica-Tacoma).

Field-screening and confirmation samples will be collected in accordance with ADEC Draft Field Sampling Guidance (ADEC, 2010) and Bristol SOPs (listed in Worksheet #21 and fully presented in Attachment 1). Site-specific sampling programs are described in the latter sections of this worksheet.

The goal of the HTRW RAs is to implement selected remedies for the NE Cape site, as detailed in the Final Decision Document for the NE Cape HTRW Project (USACE, 2009).

MATRICES

The matrices for samples collected at NE Cape are soil (surface and subsurface), sediment, and water (surface water and groundwater). Concrete will also be sampled with PCB wipes at Site 13.

HOW "GOOD" DO THE DATA NEED TO BE IN ORDER TO SUPPORT THE ENVIRONMENTAL DECISION?

Laboratory analytical data must be determined to be of usable quality for regulatory purposes. The LOQs must be at or below evaluation criteria. Tables 15-1 (soil) and 15-2 (water) list the compounds of concern, site-specific cleanup levels and empirical LODs, and LOQs. No compounds have empirical LOQs above site-specific cleanup levels.

Analytical methods were selected during the planning process to ensure that the LOQs for the various analytes are adequate to make decisions in the HTRW RA or additional site characterization. Field instrumentation will be selected to cover the range of variation for the parameters being measured

(refer to Worksheet #22). Additional detail on sampling methods, analyses, and equipment is provided in subsequent QAPP worksheets.

All soil and groundwater results will be compared to site-specific cleanup levels for the NE Cape project specified in the Decision Document, HTRW, Project #F10AK096903_05.09_0500_a 200_1e, NE Cape FUDS, St Lawrence Island, Alaska (USACE, 2009). All confirmation sample results will be compared to the performance measurement criteria shown in Tables 15-1 and 15-2 to determine usability. The RA data must be suitable for making a determination if further removal action is necessary or to demonstrate that cleanup goals have been achieved to ensure site closure. Third-party data verification will be performed by AECOM on all data packages generated by the confirmation laboratory.

HOW MUCH DATA ARE NEEDED? (Number of samples for each analytical group, matrix, and concentration.)

Tables 11-1 and 11-2 list the estimated number of confirmation samples for each matrix and the analytical suites for which the samples will be analyzed. The tables list the various sites and appropriate analyses for each site. The actual number of confirmation samples collected and analyzed will be based on the size of the excavations at removal action sites. Excavation and stockpile sample quantities will be consistent with the ADEC *Draft Field Sampling Guidance* (ADEC, 2010). Characterization Sites 8 and 28 have specific sampling rationales based on the intended use of the results. Site 8 characterization addresses efficacy of natural attenuation of petroleum-contaminated soils, and the Site 28 characterization will be used to determine the extent and magnitude of possible contamination. Tables 15-1 and 15-2 contain specific analytes, their analytical sensitivity levels, and site-specific cleanup criteria.

WHERE, WHEN, AND HOW SHOULD THE DATA BE COLLECTED/GENERATED?

Where:

Sampling data will be collected from Sites 8, 13, 21, 28, 31, the MOC, and the Tar Removal Area. Sampling details in these areas is outlined below.

<u>Site 8 Surface Water and Soil Sampling Locations:</u> The Pipeline Break Site is located southwest of the intersection of Cargo Beach Road and the Airport Access Road. A fuel pipeline extended from the pump house at Cargo Beach to the bulk storage tanks at the MOC. A reported break in the pipeline

was located on the west side of the main road embankment and north of the Suqitughneq River. The fuel pipeline was drained and removed in 2000.

The site is a wetland with thick surface vegetation, typical of locations along roads and the airstrip where the tundra mat was removed before construction. The wetland slopes southward toward the Suqitughneq River. The wetland narrows as it approaches the river and a spring of flowing water is present. The wetland consists of dense, grassy vegetation and roots with little soil or peat development. This vegetation does not appear stressed, though petroleum odor is evident when a person walks across the vegetative mat. Previous sampling events indicate DRO remains in the soil above cleanup levels.

In 2010, Bristol developed and implemented a SAP to monitor natural attenuation parameters and collect surface water samples where the wetland empties into the Suqitughneq River. Also, in 2010, Bristol divided the wetland area into three DUs (upper, middle and lower), with each unit measuring approximately 100 feet long by 40 feet wide, oriented roughly southwest to northeast. Each DU was divided into 40 grids, from which eight grids were randomly selected for MNA field parameters in the surface water and soil sample collection. Eight soil samples were field composited into one laboratory sample for each DU. In 2011, Bristol will continue to monitor natural attenuation of soil and surface water at Site 8. Bristol will use the same DUs that were established in 2010 (Figure 15 in Work Plan). The same sample rationale will be used in 2011 to evaluate the efficacy of MNA as a remedial approach. Two additional surface water samples will be collected at Site 8 from an area where a small spring creates a stream that flows into the Suqitughneq River. Surface water samples were collected at the same location, but contaminants were not detected in 2010.

<u>MOC Subsurface Soil and Groundwater Sampling Locations</u>: The MOC once provided the majority of the site infrastructure, including central housing, administrative buildings, power generation sites, fuel storage tanks, and maintenance areas for the entire NE Cape facility. Multiple sites, including Sites 10, 11, 13, 15, 19, and 27 comprise the MOC. The primary COCs in shallow groundwater at the MOC are gasoline range organics, DRO, RRO, benzene, and naphthalene. According to the USACE, the affected area comprises approximately 175,000 square feet. Nine monitoring wells were sampled at the MOC in 2010. In 2011, the same monitoring wells will be sampled for COCs and MNA parameters. Also in 2011, petroleum-contaminated soils will be removed at the MOC and confirmation samples will be sent to the fixed-based analytical laboratory to confirm that the various areas within the MOC have been cleaned up to the site-specific cleanup level of 9,200 mg/kg DRO.

PCB-contaminated soils will also be removed at Site 13 in 2011. Further discussion of Site 13 is presented below.

Site 21 Subsurface Soil Sampling Locations: Site 21 included the wastewater treatment system for the main housing and operations complex. Located west of the perimeter road, the site consisted of a concrete septic settling tank, which discharged via an 8-inch insulated cast-iron pipe to the wetland area approximately 450 feet west. The septic tank compartments were cleaned and decommissioned, along with the utilidor corridor, which extended from the main complex to the septic tank, and the wooden utilidor outfall line, during the 2003 RA.

Following the 2003 RA, confirmation soil samples were collected and analyzed for PCBs. In 2003, PCBs were detected above cleanup levels in one location situated directly beneath the outfall piping, adjacent to the septic tank; 10.4 tons of PCB-contaminated soils were excavated from Site 21 in 2010. Another location at Site 21 that was excavated in 2010 contains an unusually high concentration of arsenic (170 mg/kg). In 2010, 16.7 tons of arsenic-contaminated soil was removed. In 2011, nine background samples will be initially collected to determine if the arsenic at Site 21 is attributable to natural occurrence. If it is determined that the arsenic concentrations are not naturally occurring, then additional arsenic-contaminated soil will be removed at locations where confirmation samples collected in 2010 indicated that arsenic concentrations remained above cleanup levels. Ten tons of soil will be removed and the excavation will be resampled. If analytical results indicate that arsenic concentrations still exceed site cleanup levels, up to 10 tons of additional soil will be removed at the option of USACE PMs.

Site 28 Surface Soil and Sediment Sampling Locations: Site 28 lies north of the MOC and flows north into the Suqitughneq River. This site has been impacted by fuel releases from the bulk fuel storage tanks and other possible releases from floor drains originating in maintenance and operations buildings at the MOC. Surface water run-off and subsurface water seeps from the MOC gravel pad drain into the tundra and wetland area. Three drainages originate from the MOC gravel pad and contribute flow to Site 28 (Figure 13 in Work Plan). The sample locations at Site 28 will be established across the drainages using ten pre-determined transects with seven locations along each transect. The locations will be sampled during the 2011 field season at the soil surface, 0.5 feet bgs and 1.5 feet bgs using shovels, T-handled samplers, and stainless steel spoons.

Sampling activities have occurred at the drainage basin between 1994 and 2001. The primary COCs in sediments are chromium, lead, zinc, PCBs, PAHs, DRO, and RRO. The highest concentrations of contaminants are located proximal to the edge of the MOC immediately below two culverts that were removed in 2010, which are located in the middle and western drainages. The highest concentrations of most COCs are located within this zone according the 2009 Decision Document (USACE, 2009).

Surface water samples were collected in the drainage basin in 1994, 1996, and 2001. Concentrations of DRO, TRPH, PCBs, and lead were elevated in 1994 surface water samples. Sampling events performed in 2001 indicated elevated concentrations of DRO ranging from 0.39 to 2.3 mg/L, but PCB and RRO concentrations were not elevated.

In 2010, the manhole was cleaned and removed, and 91 feet of culvert was removed and capped at Site 28 by Bristol. The extent and magnitude of sediment/soil contamination will be delineated in 2011.

<u>Site 13 Subsurface Soil Sampling Locations</u>: Site 13, located in the MOC, consisted of the Heat and Electrical Power Building (Building 110). Several tanks, diesel generators, and power transformers were formerly located at this site. Prior to 2010, during previous field remediation activities, more than 700 tons of PCB-contaminated soils were excavated and removed. An estimated 592 tons of PCB-contaminated soil was excavated from Site 13 in 2010.

The PCB soil concentrations are elevated at various spots surrounding Building 110 and the transformer pads. A wooden utilidor corridor south of Building 110 contains PCB concentrations exceeding cleanup levels, at depths of 4 to 5 feet bgs. In 2011, additional PCB-contaminated soils will be excavated and petroleum-contaminated soils may be removed from Site 13.

<u>Site 13 PCB Wipe Sampling Locations</u>: After the Site 13 PCB soil cleanup has been confirmed, the crew will break up the concrete foundations that will interfere with the DRO plume removal for sites around the MOC. Concrete removed from these foundations may be used as backfill for some of the POL excavations after wipe tests have been performed by the field-screening laboratory. Wipe samples from the concrete will be collected from locations most likely to be exposed to PCBs (e.g., edge of floor drains and areas contacted by PCB-contaminated soil).

<u>Site 31 Subsurface Soil Sampling Locations:</u> Site 31 is located uphill from the MOC, south towards a valley at the base of Mt. Kangukhsam. The site formerly contained four large antennae, a central main

electronics building, supporting structures, and seven ASTs, all of which were demolished and removed during the 2003 removal action.

A total of 118 tons of PCB-contaminated soil was excavated south and west of the former main electronics building, adjacent to a former transformer pad, and at the septic tank outfall during the 2005 field season. Seventy-nine tons of PCB-contaminated concrete were also removed from portions of the Building 1001 foundation.

Soil samples have been collected to analyze for petroleum hydrocarbons and PCBs associated with the site. Three previously identified PCB-contaminated areas were excavated in 2005. Confirmation samples indicated that PCB concentrations remain above cleanup levels in one of the three areas located adjacent to the former transformer pad. Approximately 638 tons of PCB-contaminated soil was excavated in 2010 from Site 31. In 2011, additional PCB-contaminated soils will be removed to reach cleanup objectives (1.0 mg/kg PCBs).

When:

Confirmation samples at Sites 13, 31, and the MOC excavations will be collected after field-screening results indicate that excavations meet the project cleanup goals. Background samples will be initially collected at Site 21to determine if the arsenic present at the site is naturally occurring. If the arsenic is determined to be the result of anthropogenic activities, then confirmation samples will be collected at Site 21 following the excavation of prescribed tonnages. The Site 8 samples and the MOC groundwater samples will be collected once during the 2011 summer field season. The MOC wells will be sampled prior to excavation activities at the MOC which may impact MNA evaluations. PAH confirmation samples will be collected at the Tar Removal Area after the tar and potentially impacted soil has been removed.

How:

The sampling design detailed in the Scope of Work was selected as a result of the Decision Document (USACE, 2009) to meet cleanup objectives. Table 11-1 summarizes the soil sampling program at NE Cape, and Table 11-2 presents the sampling design for Site 8 surface water and for the MOC groundwater wells. The table includes the following information: sample media, sample IDs, estimated quantity of samples to be collected, empirical sample IDs; analytical suites, QC samples, and sampling rationale. The paragraphs below outline additional detail on the sampling for each medium.

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TABLE 11-1 – SOIL SAMPLING PROGRAM NE CAPE

Table 11-1 Soil Sampling Program NE Cape

Sample Location	Total Depth (ft bgs)	Point ID (Location ID)	Sample ID (the last digits identify the chronological order of collection)	Matrix	Sample Type	Sampling Method/ Tool	Sampling Frequency	Sample Depth (ft bgs)	Expected Concentration Level	Analytical Suite: BTEX	8270C PAHs	GRO	AK102-DRO	DRO-RRO	DRO-RRO-SG	8082-PCBs	METALS-10	6020 Arsenic	TOC by 9060	Sampling Rationale	Contractor Field SOP
Site 8																					
Three Decision Units, UDU, MDU and LDU (see Figure 15 of the work plan)	0.5	UDU-1, MDU-1 and LDU-1	11NC08SS001	Soil	Composite	T-handled sampler, stainless bowl for compositing	Once	0.5 (below vegetation layer)	Low	0	3	0	0	3	3	0	0	0	3	Decision unit boundaries were established in 2010. Each DU will select 8 grids within the DU. Samples will only be collected from grids with surface water present. The 8-grid soil-sediment samples for each DU will be composited. See Table 15-2 for water analyses at the grid locations.	BERS-01, BERS-03, BERS-04, BERS-05, BERS-11,
Site 8 Field QC Samples																					
Field Duplicates	0.5	Same as the sample with which it is associated	11NC08SS004 or other unique ID.	Soil	QC	T-handled sampler, stainless bowl for compositing	One duplicate per 10 primary samples	Same as the sample with which it is associated	Low	0	1	0	0	1	1	0	0	0	1	QC	same as original sample
MS/MSDs for Grab Samples	0.5	Same as the sample with which it is associated	Same as the sample with which it is associated	Soil	QC	T-handled sampler, stainless bowl for compositing	One set per extraction batch	Same as the sample with which it is associated	Low	0	1	0	0	1	1	0	0	0	1	QC Note: One set of MS/MSD samples = 2 samples	same as original sample
Site 8 Total Soil QC Samples										**0**	**3**	**0**	**0**	**3**	**0**	**0**	**0**	**0**	**3**		
Site 8 Total Soil Samples										**0**	**6**	**0**	**0**	**6**	**0**	**0**	**0**	**0**	**6**		
MOC																					
Floor and sidewalls of excavation area(s) (See Figure 9 of the work plan)	Variable	MOC-# (Loc IDs will chronologically increase in the order collected unless resampling is necessary)	11NCMOCSS001	Soil	Grab	Disposable stainless spoon	Floor: two samples for first 250 square feet, one for each additional 250 square feet. Sidewalls: one sample for every 20 linear feet	Confirmation samples can be collected from the floor and sidewalls of the excavation	Low to Medium	0	0	0	146	0	0	0	0	0	0	Field screening will indicate when cleanup goals have potentially been achieved. Confirmation samples will be collected from the floor and sidewalls if the excavation can be safely entered. If excavation depths are deemed unsafe for entry then samples will be collected from the center of an excavator bucket.	BERS-01, BERS-03, BERS-04, BERS-05, BERS-11,
MOC Field QC Samples																					
Field Duplicates	Same as the sample with which it is associated	Same as the sample with which it is associated	11NCMOCSS###	Soil	QC	Disposable stainless spoon, bowl for mixing and splitting sample	One duplicate per 10 primary samples	Same as the sample with which it is associated	Low	0	0	0	15	0	0	0	0	0	0	Field QC	same as original sample
MS/MSDs for Grab Samples	Same as the sample with which it is associated	Same as the sample with which it is associated	Same as the sample with which it is associated	Soil	QC	Disposable stainless spoon, bowl for mixing and splitting sample	One set per extraction batch	Same as the sample with which it is associated	Low	0	0	0	15	0	0	0	0	0	0	Field QC Note: One set of MS/MSD samples = 2 samples	same as original sample
MOC Total Soil QC Samples										**0**	**0**	**0**	**45**	**0**	**0**	**0**	**0**	**0**	**0**		
MOC Total Soil Samples										**0**	**0**	**0**	**191**	**0**	**0**	**0**	**0**	**0**	**0**		
MOC Tar Removal Area																					
Tar Removal Area (South of MOC-See Figure 12 of the work plan)	Variable	TAR-1	11NCTARSS001	Soil	Grab	Disposable stainless spoon	Floor: two samples for first 250 square feet, one for each additional 250 square feet. Sidewalls: if sidewlls are greater than 1 foot, one sample for every 20 linear feet	Confirmation samples will be collected from the surface below the area where the tar was removed.	Low	0	15	0	0	0	0	0	0	0	0	Samples will be collected from the soil surface below the area where the tar was removed.	BERS-01, BERS-03, BERS-04, BERS-05, BERS-11,
MOC Tar Removal Area Field QC Samples																					
Field Duplicates	Same as the sample with which it is associated	Same as the sample with which it is associated	11NCMOCSS###	Soil	QC	Disposable stainless spoon, bowl for mixing and splitting sample	One duplicate per 10 primary samples	Same as the sample with which it is associated	Low	0	2	0	0	0	0	0	0	0	0	Field QC	same as original sample
MS/MSDs for Grab Samples	Same as the sample with which it is associated	Same as the sample with which it is associated	Same as the sample with which it is associated	Soil	QC	Disposable stainless spoon, bowl for mixing and splitting sample	One set per extraction batch	Same as the sample with which it is associated	Low	0	1	0	0	0	0	0	0	0	0	Field QC Note: One set of MS/MSD samples = 2 samples	same as original sample
MOC Tar Total Soil QC Samples										**0**	**4**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**		
MOC Total Soil Samples										**0**	**19**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**		

TABLE 11-1 – SOIL SAMPLING PROGRAM NE CAPE (continued)

Table 11-1 Soil Sampling Program NE Cape (continued)

Sample Location	Total Depth (ft bgs)	Point ID (Location ID)	Sample ID (the last digits identify the chronological order of collection)	Matrix	Sample Type	Sampling Method/ Tool	Sampling Frequency	Sample Depth (ft bgs)	Expected Concentration Level	Analytical Suite: BTEX	8270C PAHs	GRO	AK102-DRO	DRO-RRO	DRO-RRO-SG	8082-PCBs	METALS-10	6020 Arsenic	TOC by 9060	Sampling Rationale	Contractor Field SOP
Site 13																					
Floor and sidewalls of excavation area (See Figure 4 of the work plan)	Variable	13-# (Loc IDs will chronologically increase in the order collected unless resampling is necessary)	11NC13SS001	Soil	Composite	Disposable stainless spoon	Once	Up to 9 contiguous grab samples may be collected from the floor or sidewalls of the excavation and composited at the laboratory	Low	0	0	0	0	0	0	30	0	0	0	Field screening will indicate when cleanup goals have potentially been achieved. Confirmation samples will be collected from the floor and sidewalls if the excavation can be safely entered. If excavation depths are deemed unsafe for entry, then samples will be collected from the center of an excavator bucket that will be used to collect soil samples.	BERS-01, BERS-03, BERS-04, BERS-05, BERS-11,
Site 13 Field QC Samples																					
Field Duplicates	Same as the sample with which it is associated	Same as the sample with which it is associated	11NC13SS###	Soil	QC	Disposable stainless spoon, bowl for mixing and splitting sample	One duplicate per 10 primary samples	Same as the sample with which it is associated	Low	0	0	0	0	0	0	3	0	0	0	Field QC duplicate samples will be collected from the same grids as the parent sample and submitted in similar fashion. The laboratory will composite the duplicate sample.	same as original sample
MS/MSDs for Grab Samples	Same as the sample with which it is associated	Same as the sample with which it is associated	Same as the sample with which it is associated	Soil	QC	Disposable stainless spoon, bowl for mixing and splitting sample	One set per extraction batch	Same as the sample with which it is associated	Low	0	0	0	0	0	0	2	0	0	0	Field QC Note: One set of MS/MSD samples = 2 samples	same as original sample
Site 13 Total Soil QC Samples										**0**	**0**	**0**	**0**	**0**	**0**	**7**	**0**	**0**	**0**		
Site 13 Total Soil Samples										**0**	**0**	**0**	**0**	**0**	**0**	**37**	**0**	**0**	**0**		
Site 21 Background Samples (BKG)																					
Nine primary background samples will be collected from a nearby undisturbed location with similar geographic features.	below vegetative layer	21-#-#-ft (Loc IDs will include a transect ID, horizontal ID and depth collected)	11NC21SS001-ft (ft is depth bgs from which its collected)	Soil	Grab	Disposable stainless spoon	Once	Below vegetative layer	Low	0	0	0	0	0	0	0	0	9	0	Nine background samples and field QC samples will be collected from a nearby similar unimpacted drainage to evaluate biogenic interference.	BERS-01, BERS-03, BERS-04, BERS-05, BERS-11,
Site 21 Background Field QC Samples																					
Field Duplicates	Same as the sample with which it is	Same as the sample with which it is associated	11NC28SS###	Soil	QC	Disposable stainless spoon	One duplicate per 10 primary samples	Same as the sample with which it is associated	Low	0	0	0	0	0	0	0	0	1	0	QC	same as original sample
MS/MSDs for Grab Samples	Same as the sample with which it is associated	Same as the sample with which it is associated	Same as the sample with which it is associated	Soil	QC	Disposable stainless spoon	One set per extraction batch	Same as the sample with which it is associated	Low	0	0	0	0	0	0	0	0	1	0	QC Note: One set of MS/MSD samples = 2 samples	same as original sample
Site 21																					
Floor and sidewalls of excavation area (See Figure 10 of the work plan)	Variable	21-# (Loc IDs will chronologically increase in the order collected unless resampling is necessary)	11NC21SS001	Soil	Grab	Disposable stainless spoon	Floor: two samples for first 250 square feet, one for each additional 250 square feet. Sidewalls: one sample for every 20 linear feet	Confirmation samples can be collected from the floor and sidewalls of the excavation	Low	0	0	0	0	0	0	0	0	8	0	Confirmation samples will be collected from the floor and sidewalls if the excavation can be entered safely. If excavation depths are deemed unsafe for entry, then samples will be collected from the center of an excavator bucket that will collect the samples. There is no field screening for arsenic in soil.	BERS-01, BERS-03, BERS-04, BERS-05, BERS-11,
Site 21 Field QC Samples																					
Field Duplicates	Same as the sample with which it is	Same as the sample with which it is associated	11NC21SS###	Soil	QC	Disposable stainless spoon, bowl for mixing and splitting sample	One duplicate per 10 primary samples	Same as the sample with which it is associated	Low	0	0	0	0	0	0	0	0	1	0	QC	same as original sample
MS/MSDs for Grab Samples	Same as the sample with which it is	Same as the sample with which it is associated	Same as the sample with which it is associated	Soil	QC	Disposable stainless spoon, bowl for mixing and splitting sample	One set per extraction batch	Same as the sample with which it is associated	Low	0	0	0	0	0	0	0	0	1	0	Field QC Note: One set of MS/MSD samples = 2 samples	same as original sample
Site 21 Total Soil QC Samples										**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**6**	**0**		
Site 21 Total Soil Samples										**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**23**	**0**		
Site 31																					

TABLE 11-1 – SOIL SAMPLING PROGRAM NE CAPE (CONTINUED)

Table 11-1 Soil Sampling Program NE Cape (continued)

Sample Location	Total Depth (ft bgs)	Point ID (Location ID)	Sample ID (the last digits identify the chronological order of collection)	Matrix	Sample Type	Sampling Method/ Tool	Sampling Frequency	Sample Depth (ft bgs)	Expected Concentration Level	Analytical Suite: BTEX	8270C PAHs	GRO	AK102-DRO	DRO-RRO	DRO-RRO-SG	8082-PCBs	METALS-10	6020 Arsenic	TOC by 9060	Sampling Rationale	Contractor Field SOP
Floor and sidewalls of excavation area (See Figure 5 of the work plan)	Variable	31-# (Loc IDs will chronologically increase in the order collected unless resampling is necessary)	11NC31SS001	Soil	Grab	Disposable stainless spoon	Once	Up to 9 contiguous grab samples may be collected from the surface or sidewalls of the excavation and may be composited at the laboratory	Low	0	0	0	0	0	0	30	0	0	0	Field screening will indicate when cleanup goals have potentially been achieved. Confirmation samples will be collected from the floor and sidewalls if the excavation can be safely entered. If excavation depths are deemed unsafe for entry then samples will be collected from the center of an excavator bucket that will be used to collect soil samples.	BERS-01, BERS-03, BERS-04, BERS-05, BERS-11,
Site 31 Field QC Samples																					
Field Duplicates	Same as the sample with which it is	Same as the sample with which it is associated	11NC31SS###	Soil	QC	Disposable stainless spoon, bowl for mixing and splitting sample	One duplicate per 10 primary samples	Same as the sample with which it is associated	Low	0	0	0	0	0	0	3	0	0	0	Field QC duplicate samples will be collected from the same grids as the parent sample and submitted in similar fashion. The laboratory will composite the duplicate sample.	same as original sample
MS/MSDs for Grab Samples	Same as the sample with which it is	Same as the sample with which it is associated	Same as the sample with which it is associated	Soil	QC	Disposable stainless spoon, bowl for mixing and splitting sample	One set per extraction batch	Same as the sample with which it is associated	Low	0	0	0	0	0	0	2	0	0	0	Field QC Note: One set of MS/MSD samples = 2 samples	same as original sample
Site 31 Total Soil QC Samples										**0**	**0**	**0**	**0**	**0**	**0**	**7**	**0**	**0**	**0**		
Site 31 Total Soil Samples										**0**	**0**	**0**	**0**	**0**	**0**	**37**	**0**	**0**	**0**		
Site 28																					
Ten transects with seven sample locations per transect. Three samples at pre-determined depths will be collected at each location (See Figure 13 of the Work Plan)	0.0, 0.5, 1.5	28-#-#-ft (Loc IDs will include a transect ID, horizontal ID and depth collected)	11NC28SS001-ft (ft is depth bgs from which its collected)	Soil	Grab	T-handled sampler,shovel, disposable stainless spoon	Once	0.0, 0.5, 1.5	Low	210	210	210	0	210	210	210	210	0	210	Samples will be collected from locations throughout Site 28 along seven transects with ten locations per transect. Each location will be sampled at 0.5, 0.5 and 1.5 feet bgs. The purpose of the sampling is to delineate the extent and concentration of possible contaminants of concern at the site.	BERS-01, BERS-03, BERS-04, BERS-05, BERS-11,
Site 28 Field QC Samples																					
Field Duplicates	Same as the sample with which it is	Same as the sample with which it is associated	11NC28SS###	Soil	QC	Disposable stainless spoon, bowl for mixing and splitting sample (except volatiles)	One duplicate per 10 primary samples	Same as the sample with which it is associated	Low	21	21	21	0	21	21	21	21	0	21	QC	same as original sample
MS/MSDs for Grab Samples	Same as the sample with which it is	Same as the sample with which it is associated	Same as the sample with which it is associated	Soil	QC	Disposable stainless spoon, bowl for mixing and splitting sample (except volatiles)	One set per extraction batch	0.5, 1.0, 1.5	Low	12	12	12	0	12	12	12	12	0	12	QC Note: One set of MS/MSD samples = 2 samples	same as original sample
Trip Blanks	NA	NA	NA	Water	QC	NA	1 per cooler with VOCs	NA	Low	4	0	4	0	0		0	0	0	0	Trip blanks will accompany all sample shipments for Site 28 and will be placed in coolers containing GRO and BTEX samples.	NA
Site 28 Background Samples (BKG)																					
Twelve primary background samples will be collected from a nearby undisturbed location that does not show anthropogenic impact.	0.0, 0.5, 1.5	28-#-#-ft (Loc IDs will include a transect ID, horizontal ID and depth collected)	11NC28SS001-ft (ft is depth bgs from which its collected)	Soil	Grab	T-handled sampler,disposable stainless spoon	Once	Based on field observations	Low	0	0	0	0	12	12	0	0	0	12	Twelve background samples and field QC samples will be collected from a nearby similar unimpacted drainage to evaluate biogenic interference.	BERS-01, BERS-03, BERS-04, BERS-05, BERS-11,
Site 28 Background Field QC Samples																					
Field Duplicates	Same as the sample with which it is	Same as the sample with which it is associated	11NC28SS##	Soil	QC	T-handled sampler,disposable stainless spoon	One duplicate per 10 primary samples	Same as the sample with which it is associated	Low	0	0	0	0	2	2	0	0	0	2	QC	same as original sample
MS/MSDs for Grab Samples	Same as the sample with which it is	Same as the sample with which it is associated	Same as the sample with which it is associated	Soil	QC	T-handled sampler,disposable stainless spoon	One set per extraction batch	Same as the sample with which it is associated	Low	0	0	0	0	1	1	0	0	0	1	QC Note: One set of MS/MSD samples = 2 samples	same as original sample
Site 28 BKG Soil QC Samples										**0**	**0**	**0**	**0**	**4**	**4**	**0**	**0**	**0**	**4**		
Site 28 BKG Total Soil Samples**										**0**	**0**	**0**	**0**	**16**	**16**	**0**	**0**	**0**	**16**		
Site 28 Total Soil QC Samples										**41**	**37**	**41**	**0**	**37**	**37**	**37**	**37**	**0**	**37**		
Site 28 Total Soil Samples										**251**	**247**	**251**	**0**	**241**	**241**	**241**	**241**	**0**	**241**		
Total Samples										**251**	**272**	**251**	**191**	**247**	**241**	**315**	**241**	**23**	**247**		
										251	272	251	191	247	241	315	241	23	247		

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TABLE 11-2 – WATER FIELD SAMPLING PROGRAM NE CAPE

Table 11-2 Water Field Sampling Program
NE Cape 2011

Sample Location	Total Depth (ft bgs)	Point ID (Location ID)	Sample ID	Matrix	Sample Type	Sampling Method/ Tool	Sampling Frequency	Sample Depth (ft bgs)	Expected Conc Level	Analytical Suite															Sampling Rationale	Contractor Field SOP
										BTEX	GRO	DRO/RRO	PAHs	PCBs	[1]TAL Metals	[2]TAL Dissolved Metals	[3]MNA	Methane	pH	Conductivity	Temperature	[3]ORP	DO	Turbidity		
Site 8 MNA Decision Units																										
Eight individual grid cells within each decision unit (See Figure 15 of the workplan)	NA	Decision unit and grid location (ex. UDU A-4)	11NC08WA001	Water	Grab	Peristaltic pump	Once	NA	Low	0	0	0	0	0	0	0	24	24	24	24	24	24	24	24	Water samples and field parameters will be collected before soil samples from grid locations within three decision units. Grid locations will be selected with a random number generator	BERS-02, BERS-03, BERS-04, BERS-05, BERS-09 BERS-11
Site 8 Decision Unit Field QC Samples																										
Field Duplicates	NA	Same as the sample is associated with	11NC08SWA002 or other unique ID.	Water	QC	Peristaltic pump	One per ten primary samples	Same as the parent sample	Low	0	0	0	0	0	0	0	3	3	0	0	0	0	0	0	Duplicate samples will be collected as part of the project data quality objectives	Same as parent sample
MS/MSDs for Grab Samples	NA	Same as parent sample	NA	Water	QC	Peristaltic pump	NA	NA	Low	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	No methane MS/MSDs will be collected due to analytical method limitations	NA
Trip Blanks	NA	NA	NA	Water	QC	NA	1 per cooler with methane samples	NA	Low	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	Trip blanks will accompany all sample shipments in coolers containing methane samples.	
Site 8 MNA Decision Unit QC Samples										**0**	**0**	**0**	**0**	**0**	**0**	**0**	**3**	**4**	**0**	**0**	**0**	**0**	**0**	**0**		
Site 8 MNA Decision Unit Total Samples										**0**	**0**	**0**	**0**	**0**	**0**	**0**	**27**	**28**	**24**	**24**	**24**	**24**	**24**	**24**		
Site 8 Outfall																										
Two locations previously surveyed at outfall to Suqi	NA	8-01 or 8-10	11NC08WA028 or other unique ID.	Water	Grab	Surface Water Collection-unpreserved container	Once	NA	Low	0	0	2	2	0	0	0	0	0	2	2	2	2	2	2	Water samples will be collected to measure if Site 8 is contributing contaminants to the Suqi River	BERS-02, BERS-03, BERS-04, BERS-05, BERS-09 BERS-11
Site 8 Outfall Field QC Samples																										
Field Duplicates	NA	Same as parent sample	11NC08WA029 or other unique ID.	Water	QC	Same as parent sample	One duplicate per 10 primary samples	Same as parent sample	Low	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	Duplicate samples will be collected as part of the project data quality objectives	Same as parent sample
MS/MSDs for Grab Samples	NA	Same as parent sample	Same as parent sample	Water	QC	Same as parent sample	One set per extraction batch	Same as parent sample	Low	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	MS/MSD samples will be collected as part of the project data quality objectives	Same as parent sample
Site 8 Decision Unit QC Samples										**0**	**0**	**3**	**3**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**	**0**		
Site 8 Decision Unit Total Samples										**0**	**0**	**5**	**5**	**0**	**0**	**0**	**0**	**0**	**2**	**2**	**2**	**2**	**2**	**2**		

TABLE 11-2 – WATER FIELD SAMPLING PROGRAM NE CAPE (continued)

Table 11-2 Water Field Sampling Program
NE Cape 2011 (continued)

Sample Location	Total Depth (ft bgs)	Point ID (Location ID)	Sample ID	Matrix	Sample Type	Sampling Method/ Tool	Sampling Frequency	Sample Depth (ft bgs)	Expected Conc Level	Analytical Suite															Sampling Rationale	Contractor Field SOP
										BTEX	GRO	DRO/RRO	PAHs	PCBs	[1]TAL Metals	~~[1]TAL Dissolved Metals~~	[2]MNA	Methane	pH	Conductivity	Temperature	[3]ORP	DO	Turbidity		
MOC Wells																										
MOC wells;17MW-1, 88-1, 20MW-1, 88-4, MW10-1, 88-10, 22MW2, 26MW1, 88-5 (see Figure 16 of the workplan)	Various-dependent on water level	Loc IDs will be the same as well IDs.	11NCMOCWA001	Water	Grab	Submersible or peristaltic pump with low flow purging	Once	NA	Low	9	9	9	9	9	9	9	9	9	9	9	9	9	9	9	Water samples, water levels and field parameters, including MNA, will be collected at each well location	BERS-02, BERS-03, BERS-04, BERS-05, BERS-08, BERS-09 BERS-11
MOC QC Samples																										
Field Duplicates	Same as parent sample	Same as parent sample	11NC08SS004 or other unique ID.	Water	QC	Submersible or peristaltic pump with low flow purging	One duplicate per 10 primary samples	Same as parent sample	Low	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0	Duplicate samples will be collected as part of the project data quality objectives	Same as parent sample
MS/MSDs for Grab Samples	NA	Same as parent sample	Same as the sample with which it is associated	Water	QC	Submersible or peristaltic pump with low flow purging	One set per extraction batch	Same as parent sample		2	2	2	2	2	2	2	0	0	0	0	0	0	0	0	MS/MSD samples will be collected as part of the project data quality objectives. No methane MS/MSD samples will be collected due to analytical method limitations.	Same as parent sample
Trip Blanks	NA	NA	NA	Water	QC	NA	1 per cooler with VOCs	NA	Low	2	2	0	0	0	0	0	0	2	0	0	0	0	0	0	Three sets of trip blanks will accompany all sample shipments in coolers, one set for GRO, one set for BTEX, and one set for methane.	
MOC QC Samples										**7**	**7**	**5**	**5**	**5**	**5**	**5**	**1**	**3**	**0**	**0**	**0**	**0**	**0**	**0**		
MOC Total Samples										**16**	**16**	**14**	**14**	**14**	**14**	**14**	**10**	**11**	**9**	**9**	**9**	**9**	**9**	**9**		
Total Aqueous QC Samples										**7**	**7**	**8**	**8**	**5**	**5**	**5**	**4**	**7**	**0**	**0**	**0**	**0**	**0**	**0**		
Total Aqueous Samples										**16**	**16**	**19**	**19**	**14**	**14**	**14**	**37**	**39**	**35**	**35**	**35**	**35**	**35**	**35**		

Notes
[1]TAL metals include: arsenic, barium, cadium, chromium, lead, mercury, selenium, silver, nickel and vanadium.
[2]MNA parameters are: nitrate, sulfate, dissolved manganese, ferrous iron, and alkalinity.
[3]ORP=oxidation-reduction potential (redox)
MS/MSD = matrix spike/matrix spike duplicate

Surface Soil Sampling Design: Nine background arsenic samples will be collected upgradient of the 2010 Site 21 soil excavation, in a drainage west of the site. Background sample locations will exhibit vegetative cover and soil type similar to those observed during the 2010 Site 21 excavation. If arsenic is determined to be non-naturally occurring, Bristol may be instructed to excavate contaminated soil from Site 21. A cumulative risk calculation using the EPA PROUCL program will be done.

If excavation of arsenic-contaminated soil occurs at Site 21, confirmation samples will be collected from the excavation per ADEC's *Draft Field Sampling Guidance* (ADEC, 2010). Two floor confirmation samples will be collected for the first 250 square feet of excavated area, and one sample will be collected for each additional 250 square feet of the excavation. Samples will be collected from the excavation sidewalls at a frequency of 1 sample per 20 linear feet. Samples will be collected at the surface of mineral soil or just below the vegetative layer if a vegetative layer is present.

Confirmation samples will be collected at the Tar Removal Area based on square footage of the impacted area. Two samples will be collected for the first 250 square feet and one sample will be collected for each additional 250 square feet of impacted area, as prescribed in 18AAC 78.090 (UST regulations). If the excavation is greater than 1 foot, sidewall samples will be collected at a frequency of 1 sample per 20 linear feet. Samples will be collected at the surface of mineral soil or just below the vegetative layer if a vegetative layer is present.

Site 8 MNA Samples: In 2010, Bristol divided the wetland area into three DUs with approximate dimensions 100 feet long by 40 feet wide, oriented roughly southwest to northeast. Each DU was divided into 40 grids, from which eight grids will be randomly selected for surface water and soil sample collection. Surface water samples for MNA parameters will be collected with a peristaltic pump. From each DU, the eight soil samples will be composited into one laboratory sample in the field. Only grids that contain surface water will be included in the sampling event. Two additional surface water samples will be collected at Site 8 from an area where a small spring creates a small rivulet that flows into the Suqitughneq River.

POL and PCB Confirmation Samples: The DRO confirmation sample grids within excavations at the MOC will be approximately 250 square feet per ADEC requirements (ADEC, 2010). Samples will be collected from the excavation sidewalls at a frequency of 1 sample per 20 linear feet. The POL-impacted soils will not be composited at excavated areas. Floor and sidewall areas will be treated separately.

The PCB confirmation sample grids at Site 13 and Site 31 will be 25 square feet to meet Toxic Substances Control Act (TSCA) sample requirements. The PCB samples may be composited with up to 9 samples per composite. Floor and sidewall areas will be treated separately. Floor samples from the excavation will be composited from contiguous grids and from similar depth levels. Sidewall samples will be a composite of soil samples collected near the mid-point of the sidewall at that location. The PCB composite sample will be made up of discrete samples collected one every 5 feet of horizontal distance along the sidewall for PCB excavations. Analytical results for composite samples will indicate if cleanup goals have been achieved by multiplying the result by the number of discrete samples that went into the composite. If the result is less than one, no further action will be taken over the sampled area. If the result is greater than one, the samples that made up the composite will be analyzed as discrete samples to identify whether any sample locations remain above the 1.0 mg/kg cleanup level. If any area is above 1.0 mg/kg, the area will be re-excavated and resampled.

Sampling techniques include discrete and composite sampling techniques as summarized in Table 11-1 and Worksheet #17.

For both the POL and PCB field screening and confirmation samples, the sample will be collected midway up the wall from each grid at the perimeter of the excavated area. The sidewall depth from the excavated areas will vary from 1.0 foot to possibly up to 15 feet deep, and potentially even deeper if PCB contamination is still above cleanup levels at a depth of 15 feet. The field team will attempt to field screen the most POL-contaminated areas based on visual observations, such as staining and odors.

<u>PCB Wipe Sampling Design</u>: Samples from the concrete will be collected from locations most likely to be exposed to PCBs (e.g., edge of floor drains and areas contacted by PCB contaminated soil). One sample per 250 square feet of exposed concrete will be collected.

<u>Groundwater Sampling Design:</u> Groundwater samples will be collected from nine existing wells that were sampled in 2010 (see Figure 16 in Work Plan). Sampling techniques include low-flow purging as described in Bristol's SOP BERS-02 (Attachment 1). Field parameters (pH, DO, conductivity, temperature, ORP and turbidity) will be collected just prior to analytical sample collection. Analytical samples will also be collected along with MNA parameters (nitrate, sulfate, ferrous iron, dissolved manganese, and alkalinity). Methane samples will also be collected and analyzed by TestAmerica as an MNA parameter.

Site 28 Drainage Basin Sediment and Soil Sampling Design: Sediment and soil sampling will be conducted along 10 transects placed between the upper end of Site 28 and its confluence with the Suqi River. Each transect will encompass the area from the left bank and right bank of the existing, vegetated drainage. Transects will be located to fill data gaps and confirm existing site data. Locations of transects are shown on Figure 13 in the Work Plan. One sample location will be established along every 10 feet of transect, not to exceed 7 distinct sampling locations along each transect, for a total of 70 distinct sampling locations. If all sample locations are not used on a particular transect, additional samples may be collected in other transects after consultation with the on-site USACE QAR. Three samples will be collected at each sampling location, from depths of 0.5 foot bgs, 1.0 foot bgs, and 1.5 feet bgs, for a total of 210 primary samples. Sampling techniques include discrete and composite sampling techniques as discussed in Table 11-1 and Worksheet #17. Sampling tools are identified in Table 11-1 for each type of sample. Additional detail on sample collection is provided in Worksheet #17.

WHO WILL COLLECT AND GENERATE THE DATA

The Bristol field scientists, Eric Barnhill and Lyndsey Kleppin, will collect the field data and environmental samples. The on-site field laboratory run by the Bristol chemist will analyze PCB and POL soil samples for field-screening purposes. The fixed-based analytical laboratory, TestAmerica, will analyze the environmental confirmation samples and generate laboratory results.

HOW WILL THE DATA BE REPORTED

The data will be reported in an HTRW Final Report. The information inputs for the report are made of both existing and new data. The information collected prior to the 2011 HTRW RA will only be summarized to the extent necessary to establish the baseline for the 2011 Final HTRW RA report. Regarding new data, concentrations of compounds will be summarized in report tables, and maps will depict the locations of sampling points. Laboratory analytical reports, field forms (including sampling data forms, etc.), and copies of field log books will be included as attachments to the report. Ultimately, the 2011 HTRW RA Report will be comprehensive in nature and no additional sources of information will be necessary to capture the full extent of the field operations and data collected.

A series of software applications will be utilized to handle chemical data from the time of sample collection to processing for the HTRW RA Report. At the end of the project, chemical data (hard copy and electronic) and associated location information, field sample information, and chain-of-

custody information will be submitted as part of the Final RA report. The Geographic Information System (GIS) data will maintain formatting consistent with Environmental Systems Research Institute, Inc., ArcGIS® software and will conform to the Spatial Data Standards for Facilities, Infrastructure, and Environment. Final GIS deliverables to the USACE may consist of geodatabases and shapefiles. Data deliverables will be compliant with the 2009 USACE Alaska District Manual for Electronic Deliverables (USACE, 2009).

HOW WILL THE DATA BE ARCHIVED

The laboratory data will be saved in existing electronic formats (PDFs of the entire Level IV reports, Corps of Engineers Loading Tool (COELT), and staged electronic data deliverables [SEDD] files will be included as part of the laboratory deliverable package. Planning documents and the final report will be saved in Microsoft® Word, Excel®, and PDF formats in project archives at Bristol. Field notes will be provided as PDFs in an attachment to the final report. All information will be retained on servers and in hard copy formats. The GIS data will maintain formatting consistent with Environmental Systems Research Institute, Inc. (ESRI®) ArcGIS software. Final deliverables to the USACE may consist of geodatabases and shapefiles. The GIS data will conform to the Spatial Data Standards for Facilities, Infrastructure, and Environment (SDSFIE).

All reports and data will be presented in accordance with the Manual for Electronic Deliverables (USACE, 2009).

QAPP WORKSHEET #12-1
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Soil
Analytical Group	**Gasoline Range Organics**
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP BERS-01, BERS-03, BERS-05, BERS-10, BERS-11	AK101 TA-MV-0376 Rev 8	Precision	Relative Percent Difference (RPD) <50%	Field Duplicate (Discrete)	S&A
		Accuracy/Bias/ Contamination	< ½ Limit of Quantitation (LOQ) and 1/10 the amount in any sample or 1/10 the regulatory limit.	Blanks (Method Blank and Trip Blank)	A
		Accuracy/bias	≤20% Difference	Initial Calibration Verification (ICV)	A
		Accuracy	75 to125%	CCV	A
		Accuracy	60 to 120% Recovery	LCS & LCSD	A
		Accuracy	50 to 150% Recovery	MS & MSD	S&A
		Precision	≤20% RPD	LCS, LCSD	A
		Precision	≤50% RPD	MS & MSD	S&A
		Accuracy	Surrogate: a,a,a-Trifluorotoluene 60 to 120% Recovery	Surrogate-Method Blank, LCS & LCSD	A
		Accuracy	Surrogate: a,a,a-Trifluorotoluene 50 to 150% Recovery	Field Samples	S&A
		Sample Handling	Temperature and holding times	Temperature and Time	S&A

QAPP WORKSHEET #12-2
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Soil
Analytical Group	**Diesel Range Organics**
Concentration Level	Low to high

Sampling Procedure	Analytical Method/SOP	DQIs	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP BERS-02, BERS-03, BERS-05, BERS-10, BERS-11	AK102 TA-GS-0363 Rev 13	Precision	RPD<50%	Field Duplicate	S&A
		Accuracy/Bias/ Contamination	< ½ Limit of Quantitation (LOQ) and 1/10 the amount in any sample or 1/10 the regulatory limit.	Blanks (Method Blank)	A
		Accuracy/bias	≤20% Difference	ICV	A
		Accuracy	75 to 125%	CCV	A
		Accuracy	75 to 125% Recovery	LCS & LCSD	A
		Accuracy	72 to 128% Recovery	MS & MSD	A
		Precision	≤20% RPD	LCS/LCSD	A
		Precision	≤20% RPD	MS/MSD	S&A
		Accuracy	Surrogate: o-Terphenyl 60 to 120% Recovery	Surrogate-Method Blank and LCS/LCSD	A
		Accuracy	Surrogate: o-Terphenyl 50 to 150% Recovery	Field Samples	A
		Sample Handling	Temperature and holding times	Temperature and Time	S&A

QAPP WORKSHEET #12-3
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Soil
Analytical Group	**Residual Range Organics**
Concentration Level	Low to High

Sampling Procedure	Analytical Method/SOP	DQIs	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP BERS-01, BERS-03, BERS-05, BERS-10, BERS-11	AK103 TA-GS-0363 Rev 13	Precision	RPD<50%	Field Duplicate (Discrete)	S&A
		Accuracy/Bias/ Contamination	< ½ Limit of Quantitation (LOQ) and 1/10 the amount in any sample or 1/10 the regulatory limit.	Blanks (Method Blank)	A
		Accuracy/bias	≤20% Difference	ICV	A
		Accuracy	75 to 125%	CCV	A
		Accuracy	60 to 120% Recovery	LCS & LCSD	A
		Accuracy	53 to 116% Recovery	MS & MSD	A
		Precision	≤20% RPD	LCS/LCSD, & MS/MSD	A
		Accuracy	Surrogate: n-Triacontane-d62 60 to 120% Recovery	Surrogate-Method Blank and LCS/LCSD	A
		Accuracy	Surrogate: n-Triacontane-d62 50 to 150% Recovery	Field Samples	A
		Sample Handling	Temperature and holding times	Temperature and Time	S&A

QAPP WORKSHEET #12-4
MEASUREMENT CRITERIA PERFORMANCE TABLE

Matrix	Soil
Analytical Group	**PCBs**
Concentration Level	Low to High

Sampling Procedure	Analytical Method/SOP	DQIs	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP BERS-02, BERS-03, BERS-05, BERS-10, BERS-11	SW3550B TA-OP-0302 (extraction) SW8082A TA-GS-0351 (analysis)	Precision	RPD<50%	Field Duplicate	S&A
		Accuracy/Bias/ Contamination	< ½ Limit of Quantitation (LOQ) and 1/10 the amount in any sample or 1/10 the regulatory limit.	Blanks (Method Blank)	A
		Accuracy/bias	≤20% Difference	ICV & CCV	A
		Accuracy	40 to 140% Recovery-Aroclor® 1016 60 to 130% Recovery-Aroclor 1260	LCS/LCSD & MS/MSD	A
		Precision	≤20% RPD	LCS/LCSD & MS/MSD	A
		Accuracy	Surrogates: Tetrachloro-meta Xylene (TCMX) 45 to 155% Recovery; Decachlorobiphenyl 60 to 125%	Surrogate-All samples	A
		Sample Handling	Temperature and holding times	Temperature and Time	S&A

QAPP WORKSHEET #12-5
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Soil
Analytical Group	**BTEX**
Concentration Level	Low/Medium/High

Sampling Procedure	Analytical Method/SOP	DQIs	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP BERS-01, BERS-03, BERS-05, BERS-10, BERS-11	SW8260B, TA-MV-0312 Rev 17	Precision	RPD<50%	Field Duplicate	S&A
		Accuracy/Bias/ Contamination	< ½ Limit of Quantitation (LOQ) and 1/10 the amount in any sample or 1/10 the regulatory limit.	Method Blank, Trip Blank	S&A
		Accuracy/bias	≤20% difference	ICV & CCV	A
		Instrument Performance	Tune criteria consistent with SW8260B	Mass spectrometer tuning check, bromoflourobenzene	A
		Sensitivity	Retention time ±30 seconds from the internal standard (IS) of the calibration mid-point standard and extracted ion current profile area within -50% to +100% of area from IS calibration mid-point standard	Internal Standards	A
		Accuracy	% Recovery, DoD QSM 4.1 Limits	LCS & LCSD	A
		Accuracy	% Recovery, DoD QSM 4.1 Limits	MS & MSD	A
		Precision	RPD< 30%	LCS, LCSD, MS & MSD	A

Matrix	Soil
Analytical Group	**BTEX**
Concentration Level	Low/Medium/High

Sampling Procedure	Analytical Method/SOP	DQIs	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
		Accuracy	4-Bromofluorobenzene-85-120% Toluene d_8 85-115%	Surrogate recoveries	A
		Sample Handling	Temperature and holding times	Temperature and Time	S&A

QAPP WORKSHEET #12-6
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Soil
Analytical Group	PAHs
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	DQIs	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP BERS-01, BERS-03, BERS-05, BERS-10, BERS-11, BERS-14	SW8270C selected ion monitoring (SIM) mode, TA-MS-0313	Precision	RPD<50%	Field Duplicate (Discrete)	S&A
		Accuracy/Bias/ Contamination	< ½ Limit of Quantitation (LOQ) and 1/10 the amount in any sample or 1/10 the regulatory limit.	Blanks (Method Blank)	A
		Accuracy/bias	≤20% difference	ICV & CCV	A
		Instrument Performance	Tune criteria consistent with SW8270C	Mass Spectrometer Tuning Check, DFTPP	A
		Sensitivity	Retention time ±30 seconds from retention time of the IS of the calibration mid-point standard, and extracted ion current profile area within -50% to +100% of area from IS calibration mid-point standard	Internal Standards	A
		Accuracy	% Recovery, in-house limits	LCS, LCSD, MS & MSD	A
		Precision	RPD, In house laboratory limits	LCS/LCSD & MS/MSD	A
		Accuracy	% Recovery, in-house limits	Surrogate recoveries-all samples	A
		Sample Handling	Temperature and holding times	Temperature and Time	S&A

QAPP WORKSHEET #12-7
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Soil
Analytical Group	**ICP/MS Metals**
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	DQIs	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP BERS-02, BERS-03, BERS-05, BERS-10, BERS-11	SW6020A, TA-MT-0217 Rev 21	Precision	RPD<50%	Field Duplicate	S&A
		Accuracy/Bias/ Contamination	< ½ Limit of Quantitation (LOQ) and 1/10 the amount in any sample or 1/10 the regulatory limit.	Blanks (Method Blank/Calibration Blanks)	A
		Accuracy/bias	≤10% Recovery	ICV & CCV	A
		Instrument Performance	Tune criteria consistent with SW6020A and DoD QSM 4.1	Tuning	A
		Accuracy/bias	ICS-A: All non-spiked analytes < LOD ICS-AB: Within ± 20% of expected value	Interfering Element Check Standards	A
		Sensitivity	IS intensity within 30 to 120 of the intensity of the IS calibration	Internal Standards	A
		Accuracy	80 to 120% Recovery	LCS, LCSD, MS & MSD	A
		Precision	<20% RPD	LCS, LCSD, MS & MSD	A
		Sample Handling	Temperature and holding times	Temperature and Time	S&A

*ICP/MS metals are: arsenic, barium, cadmium, chromium, lead, selenium, silver, nickel and vanadium.

QAPP WORKSHEET #12-8
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Soil
Analytical Group	**Mercury**
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP BERS-01, BERS-03, BERS-05, BERS-10, BERS-11, BERS-14	SW7471A, TA-MT-0202 REV 18	Precision	RPD<50%	Field Duplicate (Discrete)	S&A
		Accuracy/Bias/ Contamination	< ½ Limit of Quantitation (LOQ) and 1/10 the amount in any sample or 1/10 the regulatory limit.	Blanks (Method Blank/Calibration Blanks)	A
		Accuracy/bias	80 to 120% Recovery	ICV & CCV	A
		Accuracy	80 to 120% Recovery	LCS, LCSD, MS & MSD	A
		Precision	≤20% RPD	LCS, LCSD, MS & MSD	A
		Sample Handling	Temperature and holding times	Temperature and Time	S&A

QAPP WORKSHEET #12-9
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Soil
Analytical Group	**Total Organic Carbon (TOC)**
Concentration Level	Low/medium/high

Sampling Procedure	Analytical Method/SOP	DQIs	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP BERS-01, BERS-03, BERS-05, BERS-10, BERS-11	SW9060 TA-WC-0157 Rev 12	Precision	RPD<50%	Field Duplicate (Discrete)	S&A
		Accuracy/Bias/ Contamination	< ½ Limit of Quantitation (LOQ) and 1/10 the amount in any sample or 1/10 the regulatory limit.	Blanks (Method Blank)	A
		Accuracy/bias	≤20% difference from true value	ICV & CCV	A
		Accuracy	12.8-187%	LCS & LCSD	A
		Accuracy	76-128%	MS & MSD	A
		Precision	RPD <28%	LCS, LCSD, MS & MSD	A
		Sample Handling	Temperature and holding times	Temperature and Time	S&A

QAPP WORKSHEET #12-10
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water
Analytical Group	**Gasoline Range Organics**
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP BERS-01, BERS-03, BERS-05, BERS-10, BERS-11	AK101 TA-MV-0376 Rev 8	Precision	RPD <30%	Field Duplicate (Discrete)	S&A
		Accuracy/Bias/ Contamination	< ½ Limit of Quantitation (LOQ) and 1/10 the amount in any sample or 1/10 the regulatory limit.	Blanks (Method Blank, Trip Blank)	A
		Accuracy/bias	≤20% Difference	Initial Calibration Verification (ICV) Continuing Calibration Verification (CCV)	A
		Accuracy	75-125%	CCV	A
		Accuracy	60 to 120% Recovery	LCS & LCSD	A
		Accuracy	50 to 150% Recovery	MS & MSD	A
		Precision	≤20% RPD	LCS, LCSD	A
		Precision	≤50% RPD	MS & MSD	A
		Accuracy	Surrogate: a,a,a-Trifluorotoluene 60 to 120% Recovery	Method Blank, LCS & LCSD	A
		Accuracy	Surrogate: a,a,a-Trifluorotoluene 50 to 150% Recovery	Field Samples	A
		Sample Handling	Temperature and holding times	Temperature and Time	S&A

QAPP WORKSHEET #12-11
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water
Analytical Group	**Diesel Range Organics**
Concentration Level	Low to high

Sampling Procedure	Analytical Method/SOP	DQIs	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP BERS-02, BERS-03, BERS-05, BERS-10, BERS-11	AK102 TA-GS-0363 Rev 13	Precision	RPD<30%	Field Duplicate	S&A
		Accuracy/Bias/ Contamination	< ½ Limit of Quantitation (LOQ) and 1/10 the amount in any sample or 1/10 the regulatory limit.	Blanks (Method Blank)	A
		Accuracy/bias	≤20% Difference	ICV & CCV	A
		Accuracy	75 to 125%	CCV	A
		Accuracy	75 to 125% Recovery	LCS & LCSD	A
		Accuracy	61 to 127% Recovery	MS & MSD	A
		Precision	≤20% RPD	LCS/LCSD	A
		Precision	≤27% RPD	MS/MSD	A
		Accuracy	Surrogate: o-Terphenyl 60 to 120% Recovery	Surrogate-Method Blank and LCS/LCSD	A
		Accuracy	Surrogate: o-Terphenyl 50 to 150% Recovery	Field Samples	A
		Sample Handling	Temperature and holding times	Temperature and Time	S&A

QAPP WORKSHEET #12-12
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water
Analytical Group	**Residual Range Organics**
Concentration Level	Low to High

Sampling Procedure	Analytical Method/SOP	DQIs	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP BERS-01, BERS-03, BERS-05, BERS-10, BERS-11	AK103 TA-GS-0363 Rev 13	Precision	RPD<30%	Field Duplicate (Discrete)	S&A
		Accuracy/Bias/ Contamination	< ½ Limit of Quantitation (LOQ) and 1/10 the amount in any sample or 1/10 the regulatory limit.	Blanks (Method Blank)	A
		Accuracy/bias	≤20% Difference	ICV & CCV	A
		Accuracy	75 to 125%	CCV	A
		Accuracy	60 to 120% Recovery	LCS & LCSD	A
		Accuracy	53 to 118% Recovery	MS & MSD	A
		Precision	≤20% RPD	LCS/LCSD	A
		Precision	≤28% RPD	MS/MSD	A
		Accuracy	Surrogate: n-Triacontane-d62 60 to 120% Recovery	Surrogate-Method Blank and LCS/LCSD	A
		Accuracy	Surrogate: n-Triacontane-d62 50 to 150% Recovery	Surrogate-Field Samples	A
		Sample Handling	Temperature and holding times	Temperature and Time	S&A

QAPP WORKSHEET #12-13
MEASUREMENT CRITERIA PERFORMANCE TABLE

Matrix	Water
Analytical Group	**PCBs**
Concentration Level	Low to High

Sampling Procedure	Analytical Method/SOP	DQIs	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP BERS-02, BERS-03, BERS-05, BERS-10, BERS-11	SW8082A TA-OP-0323 (extraction) TA-GS-0351 (analysis)	Precision	RPD<30%	Field Duplicate	S&A
		Accuracy/Bias/ Contamination	< ½ Limit of Quantitation (LOQ) and 1/10 the amount in any sample or 1/10 the regulatory limit.	Blanks (Method Blank)	A
		Accuracy/bias	≤20% Difference	ICV & CCV	A
		Accuracy	25 to 145% Recovery-Aroclor 1016 30 to 145% Recovery-Aroclor 1260	LCS/LCSD & MS/MSD	A
		Precision	≤30% RPD	LCS/LCSD & MS/MSD	A
		Accuracy	Surrogates: TCMX 60 to 150% Recovery; Decachlorobiphenyl 40 to 135%	Surrogate-All samples	A
		Sample Handling	Temperature and holding times	Temperature and Time	S&A

QAPP WORKSHEET #12-14
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water
Analytical Group	**BTEX**
Concentration Level	Low/Medium/High

Sampling Procedure	Analytical Method/SOP	DQIs	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP BERS-02, BERS-03, BERS-05, BERS-10, BERS-11	SW8260B, DV-MS-0010	Precision	RPD<30%	Field Duplicate	S&A
		Accuracy/Bias/ Contamination	< ½ Limit of Quantitation (LOQ) and 1/10 the amount in any sample or 1/10 the regulatory limit.	Blanks (Trip Blank/Method Blank)	S&A
		Accuracy/bias	≤20% difference	ICV & CCV	A
		Instrument Performance	Tune criteria consistent with SW8260B	Mass spectrometer tuning check, BFB	A
		Sensitivity	Retention time ±30 seconds from retention time of the IS and extracted ion current profile area within -50% to +100% of area from IS calibration mid-point standard	Internal Standards	A
		Accuracy	% Recovery, DoD QSM 4.1 Limits	LCS & LCSD	A
		Accuracy	% Recovery, DoD QSM 4.1 Limits	MS & MSD	A
		Precision	RPD 30%RPD	LCS/LCSD, MS/MSD	A

Matrix	Water
Analytical Group	**BTEX**
Concentration Level	Low/Medium/High

Sampling Procedure	Analytical Method/SOP	DQIs	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP BERS-02, BERS-03, BERS-05, BERS-10, BERS-11	SW8260B, DV-MS-0010	Accuracy	1,2-Dichloroethane-d_4 70-120% 4-Bromofluorobenzene 75-120% Dibromofluoromethane 85-115% Toluene d_8 85 to120%	Surrogates-All Samples	A
		Sample Handling	Temperature and holding times	Temperature and Time	S&A

QAPP WORKSHEET #12-15
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water
Analytical Group	**PAHs**
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	DQIs	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP BERS-02, BERS-03, BERS-05, BERS-10, BERS-11, BER-14	SW8270C selected ion monitoring mode, DV-MS-0002	Precision	RPD<30%	Field Duplicate	S&A
		Accuracy/Bias/ Contamination	< ½ Limit of Quantitation (LOQ) and 1/10 the amount in any sample or 1/10 the regulatory limit.	Blanks (Method Blank)	A
		Accuracy/bias	≤20% difference	ICV & CCV	A
		Instrument Performance	Tune criteria consistent with SW8270C	Mass Spectrometer Tuning Check DFTPP	A
		Sensitivity	Retention time ±30 seconds from retention time of the IS of the calibration mid-point standard, and extracted ion current profile area within -50% to +100% of area from IS calibration mid-point standard	Internal Standards	A
		Accuracy	% Recovery, In-house Limits	LCS, LCSD, MS & MSD	A
		Precision	RPD, In house laboratory limits	LCS, LCSD, MS & MSD	A

Matrix	Water
Analytical Group	**PAHs**
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	DQIs	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
		Sample Handling	Temperature and holding times	Temperature and Time	S&A
		Accuracy	2-Fluorobiphenyl (50 to 110% Recovery) Nitrobenzene-d5 (40 to 110% Recovery) Terphenyl-d14 (50 to 135% Recovery)	Surrogates-All samples	A

QAPP WORKSHEET #12-16
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water
Analytical Group	**ICP/MS Metals***
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	DQIs	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP BERS-02, BERS-03, BERS-05, BERS-10, BERS-11	SW6020A, TA-MT-0217	Precision	RPD<30%	Field Duplicate	S&A
		Accuracy/Bias/ Contamination	< ½ Limit of Quantitation (LOQ) and 1/10 the amount in any sample or 1/10 the regulatory limit.	Blanks (Method Blank/Calibration Blanks)	A
		Accuracy/bias	≤10% True Value	ICV & CCV	A
		Instrument Performance	Tune criteria consistent with SW6020A and DoD QSM 4.1	Tuning	A
		Accuracy/bias	ICS-A: All non-spiked analytes < LOD ICS-AB: Within ± 20% of expected value	Interfering Element Check Standards	A
		Sensitivity	IS intensity within 30 to 120% of the intensity of the IS in the initial calibration (ICAL)	Internal Standards	A
		Accuracy	80 to 120% Recovery	LCS, LCSD& MS/MSD	A
		Precision	≤20% RPD	LCS, LCSD, MS & MSD	A

Matrix	Water
Analytical Group	**ICP/MS Metals***
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	DQIs	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
		Accuracy/bias	X5 dilution within ±10% of original value	Serial Dilution	A
		Sample Handling	Temperature and holding times	Temperature and Time	S&A
		Accuracy/bias	Within ±25% of expected value	Post Digestion Spike	A

Note:

*ICP/MS METALS include: arsenic, barium, cadmium, chromium, lead, selenium, silver, nickel and vanadium.

QAPP WORKSHEET #12-17
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water
Analytical Group	**Mercury**
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	DQIs	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP BERS-02, BERS-03, BERS-05, BERS-10, BERS-11	SW7470A, DV-MT-0017	Precision	RPD<30%	Field Duplicate	S&A
		Accuracy/Bias/ Contamination	< ½ Limit of Quantitation (LOQ) and 1/10 the amount in any sample or 1/10 the regulatory limit.	Blanks (Method Blank/Calibration Blanks)	A
		Accuracy/bias	80 to 120% Recovery	ICV & CCV	A
		Accuracy	80 to 120% Recovery	LCS, LCSD, MS & MSD	A
		Precision	≤20% RPD	LCS, LCSD, MS & MSD	A
		Sample Handling	Temperature and holding times	Temperature and Time	S&A

QAPP WORKSHEET #12-18
MEASUREMENT PERFORMANCE CRITERIA TABLE

Matrix	Water
Analytical Group	**Methane**
Concentration Level	Low

Sampling Procedure	Analytical Method/SOP	Data Quality Indicators (DQIs)	Measurement Performance Criteria	QC Sample and / or Activity Used to Assess Measurement Performance	QC Sample Assesses Error for Sampling (S), Analytical (A) or both (S&A)
SOP BERS-01, BERS-03, BERS-05, BERS-10, BERS-11, BERS-14	RSK 175, SV-VG-60	Precision	RPD<30%	Field Duplicate (Discrete)	S&A
		Accuracy/Bias/ Contamination	< ½ Limit of Quantitation (LOQ) and 1/10 the amount in any sample or 1/10 the regulatory limit.	Blanks (Method Blank/Calibration Blanks)	A
		Accuracy/bias	≤75 to 125% Recovery	ICV & CCV	A
		Accuracy	80 to 120% Recovery	LCS, LCSD, MS & MSD	A
		Precision	≤20% RPD	LCS, LCSD, MS & MSD	A
		Sample Handling	Temperature and holding times	Temperature and Time	S&A

QAPP WORKSHEET #13
SECONDARY DATA CRITERIA AND LIMITATIONS TABLE

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Organization, Data Types, Data Generation/Collection Dates)	Data Quality Issues	How Data Will Be Used / Limitations on Data Use
Historical Site Information and Military Operations Groundwater and Soil Quality Data	USACE, 2009. Decision Document: Hazardous, Toxic, and Radioactive Waste (HTRW) Project #F10AK096903, Northeast Cape Formerly Used Defense Site (FUDS) St. Lawrence Island, Alaska. Prepared by U.S. Army Corps of Engineers-Alaska District, January 2009.	USACE, Alaska District, identified areas that either required or did not require remedial action. The report contained historical site summaries from previous investigations.	Data quality issues were not addressed in the document.	Data is used for determining the site-specific cleanup levels.
Groundwater and Soil Quality Data, and In-Situ Remediation Study.	Bristol, 2010. U.S. Army Corps of Engineers, Alaska District In-Situ Chemical Oxidation (Phase I) and Intrusive Drum Removal/Landfill Cap Northeast Cape, St. Lawrence Island, Alaska, January 2010	Bristol, soil, groundwater analytical data, collected July – September, 2009.	No major data quality issues were noted.	Data is used for historical sample data and coordinates.
Soil, Sediment, Surface water, and Groundwater Quality Data. UVOST delineation of fuel contamination.	Bristol, 2011. Northeast Cape HTRW Remedial Actions; Prepared by Bristol Environmental Engineering Services, LLC, February 2011	Bristol, soil, sediment, surface water, and groundwater analytical data, collected July – September, 2010.	No major data quality issues were noted.	Data is used for historical sample data and coordinates.
Soil, Sediment, Surface water, and Groundwater Data	Shannon & Wilson, Inc. 2005. *Phase IV Remedial Investigation, Northeast Cape, St. Lawrence Island, Alaska. Final, June 2005*	Shannon & Wilson, Inc., soil, sediment, groundwater surface water – collected August – September 2004	No major data quality issues were noted.	Data is used for historical sample data and coordinates.

Secondary Data	Data Source (Originating Organization, Report Title, and Date)	Data Generator(s) (Originating Organization, Data Types, Data Generation/Collection Dates)	Data Quality Issues	How Data Will Be Used / Limitations on Data Use
Surface water, groundwater, sediment, surface and subsurface soils data.	Montgomery Watson. 2003. Phase III, Phase III Remedial Investigation Northeast Cape, St. Lawrence Island, Alaska, Final, Prepared by MWH. 2003	MWH, surface water, groundwater, sediment, surface and subsurface soils – Summer 2001 and 2002	No major data quality issues were noted.	Data is used for historical sample data and coordinates.
Soil sample data.	Bristol 2006, U.S. Army Corps of Engineers, Alaska District White Alice Tram and Debris Removal Northeast Cape, St. Lawrence Island, Alaska, Removal Action Report. September 2006.	Bristol, Soil samples collected June – September 2005	No major data quality issues were noted.	Data is used for historical sample data and coordinates.

QAPP WORKSHEET #14
SUMMARY OF PROJECT TASKS

Sampling Tasks:

Worksheet #11 and Tables 11-1 and 11-2 provide details and summaries of sample collection and analyses. Professional land surveyors will reestablish sample locations at Site 8 and excavation areas at Site 13 and Site 31, along with 2010 UVOST probe locations that will be used to guide the excavations at the MOC.

The following sections briefly reiterate the sampling tasks:

Subsurface Soil

- Excavating, processing, and disposing of petroleum-contaminated soils to a depth of up to 15 feet bgs where accessible, or 2 feet below the groundwater, whichever comes first at the MOC, specifically at Sites 10, 11, 13, 15, 19 and 27. Subsurface confirmation soil samples will be collected from excavation limits from the floor if above groundwater and sidewalls;
- Excavating, and disposing of PCB-contaminated soils from Site 13 (Heat and Power Plant) and Site 31 (White Alice Communications Station). Subsurface confirmation soil samples will be collected from excavation limits from the floor if above groundwater and sidewalls;
- Collecting 9 primary background samples near Site 21 to evaluate background levels of arsenic. Excavating, and disposing of arsenic-contaminated soils from Site 21 (Wastewater Treatment Tank). Subsurface confirmation soil samples will be collected from excavation limits;
- Excavating and removing spilled roofing tar south of the MOC. Subsurface confirmation soil samples will be collected from excavation limits;
- Conducting MNA sampling of petroleum-contaminated soil at Site 8 (POL Spill Site);

Surface Sediment/Soil

Surface (0.5 foot bgs) and subsurface sediment/soil (1.0 foot bgs and 1.5 feet bgs) samples will be collected while delineating extent and magnitude of sediment/soil contamination at Site 28 Drainage Basin.

Groundwater

Sample nine monitoring wells at the MOC:

Surface Water

Conduct MNA sampling of petroleum-contaminated surface water at Site 8 (POL Spill Site);

Bulk Bags

A sub-sample will be collected from each DOT-approved bulk bag and will be composited with as many as seven other grab samples to make one composite sample. The sub-sample will consist of soil collected from each end of the containers (two total per bulk bag). Bulk PCB and POL waste sample composites will be submitted to the field-screening laboratory for waste characterization. Bulk tar will be submitted to the confirmation laboratory for Toxicity Characteristic Leaching Procedure (TCLP) extraction and analysis of semivolatile organic compounds (SVOCs).

Analysis Tasks:

Field analyses will consist of measuring temperature, pH, DO, conductivity, ORP, turbidity, nitrate, sulfate, ferrous iron, alkalinity, and dissolved manganese in surface and groundwater. The on-site field-screening laboratory will measure PCBs and DRO for field-screening purposes. TestAmerica will process, prepare, and analyze COCs in surface and subsurface soil, and groundwater, See Tables 11-1 and 11-2 for analytical requirements for each sample. Laboratory analysis will follow the SOPs listed on Worksheet #23.

An on-site field-screening laboratory will utilize gas chromatographs to provide results for DRO/RRO analyzed by Method AK 102/103 and for PCBs analyzed by EPA Method 8082. The field-screening laboratory will not be certified. The SOPs for the field-screening laboratory are in Attachment 5.

Quality Control Tasks:

Field and laboratory QC samples are listed on Worksheets # 12, 24, and 28, and on Tables 11-1 and 11-2.

Tables 11-1 and 11-2 depict only the laboratory QC samples that have an impact on either field collection, or are relevant to the cost of the confirmation sampling. Laboratory QC samples will be prepared and analyzed according to the analytical method requirements and the laboratory's Quality Assurance Plan. Laboratory technical systems audits (TSAs) will be conducted by the Contract Laboratory QA manager prior to the start of the field sampling program, as identified in Worksheet #7. The Bristol Senior Technical Review Chemist will review data as it is submitted to Bristol to ensure that the laboratory is reporting in conformance with the QAPP and QC non-conformance issues are tracked and resolved as soon as possible. All laboratory analyses other than field screening will be performed in accordance with DoD QSM 4.1.

Secondary Data:

See Worksheets # 10 and #13 for a synopsis of secondary data.

Data Management Tasks:

For each sample delivery group (SDG), a final analytical report and two electronic data deliverables (EDDs) will be provided. The final analytical report will be in a searchable PDF. One of the EDDs will be in SEDD format, Stage 2A, and compliant with the POA Instructional_Set. The second EDD will be in the COELT EDF 1.2a format. All reports, photographs, data packages, and other deliverables will be compliant with the USACE, Alaska District, Manual for Electronic Deliverables (USACE, 2009). All laboratory reports and EDDs will be error free and full reports and EDDs will be provided in the Supplemental Data section of the final report. Hard copies of the analytical and QC samples will be provided as hard copy with the final report.

Documentation and Records:

All sample locations will be surveyed by a Professional Land Surveyor and recorded. A field notebook will be used to record information about each sample, along with all field measurements. Information contained in the field books will be in compliance with Section 4.4.6 of the Statement of Work. Each sample will be tracked using secure chain-of-custody protocol until receipt at the laboratory and using laboratory sample logs afterward. Air bills for sample shipping will be retained. Site conditions, field measurements and soil descriptions will be recorded in the logbooks. Additional field forms may be completed as required by Bristol SOPs (see Attachments 1 and 2).

Well purging and sampling information will be recorded on a field form, including notes on groundwater sample collection.

Field Log Books:

Fieldwork will be documented in bound field log books with pre-numbered pages. Each book will contain the following information on the cover:

- Owner of the book
- Book number
- Job name and work order

- Start date
- End date

Daily entries will be recorded in field logbooks. The entries will include:

- Date and time
- Work start/stop times
- Full names and titles/roles of personnel on site, including visitors
- Safety meetings/tailgates
- Level of PPE
- Name(s) of person(s) collecting samples or performing work
- Location of work areas (excavations and landfill areas) and sampling points (sketches when appropriate)
- Sample identification numbers and descriptions
- Sample shipping information (date, time, destination, location)
- Type of field instrumentation (model number and serial number)
- All calibrations performed
- Other work performed
- Any deviations from the work plan

Assessment/Audit Tasks:

Field sample collection and documentation audits will be conducted on site by the Bristol Project CQCSM and on site Chemist-QA/QC Manager as identified in Worksheet #7.

Laboratory Technical Systems Audits will be conducted prior to the initiation of the sampling program by the Contract Laboratory QA manager, as identified in Worksheet #7.

Data Review Tasks:

When final laboratory analytical data has been received, a Bristol subcontractor, AECOM, will perform data verification in accordance with Worksheets #34 thru 37. Bristol will complete the ADEC laboratory data checklists. AECOM will perform data verification after receiving all final reports for the 2011 field effort.

QAPP WORKSHEET #15
REFERENCE LIST AND EVALUATION TABLES

Tables 15-1 and 15-2 present the reporting limits (detection limit [DL], LOD, LOQ) and evaluation criteria tables for soil and groundwater, respectively. These tables identify the analytical groups, site-specific cleanup levels, empirical sample IDs, and reporting limits for which samples collected at the NE Cape sites will be analyzed. For each target analyte/COC, the evaluation criteria have been identified based on either site-specific cleanup levels established in the NE Cape Decision Document (USACE, 2009) or ADEC cleanup levels stated in 18AAC75, section 341, Tables B1 and B2, Migration to Groundwater for Soils and Table C from section 345 for groundwater cleanup levels.

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TABLE 15-1 – REFERENCE LIMITS AND EVALUTATION CRITERIA FOR SOIL AND SEDIMENT

TABLE 15-1 REFERENCE LIMITS AND EVALUATION CRITERIA FOR SOIL and SEDIMENT
NE CAPE

Analyte	Analytical Group	Analytical Method	Preparation Method	CASRN	Units	NOAA SQuiRT Sediment Screening Criteria		Site Specific Cleanup Criteria		Achievable Laboratory Limits		
						SEDIMENT-TEL[3]	SEDIMENT-PEL[3]	SEDIMENT	SOIL	DL	LOD	LOQ
POL												
Gasoline Range Organics (GRO) - C_6 to C_{10}	FUELS	AK101	SW5035A	NS	mg/Kg	NS	NS	NS	300[2]	0.46	1	4
Diesel Range Organics - C_{10} to C_{25}	FUELS	AK102	SW3550B	NS	mg/Kg	NS	NS	3500[1]	9200[1]	2.3	6.17	20
Residual Range Organics - C_{25} to C_{36}	FUELS	AK103	SW3550B	NS	mg/Kg	NS	NS	3500[1]	9200[1]	10	31.7	50
Volatile Organic Compounds												
Benzene	VOC	SW8260B	SW5035A	71-43-2	µg/kg	NS	NS	NS	2000[1]	4	10.0	16.0
Ethylbenzene	VOC	SW8260B	SW5035A	100-41-4	µg/kg	NS	NS	NS	6900[2]	10.00	30.0	40.0
Toluene	VOC	SW8260B	SW5035A	108-88-3	µg/kg	NS	NS	NS	6500[2]	10.00	30.0	40.0
m-Xylene & p-Xylene	VOC	SW8260B	SW5035A	1330-20-7	µg/kg	NS	NS	NS	NS	10.0	30.0	40
o-Xylene	VOC	SW8260B	SW5035A	95-47-6	µg/kg	NS	NS	NS	NS	10.00	30.0	40.0
Xylenes, total	VOC	SW8260B	SW5035A	1330-20-7	µg/kg	NS	NS	NS	63000[2]	10.00	30.0	40.0
Polycyclic Aromatic Hydrocarbons												
Acenaphthene	PAH	SW8270C-SIM	SW3550B	83-32-9	µg/kg	6.71	88.9	500[1]	180000[2]	1.5	2.5	5.0
Acenaphthylene	PAH	SW8270C-SIM	SW3550B	208-96-8	µg/kg	5.87	128	NS	180000[2]	1.5	2.5	5.0
Anthracene	PAH	SW8270C-SIM	SW3550B	120-12-7	µg/kg	46.9	245	NS	3000000[2]	1.5	2.5	5.0
Benzo(a)anthracene	PAH	SW8270C-SIM	SW3550B	56-55-3	µg/kg	31.7	385	NS	3600[2]	1.5	2.5	5.0
Benzo(b)fluoranthene	PAH	SW8270C-SIM	SW3550B	205-99-2	µg/kg	NS	NS	NS	12000[2]	1.5	2.5	5.0
Benzo(k)fluoranthene	PAH	SW8270C-SIM	SW3550B	207-08-9	µg/kg	NS	NS	NS	120000[2]	1.5	2.5	5.0
Benzo(a)pyrene	PAH	SW8270C-SIM	SW3550B	50-32-8	µg/kg	370	782	NS	2100[2]	1.5	2.5	5.0
Benzo(g,h,i)perylene	PAH	SW8270C-SIM	SW3550B	191-24-2	µg/kg	170	NS	1.7[1]	38700000[2]	1.5	2.5	5.0
Chrysene	PAH	SW8270C-SIM	SW3550B	218-01-9	µg/kg	57.1	862	NS	360000[2]	1.5	5.0	5.0
Dibenz(a,h)anthracene	PAH	SW8270C-SIM	SW3550B	53-70-3	µg/kg	6.22	135	NS	4000[2]	1.5	2.5	5.0
Fluoranthene	PAH	SW8270C-SIM	SW3550B	206-44-0	µg/kg	111	2355	2000[1]	1400000[2]	1.5	2.5	5.0
Fluorene	PAH	SW8270C-SIM	SW3550B	86-73-7	µg/kg	21.2	144	800[1]	220000[2]	1.5	2.5	5.0
Indeno(1,2,3-cd)pyrene	PAH	SW8270C-SIM	SW3550B	193-39-5	µg/kg	NS	NS	3200[1]	41000[2]	1.5	2.5	5.0
2-Methylnaphthalene	PAH	SW8270C-SIM	SW3550B	91-57-6	µg/kg	NS	NS	600[1]	6100[2]	2.0	5.0	5.0
Phenanthrene	PAH	SW8270C-SIM	SW3550B	94-09-7	µg/kg	41.9	515	4800[1]	3000000[2]	1.5	2.5	5.0
Pyrene	PAH	SW8270C-SIM	SW3550B	129-00-0	µg/kg	53	875	NS	1000000[2]	1.5	2.5	5.0
Polychlorinated Biphenyls												
PCB-1221	PCB	SW8082A	SW3550B	11104-28-2	mg/kg	NS	NS	0.7[1]	1[1]	0.0032	0.008	0.010
PCB-1016	PCB	SW8082A	SW3550B	12674-11-2	mg/kg	NS	NS	0.7[1]	1[1]	0.0080	0.010	0.010
PCB-1232	PCB	SW8082A	SW3550B	11141-16-5	mg/kg	NS	NS	0.7[1]	1[1]	0.0070	0.010	0.010
PCB-1242	PCB	SW8082A	SW3550B	53469-21-9	mg/kg	NS	NS	0.7[1]	1[1]	0.0021	0.006	0.010
PCB-1248	PCB	SW8082A	SW3550B	12672-29-6	mg/kg	NS	NS	0.7[1]	1[1]	0.0013	0.003	0.010
PCB-1254	PCB	SW8082A	SW3550B	11097-69-1	mg/kg	.06	.34	0.7[1]	1[1]	0.0021	0.006	0.010
PCB-1260	PCB	SW8082A	SW3550B	11096-82-5	mg/kg	NS	NS	0.7[1]	1[1]	0.0030	0.008	0.010
PCBs (sum)	PCB	SW8082A	SW3550B	1336363	mg/kg	0.034	0.277	0.7[1]	1[1]	NS	NS	NS

TABLE 15-1 – REFERENCE LIMITS AND EVALUTATION CRITERIA FOR SOIL AND SEDIMENT (continued)

TABLE 15-1 REFERENCE LIMITS AND EVALUATION CRITERIA FOR SOIL and SEDIMENT
NE Cape (continued)

Analyte	Analytical Group	Analytical Method	Preparation Method	CASRN	Units	NOAA SQuiRT Sediment Screening Criteria		Site Specific Cleanup Criteria		Achievable Laboratory Limits		
						SEDIMENT-TEL[3]	SEDIMENT-PEL[3]	SEDIMENT	SOIL	DL	LOD	LOQ
Total Metals												
Arsenic	Metals	SW6020A	SW3050B	7440-38-2	mg/kg	5900	17000	93 [1]	11[1]	0.368	1	0.50
Barium	Metals	SW6020A	SW3050B	7440-39-3	mg/kg	NS	NS	NS	3.9[2]	0.012	0.03	0.20
Cadmium	Metals	SW6020A	SW3050B	7440-43-9	mg/kg	596	3530	NS	5.0[2]	0.008	0.02	0.20
Chromium	Metals	SW6020A	SW3050B	7440-47-3	mg/kg	37300	90000	270[1]	25[2]	0.072	0.2	0.20
Lead	Metals	SW6020A	SW3050B	7439-92-1	mg/kg	35000	91300	530[1]	400[2]	0.007	0.020	0.20
Mercury	Metals	SW7471B	SW7471B	7439-97-6	mg/kg	174	486	NS	1.4[2]	0.0063	0.01	0.20
Nickel	Metals	SW6020A	SW3050B	7440-02-0	mg/kg	18000	36000	NS	86[2]	0.02	0.05	0.20
Selenium	Metals	SW6020A	SW3050B	7782-49-2	mg/kg	NS	NS	NS	3.4[2]	0.6	1.6	0.70
Silver	Metals	SW6020A	SW3050B	7440-22-4	mg/kg	NS	NS	NS	11.2[2]	0.007	0.02	0.20
Vanadium	Metals	SW6020A	SW3050B	7440-62-2	mg/kg	NS	NS	NS	3400[2]	0.223	0.6	0.50
Zinc	Metals	SW6020A	SW3050B	7440-66-6	mg/kg	123000	315000	960[1]	4100[2]	0.201	0.28	0.70

Notes:

[1]Site Specific Cleanup Values Established in 2009 Decision Document

[2] Cleanup Levels from 18AAC75 Section 341, Tables B1 and B2, migration to groundwater

[3] Screening Values from NOAA SQuiRT Tables, Freshwater Sediment 2009

µg/kg = micrograms per kilogram
CASRN = Chemical Abstracts Service Registry Number
LOD = limit of detection
DL= detection limit
mg/kg = milligrams per kilogram
NA = not applicable
NS = not specified
LOQ = Limit of quantitation

TABLE 15-2 REFERENCE LIMITS AND EVALUATION CRITERIA FOR WATER
NE CAPE

Analyte	Analytical Group	Analytical Method	CASRN	Preparation Method	Units	Site Specific Cleanup Levels	Achievable Laboratory Limits		
						ADEC Cleanup Levels[1]	DL	LOD	LOQ
POL									
Gasoline Range Organics (GRO) - C_6 to C_{10}	TPH	AK101	NS	SW5030B	mg/L	1.3 [2]	0.015	0.044	0.05
Diesel Range Organics - C_{10} to C25	TPH	AK102	NS	SW3510C	mg/L	1.5	0.022	0.06	0.1
Residual Range Organics - C_{25} to C36	TPH	AK103	NS	SW3510C	mg/L	1.1	0.027	0.06	0.1
Volatile Organic Compounds									
Benzene	VOC	SW8260B	71-43-2	SW5030B	µg/L	5.0	0.15	0.45	1.0
Ethylbenzene	VOC	SW8260B	100-41-4	SW5030B	µg/L	700	0.15	0.45	1.0
Toluene	VOC	SW8260B	108-88-3	SW5030B	µg/L	1,000	0.15	0.45	1.0
m-Xylene & p-Xylene	VOC	SW8260B	1330-20-7	SW5030B	µg/L	NS	0.30	0.9	2.0
o-Xylene	VOC	SW8260B	95-47-6	SW5030B	µg/L	NS	0.15	0.45	1.0
Xylenes, total	VOC	SW8260B	1330-20-7	SW5030B	µg/L	10,000	0.45	1.35	3.0
Polynuclear Aromatic Hydrocarbons (PAHs)									
Acenaphthene	PAH	SW8270C-SIM	83-32-9	SW3510C	µg/L	2,200	0.03	0.075	0.13
Acenaphthylene	PAH	SW8270C-SIM	208-96-8	SW3510C	µg/L	2,200	0.03	0.075	0.10
Anthracene	PAH	SW8270C-SIM	120-12-7	SW3510C	µg/L	11,000	0.03	0.075	0.10
Benzo(a)anthracene	PAH	SW8270C-SIM	56-55-3	SW3510C	µg/L	1.2	0.03	0.075	0.10
Benzo(b)fluoranthene	PAH	SW8270C-SIM	205-99-2	SW3510C	µg/L	1.2	0.03	0.075	0.10
Benzo(k)fluoranthene	PAH	SW8270C-SIM	207-08-9	SW3510C	µg/L	12	0.03	0.075	0.10
Benzo(a)pyrene	PAH	SW8270C-SIM	50-32-8	SW3510C	µg/L	0.2	0.03	0.075	0.20
Benzo(g,h,i)perylene	PAH	SW8270C-SIM	191-24-2	SW3510C	µg/L	1,100	0.03	0.075	0.10
Chrysene	PAH	SW8270C-SIM	218-01-9	SW3510C	µg/L	120	0.03	0.075	0.10
Dibenz(a,h)anthracene	PAH	SW8270C-SIM	53-70-3	SW3510C	µg/L	0.12	0.03	0.075	0.10
Fluoranthene	PAH	SW8270C-SIM	206-44-0	SW3510C	µg/L	1,500	0.03	0.075	0.10
Fluorene	PAH	SW8270C-SIM	86-73-7	SW3510C	µg/L	1,500	0.03	0.075	0.10
Indeno(1,2,3-cd)pyrene	PAH	SW8270C-SIM	193-39-5	SW3510C	µg/L	1.2	0.03	0.08	0.10
1-Methylnaphthalene	PAH	SW8270C-SIM	90-12-0	SW3510C	µg/L	150	0.03	0.075	0.10
2-Methylnaphthalene	PAH	SW8270C-SIM	91-57-6	SW3510C	µg/L	150	0.03	0.075	0.10
Naphthalene	PAH	SW8270C-SIM	91-20-3	SW3510C	µg/L	730	0.04	0.075	0.10
Phenanthrene	PAH	SW8270C-SIM	94-09-7	SW3510C	µg/L	11,000	0.03	0.075	0.10
Pyrene	PAH	SW8270C-SIM	129-00-0	SW3510C	µg/L	1,100	0.03	0.075	0.10
Metals									
Arsenic (total)	Metals	SW6020A	7440-38-2	SW3005A	µg/L	NS	0.24	0.4	2.0
Arsenic (dissolved)	Metals	SW6020A	7440-38-2	SW3005A	µg/L	10	0.24	0.4	2.0
Barium (total)	Metals	SW6010C	7440-39-3	SW3005A	µg/L	NS	0.27	0.4	6
Barium (dissolved)	Metals	SW6010C	7440-39-3	SW3005A	µg/L	2,000	0.27	0.4	6
Cadmium (total)	Metals	SW6020A	7440-43-9	SW3005A	µg/L	NS	0.140	0.4	2.0
Cadmium (dissolved)	Metals	SW6020A	7440-43-9	SW3005A	µg/L	5	0.140	0.4	2.0
Chromium (total)	Metals	SW6010C	7440-70-2	SW3005A	µg/L	NS	0.37	0.4	2
Chromium (dissolved) (includes Cr+3 and Cr+6)	Metals	SW6010C	7440-47-3	SW3005A	µg/L	100	0.37	0.4	2

TABLE 15-2. REFERENCE LIMITS AND EVALUATION CRITERIA FOR WATER
NE CAPE (continued)

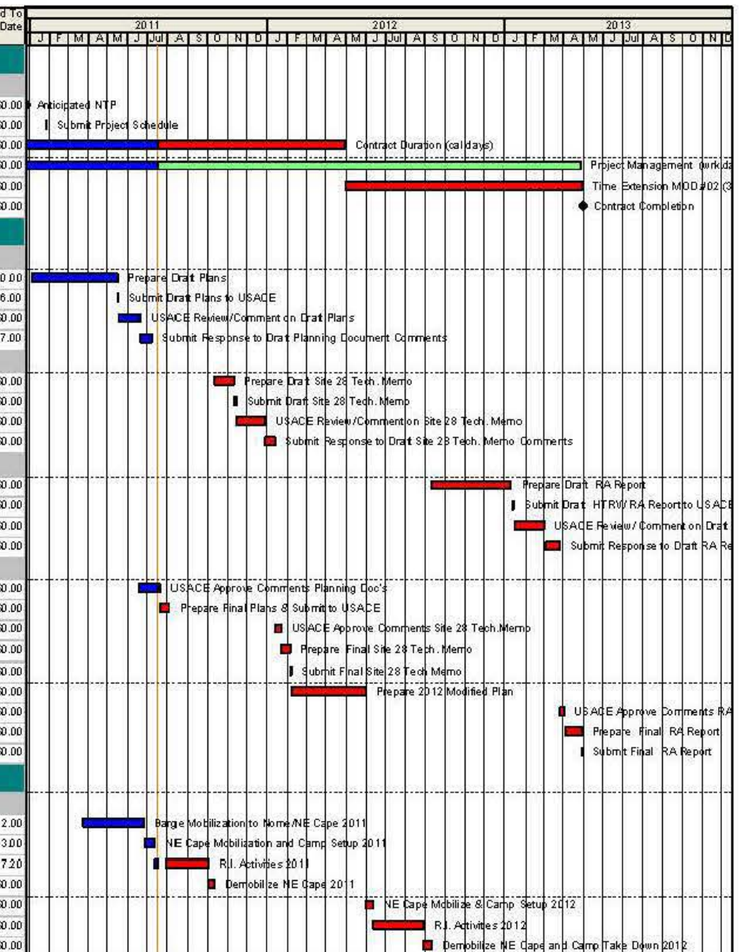
Analyte	Analytical Group	Analytical Method	CASRN	Preparation Method	Units	Site Specific Cleanup Levels	Achievable Laboratory Limits		
						ADEC Cleanup Levels[1]	DL	LOD	LOQ
Lead (total)	Metals	SW6010C	7439-89-6	SW3005A	µg/L	NS	0.17	0.4	2
Lead (dissolved)	Metals	SW6020A	7439-92-1	SW3005A	µg/L	15	0.17	0.4	2.0
Mercury (total)	Metals	SW6020A	7439-96-5	SW3005A	µg/L	NS	0.04	0.1	0.2
Mercury (dissolved)	Metals	SW7470A	7439-97-6	SW7470A	µg/L	2	0.490	1.000	4.00
Molybdenum (total)	Metals	SW7470A	7439-97-6	SW7470A	µg/L	NS	0.490	1.000	4.00
Molybdenum (dissolved)	Metals	SW6010C	7439-98-7	SW3005A	µg/L	NS	0.5	1.0	4
Nickel (total)	Metals	SW6010C	7439-98-7	SW3005A	µg/L	NS	0.2	0.4	2
Nickel (dissolved)	Metals	SW6010C	7440-02-0	SW3005A	µg/L	100	0.2	0.4	2
Selenium (total)	Metals	SW6010C	7440-09-7	SW3005A	µg/L	NS	0.34	0.4	2
Selenium (dissolved)	Metals	SW6020A	7782-49-2	SW3005A	µg/L	50	0.34	0.4	2.0
Silver (total)	Metals	SW6020A	7782-49-2	SW3005A	µg/L	NS	0.15	0.4	2.0
Silver (dissolved)	Metals	SW6020A	7440-22-4	SW3005A	µg/L	100	0.150	0.4	2.0
Vanadium (total)	Metals	SW6020A	7440-31-5	SW3005A	µg/L	NS	0.23	0.4	10
Vanadium (dissolved)	Metals	SW6020A	7440-31-5	SW3005A	µg/L	260	0.23	0.4	10
Zinc (total)	Metals	SW6010C	7440-62-2	SW3005A	µg/L	NS	2.0	5.0	7
Zinc (dissolved)	Metals	SW6020A	7440-66-6	SW3005A	µg/L	5,000	2.0	5	7
Polychlorinated Biphenyls									
PCB-1221	PCB	SW8082A	11104-28-2	SW3520C	µg/L	0.5	0.045	0.08	0.5
PCB-1016	PCB	SW8082A	12674-11-2	SW3520C	µg/L	0.5	0.062	0.06	0.5
PCB-1232	PCB	SW8082A	11141-16-5	SW3520C	µg/L	0.5	0.041	0.05	0.5
PCB-1242	PCB	SW8082A	53469-21-9	SW3520C	µg/L	0.5	0.041	0.06	0.5
PCB-1248	PCB	SW8082A	12672-29-6	SW3520C	µg/L	0.5	0.071	0.06	0.5
PCB-1254	PCB	SW8082A	11097-69-1	SW3520C	µg/L	0.5	0.044	0.06	0.5
PCB-1260	PCB	SW8082A	11096-82-5	SW3520C	µg/L	0.5	0.039	0.08	0.5

Notes:

CASRN = Chemical Abstracts Service Registry Number
DL= detection limit
LOD = limit of detection
LOQ = limit of quantitation
mg/L= milligrams per liter
µg/L = micrograms per liter
NS = not specified
USEPA = U.S. Environmental Protection Agency
[1]Cleanup Levels Stated in 18AAC75 Section 345, Table C, Groundwater Cleanup Level
[2]Site Specific Cleanup Values Established in 2009 Decision Document

QAPP WORKSHEET #16
PROJECT SCHEDULE / TIMELINE TABLE

Activity ID	Activity Name	OD	Early Start	Early Finish	TF	JTD%	Actual Start	Actual Finish	Budgeted Total Cost	Period Earned	Earned To Date
General Conditions											
General Conditions											
GC01	Anticipated NTP	0	Jul-18-11			100 %	Dec-27-10		$0.00	$0.00	$0.00
GC06	Submit Project Schedule	1	Jul-18-11	Jul-18-11		100 %	Jan-26-11	Jan-26-11	$0.00	$0.00	$0.00
GC03	Contract Duration (cal.days)	491	Jul-18-11	Apr-30-12	0	41.34 %	Dec-27-10		$0.00	$0.00	$0.00
GC05	Project Management (wrk.days)	336	Jul-18-11	Apr-26-13	2	0 %	Dec-27-10		$124,740.00	($24,131.25)	$0.00
GC03-1	Time Extension MOD.#02 (365 cd's)	365	May-01-12	Apr-30-13	0	0 %			$0.00	$0.00	$0.00
GC04	Contract Completion	0		May-01-13	0	0 %			$0.00	$0.00	$0.00
Submittals											
Planning Doc's Draft											
P01	Prepare Draft Plans	59	Jul-18-11	Jul-18-11		100 %	Jan-03-11	May-16-11	$70,000.00	$17,796.61	$70,000.00
P01-1	Submit Draft Plans to USACE	1	Jul-18-11	Jul-18-11		100 %	May-17-11	May-17-11	$106.00	$106.00	$106.00
P01-2	USACE Review/Comment on Draft Plans	32	Jul-18-11	Jul-18-11		100 %	May-18-11	Jun-21-11	$0.00	$0.00	$0.00
P02	Submit Response to Draft Planning Document Comments	8	Jul-18-11	Jul-18-11		100 %	Jun-21-11	Jul-08-11	$497.00	$497.00	$497.00
Site 28 - TECH MEMO											
P50	Prepare Draft Site 28 Tech. Memo	21	Oct-12-11	Nov-10-11	0	0 %			$39,000.00	$0.00	$0.00
P50-1	Submit Draft Site 28 Tech. Memo	1	Nov-10-11	Nov-14-11	0	0 %			$358.00	$0.00	$0.00
P50-2	USACE Review/Comment on Site 28 Tech. Memo	45	Nov-14-11	Dec-29-11	0	0 %			$0.00	$0.00	$0.00
P50-3	Submit Response to Draft Site 28 Tech. Memo Comments	11	Dec-29-11	Jan-13-12	0	0 %			$119.00	$0.00	$0.00
2011-2012 RA Report											
P70	Prepare Draft RA Report	83	Sep-10-12	Jan-11-13	0	0 %			$66,778.00	$0.00	$0.00
P70-1	Submit Draft HTRW RA Report to USACE	1	Jan-14-13	Jan-15-13	0	0 %			$387.00	$0.00	$0.00
P70-2	USACE Review / Comment on Draft RA Report	45	Jan-16-13	Mar-02-13	0	0 %			$0.00	$0.00	$0.00
P70-3	Submit Response to Draft RA Report Comments	17	Mar-04-13	Mar-26-13	0	0 %			$922.00	$0.00	$0.00
Final Doc's											
P02-2	USACE Approve Comments Planning Doc's	5	Jul-18-11	Jul-20-11	0	40 %	Jun-18-11		$0.00	$0.00	$0.00
P02-1	Prepare Final Plans & Submit to USACE	11	Jul-20-11	Aug-04-11	0	0 %			$31,000.00	$0.00	$0.00
P50-4	USACE Approve Comments Site 28 Tech.Memo	5	Jan-13-12	Jan-23-12	0	0 %			$0.00	$0.00	$0.00
P51	Prepare Final Site 28 Tech. Memo	10	Jan-23-12	Feb-06-12	0	0 %			$0.00	$0.00	$0.00
P51-1	Submit Final Site 28 Tech Memo	1	Feb-06-12	Feb-07-12	0	0 %			$13,000.00	$0.00	$0.00
P51-2	Prepare 2012 Modified Plan	81	Feb-07-12	Jun-01-12	0	0 %			$0.00	$0.00	$0.00
P70-6	USACE Approve Comments RA Report	5	Mar-27-13	Apr-02-13	0	0 %			$0.00	$0.00	$0.00
P70-4	Prepare Final RA Report	19	Apr-03-13	Apr-29-13	0	0 %			$0.00	$0.00	$0.00
P70-5	Submit Final RA Report	1	Apr-30-13	Apr-30-13	0	0 %			$42,000.00	$0.00	$0.00
Remedial Activities											
Remedial Activities											
1001	Barge Mobilization to Nome/NE Cape 2011	66	Jul-18-11	Jul-18-11		100 %	Mar-25-11	Jun-26-11	$1,266,212.00	$1,266,212.00	$1,266,212.00
1002	NE Cape Mobilization and Camp Setup 2011	12	Jul-29-11	Jul-29-11		100 %	Jun-27-11	Jul-13-11	$755,473.00	$755,473.00	$755,473.00
1003	R.I. Activities 2011	48	Jul-30-11	Oct-01-11	0	10 %	Jul-14-11		$4,883,966.00	$406,997.20	$406,997.20
1004	Demobilize NE Cape 2011	10	Oct-02-11	Oct-11-11	0	0 %			$826,374.00	$0.00	$0.00
1005	NE Cape Mobilize & Camp Setup 2012	12	Jun-01-12	Jun-13-12	0	0 %			$853,107.00	$0.00	$0.00
1006	R.I. Activities 2012	78	Jun-13-12	Aug-30-12	0	0 %			$7,754,312.00	$0.00	$0.00
1007	Demobilize NE Cape and Camp Take Down 2012	11	Aug-30-12	Sep-10-12	0	0 %			$1,326,085.00	$0.00	$0.00



Actual Work
Remaining Work
Critical Remaining Work
Milestone

Cape03

NE Cape 2011 - 2012 Remedial Action DD7-18-11

Page 1 of 1

Bristol ENVIRONMENTAL REMEDIATION SERVICES, LLC

Date	Revision	Checked	Approved
Jan-14-11	cost edits		
Jan-18-11	review		
Apr-07-11	update DD3-31-11		

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QAPP WORKSHEET #17
SAMPLE DESIGN AND RATIONALE

Describe and provide a rationale for choosing the sampling approach (e.g., grid system, biased statistical approach):

The sampling details, such as matrix, analyses type of sampling, sample depth, sampling tools, and rationale for sample collection to be performed at each of the sites are summarized in Worksheet #11 and Tables 11-1 and 11-2. Sample locations are depicted in figures contained in the Work Plan. Specific compounds of potential concern (COPCs) for the various analyses are listed on Tables 15-1 and 15-2. The field procedures that will be applicable in the implementation of the sampling strategies are listed in Worksheet #21 and included in Attachment 1. The rationale for choosing the sampling approach for each site is discussed below.

Sediment and Surface Soil Sampling at Site 28:

Site 28 soil-sediment sampling will be conducted along 10 transects located between the upper end of Site 28 and its confluence with the Suqi River. Each transect will encompass the area from the left bank and right bank of the existing, vegetated drainage. Transect locations will be selected to fill data gaps and confirm existing site data. Transect locations may be altered in the field following consultation with the USACE QAR based on site conditions, such as visual observation or safety issues, at the time of sampling. One sample location will be established along approximately every 10 feet of transect, not to exceed seven distinct sampling locations along any one transect, for a total of 70 distinct sampling locations. If all samples are not used on a particular transect, additional samples may be collected on longer transects or in other areas identified during the Site 28 investigation after consultation with the on-site USACE QAR. Three samples will be collected at each distinct sampling location, the first from a depth of 0.5 feet bgs, the second from a depth of 1 foot bgs, and the third from a depth of 1.5 feet bgs, for a total of 210 primary samples. Samples will be analyzed for BTEX, PAHs, DRO/RRO (with and without silica gel cleanup), PCBs, metals and TOC. The metals are arsenic, barium, cadmium, chromium, lead, mercury, nickel, selenium, silver, vanadium and zinc. Samples for multiple analyses may be collected and submitted in a single jar, except for BTEX analyses. The rationale for sampling is to characterize Site 28 and determine if site conditions have changed since previous sampling events.

Background Arsenic Sampling at Site 21:

Nine background arsenic samples will be collected upgradient of the 2010 Site 21 soil excavation in a drainage west of the site. Sample locations will exhibit vegetative cover and soil type similar to those observed during the 2010 Site 21 excavation. Samples will be submitted to TestAmerica for analysis. If arsenic is determined to be non-naturally occurring, Bristol may be instructed to excavate up to 20 tons of contaminated soil from Site 21.

Subsurface Soil Sampling at Excavation Sites:

Confirmation samples from excavations will be collected using a grid system. Field-screening results from the on-site laboratory for POL and PCBs will indicate when cleanup goals have potentially been achieved in a portion or all of an excavation. Confirmation samples will be collected from the floor and sidewalls of the contaminated areas. Confirmation samples will not be collected from the excavation floor if water has submerged that portion of the floor. The total number of samples collected will be based on the final area excavated, which will be determined in the field.

The PCB soil confirmation samples will be collected for each 25 square feet of excavated area and up to 9 samples may be composited by the laboratory into one analytical sample. Floor samples and sidewall samples will be composited separately. Less than 9 samples may be composited if screening results indicate that the PCB concentrations are less than cleanup levels but above concentrations that would fail the 1/n threshold if up to 9 samples were composited together.

The POL confirmation samples will be collected and analyzed as discrete samples. Two samples will be collected for the first 250 square feet of contaminated area that was excavated, and one sample will be collected from each additional 250 feet of excavated area. Samples will be collected from the excavation sidewalls at a frequency of 1 sample per 20 linear feet.

There is no field screening for arsenic in soil, so only confirmation samples will be collected from the Site 21 excavation. Two floor confirmation samples will be collected for the first 250 square feet and one sample will be collected for each additional 250 square feet of impacted area. Samples will be collected from the excavation sidewalls at a frequency of 1 sample per 20 linear feet.

Two soil confirmation samples for PAHs will be collected from the Tar Removal Area after the tar has been removed for the first 250 square feet of excavation area, and one sample will be collected per ADEC sampling guidance every additional 250 feet of contaminated area that is excavated, as

specified in the ADEC Field Sampling Guidance (ADEC, 2010). If the excavation is greater than 1 foot, sidewall samples will be collected at a frequency of 1 sample per 20 linear feet.

Bulk Waste Sampling Protocol:

The PCB and POL bulk waste samples will be collected from two locations within each bulk bag immediately after they are filled. Bulk waste samples will be stored in sealed glass containers for compositing. Up to seven bulk bags will be composited for waste characterization. If PCB excavation field screening indicates that soil concentrations are greater than 45 mg/kg, then those soils will be bagged, segregated, and manifested as TSCA-level waste without characterizing or compositing. Bulk waste samples will be analyzed by the field-screening laboratory, except for arsenic and tar. Arsenic bulk soil will be analyzed by TestAmerica. The tar bulk waste will be analyzed by TestAmerica for SVOCs following TCLP extraction. Bulk waste results will be used to properly dispose of the wastes at the waste handling facilities.

Site 13 PCB Wipe Sample Collection:

One sample per 250 square feet of exposed concrete will be collected. The sampler will brush the area to be sampled with a hand brush or push broom to remove any soil, sediment, dust or other non-concrete material from the sample location.

Site 8 Soil and Surface Water Collection:

Surface water samples and field parameters for natural attenuation evaluation at Site 8 will be collected from the same DUs as 2010 for comparing natural attenuation parameters as summarized in Table 11-2. Individual grid locations will again be selected using a random number generator. Only grid locations containing surface water will be sampled. The two surface water sample locations near the outfall of Site 8 and the Suqi River will be at the same locations. The Site 8 DU boundaries and surface water sample locations near the outfall will be reestablished using 2010 survey data prior to any sample collection.

Soil samples will be collected from the same grid locations as MNA locations after field parameter and MNA sample collection. A T-handled sampler will be used to collect the soil samples. Soil from the eight locations within each DU will be composited and analyzed for DRO/RRO (with and without silica gel cleanup), PAHs and TOC.

Groundwater:

Locations for groundwater sampling were selected based on the previous results and the condition that wells were in (usable wells) in 2010. The proposed 2011 monitoring well locations at MOC are those that were sampled in 2010. Samples from these existing wells are meant to provide additional information for MNA and monitor COCs. The results will be used to establish contaminant trends and determine if MNA is a viable remedial option.

Describe the sampling design and rationale in terms of what matrices will be sampled, what analytical groups will be analyzed and at what concentration levels, the sampling locations (including QC, critical, and background samples), the number of samples to be taken, and the sampling frequency (including seasonal considerations):

The sampling details, such as media, type of sampling, sample depth, sample analyses, sampling tools, and rationale for sample collection to be performed at each of the project areas is presented in Worksheet #11 and Tables 11-1 and 11-2. The SOPs that will be applicable in the implementation of the sampling strategies are included in Attachment 1.

Soil, sediment, subsurface soil, surface water and groundwater will be sampled. Background levels of arsenic and DRO/RRO will be characterized for soil samples only. Discussion of IDW sampling, characterization, and disposal are provided in the Work Plan (Bristol, 2011b) and BERS-09.

To reduce redundancy, only general information on how decisions were made regarding these elements is presented in the paragraphs below. Worksheet #11 and Tables 11-1 and 11-2 outline the sampling design and rationale, matrices and associated suites of analytes, expected concentration levels, as well as types and number of field and laboratory QC samples applicable to each sub-site.

Based on historical soil data, POL concentrations are expected to be from approximately 250 mg/kg to greater than 70, 000 mg/kg. Arsenic concentrations are expected to be non-detect to approximately 180 mg/kg, and PCBs are expected to be non-detect to greater than 50 mg/kg. Based on historical groundwater data, DRO concentrations are expected to range from non-detect to approximately 12 mg/L, RRO from non-detect to approximately 1.6 mg/L, and benzene from non-detect to approximately 10 µg/L.

Details regarding QC samples are presented in Worksheets #12, #24, and #28.

Investigation Derived Waste Management

Investigation-derived waste will be generated during soil and groundwater sampling and equipment decontamination, and will consist of soil cuttings; purge, development, and decontamination water; and personal protective equipment. Management of soil and water IDW is covered in Bristol's SOP BERS-09 (Attachment 1). Purge water from the MOC wells will be treated on site through a media filtration system. Excess soil will be placed in the proper bulk bags for disposal. Personal protective equipment generated during this field effort is considered nonhazardous and will be disposed of as solid waste.

Sample Preservation

Appropriate preservatives will be added to the sample containers at the laboratory prior to sample container shipment. Worksheet #19 details the specific containers and preservatives required for each media/analyte. The sample containers and preservatives will be supplied by the analytical laboratory. All soil samples, except VOCs, are not preserved except for maintaining temperatures at 4 degrees Celsius ± 2 degrees.

Sample Container Labeling, Storage and Shipment

Refer to Worksheets #26 and #27.

Sample Identification

Sample IDs will contain unique identifying schemes that address the year, NE Cape site, location, type of sample, and chronological sample number, as example: 11NC28SS001

In the example, 11 is the year 2011, NC for NE Cape, 28 for Site 28, SS for soil sample and 001 as the first sample collected at Site 28.

Field duplicates will have a unique ID similar to other samples collected, so as not to be distinguishable from other field samples. The matrix spike/matrix spike duplicate (MS/MSD) samples will have the same ID as the parent sample. Samples selected for MS/MSD QC analysis will be identified on the chain-of-custody.

Decontamination Procedures

Decontamination procedures will be done in accordance with the Bristol's SOP BERS-05 (included in Attachment 1). Sampling options will be selected such that they will minimize the need for decontamination by using disposable sampling equipment. Moreover, to minimize the impact of media contamination on the reusable equipment, an attempt will be made to always sample the least impacted location first and move progressively to the more contaminated areas.

QAPP WORKSHEET #18
SAMPLING LOCATIONS AND METHODS / SOP REQUIREMENTS TABLE

Sample sites, matrices, sample depth, analytical suite, concentration levels, number of samples (including QC such as field duplicates and MS/MSD samples), field sampling SOP references, and the rationale for sampling are included in Worksheet #11 and Tables 11-1 and 11-2. Exact sample locations will be determined based on the size of the excavations using a grid-system for the confirmation samples at Sites 13, Site 31, the MOC, and the Tar Removal Area.

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QAPP WORKSHEET #19
ANALYTICAL SOP AND SAMPLE CONTAINER REQUIREMENTS TABLE

TestAmerica-Tacoma will perform the work in accordance with the requirement set forth in the Quality Assurance Manual (TestAmerica, 2009) (see Attachment 3 for this plan and the ELAP certification) as well as DoD QSM 4.1 (DoD, 2009). Once received at the laboratory, samples will be handled in accordance with the TestAmerica SOP TA-QA-0001, Sample Receipt and Login, and the quality assurance program as specified in SOP TA-QAM, Revision 3. These SOPs and those listed below are included as Attachment 4 of this UFP QAPP. Dissolved gas samples will be analyzed for methane by TestAmerica Denver. Samples will be forwarded from TestAmerica-Tacoma to TestAmerica-Denver as specified in Work Sharing Process (SOP CA-CS-001 Rev. 2, effective 23 Nov 2009).

Soil samples may be combined in a single jar for multiple analyses where appropriate. Extra jars will be collected for MS/MSD analyses. Water samples for DRO/RRO analyses can be extracted from a single container.

Analytical Group	Analytical Method	Preparation Method	Conc. Level	Sample Extraction Volume	Container Quantity/Size/Type	Preservation	Maximum Holding Time for Preparation/ Analysis	Analytical SOP
Water								
TPH-GRO (C_6-C_{10})	AK101	SW5030B	Low	5mL	3 x 40-mL glass VOA vials with Teflon® septum top	4±2°C, HCL to pH<2	14 days from sample collection until analysis	TA-MV-0376, Rev 8 Effective 16 Apr 2010
TPH-DRO (C_{10}-<C_{25})	AK102	SW3510C	Low	1 Liter	2 x 1-L amber glass with Teflon-lined cap.	4±2°C, HCL to pH<2	7 days from sample collection until extraction; 40 days from extraction until analysis	TA-GS-0363, Rev 13 Effective 26 Mar 2010

Analytical Group	Analytical Method	Preparation Method	Conc. Level	Sample Volume	Container Size/Type	Preservation	Maximum Holding Time for Preparation/ Analysis	Analytical SOP
Water								
TPH-RRO (<C25-C36)	AK103	SW3510C	Low	1 Liter	2 x 1-L amber glass with Teflon-lined cap.	4±2°C, HCL to pH<2	7 days from sample collection until extraction; 40 days from extraction until analysis	TA-GS-0363, Rev 13 Effective 26 Mar 2010
BTEX	SW8260B	SW5030B	Low	5 mL	3 x 40-mL glass VOA vials with Teflon septum top	4±2°C, HCL to pH<2	14 days from sample collection until analysis (if preserved with HCl as described)	TA-MV-0312 Rev 17 Effective 16 Apr 2010
PAH	SW8270C-SIM	SW3510C	Low	1 Liter	2 x 1-L amber glass with Teflon-lined cap.	4±2°C	7 days from sample collection until extraction; 40 days from extraction until analysis	TA-MS-0313, Rev 16 Effective 26 Mar2010
Metals (except mercury)	SW6020A	SW3005A	Low	50 mL	1 x 100-mL HDPE	4±2°C, HNO_3 to pH<2	180 days from sample collection until analysis	TA-MT-0217, Rev 21 Effective 16 Apr 2010
Mercury	SW7470A	SW7470A	Low	50 mL	1 x 100-mL HDPE	4±2°C, HNO_3 to pH<2	28 days from sample collection until analysis	TA-MT-0212, Rev 18 Effective 4 Jun 2010

Analytical Group	Analytical Method	Preparation Method	Conc. Level	Sample Volume	Container Size/Type	Preservation	Maximum Holding Time for Preparation/ Analysis	Analytical SOP
PCBs	SW8082A	SW3510C	Low	1 Liter	2 x 1-L amber glass with Teflon-lined cap.	4±2°C	7 days from sample collection until extraction; 40 days from extraction until analysis	TA-GS-0351-Rev 17, Effective 29 Apr 2010
Methane	RSK-175	5030B	Low	18 mL	3 x 40-mL glass VOA vial with Teflon septum top	4±2°C, HCL to pH<2	14 days from sample collection until analysis (if preserved with HCl as described)	(Denver) DV-GC-0025 Rev 2.3 Effective 8 Oct 2010
Soil								
TPH-GRO (C_6-C_{10})	AK101	SW5035A	Mid/High	25 g	Pre-tared 4 oz jar with Teflon septa, 25-mL methanol & surrogate in VOA vial (added immediately after sample collection)	4±2°C methanol	14 days from sample collection until analysis	TA-MV-0376, Rev 8 Effective 16 Apr 2010
TPH-DRO (C_{10}-<C_{25})	AK102	SW3550B	Low	30 g	(1) 4-oz or 8-oz jar with Teflon-lined cap.	4±2°C	14 days from sample collection until extraction; 40 days from extraction until analysis	TA-GS-0363, Rev 13 Effective 26 Mar 2010

Analytical Group	Analytical Method	Preparation Method	Conc. Level	Sample Volume	Container Size/Type	Preservation	Maximum Holding Time for Preparation/ Analysis	Analytical SOP
TPH-RRO ($<C_{25}$-$<C_{36}$)	AK103	SW3550B	Low	30 g	(1) 4-oz or 8-oz jar with Teflon-lined cap.	4±2°C	14 days from sample collection until extraction; 40 days from extraction until analysis	TA-GS-0363, Rev 13 Effective 26 Mar 2010
BTEX	SW8260B	SW5035A	Medium	25 g	Pre-tared 4 oz jar with Teflon septa, 25-mL methanol in VOA vial (added immediately after sample collection)	4±2°C methanol	14 days from sample collection until analysis (if preserved with MeOH as described)	TA-MV-0312, Rev 17 Effective 16 Apr 2010
PAH	SW8270C-SIM	SW3550B	Low	30 g	(1) 4-oz or 8-oz jar with Teflon-lined cap.	4±2°C	14 days from sample collection until extraction; 40 days from extraction until analysis	TA-MS-0313, Rev 16 Effective 26 Mar 2010
Metals (except mercury)	SW6020A	SW3050B	Low	1 to 5 g	(1) 4-oz or 8-oz jar with Teflon-lined cap.	4±2°C	180 days from sample collection until analysis	TA-MT-0217, Rev 21 Effective 16 Apr 2010

Analytical Group	Analytical Method	Preparation Method	Conc. Level	Sample Volume	Container Size/Type	Preservation	Maximum Holding Time for Preparation/ Analysis	Analytical SOP
Mercury	SW7471A	SW7471A	Low	0.2 to 1 g	(1) 4-oz or 8-oz jar with Teflon-lined cap.	4±2°C	28 days from sample collection until analysis	TA-MT-0212, Rev 18 Effective 4 Jun 2010
PCBs	SW8082A	SW3550B	Low	30 g	(1) 4-oz or 8-oz jar with Teflon-lined cap.	4±2°C	14 days from sample collection until extraction; 40 days from extraction until analysis	TA-GS-0351-Rev 17, Effective 29 Apr 2010
Total Organic Carbon (TOC)	SW9060	SW9060	Low-Med-High	3 grams	(1) 4-oz or 8-oz jar	4±2°C	28 Days, Sediments may be frozen for up to 6 months	TA-WC-0157, Rev 12,

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QAPP WORKSHEET #20
FIELD QUALITY CONTROL SAMPLE SUMMARY TABLE

Field QC samples are included in Worksheet #11, Tables 11-1 and 11-2 and Worksheet #28. These tables identify the matrices of the samples, the analytical suite, number of samples and sample locations, duplicates for grab samples, as well as the estimated total number of samples per analytical suite to be analyzed for the SIs. No field blanks or equipment rinsates are planned for this field effort. Trip blanks for BTEX, GRO, and methane will be included with all volatile samples and shipped in the same coolers. Moreover, the analytical and preparation SOPs for the QC samples are the same as the SOPs employed during collection of the associated environmental samples that are depicted in Worksheet #19.

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QAPP WORKSHEET #21
PROJECT SAMPLING SOP REFERENCES TABLE

Reference Number	Title, Revision Date, and/or Number	Organizing Organization	Equipment Type	Modified for Project Work (Check if yes)	Comments
BERS-01	Soil Sampling - Revision 2	Bristol Team	Various, including but not limited to: spoons, shovels, hand-augers, split spoon samplers, backhoes, acetate sleeves, coring devices, and sample containers	No	Note how to avoid cross-contamination of samples and how to ensure representative soil samples. Modified SOP to address frozen low-level VOC soil samples.
BERS-02	Groundwater Sampling - Revision 2	Bristol Team	Submersible or peristaltic pumps and disposable tubing, YSI multi-meter, and water level indicator.	No	Purging requirements and low-flow sampling.
BERS-03	Sample Management – Revision 1	Bristol Team	Sample containers, labels, chain of custody, custody seals, sample coolers, shipping labels, clear tape, plastic baggies, inert packing material, and gel ice or water ice	No	Follow EPA Office of Solid Waste and Emergency Response (OSWER) Directive #9240.0-05A *Specifications and Guidance for Contaminant-Free Sample Containers* (EPA *540/R-93/05* 1, December 1992).
BERS-04	Field Measurement & Test Equipment – Revision 1	Bristol Team	Various, including but not limited to: multi-parameter water quality meters and turbidity meters.	No	Follow manufacturer's instructions regarding calibration and maintenance of field equipment.
BERS-05*	Equipment Decontamination – Revision 2	Bristol Team	Non-phosphate rinse and tap water. Deionized/distilled water when sampling for trace organic compounds.	No	Use disposable equipment when possible; use of some cleaning agents will create IDW.
BERS-08	Water Level Measurement – Revision 1	Bristol Team	Pumps, water quality monitoring instruments, and water level indicator	No	Decontaminate equipment between water level measurements. Air monitoring of well casing may be required.

Reference Number	Title, Revision Date, and/or Number	Organizing Organization	Equipment Type	Modified for Project Work (Check if yes)	Comments
BERS-09	IDW Management – Revision 1	Bristol Team	Nonhazardous waste disposal – on-site Dumpsters, waste treatment systems, impervious surfaces; hazardous waste disposal - varies	No	Suspected hazardous waste to be tested for proper classification prior to disposal.
BERS-11	Field Documentation – Revision 0	Bristol Team	Field book and field forms	No	Proper use of field books, and information required for various field tasks.
BERS-12	Excavation and Trenching – Revision 0	Bristol Team	Heavy equipment	No	Addresses trenching and regulations set in 29 CFR, USACE Manual 385 1-1.
BERS-13	General Backfill and Compaction – Revision 0	Bristol Team	Heavy equipment	No	Describes safe operation around backfill and compaction activities.
BERS-15	Document Control System – Revision 0	Bristol Team	None	No	None
BERS-17	Trimble GPS Procedures-Revision 1	Bristol Team	Handheld GPS	No	Describes coordinate systems, compliance with Spatial Data Standards for Facilities, Infrastructure and Environment (SDSFIE) and Post-Processing.

*Note: Heavy equipment decontamination will deviate from the SOP slightly. No water will be used to decontaminate the heavy equipment. Rakes, shovels, and brushes will be used to remove all soil from the excavator bucket and tracks. It is expected that only the excavator buckets will contact contaminated soil.

QAPP WORKSHEET #22
FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING AND INSPECTION TABLE

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
YSI 556 Multi-Probe System	Calibrate probe with pH, conductivity, ORP, and DO standards	Decontaminate and place in hard case between sampling activities	Field test in accordance with the manual	Inspect for external damage (i.e., connections, liquid crystal display(LCD) screen, etc.)	Daily, before use and when unstable readings occur	Within calibration standard(s) range	Recalibration	Field personnel	BERS-04
Hach 2100P Turbidimeter	Calibrate with Gelex Secondary Turbidity Standards	Keep clean and place in hard case between sampling activities	Field test in accordance with the manual	Inspect for external damage (i.e., LCD screen, etc.)	Daily, before use and when unstable readings occur	Within calibration standard(s) range	Recalibration	Field personnel	BERS-04
Electronic Water Level Meter	Not applicable. Operate in accordance with the manufacturer's instructions	Decontaminate between wells	Field test in accordance with the manual	Inspect tape for kinks and cuts, inspect probe for dirt, check batteries	Daily	Response	Replace battery if no response during test button check. If battery replacement does not correct problem, replace meter.	Field personnel	BERS-08
Trimble® GeoXT™ Global Positioning System Unit	Validate accuracy using nearby benchmark	Charge battery and place in case at the end of each day	Field test in accordance with the manual	Inspect for external damage (i.e., LCD screen, dents, etc.).	Daily	Refer to manufacturer's instructions	Refer to manufacturer's instructions	Field personnel	See Equipment Manual
Gas Chromatograph	Initial and continuing calibration checks	Change septa, add rinse solvent	Analyze soil samples for PCBs or DRO	Check for leaks, inspect moving parts	Daily	Acceptable calibration	Fix problems, recalibrate	Chemist	Field-Screening SOP

Field Equipment	Calibration Activity	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
Lab Balance	Daily Calibration Check	Keep balance clean	Weigh samples	Calibration check	Daily	Within 1% of actual weight	Recalibrate	Chemist	NA

QAPP WORKSHEET #23
ANALYTICAL SOP REFERENCES TABLE

Laboratory Analytical SOP References						
Reference Number	**Title, Revision Date, and/or Number**	**Definitive or Screening Data**	**Analytical Group**	**Instrument**	**Organization Performing Analysis**	**Modified for Project Work?**
NA	DoD Quality Systems Manual for Environmental Laboratories, Version 4.1, 22 Apr 2009	NA	General	NA	DoD Environmental Quality Workgroup (EDQW)	No
TA-QAM	TestAmerica Laboratories Tacoma Quality Assurance Manual, Revision 3, Effective 30 Jun 2010	NA	General	NA	TestAmerica, Tacoma, WA	No
TA-QA-0001	Sample Receiving and Login, Revision 20, Effective 7 Jun 2010	NA	General	NA	TestAmerica, Tacoma, WA	No
TA-QA-0003	Sample Data Processing, Revision 14, Effective 26 Mar 2010	NA	General	NA	TestAmerica, Tacoma, WA	No
TA-QA-0032	Sample Documentation, Revision 11, Effective 31 Mar 2010	NA	General	NA	TestAmerica, Tacoma, WA	No
TA-QA-0601	Quality Assurance Audit Procedures	NA	General	NA	TestAmerica, Tacoma, WA	No
TA-QA-0606	QA Review of Audit Reports, Effective 4 Nov, 2010	Definitive	General	NA	TestAmerica, Tacoma, WA	No
CA-C-S-004	Work Sharing Process, Revision 2, Effective 23 Nov 2009	NA	General	NA	TestAmerica, Tacoma, WA	No
TA-MV-0376	Gasoline Range Organics Analysis, Rev 8 Effective 16 Apr 2010	Definitive	TPH-GRO	GC/FID	TestAmerica, Tacoma, WA	No
TA-GS-0363	Diesel and/or Residual Range Organics (Methods AK102 & AK103), Rev 13 Effective 26 Mar 2010	Definitive	TPH-DRO/RRO	GC/FID	TestAmerica, Tacoma, WA	No
TA-MV-0312	Determination of Volatile Organics by GC/MS, SW-846 8260B, Revision 17, Effective 16 Apr 2010	Definitive	BTEX	GC/MS	TestAmerica, Tacoma, WA	No
TA-MS-0313	Semi-Volatile Organic Compounds Analysis by GC/MS Selected Ion Monitoring, SW-846 8270C, Revision1 6, Effective 26 Mar 2010	Definitive	PAHs	GC/MS	TestAmerica, Tacoma, WA	No

Laboratory Analytical SOP References						
Reference Number	**Title, Revision Date, and/or Number**	**Definitive or Screening Data**	**Analytical Group**	**Instrument**	**Organization Performing Analysis**	**Modified for Project Work?**
TA-MT-0202	Mercury Analysis by Cold Vapor Atomic Absorption, SW-846, Methods 7470A and 7471A, Revision 18, Effective 16 Apr 2010	Definitive	Metals-Mercury	cold vapor atomic adsorption spectroscopy (CVAAS)	TestAmerica, Tacoma, WA	No
TA-MT-0217	Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) SW-846 Method 6020, Revision 21, Effective 16 Apr 2010	Definitive	Metals	ICP-MS	TestAmerica, Tacoma, WA	No
TA-GS-0351	PCBs by Method 8082, Revision 17, Effective 26 Mar 2010	Definitive	PCBs	GC/ECD	TestAmerica, Tacoma, WA	No
DV-GS-0025	Dissolved Gases in Water, Method No. RSK-175, Revision 2.3, Effective 8 Oct 2010	Definitive	NA	GC/FID	TestAmerica, Denver, CO	No
TA-WC-0157	Total Organic Carbon in Solids, Revision 12, Effective 12 Nov 2009	Definitive	Organics	TOC Analyzer	TestAmerica, Tacoma, WA	No

QAPP WORKSHEET #24
ANALYTICAL INSTRUMENT CALIBRATION TABLE

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
GC/FID (purgeable)	Initial multipoint calibration for target analytes (minimum five standards)	Initial calibration is performed prior to sample analysis initially upon instrument set up, after major changes to system, or when initial or continuing calibration criteria cannot be met. A second source initial calibration verification (ICV) standard is run after an acceptable calibration and a continuing calibration verification (CCV) standard is analyzed after every 10 samples and at the end of the analytical sequence: percent difference (%D)≤20%	One of the options below: *Option 1*: linear – relative standard deviation (RSD) for each analyte ≤ 20% *Option 2*: linear – least squares regression $r^2 \geq 0.995$ for each analyte or *Option 3*: non-linear – coefficient of determination (COD) ≥ 0.99 (six points shall be used for second order, seven points shall be used for third order)	Correct problem, document in maintenance log, then repeat initial calibration.	Analyst	TA-MV-0376, Rev 8 Effective 16 Apr 2010
GC/FID (extractable)	Initial multipoint calibration for target analytes (minimum five standards)	Initial calibration is performed prior to sample analysis initially upon instrument set up, after major changes to system, or when initial or continuing calibration criteria cannot be met. A second source ICV standard is run after an acceptable calibration and a CCV standard is analyzed after every 10 samples and at the end of the analytical sequence: %D≤20%	One of the options below: *Option 1*: linear – RSD for each analyte ≤ 20% *Option 2*: linear – least squares regression $r^2 \geq 0.995$ for each analyte or *Option 3*: non-linear – COD ≥ 0.99 (six points shall be used for second order, seven points shall be used for third order)	Correct problem, document in maintenance log, then repeat initial calibration.	Analyst	TA-GS-0363, Rev 8 Effective 16 Apr 2010

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
GC/MS (purgeable)	Check of mass spectral ion intensities (tuning procedure) using BFB (8260B)	Prior to ICAL and at the beginning of each 12-hour period.	Refer to method/SOP for specific ion criteria.	Retune instrument and verify.	Laboratory Manager / Analyst [b]	TA-MV-0312, Rev 17 Effective 16 Apr 2010
GC/MS (purgeable)	Initial multipoint calibration for target analytes (minimum five standards)	Initial calibration is performed prior to sample analysis initially upon instrument set up, after major changes to system, or when initial or continuing calibration criteria cannot be met. A second source ICV standard is run after an acceptable calibration and a CCV standard is analyzed daily and every 12 hours: %D≤20%	1. Average Response Factor for SPCCs: ≥ 0.30 for chlorobenzene, and 1,1,2,2-tetrachloroethane; ≥ 0.10 for chloromethane, bromoform, and 1,1-dichloroethane 2. RSD for RFs for CCCs: ≤ 30% and one option below: Option 1: RSD for each analyte ≤ 15% Option 2: Linear regression r ≥ 0.995 Option 3: Non linear regression r^2 ≥ 0.990 and 6 points must be used.	Terminate analysis; correct the problem; recalibrate. Problem must be corrected. No samples may be run until ICAL-ICV has passed.	Analyst	TA-MV-0312, Rev 17 Effective 16 Apr 2010
GC/MS (extractable)	Check of mass tuning using DFTPP	Prior to ICAL and at the beginning of each 12-hour period.	Method specific criteria. Section 10.5 of SOP	Retune instrument and verify.	Laboratory Manager / Analyst [b]	TA-MS-0313 Revision 16 Effective 26 Mar 2010

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
GC/MS (extractable)	Breakdown Check	At the beginning of each 12-hour period and prior to analyzing samples	Degradation ≤ 20% for DDT. Benzidine and PCP should be present at their normal responses, and should not exceed a tailing factor of 2.	Correct problem then repeat breakdown check. No samples can be run until degradation is acceptable.	Laboratory Manager / Analyst [b]	TA-MS-0313 Revision 16 Effective 26 Mar 2010
GC/MS (extractable)	Minimum five-point initial calibration for target analytes, lowest concentration standard at or near the reporting limit (ICAL).	Initial calibration is performed prior to sample analysis initially upon instrument set up, after major changes to system, or when initial or continuing calibration criteria cannot be met. A second source ICV standard is run after a acceptable calibration and a CCV standard is analyzed daily and every 12 hours: %D≤20%	1. Average Response Factor for SPCCs: ≥ 0.050 2. RSD for RFs for CCCs: ≤ 30% and one option below: Option 1: RSD for each analyte ≤ 15% Option 2: Linear regression r ≥ 0.995. Option 3: Non-linear regression r^2 ≥ 0.990 and 6 points must be used.	Terminate analysis; correct the problem; recalibrate. Problem must be corrected. No samples may be run until ICAL has passed.	Laboratory Manager / Analyst [b]	TA-MS-0313 Revision 16 Effective 26 Mar 2010
ICP/MS	Tuning	Prior to initial calibration	Mass calibration ≤ 0.1 atomic mass unit (amu) from true value; Resolution < 0.9 amu full width at 10% peak height; For stability, RSD ≤ 5% for at least four replicate analyses.	Correct problem, then repeat tuning.	Laboratory Manager / Analyst [b]	TA-MT-0217, Rev 21 Effective 16 Apr 2010
ICP/MS	If more than one standard is used, correlation coefficient must be ≥ 0.995	Initial calibration is performed daily prior to sample analysis and initially upon instrument set-up, after major changes to system, or when initial or continuing calibration criteria cannot be met.	Calibration curve correlation coefficient ≥ 0.995 if more than one standard and a blank; calibration verification acceptance ranges must be met: ICV/CCV ±10% recovery of true value.	Correct problem, then repeat initial calibration. Reported samples must be bracketed by compliant QC.	Analyst	TA-MT-0217, Rev 21 Effective 16 Apr 2010

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
CVAAS	Initial multipoint calibration for target analytes (minimum three standards and blank)	Initial calibration is performed daily prior to sample analysis and initially upon instrument set-up, after major changes to system, or when initial or continuing calibration criteria cannot be met.	Calibration curve correlation coefficient ≥0.995; calibration verification acceptance ranges must be met: ICV/CCV ±10% recovery of true value.	The validity of the calibration is determined by the subsequent calibration verifications. If invalid, identify and correct problem, then repeat ICAL.	Analyst	TA-MT-0200, Rev 18 Effective 16 Apr 2010
GC/ECD (PCBs)	Initial multipoint calibration for target analytes (minimum five standards)	Initial calibration is performed prior to sample analysis initially upon instrument set-up, after major changes to system, or when initial or continuing calibration criteria cannot be met. A second source ICV standard is run after an acceptable calibration and a CCV standard is analyzed after every 10 samples, and at the end of the analytical sequence: %D≤20%.	One of the options below: *Option 1*: linear – RSD for each analyte ≤ 20% *Option 2*: linear – least squares regression $r^2 \geq 0.995$ for each analyte or *Option 3*: non-linear – COD ≥ 0.99 (six points shall be used for second order, seven points shall be used for third order)	Evaluate standards, chromatography, and detector response. If problem found with above, correct as appropriate, then repeat initial calibration.	Laboratory Manager / Analyst [b]	WS-GC-0002, Rev 17 Effective 26 Mar, 2010
GC-FPD/TCD (headspace)	ICAL – Minimum 5 points. Lowest point at or below RL. Upper point defines calibration range.	Initially, and when CCV is unacceptable	<25% RSD r2>0.990	Correct problem. Recalibrate.	Analyst	DV-GS-0025 Revision 2.3 Effective 8 Oct 2010

Instrument	Calibration Procedure	Frequency of Calibration	Acceptance Criteria	Corrective Action	Person Responsible for Corrective Action	SOP Reference
GC-FPD/TCD (headspace)	Second Source Calibration Verification (ICV)	After each ICAL	<25% D	Correct problem. Recalibrate or reanalyze ICV.	Analyst	DV-GS-0025 Revision 2.3 Effective 8 Oct 2010
GC-FPD/TCD (headspace)	Continuing Calibration Verification (CCV)	Every 24 hours or 20 samples	<25% D	Correct problem. Reanalyze CCV and all affected samples.	Analyst	DV-GS-0025 Revision 2.3 Effective 8 Oct 2010
TOC Analyzer	ICAL - Minimum 5 points. Lowest point at or below RL. Upper point defines calibration range	Initially, and when CCV is unacceptable	<25% RSD r2>0.990	Correct problem. Recalibrate.	Analyst	TA-WC-0157 Revision 12, Effective 12 Nov 2009
TOC Analyzer	Second Source Calibration Verification (ICV)	After each ICAL	<30% D from True Value	Correct problem. Recalibrate or reanalyze ICV.	Analyst	TA-WC-0157 Revision 12, Effective 12 Nov 2009
TOC Analyzer	CCV	Prior to sample analysis and after every 10 samples.	<20% difference from True Value	Correct problems, recalibrate, and re-analyze all samples analyzed since the last successful CCV.	Analyst	TA-WC-0157 Revision 12, Effective 12 Nov 2009

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QAPP WORKSHEET #25
ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING, AND INSPECTION TABLE

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
GC-FPD/TCD (headspace)	Daily: Check carrier gas supply; check temperatures of inlet and detectors; verify temperature program. range.	Dissolved methane in water (RSK-175)	The analyst checks and records the condition of connections, carrier gas supply, and temperatures of inlet, detectors, and verifies temperature programs; replaces disposables; bakes out instrument; and performs leak test.	Daily	Successful analysis of blanks and calibration standards	Corrective action may include inspecting system; correcting problem; rerunning calibration and affected samples, as well as calling the service engineer.	Analyst	DV-GS-0025 Revision 2.3 Effective 8 Oct 2010 (Denver)
GC-FID (purgeable)	Change septum, clean injection port, change or clip column, install new liner	Detector signals and chromatogram review for GRO	Instrument performance and sensitivity	As needed	CCV passes criteria	Reinspect injector port, cut additional column, reanalyze CCV, recalibrate instrument	Analyst	TA-MV-0376, Rev. 8 Effective 16 Apr 2010
GC/FID (extractable)	Change septum, clean injection port, change or clip column, install new liner	Detector signals and chromatogram review for DRO/RRO	Instrument performance and sensitivity	As needed	CCV passes criteria	Reinspect injector port, cut additional column, reanalyze CCV, recalibrate instrument	Analyst	TA-GS-0363, Rev. 13 Effective 26 Mar 2010

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
GC/MS (purgeable)	Daily: Check inlet pressure and sufficient supply of carrier gas; check temperatures of inlet and detectors; verify temperature program; check septa, clean injection port or replace injection port liner and cut column if needed; check carrier gas supply; check tune parameters. As needed: Check oil levels in mechanical pumps and the diffusion pump if vacuum is insufficient; replace electron multiplier; clean source; replace filaments; change rough pump oil and exhaust filters; relubricate the turbomolecular pump bearing wick.	BTEX (SW8260B)	The analyst checks and records the condition of connections, carrier gas supply, and temperatures of inlet, detectors, and verifies temperature programs; replaces disposables; bakes out instrument, reconditions column, and performs leak test. Inspect chromatograph to verify symmetrical peak shape and adequate resolution between closely eluting peaks.	Daily or as needed	Tune and CCV pass criteria	Corrective action may include inspecting system; correcting problem; rerunning calibration and affected samples, as well as calling the service engineer.	Analyst	TA-MV-0312, Rev 17 Effective 16 Apr 2010

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
GC/MS (extractable)	Daily: Check inlet pressure and sufficient supply of carrier gas; check temperatures of inlet and detectors; verify temperature program; check septa, clean injection port or replace injection port liner and cut column if needed; check carrier gas supply; check tune parameters. As needed: Check oil levels in mechanical pumps and the diffusion pump if vacuum is insufficient; replace electron multiplier; clean source; replace filaments; change rough pump oil and exhaust filters; relubricate the turbomolecular pumpbearing wick.	Tuning, Calibration-8270C-SIM	The analyst checks and records the condition of connections, carrier gas supply, and temperatures of inlet, detectors, and verifies temperature programs; replaces disposables; bakes out instrument, reconditions column, and performs leak test. Inspect chromatograph to verify symmetrical peak shape and adequate resolution between closely eluting peaks.	Daily or as needed	Tune and CCV pass acceptance criteria	Corrective action may include inspecting system; correcting problem; rerunning calibration and affected samples, as well as calling the service engineer.	Analyst	TA-MS-0313 Revision 16 Effective 26 Mar 2010

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
TOC Analyzer	Daily: Check carrier gas supply; check temperatures of inlet and detectors; verify temperature program. range.	Total Organic Carbon, (SW9060)	Check gas supply lines, reagent reservoirs, tubing and transfer lines for leaks. Check temperatures of heated zones.	Daily or as needed	Successful analysis of blanks and calibration standards	Corrective action may include inspecting system; changing tubing; rerunning calibration and affected samples, as well as calling the service engineer.	Analyst	TA-WC-0157, Rev 12 Effective 12 Nov 2009
ICP/MS	Daily: Monitor gas supplies; examine and replace pump tubing, filters, and O-rings. As needed: monitor and clean or replace torches, spray chambers, air filters, injectors, purge windows and lenses, and igniters and load coils; fill argon humidifier with water; change oil in vacuum pumps.	Metals (SW6020A)	The analyst checks and records the argon supply pressure, the operating vacuum, the temperature of the cooling chiller, and the nebulizer flow-rate, torch for residue, and level of the internal fluid reservoir and cooling fluid, as well as waste container.	Daily or as needed	Intensity of Daily performance check for Rh at least 200,000 counts	Corrective action may include inspecting system, changing the auto sampler pump tubing, cleaning or changing torch, adjusting the nebulizer flow, cleaning or changing cones, rerunning calibration and affected samples, as well as calling the service engineer.	Analyst	TA-MT-0217, Rev 21 Effective 16 Apr 2010

Instrument/ Equipment	Maintenance Activity	Testing Activity	Inspection Activity	Frequency	Acceptance Criteria	Corrective Action	Responsible Person	SOP Reference
CVAAS	Daily: Change rinse solution; optimize light path; check nitrogen flow; monitor gas supplies, examine and replace pump tubing, filters, and O-rings and replace as needed. Monthly: Check lamp intensity and clean or replace lamps; check drain and condition of dryer; clean cell and aspirator in aqua regia; check silica gel in drying tube. Annually: Change lamp and check liquid/gas separator.	Mercury (SW7470A and SW7471B)	The analyst checks and records the pump tubing and pump flow and level in waste container.	See SOP Nos. DV-MT-0017, Rev 0.2 Effective 07 Aug 2009 and DV-MT-0023, Rev 0.5 Effective 07 Aug 2009	See SOP Nos. DV-MT-0017, Rev 0.2 Effective 07 Aug 2009 and DV-MT-0023, Rev 0.5 Effective 07 Aug 2009	Corrective action may include inspecting system, changing the auto sampler pump tubing, cleaning cell, rerunning calibration and affected samples, as well as calling the service engineer.	Analyst	DV-MT-0017, Rev 0.2 Effective 07 Aug 2009 and DV-MT-0023, Rev 0.5 Effective 07 Aug 2009
GC/ECD (PCBs)	Daily: Check carrier gas supply; check temperatures of inlet and detectors; verify temperature program. As needed: Check septa clean injection port or replace injection port liner and cut column if needed; reactivate carrier gas drying agents; replace or repair flow controllers if constant flow cannot be maintained; replace disposables; bake out instrument; recondition column; and detector cleaning.	PCBs as Aroclors	The analyst checks and records the condition of connections, carrier gas supply, and temperatures of inlet, detectors, and verifies temperature programs; replaces disposables; bakes out instrument, reconditions column, and performs leak test.	Daily or as needed	CCV passes criteria	Corrective action may include inspecting system; correcting problem; rerunning calibration and affected samples, as well as calling the service engineer.	Analyst	TA-GS-0351 Revision 17, Effective 26 Mar 2010

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QAPP WORKSHEET #26
SAMPLE HANDLING SYSTEM

SAMPLE COLLECTION, PACKAGING, AND SHIPMENT

Sample Collection (Personnel/Organization): Bristol Field Personnel

Sample Packaging (Personnel/Organization): Eric Barnhill, Lyndsey Kleppin- Bristol

Coordination of Shipment (Personnel/Organization): Eric Barnhill, Bristol

Type of Shipment/Carrier: Coolers containing samples, Bering Air to Nome, Alaska Airlines Goldstreak® Nome to SEATAC, TestAmerica courier to Tacoma Laboratory.

SAMPLE RECEIPT AND ANALYSIS

Sample Receipt (Personnel/Organization): Samples will be sent to TestAmerica-Tacoma (point of contact [POC]-Terri Torres).

Sample Custody and Storage (Personnel/Organization): Samples will be handled and stored at the laboratory in accordance with TestAmerica SOPS (as noted in Worksheet #23, and included in Attachment 4). Analysis will be coordinated by POC-Terri Torres. Samples will be stored at the site in dedicated refrigerators in the "environmental Conex" until shipped to TestAmerica for analysis.

Sample Preparation (Personnel/Organization): Sample preservation will be done in the field (POC Eric Barnhill, Bristol) and preparation will occur upon arrival at the performing laboratory, TestAmerica. The samples will be prepared by laboratory depending on each matrix and analyte. The laboratory POC (Terri Torres) will assign tasks to the appropriate personnel at that time in accordance with TestAmerica SOPS (as noted in Worksheet #23, and included in Attachment 4).

Sample Determinative Analysis (Personnel/Organization): Sample analysis will occur after formal receipt by the performing laboratory. The laboratory POC (noted above) will assign tasks to the appropriate personnel at that time in accordance with TestAmerica SOPS (as noted in Worksheet #23, and included in Attachment 4).

SAMPLE ARCHIVING

Field Sample Storage (No. of days from sample collection): Samples will be stored within the proper storage conditions as soon as possible after sampling. The samples will then be maintained at the proper storage conditions until shipment. The storage and shipment of samples will be done as quickly as possible and in compliance with appropriate SOPs. The storage and shipping of samples

will be done as to allow the laboratories enough time not to exceed their holding times (see Worksheet #19). In general, samples will be sent to the laboratories on a daily basis to minimize field storage time.

Sample Extract/Digestate Storage (No. of days from extraction/digestion): Sample extract/digestate storage will be done by the performing laboratory in accordance with TestAmerica SOPS (as noted in Worksheet #23, and included in Attachment 4).

SAMPLE DISPOSAL

Personnel/Organization: Sample disposal will be done by the performing laboratory in accordance with TestAmerica SOPS (as noted in Worksheet #23, and included in Attachment 4).

Number of Days from Analysis: Sample disposal will comply with the laboratory protocols. Subcontracted laboratory will store samples for approximately 60 days after sample analysis.

QAPP WORKSHEET #27
SAMPLE CUSTODY REQUIREMENTS

Field sample custody procedures (sample collection, packaging, shipment, and delivery to laboratory):

Soil samples will be collected with disposable stainless steel spoons. Groundwater samples will be collected with disposable sample tubing using either submersible or peristaltic pumps. Soil and groundwater samples will be containerized, labeled, and immediately placed in a cooler containing gel ice. Samples may be stored in an on-site refrigerator until prepared for shipment. Sample collection information (i.e., sample identification, time and date of collection, sampler's initials, type of container, and analytes to be tested, etc.) will be included on the chain-of-custody form. Prior to shipment to the analytical laboratory, sample containers will be bubble-wrapped and the chain-of-custody forms will be inserted into a plastic bag and taped on the inside lid of the cooler. 500 mL temperature blanks and appropriate QC samples (such as trip blanks) will be included in each shipment or cooler. Each cooler will then be taped closed with strapping tape and two custody seals (one front, one back) will be initialed and dated by the field personnel, and affixed on the lid of the cooler in a manner such that if the cooler is opened, the custody seal will break. The coolers will then be shipped via Bering Air and Alaska Airlines Goldstreak to the analytical laboratory.

<u>Detailed Sample Packaging, Shipping, and Delivery</u>:

1. Soil samples will be containerized, labeled, and immediately placed in a cooler containing gel ice.
2. Each sample will be labeled with indelible ink and will contain the following information:
    a. Project Name (NE Cape)
    b. Sample ID
    c. Sampling date and time
    d. Initials of the sampling staff
    e. Analysis requested
    f. Preservatives added
3. Waterproof plastic ice chests or coolers will be used for sample storage and shipping.
4. All cooler drain holes will be taped closed on the inside and outside of the cooler.
5. Bubble packing, sorbent material, and a layer of gel ice will be placed in bottom of cooler.
6. Bubble bags containing sample bottles will be sealed. Bottles will be placed upright in cooler in such a way that they do not touch and will not touch during shipment.

7. 500 mL temperature blanks and appropriate QC samples (such as a duplicate samples and trip blanks when appropriate) will be included in each shipment or cooler.
8. Additional bubble packing, or similar packing material, will be inserted to partially cover sample bottles (more than halfway). Bags of gel ice will be placed around, among, and on top of sample bottles. Samples will be packed so as to maintain the temperature specified in Worksheet #19.
9. The remaining area of the cooler will be filled with bubble packing, cardboard or similar packing material.
10. The chain-of-custody record will be placed in a waterproof plastic bag and taped with strapping tape to the inside of the cooler lid. North Pacific Division Laboratory No. 11-072 (NPDL #11-072) will be written on all chain of custodies for this project.
11. The lid will be secured with strapping tape. The cooler will be wrapped completely with strapping tape at a minimum of two locations. Labels will not be covered.
12. The custody seals will be signed and dated, and attached on both the front and back of the cooler in a manner such that if the cooler is opened, the custody seal will break. Custody seals will be covered with wide, clear tape.
13. The cooler will be shipped via charter carrier to Nome and transshipped via Alaska Airlines Goldstreak to TestAmerica in Tacoma, Washington.

Laboratory sample custody procedures (receipt of samples, archiving, disposal):

The laboratory sample custody protocol will be followed for the analysis.

Sample Bottle Preparation

The chain-of-custody procedure begins with the preparation of the sample containers and preservatives to be used for sample collection. TestAmerica will provide the necessary sample containers pre-cleaned. Vendors are required to provide documentation of analysis for each lot of containers, and the documentation is kept on file in the laboratory's sample management office. Additionally, potential contaminant levels in each vendor lot are evaluated by the laboratory through analysis of randomly selected containers. Worksheet #19 defines the types of containers required, preservation techniques, and holding times for specific analyses. Preservatives will be added to the sample containers in the laboratory, or as soon as possible after collection of soil BTEX or GRO, prior to shipment. Sample kits, which are coolers containing chain-of-custody forms, custody seals, sample containers (with preservatives), and packing material, are prepared by the sample management office at the laboratory in response to receipt of an analytical task order from the PM or company representative.

The laboratory will receive and document samples per QSM 4.1 requirements. A cooler receipt form shall be prepared for each cooler of samples received by the project laboratory and will contain the following at a minimum: chain of custody; signed custody seals; and laboratory documentation of

sample receipt, which will include any discrepancies. The analytical laboratory shall e-mail a copy of the cooler receipt form to receipt.cooler@usace.army.mil within 24 hours of delivery of each sample data group.

Sample identification procedures:

Sample Identification

Each sample will receive a unique identification string based on the project name, the locations within the project area, the type of sample being collected, and the depth of the bottom of the sample. Background samples will be designated in a similar manner.

Sample Documentation

Sample tracking will start at the point of collection with log book entries. The log entries will be recorded in waterproof ink in a bound, paginated field logbook, updated daily and maintained at the site. Information to be recorded in the logbook will include the project name (*NE Cape 2011, 34110008*) and site for which sampling is being conducted; a unique, sequential sample number for each sample taken; sampling date and time; specific sampling location in sufficient detail to allow resampling at the same location, if required; method of sampling; preservation techniques; analyte classes of interest (i.e., BTEX, metals); significant observations made during the sampling process; results of any field measurements, such as depth of soil sample; and printed name and signature of the person performing the sampling.

Field QC samples, such as duplicates, will receive individual sample numbers and will not be identified as QC samples on the chain-of-custody. The MS/MSD samples will have the same ID as the parent sample and will be noted in sample comments on the chain-of-custody. A summary of QC sample frequency and field IDs is provided in Worksheet #11, Tables 11-1 and 11-2.

Chain-of-Custody Procedures:

Upon completion of sample collection, logging, and preservation, the chain-of-custody forms will be completed, identifying sample-specific information with a listing of the analytical parameters required on each sample. The chain-of-custody form will accompany the sample throughout the shipping and analytical process. Each cooler will have a chain-of-custody form properly sealed into the cooler prior to shipment. Samples will be accompanied by a properly completed chain-of-custody form with sample ID, date/time collected, sampler, matrix, analysis, preservative, and turnaround time for analysis. NPDL #11-072 will be written on each chain of custody. When transferring possession of

samples, the individuals relinquishing and receiving the samples, will sign, date, and note the time on the chain-of-custody form. This record will document transfer of custody of samples from the sampler to another person or to the laboratory. The original chain-of-custody form will accompany the sample shipment, and copies will be retained by the Bristol PM for the project file. The performing laboratories will follow their documented, internal chain-of-custody procedures. Custody seals will be placed on the front and back lids of the sample coolers to ensure that the samples are not tampered with during shipment.

QAPP WORKSHEET #28
QC SAMPLES TABLE

In an effort to avoid duplication of information throughout this QAPP, the following will not be presented in this worksheet because it has already been provided in the following locations:

- The number of samples, sample IDs, frequency of collection for field QC samples, concentration level, and sampling SOP are presented in Worksheet #11, Tables 11-1 and 11-2.
- The analytical SOPs are identified in Worksheets #19 and #23 and are presented in Attachment 4.
- Field sampling and analytical organization are presented in Worksheet #26.

Note: For this project, no equipment rinsates (equipment blanks) will be collected.

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
Field Duplicate for Grab Samples	One per 10 field samples of similar matrix per analytical group	≤50% RPD for soil matrix and ≤30% RPD for water matrix	Qualify data as needed.	Data reviewer	Precision	RPD
Trip Blank	One for each cooler containing GRO, methane or BTEX samples.	< ½ Limit of Quantitation (LOQ) and 1/10 the amount in any sample or 1/10 the regulatory limit.	Qualify data as needed.	Data reviewer	Accuracy/bias – contamination control	< ½ LOQ
Method blank	One per extraction batch of 20 or fewer field samples of similar matrix	< ½ Limit of Quantitation (LOQ) and 1/10 the amount in any sample or 1/10 the regulatory limit.	Correct problem, recalibrate and reanalyze affected samples or Qualify data as needed. Results less than 10 times the concentration in the method	Analyst	Laboratory Accuracy/bias – contamination control	<1/2 LOQ

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Data Quality Indicator	Measurement Performance Criteria
			blank will be B flagged.			
Laboratory Control Sample/Laboratory Control Sample Duplicate	One set per extraction batch of 20 or fewer field samples of similar matrix (See Worksheet #12)	See Worksheet #12	Correct problem, recalibrate and reanalyze affected samples	Analyst	Accuracy/ Precision	% Recovery RPD
Matrix Spike	One set per extraction batch of 20 or fewer field samples of similar matrix	(See Worksheet #12	Qualify data as needed	Analyst	Accuracy	% Recovery
Matrix Spike/Matrix Spike Duplicate	One set per extraction batch of 20 or fewer field samples of similar matrix per analyte	(See Worksheet #12 and 24)	Qualify data as needed	Analyst	Precision	RPD
Initial Calibration Verification	Immediately following an initial calibration	As described in the analytical SOP(See Worksheets #12 and #24)	Correct problem and recalibrate	Analyst	Accuracy	As described in the respective analytical SOP
Continuing Calibration Verification	As described in the analytical SOP but before and after any samples are analyzed	As described in the analytical SOP(See Worksheet #12)	Recalibrate and reanalyze affected samples	Analyst	Accuracy	As described in the analytical SOP
Surrogate samples (organic analyses)	Surrogate spike for every sample, including QC and standards as presented in the analytical SOP	(See Worksheet #12)	Samples will be re-analyzed as long as twice the holding time has not been exceeded. If the surrogate recoveries continue to fall outside of QC limits, document the corrective action in the narrative, and report the first set of analytical results.	Analyst	Accuracy	% Recovery

QAPP WORKSHEET #29
PROJECT DOCUMENTS AND RECORDS TABLE

Sample Collection Documents and Records	On-Site Documents and Records	Off-Site Analysis Documents and Records	Data Assessment Documents and Records	Other
Site Safety meeting sign in sheets	X			Data and reports generated during this investigation will be archived at Bristol, and all information will also be provided to the USACE in the final report and accompanying project deliverables.
Contractor Quality Control Daily Report	X			
Field prep and data collection sheets and logbooks	X			
Sampling instrument calibration and decontamination logs	X			
Field notes and field forms	X			
Site entry and exit logs	X			
Shipping manifest/airbills/chain-of-custody	X	X	X	
Identification of QC samples	X	X	X	
Meteorological data	X			
Documentation of deviations from methods	X	X	X	
Corrective action forms and corrective action results	X	X	X	
Communication logs/telephone logs/email	X	X	X	
Definitions of laboratory qualifiers		X	X	
Documentation of laboratory method deviations, analytical audit checklist, and laboratory assessment	X	X	X	
Laboratory sample identification numbers, including identification of QC samples	X	X	X	
Electronic Data Deliverables		X	X	
Instrument calibration, initial precision and accuracy tests.	X	X	X	
Reporting forms, completed with actual results		X	X	

Sample Collection Documents and Records	On-Site Documents and Records	Off-Site Analysis Documents and Records	Data Assessment Documents and Records	Other
Sample chronology (time of receipt, tracking, extraction, and analysis) and associated forms	X	X	X	
Tabulated data summary forms and raw data for field samples, standards, QC checks, and QC samples		X	X	
Field-screening results and raw data	X		X	

QAPP WORKSHEET #30
ANALYTICAL SERVICES TABLE

In an effort to not duplicate information in the QAPP, please refer to the following worksheets for the following data:

- Worksheet #11: Tables 11-1 and 11-2 for analytical groups per site and sample IDs.
- Worksheet #19 for preparation and analytical methods.
- Worksheet # 12 for laboratory performance criteria.

All samples collected for this site will be analyzed by TestAmerica in Tacoma, Washington, except for RSK-175 methane analysis, which will be performed by TestAmerica Denver. All samples will be shipped to TestAmerica-Tacoma, and TestAmerica will follow internal shipping procedures as outlined in SOP CA-C-S-004 (See Attachment 4):

5755 8th Street
Tacoma, Washington 98424
(253)-922-2310.

The POC for TestAmerica is Terri Torres—phone (253) 922-2310.

The turnaround times for the analyses vary from 2 to 14 working days.

TestAmerica-Denver has been selected as the backup laboratory in case of instrument failure or over capacity. TestAmerica-Denver is ELAP and ADEC contaminated site accredited. TestAmerica-Denver also utilizes the same Laboratory Information Management System as TestAmerica-Tacoma, therefore, only a single laboratory report, including EDDs, will be provided following completion of analysis and reporting. The laboratory reports indicate which laboratory performed the analysis in the section immediately following the case narrative.

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QAPP WORKSHEET #31
PLANNED PROJECT ASSESSMENT TABLE

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment (Title and Organizational Affiliation)	Person(s) Responsible for Responding to Assessment Findings (Title and Organizational Affiliation)	Person(s) Responsible for Identifying and Implementing Corrective Action (Title and Organizational Affiliation)	Person(s) Responsible for Monitoring Effectiveness of Corrective Action (Title and Organizational Affiliation)
Field Documentation Audit	At conclusion of field event	Internal	Bristol	Russell James, CQCSM, and Marty Hannah, QA/QC Manager, Bristol	Russell James, CQCSM, Bristol	Marty Hannah, QA/QC Manager, Bristol	Molly Welker, Project Manager, Bristol
Laboratory Technical System Audit (TSA)	Before the start of sampling	Internal	Contract Laboratory	Laboratory QA Manager	Terri Torres, Analytical Laboratory Project Manager	Terri Torres, Analytical Laboratory Project Manager or appropriate persons depending on the area of the findings	Martin Hannah Analytical Task Manager, Bristol
Data Completeness Review	All data reviewed	Internal	Bristol	Martin Hannah Analytical Task Manager, Bristol	Appropriate persons depending on the area of the findings	Appropriate persons depending on the area of the findings	Molly Welker, Project Manager, Bristol
Third-Party Data Verification	Once	External	AECOM	Cathy Larson, Data Verification Chemist, AECOM	Marty Hannah, QA/QC Manager, Bristol	Marty Hannah, QA/QC Manager, Bristol	Martin Hannah Analytical Task Manager, Bristol
Management Systems Review	Once	Internal	Bristol	Marty Hannah, QA/QC Manager- Bristol	Molly Welker, Project Manager, Bristol	Molly Welker, Project Manager, Bristol	Molly Welker, Project Manager, Bristol
Cooler Receipt Form	Per sample shipment	Internal/ external	Bristol/USACE	Bristol Chemist/USACE Chemist	Bristol Chemist	Bristol Chemist/ Laboratory PM	USACE Chemist
Completion of ADEC Laboratory Data Checklist	Once per Laboratory Data Package	Internal	Bristol	Bristol Chemist	Bristol Chemist	Bristol Chemist	USACE Chemist/ADEC

QAPP WORKSHEET #32
ASSESSMENT FINDINGS AND CORRECTIVE RESPONSE ACTIONS

Assessment Type	Nature of Deficiencies Documentation[(a)]	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Field Documentation Audit	Audit Memo	Molly Welker, Project Manager, Bristol	Within 1 week of audit.	E-mail to file	Carey Cossaboom, Project Manager, USACE; Mary J. Abbott, Contract Manager, USACE; Ron Broyles, Contract Officer Representative, USACE., USACE Project Chemist	Immediate correction - written documentation due within 1 week
Laboratory TSA	Audit Memo	Martin Hannah Analytical Task Manager, Bristol	Within 1 week of audit.	E-mail or Memo to Laboratory QA Manager and the Project Manager	Carey Cossaboom, Project Manager, USACE; Mary J. Abbott, Contract Manager, USACE; Ron Broyles, Contract Officer Representative, USACE. USACE Project Chemist	Immediate correction - written documentation due within 1 week
Data Review TSA	Data Evaluation Summary Report	Martin Hannah Analytical Task Manager, Bristol	30 days after review	Reissuance of report	Carey Cossaboom, Project Manager, USACE; Mary J. Abbott, Contract Manager, USACE; Ron Broyles, Contract Officer Representative, USACE. USACE Project Chemist	21 days for reissuance
Management Systems Review	Quarterly Project Review Summary	Molly Welker, Project Manager, Bristol	7 days after audit	E-mail or Memo to file	Molly Welker, Project Manager, Bristol	Immediate correction - written documentation due within 1 week
Cooler Receipt Form	ADEC Laboratory Checklist	USACE Chemist/USACE Project Manager	Within 24 hours of receiving cooler receipt form	Change of Analysis. Possible recollection of samples	Carey Cossaboom, Project Manager, USACE; Mary J. Abbott, Contract Manager, USACE; Ron Broyles, Contract Officer Representative, USACE. USACE Project Chemist	Immediate correction - written documentation due within 1 week

[(a)]Documentation of deficiencies will also include deviations from the QAPP, including how the deviation may affect the quality or integrity of the data collected.

QAPP WORKSHEET #33
QA MANAGEMENT REPORTS TABLE

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Person(s) Responsible for Report Preparation (Title and Organizational Affiliation)	Report Recipient(s) (Title and Organizational Affiliation)
Field Documentation Audit Reports	7 days following audit	7 days following audit	Russell James, CQCSM-Bristol,	Molly Welker, Project Manager, Bristol; File Copy
Laboratory TSA Reports	Per Laboratory SOP	Verbally at time of findings/Written report within 90 days of final analytical report	Contract Laboratory QA Manager	Martin Hannah, Project QA/QC Manager, Bristol and Molly Welker, Project Manager, Bristol; File Copy
Laboratory Data Reports	Within 14 days of receipt of final report	Various throughout project	Marty Hannah	USACE Project Delivery Team
Chemical Data Quality Review	Draft and Final report	90 Days after receipt of all final laboratory reports	Cathy Larson, Data Verification Chemist, AECOM	Martin Hannah, Project QA/QC Manager, Bristol and Molly Welker, Project Manager, Bristol
QAPP Addendum	Per QAPP Revision change	Immediately after changes are accepted	Molly Welker, Bristol PM	USACE Project Delivery Team
ADEC Laboratory Data Checklists	One per laboratory data package	30 days after receipt of laboratory reports	Bristol Chemist	USACE Project Delivery Team
Field Change Request Form	Per requested change	Immediately after accepted change	Molly Welker, Bristol PM	USACE Project Delivery Team

QAPP WORKSHEET #34
VERIFICATION (STEP I) PROCESS TABLE

Verification Input	Description	Internal/ External	Responsible for Verification (Name, Organization)
Analytical Data	All laboratory reports for samples submitted for analysis from the project. ADEC checklists will be prepared by the Bristol Project Chemist.	Internal/External	Martin Hannah, Bristol Analytical Task Manager
Laboratory Data Packages	The laboratory data packages will be verified internally by the laboratory performing the work for completeness prior to submittal to Bristol. A data verification report will be prepared by a third-party data verification chemist.	External Internal	Terri Torres, TestAmerica Project Manager Cathy Larson, AECOM Data Verification Chemist and Martin Hannah, Bristol Analytical Task Manager
Planning	All planning documents prepared for the project.	Internal	Molly Welker, Project Manager, Bristol
Project Quality	Project Quality Documentation (QAPP, analytical methods, QC requirements) will be reviewed internally for completeness	Internal	Martin Hannah, Bristol Project QA/QC Officer
Investigation Plans	Project investigation plans (QAPP, CQCP, IDW Plan, SSHP and Accident Prevention Plan, Staff certifications, SOPs, analytes, locations) will be reviewed internally for completeness.	Internal	Molly Welker, Project Manager, Bristol
Laboratory QA	External documentation related to laboratory quality (ELAP certification, QA Plan, and LOD and MDL studies) will be verified for completeness.	Internal	Martin Hannah, Bristol Analytical Task Manager
Sampling Documents	Field notes, chains-of-custody, and other pertinent information will be reviewed for completeness and accuracy	Internal	Martin Hannah, Bristol Analytical Task Manager

QAPP WORKSHEET #35
VALIDATION (STEPS IIA AND IIB) PROCESS TABLE

Step IIa/IIb	Validation Input	Description	Responsible for Validation (Name, Organization)
IIa	QAPP and SOPs	Ensure that the sampling methods/procedures outlined in the QAPP were followed and that any deviations were noted/accepted.	Molly Welker, Bristol PM, Russell James, Field Technical Lead and CQCSM
IIb	QAPP and SOPs	Determine potential impacts from noted/accepted deviations, in regard to project requirements	Molly Welker, Bristol PM Russell James, Field Technical Lead and CQCSM, and Martin Hannah, Analytical Task Manager
IIa	Chain-of-Custody	Examine chain-of-custody forms against project requirements (analytical methods, sample identification, etc.).	Martin Hannah, Bristol Analytical Task Manager; Data Verification Chemist-AECOM
IIb	Laboratory Data Package	Examine packages against project requirements and chain-of-custody forms (holding times, sample handling, analytical methods, sample identification, data qualifiers, QC samples, etc.)	AECOM-Data Verification Chemist
IIb	Field duplicate-replicate (QA/QC) results	Compare results of field duplicate-replicate sample analyses with RPD criteria	AECOM-Data Verification Chemist

QAPP WORKSHEET #36
VALIDATION (STEPS IIA AND IIB) SUMMARY TABLE

Step IIa/b	Matrix	Analytical Group	Concentration Level	Validation Criteria	Data Validator (Title-Organization)
IIa/b	Soil and Water	All	Low	QAPP Worksheets #11, 12, 15, 19, 24 and 28	AECOM-Data Validation Chemist
IIa	Soil and Water	All	Low	Laboratory SOPs	Martin Hannah, Bristol Analytical Task Manager, Data Validation Chemist-AECOM
IIa/b	Soil and Water	All	Low	Project QAPP, DoD QSM 4.1, EM 200-1-6, ADEC Laboratory QA Policy	AECOM-Data Validation Chemist
IIb	Soil and Water	Field duplicate results	Variable	Compare results of field duplicate sample analyses with RPD criteria	AECOM-Data Verification Chemist
IIb	Soil and Water	All	Variable	Data Qualifiers	TestAmerica Laboratory, Martin Hannah, Bristol Analytical Task Manager, Data Validation Chemist-AECOM
IIb	Soil and Water	All	Low	LOQ/LOD	Martin Hannah, Bristol Analytical Task Manager, Data Validation Chemist-AECOM

QAPP WORKSHEET #37
USABILITY ASSESSMENT

The usability assessment will consider whether data meet PQOs as they relate to the decision(s) to be made, and evaluates whether data are suitable for making that decision. The usability assessment is a comprehensive data review and will be performed only on data of known and documented quality (i.e., verified data collected as part of the confirmation sampling).

To accomplish this step of data review, the project team will do the following:

- Summarize the usability assessment process and all usability assessment procedures, including interim steps and any statistics, equations, and computer algorithms that will be used to assess data;
- Describe the documentation that will be generated during usability assessment;
- Identify the personnel (by title and organizational affiliation) responsible for performing the usability assessment;
- Describe how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies; and
- Describe the evaluative procedures used to assess overall measurement error associated with the project and include the data quality indicators (DQIs).

A summary of the DQIs used in preparing the usability assessment is provided below. Following the discussion for each data quality indicator, the usability documentation resulting from that particular DQI assessment is detailed.

The 2011 Remedial Action Report will contain all tabulated confirmation sample results with proper data qualifiers. The final report qualifiers will likely not match the laboratory reports due to differing criteria used in the assessment, such as blind field duplicates and MS/MSD evaluation criteria. When extraction and instrument blanks have reportable results, affected samples are “B” flagged to indicate potential bias to sample results. Results below the LOQ will be changed to non-detect at the LOQ and B flagged. Sample results above the LOQ, but less than 10 times the concentration reported in the method or instrument blank, will be reported at the stated concentration and also B flagged in accordance with DoD QSM 4.1. Non-detect results will not be flagged, as there is no bias if all other data quality parameters (surrogates) are within acceptance limits.

The following table contains a summary of qualifiers that may be assigned to analytical results.

Qualifier	Definition
ND (LOD)	Analyte result is less than the DL. The non-detect result has the LOD value in parentheses.
J	Analyte result is considered an estimated value because the level is below the laboratory LOQ but above the DL (formerly method detection limit)
MH, ML, MN	Analyte result is considered an estimated value biased (high, low, uncertain) due to matrix effects
B	Analyte result is considered a high estimated value due to contamination present in the method or trip blank. Results less than 10 times the reported method blank concentration will be B flagged to indicate bias.
QH, QL, QN	Analyte result is considered an estimated value biased (high, low, uncertain) due to a quality control failure
R	Analyte result is rejected - result is not usable. Note that "R" replaces the chemical result (no result shall be reported with an "R" flag).

Summary of Data Quality Indicators

Precision, accuracy/bias, representativeness, comparability, completeness, and sensitivity are the DQIs used to assess the data produced during the project. Each DQI is described below, including a definition of the terminology, the referenced process for calculating the indicator, and the referenced measurement performance criteria for this project. A description of how the DQIs should be incorporated into the usability section is found under each parameter heading.

Precision

Precision will be expressed in terms of relative percent difference (RPD) between the values resulting from primary and duplicate sample analyses. The RPD is calculated as follows:

$$RPD = [|(x^1 - x^2)| / x^-] [100]$$

Where:

- x^1 = analyte concentration in the primary sample,
- x^2 = analyte concentration in the duplicate sample, and
- x^- = average analyte concentration of the primary and the duplicate sample.

The QC measures for precision include field duplicates, laboratory duplicates, laboratory control sample/laboratory control sample duplicates (LCS/LCSDs), and matrix spike/matrix spike duplicates (MS/MSDs). The primary measurement of extraction/analytical batch precision is the RPD of the LCS/LCSD. The primary measurement of field precision is the field duplicate RPD. Because the of

the challenging soil matrix at NE Cape, (tundra, glacial till, naturally occurring materials), the failure of MS/MSD precision will result in only qualifying (flagging) the field duplicate results or parent result of the MS/MSD QC samples and not the entire sample batch.

In order to meet the needs of the data users, project data must meet the measurement performance criteria for precision specified in QAPP Worksheet #12, Measurement Performance Criteria Tables. The project precision acceptance limit is 50% RPD for soil field duplicates and 30% RPD for water field duplicates.

Imprecision may be the result of one or more of the following: field instrument variation, analytical measurement variation, poor sampling technique, sample transport problems, or spatial variation (heterogeneous sample matrices). To identify the cause of imprecision, the field sampling design rationale and sampling techniques will be evaluated by the reviewer, and both field and analytical duplicate/replicate sample results will be reviewed. If poor precision is indicated in both the field and analytical duplicates/replicates, then the laboratory may be the source of error. If poor precision is limited to the field duplicate/replicate results, then the sampling technique, field instrument variation, sample transport, and/or spatial variability may be the source of error.

The usability report will:

- Discuss and compare overall field duplicate/replicate precision data from data collected for the project for each matrix, analytical group, and concentration level; and
- Discuss and describe the limitations on the use of project data when overall precision is poor or when poor precision is limited to a specific sampling or laboratory (analytical) group, data set or SDG, matrix, analytical group, or concentration level.

Accuracy/Bias

Accuracy is the degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) that are due to sampling and analytical operations. Accuracy will be expressed in terms of percent recovery (%R) of spike concentrations. Accuracy expressed as %R is calculated as follows:

$$\%R = [(A-B)/C]\ [100]$$

Where:

- A = spiked sample concentration,
- B = measured sample concentration (without spike), and
- C = concentration of spike added.

Examples of QC measures for accuracy include MSs, LCSs, and laboratory method blanks. In order to meet the needs of the data users, project data must meet the measurement performance criteria for accuracy/bias specified in QAPP Worksheet #12, Measurement Performance Criteria Tables.

The usability report will:

- Discuss and compare overall contamination and accuracy/bias for data collected for the project for each matrix, analytical group, and concentration level;
- Describe the limitations on the use of project data if extensive contamination and/or inaccuracy or bias exists, or when inaccuracy is limited to a specific sampling or laboratory group, data set or SDG, matrix, analytical group, or concentration level; and
- Discuss the impact of any qualitative and quantitative trends in bias on the sample data.

Representativeness

Representativeness expresses the extent to which collected data define site contamination. Sample collection, handling, preservation, and analytical procedures are designed to obtain the most representative sample possible.

Representative samples will be achieved by the following:

- Collection of samples from locations representing site conditions;
- Use of appropriate sample preservation techniques;
- Use of appropriate sampling procedures, including proper equipment;
- Use of appropriate analytical methods for the required parameters and LOQs; and,
- Analysis of samples within the required holding times.

The usability report will:

- Discuss and compare overall sample representativeness for each matrix, analytical group, and concentration level; and
- Will describe the limitations on the use of project data when overall non-representative sampling has occurred, or when non-representative sampling is limited to a specific sampling, group, data set or SDG, matrix, analytical group, or concentration level.

Comparability

Comparability is the degree to which different methods, data sets, and decisions agree or can be represented as similar. Comparability describes the confidence (expressed qualitatively or quantitatively) that two data sets can contribute to a common analysis and interpolation. In order to meet the needs of the data users, project data must meet the measurement performance criteria for comparability specified in QAPP Worksheet #12, Measurement Performance Criteria Tables.

Additional detail regarding the process of assessing comparability will be in accordance with, UFP-QAPP Manual, Section 2.6.2.5 (EPA, 2005). Different situations require different assessments of comparability, as in the following:

- If two or more sampling procedures or sampling teams will be used to collect samples, describe how comparability will be assessed for each matrix, analytical group, and concentration level;
- If replicate samples are analyzed, the specific method and percent difference formula that will be used to assess replicate sample comparability for individual data points will be discussed.

The usability report will:

- Discuss and compare overall comparability for the project for each matrix, analytical group, and concentration level;
- Document overall comparability, describe the procedures used to perform overall assessment of comparability and include mathematical and statistical formulas for evaluating screening and confirmatory data comparability;
- Discuss if the project is long-term monitoring; project data should be compared with previously generated data to ascertain the possibility of false positives and false negatives, and positive and negative trends in bias. Data comparability is extremely important in these situations;
- Discuss anomalies detected in the data that may reflect a changing environment or indicate sampling and/or analytical error. Comparability criteria should be established to evaluate these data sets to identify outliers and the need for resampling as warranted;
- Describe the limitations on the use of project data when project-required data comparability is not achieved for the overall project or when comparability is limited to a specific sampling or laboratory group, data set or SDG, matrix, analytical group, or concentration level;
- Document the failure to meet screening/confirmatory comparability criteria and discuss the impact on usability;
- Document the failure to meet replicate sampling comparability criteria and discuss the impact on usability;

- If data are not usable to adequately address environmental questions or support project decision-making, address how this problem will be resolved and discuss the potential need for resampling; and
- If long-term monitoring data are not comparable, address whether the data indicate a changing environment, or are a result of sampling or analytical error.

Sensitivity and Quantitation Limits

Sensitivity is the capability of a test method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. Examples of QC measures for determining sensitivity include laboratory fortified blanks, DL, LOD, and limit of quantitation (LOQ) studies, and the lowest calibration standards at or below the LOQ. In order to meet the needs of the data users, the project data must meet the measurement performance criteria for sensitivity and project LOQs specified in Worksheet #12 and Tables 15-1 and 15-2, Measurement Performance Criteria Tables. The process for assessing sensitivity is detailed in the UFP-QAPP Manual, Section 2.6.2.3 (EPA, 2005) and the DoD QSM Version 4.1 in Sections C.3 and D.1.2.1.

The laboratory will establish a DL, typically the MDL, using a scientifically valid and documented procedure. The method detection limit (MDL) is the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. The DL is the laboratory's "best case" sensitivity for a given analytical method. The laboratory may establish MDLs for each method, matrix, and analyte for each instrument the laboratory plans to use for the project using the statistical method presented in the 40 CFR Part 136, Appendix B.

The LOD will be established quarterly by spiking a blank matrix at two to three times the DL for single analyte standards, or one to four times the DL for multi-analyte standards. This spike concentration is the LOD for each analyte and is specific for each matrix, method, and instrument.

The LOQ will be determined at least quarterly for each analyte of concern following a documented procedure at the laboratory. The validity of the LOQ will be determined by the analysis of a QC sample containing the analyte at one to two times the estimated LOQ and within the calibration range of the instrument. The LOQ is valid if the recovery of the analyte is within the test method's acceptance recovery limits for accuracy.

The following requirements apply to the determination of DL, LOD, and LOQ:

- The apparent signal-to-noise ratio at the LOD must be at least three and in the results must meet all method requirements for analyte identification (e.g., ion abundance, second column confirmation, or pattern recognition). If no measurement of noise is available for a given method, then the LOD must yield a result that is at least three standard deviations greater than the mean blank concentration.
- If multiple instruments are used, the laboratory must verify the DL, LOD, and LOQ on each.
- If the LOD verification fails, then the laboratory must repeat the DL and LOD determinations at higher concentrations.
- The laboratory will maintain documentation of the DL, LOD, and LOQ studies and these measures of instrument sensitivity will be performed at least quarterly.

A non-detectable result will be reported as less than the LOD. The "J" flag will be applied to the detectable results that fall between the DL and the LOQ, indicating the variability associated with the result. No detectable results will be reported below the DL.

The usability report will:

- Discuss and compare overall sensitivity and quantitation limits (QLs) from multiple data sets collected for the project for each matrix, analytical group, and concentration level;
- Discuss the impact of that lack of sensitivity or higher QLs on data usability. If information is available, indicate that sensitivity or QLs were not achieved; and
- Describe the limitations on the use of project data if project-required sensitivity and QLs are not achieved for all project data, or when sensitivity is limited to a specific sampling or laboratory group, data set or SDG, matrix, analytical group, or concentration level.

The TestAmerica laboratory LODs are capable of meeting sensitivity requirements, and the COPCs can be detected below the project evaluation criteria.

Completeness

Completeness is a measure of the amount of valid data obtained from a measurement system compared with the amount that was expected to be obtained under correct, normal circumstances. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set. The completeness target is 80%. Completeness measures the effectiveness in sample collection, analysis, and result reporting of the entire investigation, and is calculated on a per-analyte basis by the following equation:

$$\%Completeness = \frac{Number\ of\ valid\ results}{Number\ of\ possible\ results} \times 100$$

For any instances of samples that could not be analyzed for any reason (holding time violations in which resampling and analysis were not possible, samples spilled or broken, etc.), the numerator of this calculation becomes the number of possible results minus the number of possible results not reported.

Completeness – A completeness check will be done on all of the data generated by the laboratory. Completeness will be calculated for each analyte as follows from the UFP-QAPP Manual Section 2.6.2.6: *For each analyte, completeness will be calculated as the number of data points for each analyte that meets the measurement performance criteria for precision, accuracy/bias, and sensitivity, divided by the total number of data points for each analyte). A discussion will follow summarizing the calculation of data completeness. Any conclusions about the completeness of the data for each analyte will be drawn and any limitations on the use of the data will be described.*

For this project, 80% of usable sample data is considered the minimal acceptance criteria for completeness. The goal is to achieve 100% completeness.

The usability report will:

- Discuss and compare overall completeness for each matrix, analytical group, and concentration level; and
- Describe the limitations on the use of project data if project-required completeness is not achieved for the overall project, or when completeness is limited to a specific sampling or laboratory group, data set or SDG, matrix, analytical group, or concentration level.
- A Chemical Data Quality Report will include the usability report

Activities

A preliminary usability assessment will be performed by the analytical task manager or designee to ensure that the PQOs are properly evaluated and the full scope is considered while field personnel are still on site. If, for whatever reason, (Precision, Accuracy/Bias, Comparability, Sensitivity, Completeness) Measurement Performance Criteria are not achieved and it has been determined that certain project data are not usable, then the project team will determine if it is necessary to take further action, such as resampling to ensure that DQOs have been met. Resampling will not occur if it is determined that site heterogeneity or matrix interference are the root causes of failure to achieve

PQOs. Resampling may occur if initial sampling, sample design, or analytical error is the root cause of failure to meet PQOs.

The items listed under **Considerations for Usability Assessment** below are examples of specific items that will be considered during the project under the usability assessment.

Describe the evaluative procedures used to assess overall measurement error with the project:

Reconciliation – Each of the PQOs presented in Worksheet #12 will be examined to determine if the objective was met. This examination will include a combined overall assessment of the results of each analysis pertinent to an objective. Each analysis will first be evaluated separately in terms of the major impacts observed from the DQIs, and measurement performance criteria assessments. Based on the results of these assessments, the quality of the data will be determined. Based on the quality determined, the usability of the data for each analysis will be determined. Based on the combined usability of the data from all analyses for an objective, it will be determined if the PQO was met and whether project action limits were exceeded. The final report will include a summary of all the points that went into the reconciliation of each objective. As part of the reconciliation of each objective, conclusions will be drawn and any limitations on the usability of any of the data will be described.

Identify the personnel responsible for performing the usability assessment Laboratory PM designee, Bristol Analytical Task Manager, Project QA/QC Manager, and third-party data reviewer (AECOM Data Review Chemist).

Describe the documentation that will be generated during usability assessment and how usability assessment results will be presented so that they identify trends, relationships (correlations), and anomalies.

A usability report will be written that discusses precision, accuracy/bias, representativeness, comparability and completeness as detailed within this worksheet. This narrative report will include worksheets and supporting documentation to assess the PQOs and any conclusions and limitations of the associated data. The specific details of each section of the usability assessment documentation can be found above under the individual DQIs.

Considerations for Usability Assessment:

Data Deliverables and QAPP, Deviation: Ensure that all necessary information was provided.

Deviations: Determine the impact of deviations on the usability of data.

Sampling Locations: Determine if alterations to sample locations continue to satisfy the project objectives.

Chain-of-Custody: Establish that problems with documentation or custody procedures do not prevent the data from being used for the intended purpose.

Holding Times: Determine the acceptability of data where holding times were exceeded.

Damaged Samples: Determine whether the data from damaged samples are usable. If the data cannot be used, determine whether resampling is necessary.

SOPs and Methods: Evaluate the impact of deviations from SOPs and specified methods on data.

QC Samples: Evaluate the implications of unacceptable QC sample results on the data usability for the associated samples. For example, consider the effects of observed blank contamination.

Matrix: Evaluate matrix effects (interference or bias).

Meteorological Data and Site Conditions: Evaluate the possible effects of meteorological (e.g., wind, rain, temperature) and site conditions on sample results. Review field reports to identify whether any unusual conditions were present and how the sampling plan was executed.

Comparability: Ensure that results from different data collection activities achieve an acceptable level of agreement.

Completeness: Evaluate the impact of missing information. Ensure that enough information was obtained for the data to be usable (completeness as defined in PQOs documented in the QAPP).

Background: Determine if background levels have been adequately established (if appropriate).

Critical Samples: Establish that critical samples and critical target analytes/COCs, as defined in the QAPP, were collected and analyzed. Determine if the results meet criteria specified in the QAPP.

Data Restrictions: Describe the exact process for handling data that do not meet PQOs (i.e., when measurement performance criteria are not met). Depending on how those data will be used, specify the restrictions on use of those data for environmental decision making.

Usability Decision: Determine if the data can be used to make a specific decision considering the implications of all deviations and corrective actions.

Usability Report: Discuss and compare overall precision, accuracy/bias, representativeness, comparability, completeness, and sensitivity for each matrix, analytical group, and concentration level. Describe limitations on the use of project data if criteria for data DQIs not met.

(Intentionally blank)

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ATTACHMENT 1

Bristol Standard Operating Procedures

BERS-01	Soil Sampling SOP
BERS-02	Groundwater Sampling SOP
BERS-03	Sample Management SOP
BERS-04	Field Measurement and Test Equipment SOP
BERS-05	Equipment Decontamination SOP
BERS-08	Water Level Measurement SOP
BERS-09	Investigation-Derived Waste (IDW) Management SOP
BERS-10	General Air Monitoring & Sampling SOP
BERS-11	Field Documentation SOP
BERS-12	Trenching SOP
BERS-13	General Backfill and Compaction SOP
BERS-15	Document Control System SOP
BERS-17	Trimble GeoXH® Global Positioning Systems

BRISTOL ENVIRONMENTAL REMEDIATION SERVICES, LLC

Anchorage, Alaska

SOIL SAMPLING

STANDARD OPERATING PROCEDURE BERS-01

Record of Changes

Revision No.	Date	Prepared by	Approved by
0	01/15/08	B. Allen	S. Ruth
1	10/14/09	L. Maserjian	P. Curl
2	02/17/10	L. Maserjian	B. Allen

SOIL SAMPLING

STANDARD OPERATING PROCEDURE

Summary: Soil samples may be collected using a variety of methods and equipment. The methods and equipment used are dependent on the depth of the desired sample, the type of the sample required, and the soil type. Manual techniques and equipment, such as hand augers, are usually used for surface or shallow, subsurface soil sampling. Power-operated equipment is usually associated with collecting deep samples, but this equipment can also be used for collecting shallow samples.

Soil samples collected for volatile organic compound (VOC) analysis are handled in a manner that minimizes the loss of contaminants due to volatilization and biodegradation. Where required to meet project objectives, field extraction and preservation with methanol are performed to ensure sample integrity and representativeness during sample handling and transport.

Health and Safety: Sampling activity should only be conducted in accordance with an approved Site Health and Safety Plan.

Personnel Qualifications: Sampling personnel will be trained and certified as hazardous site workers per Title 29 Code of Federal Regulations, Part 1910.120(e) [29 CFR 1910.120(e)]. If applicable, additional qualification requirements will be specified in the site Quality Assurance Project Plan (QAPP) and will be met.

Equipment and Materials: Prior to deployment in the field, the requisite sampling equipment and materials will be identified, secured, and inspected for signs of damage or potential contamination. Sampling equipment will be selected to preserve the chemical and physical integrity of the samples. Equipment selection will be based on the depth of the samples to be collected and, to a certain extent, the characteristics of the material being sampled. Equipment used for sampling trace contaminants should be constructed of inert materials, such as Teflon® or stainless steel. Ancillary equipment, such as auger flights, post hole diggers, etc., may be constructed of other materials if this equipment does not come in contact with the samples. However, plastic, chromium, galvanized, painted, or rusted equipment should not be used for routine soil sampling operations.

- Sample containers for collecting samples using the methanol extraction and preservation method must be prepared and weighed in advance by the laboratory performing the analysis. Required equipment may include disposable plastic syringes and a clean, sharp utility knife.
- Surface soil is generally classified as soil between the ground surface and 6 inches below ground surface (bgs). Surface soil sampling equipment typically consists of spoons, shovels, hand-augers, push tubes, and post-hole diggers.

- Subsurface soil is generally soil that is at least 6 inches bgs, and can be collected using manual or powered sampling devices. Manual sampling devices consist of hand augers, push tubes, and post-hole diggers. Powered devices typically consist of power augers; split-spoon samplers, which are driven with a drill rig drive-weight assembly or hydraulically pushed using drill rig hydraulics; continuous split-spoon samplers; specialized hydraulic cone penetrometer rigs; and/or backhoes.
- In addition to soil sampling equipment, sampling support equipment may include Global Positioning System (GPS) or survey equipment for locating sample points, organic vapor analyzer with a photoionization detector (PID), tape measures, survey stakes or flags, stainless steel buckets/bowls or disposable aluminum pie pans, canvas/plastic sheet, pre-cleaned sample containers, decontamination supplies and equipment, safety equipment, logbooks, camera, chain-of-custody forms, and supplies for sample labeling, packaging, and shipping.
- Sample containers will be of the type and size specified in the governing QAPP.

Field Screening

Field-screening samples are typically collected either before or concurrently with laboratory analytical samples. Field screening before sample collection can help guide the selection of the most appropriate location to collect a laboratory analytical sample. Collecting field-screening samples concurrently with laboratory samples can help establish a correlation between screening and analytical results at a particular site. Field screening is commonly performed using an organic vapor analyzer, such as a PID.

Headspace PID Screening

Headspace PID screening samples are collected by filling a resealable Ziploc® bag approximately one-third to one-half full of freshly exposed or uncovered soil, and immediately sealing the bag. The soil should be agitated and then allowed to warm for approximately ten minutes to an hour, to allow the headspace vapors to develop. After the headspace vapors have developed, insert the tip of a calibrated PID into the void headspace of the bag, and record the highest reading.

In-Situ PID Screening

In some instances, where a limited volume of soil is available for field screening, such as soil cores from a direct-push rig or split spoon, using the headspace method may use up material that potentially could be used for a laboratory analytical sample. In these cases, field screening of the soil may be performed by making small divots approximately every 6 inches along the length of the core, and inserting the calibrated PID tip just above the freshly exposed divot, taking care not to touch the material. Record the highest reading at each location in the field logbook or field form.

Surface Soil Sampling

1. If a thick, matted root zone is encountered at or near the surface, remove it before collecting the sample.
2. Carefully remove the top layer of soil or debris to the desired sample depth with a pre-cleaned spade.
3. Using a pre-cleaned, stainless steel scoop, spoon, or trowel, remove and discard a thin layer of soil from the area that came in contact with the spade.
4. Collect samples following procedures described in the General Soil Sampling Procedures Section.

Subsurface Soil Sampling: Subsurface samples can be collected using hand or power augers, Geoprobes®, split-spoon samplers, or from backhoes.

- Augering is the most common method used to collect shallow subsurface samples. The auger is used to bore a hole to the desired sampling depth. VOC samples are generally collected directly from the sampling device. Non-VOC samples are collected after thorough mixing. If a core sample is required, the auger tip is replaced with a thin wall tube sampler, and the system is lowered into the borehole and driven to the required sample depth. The system is withdrawn and the core is collected from the thin wall tube sampler.
- Geoprobe sampling uses a direct-push system that employs percussion power to essentially "hammer" sampling equipment (Macro-Core® samplers) into the subsurface to extract soil for laboratory analysis. The advantage of using a Geoprobe is that there is a much smaller hole diameter and minimal soil cuttings. The Macro-Core sampler is a solid barrel that is pushed into the subsurface for collecting continuous core samples of unconsolidated materials at depth. The Macro-Core soil samples are collected in a 4 to 5 foot long Teflon, polyvinyl chloride (PVC), or polyethylene terephalate glycol (PETG) liner; the samples can be obtained by splitting the liner or capped to it to preserve the samples for future analysis.
- On underground storage tank or contaminated soil excavation sites, a backhoe bucket is commonly used for collecting soil for samples. When a trench or excavation is deeper than four feet, the bucket of the backhoe or excavator will be used to collect soil, so that personnel do not climb into an unprotected hole.
- Power hand augers are commonly used to aid in the collection of subsurface soil samples at depths where hand augering is impractical. This equipment is a sampling aid, and not a sampling device; the typical lower depth range available with these devices is 20 to 25 feet. The power auger is used to advance a hole to the required sampling depth, at which point a hand auger is usually used to collect the sample.
- Split-spoon sampling provides for the collection and extraction of undisturbed soil cores of 18 or 24 inches in length. A series of consecutive cores may be extracted to give a

complete soil column profile, or an auger may be used to drill down to the desired depth for sampling. The split spoon is then driven to the sampling depth through the bottom of the augered hole, and the core is extracted. When used in conjunction with drilling, split-spoon samplers are usually driven either inside a hollow-stem auger or inside an open borehole after the rotary or cable tool drilling equipment has been temporarily removed.

- When split spoon or Macro-Core sampling is performed to gain geologic information, sampling will be performed in accordance with SOP BERS-06 Borehole Logging.
- Continuous split-spoon samplers may be used to obtain five-foot-long, continuous samples, approximately 3 to *5* inches in diameter. These devices are placed inside a five-foot section of hollow-stem auger and advanced with the auger during drilling. As the auger advances, the central core of soil moves into the sampler.
- Cone Penetrometer Rigs use a standard split spoon that is modified with a releasable tip to keep the spoon closed during the sampling push. Upon arrival at the desired depth, the tip can be remotely released and the push continued. During the subsequent push, the released tip floats freely up the inside of the sample barrel as the soil core displaces it. Split-spoon soil samples, therefore can be collected without drilling by simply pushing the device to the desired depth. This technique is particularly beneficial at highly contaminated sites, because cuttings are not produced as with drill rigs. This results in limited investigation-derived waste (IDW) and minimal exposure to sampling personnel.

Sampling using a Hand Drill with an Auger Attachment

1. Attach the auger bit to a drill-rod extension, and attach the "T" handle to the drill rod.
2. Clear the area to be sampled of any surface debris (e.g., twigs, rocks, and litter). It is generally advisable to remove the first three to six inches of surface soil.
3. Begin augering, periodically removing the auger from the hole and depositing accumulated soils onto a plastic sheet spread near the hole.
4. After reaching the desired depth, slowly and carefully remove the auger from the boring.
5. Remove auger tip from drill rods and replace with a pre-cleaned, thin-wall tube sampler. Install the proper cutting tip.
6. Carefully lower the tube sampler down the borehole. Gradually force the tube sampler into the soil. Take care to avoid scraping the borehole sides. Avoid hammering the drill rods to facilitate coring as the vibrations may cause the boring walls to collapse.
7. Remove the tube sampler and unscrew the drill rods.
8. Remove the cutting tip and the core from the device.
9. Discard approximately 1 inch off the top of the core. Place the remaining core into a labeled sample container without mixing.
10. Collect samples following procedures described in the General Soil Sampling Procedures Section.

11. If another sample is to be collected in the same hole, but at a greater depth, reattach the auger bit to the drill and assembly and follow steps 3 through 10, making sure to decontaminate the auger and tube sampler between samples.
12. Abandon the hole according to applicable state regulations and corporate procedures.

Sampling using a Geoprobe with a Macro-Core Attachment

1. Clear the area to be sampled of any surface debris (e.g., twigs, rocks, and litter). It is generally advisable to remove the first three to six inches of surface soil.
2. Begin hammering the Geoprobe.
3. After hammering the depth of the Macro-Core (either 4 or 5 feet in length), slowly and carefully remove the Macro-Core from the hammer.
4. Open the Macro-Core tubing using a two-razor tool designed for the Macro-Core.
5. Use a pre-cleaned stainless steel spoon or knife to obtain soil from the core at selected locations, based on PID field screening.
6. Collect samples following procedures described in the General Soil Sampling Procedures Section. The Macro-Core is not reusable. Remove any soil on the core material, place the used core in a plastic trash bag (with as many used cores as will fit), tie the ends of the plastic bag, and dispose of it in a trash receptacle.
7. Abandon the hole according to applicable state regulations and corporate procedures.

Sampling with a Hand Auger

1. Insert the hand auger into the material to be sampled at a 0° to 45° angle from the horizon.
2. Rotate the auger once or twice to cut a core of material.
3. Slowly withdraw the auger, with the slot facing upward.
4. Collect samples following the procedures described in the General Soil Sampling Procedures Section.

Sampling with a Split Spoon

1. Assemble the sampler by aligning both sides of barrel, then screw the drive shoe on the bottom and the headpiece on top.
2. Place the sampler perpendicular to the material sampled.
3. Using a well ring, drive the tube. Do not drive the tube past the bottom of the head piece, or the sample may be compressed.
4. Record the length of the tube used to penetrate the material being sampled, and the number of blows required to obtain this depth in the site logbook or on field data sheets.

5. Withdraw the sampler and open by unscrewing the bit and head, and splitting the barrel. Record the amount of recovery and soil type on the boring log. If a split sample is required, use a clean stainless steel knife to divide the tube contents in half, lengthwise.
6. Without disturbing the core, collect samples following the procedures described in the General Soil Sampling Procedures Section.

Sampling from a Backhoe

1. If backhoe buckets are not cleaned in between sample locations, collect samples from material in the center of the bucket.
2. Prior to collecting samples from soil in the backhoe bucket, dress the surface with a stainless steel shovel, spatula, knife, or spoon, to remove at least six inches of surface layer of soil, which may have been smeared across the trench wall as the bucket passed.
3. Be aware of "sluff" material in the bucket that is not representative of the specified sample depth.
4. Collect samples following procedures described in the General Soil Sampling Procedures Section.

General Soil Sampling Procedures:

1. If the QAPP requires field screening for VOCs using a PID, follow the procedures described in the Field Screening Section.
2. Collect samples in appropriate containers in order of volatility, with the most volatile samples collected first. Containers should be either pre-labeled or labeled immediately after sample collection. Follow the procedures for collecting volatile samples described in the following section.
3. For non-VOC samples, place the material into the appropriate container.
4. If a composite non-VOC sample is required, place the material from the designated sampling intervals or locations into a mixing bowl, mix thoroughly, and collect the sample from the mixture into the appropriate container.
5. If non-VOC duplicate, split, duplicate, or other quality assurance/quality control (QA/QC) samples are required, collect twice the routine amount of sample material, mix thoroughly, and fill two identical sets of sample containers.
6. Fill sample containers to the top with measures taken to prevent soil from remaining in the lid threads prior to being sealed.
7. After sample containers are filled, immediately seal them, chill them, and process them for shipment to the laboratory.

Volatile Sample Collection – Sample Collection for Methanol or other Preservative Extraction

General procedures for all volatile sample collection:

- Soil samples for volatile analysis can be collected using any of the sampling methods described above.
- When collecting soil for volatile sample analysis, always submit a separate non-preserved sample for moisture analysis/dry weight calculation, unless already submitting non-volatile samples from the same location.
- Never composite VOC samples.
- If VOC duplicate, split, or other QA/QC samples are required, collect and containerize samples that are co-located, not composited.
- If VOC samples are required, transfer the sample into a labeled sample container with a stainless steel laboratory spoon, or equivalent, and secure the cap tightly.
- Avoid placing pebbles or other large particles into the sample. To the extent practical, the sample should consist of sand, silt, or clay, with care to avoid rocks or pebbles.
- Ensure that the threads on the sample container and cap are free of soil particles. Wipe with a clean brush or paper towel if needed. The sample container should be open for the shortest time possible to prevent evaporation of the methanol and surrogate solution.
- After soil is placed in methanol or other preservative, it should be gently agitated or swirled so that the soil is immersed in the preservative. Do not shake the sample, as it may cause undue volatilization.

The different methods of collecting volatile samples with field extraction, using methanol or another preservative, are described in general below. Refer to the project QAPP for site-specific information on specific soil and methanol volumes required for the appropriate analytical method:

<u>Measuring 10 grams of soil into a VOA vial containing methanol</u>:

1. "Zero" one 40-milliliter volatile organic analyte (VOA) vial containing 10 milliliters of methanol on a small scale.
2. Use a disposable scoop to collect soil.
3. Very gently, transfer the soil into the vial until 10 grams of soil is weighed. Try not to let any soil drop outside the sample container onto the scale. Immediately cap the vial.
4. Ensure that the methanol does not splash. If methanol splashes or spills from the sample container, discard the container and re-sample.
5. Record the tare weight onto the sample sheet or label.

6. Repeat the process for the second VOA vial containing methanol.
7. Place the samples in a protective sleeve and store on ice until delivery to the laboratory.

Using a sampling coring device to collect soil for VOC analysis:

1. Coring devices (for example, EnCore® or Terracore®) are disposable, and are not to be reused after each sample.
2. Push the core sampler into freshly exposed soil until the sample chamber is filled. Most of these devices deliver approximately 5 grams of soil.
3. Once the core is filled with soil, retrieve the coring device from the soil.
4. Wipe all soil from outside of the sampler. The soil plug should be flush with the mouth of the sampler.
5. If the QAPP requires using a preservative (for example methanol or sodium bisulfate), use the following preservation procedure:
    a. Place the mouth of the sampler into a pre-tared VOA vial containing the appropriate preservative, and extrude the sample by pushing the plunger down. Immediately cap the VOA vial.
    b. Place the labeled sample in protective padding and on ice.
6. If the QAPP requires freezing the samples unpreserved, use the following procedure:
    a. Place the mouth of the sampler into a pre-tared VOA vial containing exactly 5 milliliters of deionized water, and extrude the sample by pushing the plunger down.
    b. Cap the VOA vial and be sure the soil is below the water level. Gently swirl the vial.
    c. Repeat the process to collect a second soil vial.
    d. Immediately place the labeled sample in protective padding and on ice.
    e. As soon as practical, freeze sample in a freezer or by placing in a cooler containing dry ice.
    f. When freezing the soil vials, it is recommended that the vials be placed at a 45° angle to reduce the likelihood of vial breakage due to freezing.
7. If the QAPP requires submitting unpreserved, unfrozen samples that were collected using an EnCore device, use the following procedure:
    a. Immediately place the cap on the open end of the core. Place the capped core inside the foil sample bag. Make sure that the sample bag is labeled.
    b. Place the sample bag on ice for shipment to the laboratory for analysis within 48 hours.

Quality Control:

The following procedures apply:

- Samples will be packaged, handled, and shipped in accordance with SOP BERS-03 *Sample Management Procedures.*
- Equipment will be operated and used in accordance with the manufacturer's instructions, unless otherwise specified in the site QAPP.
- Equipment examination activities should occur prior to field deployment, and they should be documented.
- An equipment rinsate blank is generally required per matrix, and for each sampling event, to evaluate the potential of cross contamination from sampling equipment. Equipment rinsate blanks will be collected by pouring analyte-free water over the decontaminated sampling equipment.
- Depending on the needs of the project, a field blank may be required per matrix and for each sampling event to evaluate whether contaminants have been introduced into the samples during the sampling process. Field blank samples will be obtained by pouring analyte-free water into a sampling container at the sampling point.

Interferences and Potential Problems:

There are two primary problem areas associated with soil sampling: cross-contamination and improper sample collection.

Cross-contamination can be eliminated or minimized through the use of dedicated sampling equipment. If this is not possible or practical, field personnel will decontaminate sampling equipment as described in the site Sampling and Analysis Plan (SAP). Improper techniques may include using contaminated equipment, disturbing the matrix, compacting the sample, and inadequate homogenization of the samples, any of which can produce non-representative samples.

To safeguard against collecting non-representative soil samples, the following guidelines and techniques should be adhered to during sampling:

- Samples for VOC analysis should be collected before other samples are collected, and should be transferred immediately from the sampling device into the sample container to reduce volatilization. Step-by-step instructions for field extraction and preservation with methanol are described above.
- Anytime a vertical or near vertical surface, such as that which is achieved when shovels or backhoes are used for subsurface sampling, the surface should be dressed to remove the outer smear zone. This is necessary to minimize the effects of cross contamination due to smearing of materials from other levels.

- It is extremely important that soil samples intended for non-VOC analyses be mixed as thoroughly as possible to ensure that each sample is representative of the material sampled. The most common method of mixing is referred to as quartering. Where required by the QAPP, quartering will be performed as follows:
  a. Divide the material in the sample pan into quarters and mix each quarter individually.
  b. Mix two quarters to form halves.
  c. Mix the two halves to form a homogenous matrix.
  d. Repeat this procedure until the sample is adequately mixed.
  e. If round bowls are used for sample mixing, stir the material in a circular fashion, reversing direction, and occasionally turning the material over.
- One trip blank per cooler is generally required when submitting samples for VOC analysis. Trip blanks are prepared and sealed by the laboratory. They are transported to the field and returned, unopened, to the laboratory in the same cooler as the samples collected for VOC analysis.
- Methanol blanks may also be required when soil samples designated for VOC analysis are preserved with methanol.
- Blanks will be collected at the frequency and locations specified in the site QAPP. Blanks will be analyzed for the same target analytes as the associated field samples. Each blank will be assigned a unique sample number, and submitted blind to the laboratory.

BRISTOL ENVIRONMENTAL REMEDIATION SERVICES, LLC

Anchorage, Alaska

GROUNDWATER SAMPLING

STANDARD OPERATING PROCEDURE BERS-02

Record of Changes

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1	10/14/09	B. Allen	L. Maserjian
2	02/16/2010	J. Clark	B. Allen/ J. Clark

GROUNDWATER SAMPLING

STANDARD OPERATING PROCEDURE

Summary: Groundwater samples are usually obtained from either temporarily or permanently installed groundwater monitoring wells. In order to obtain a representative groundwater sample, the stagnant water in the well casing and the water immediately adjacent to the well are purged before sample collection. Depending on the needs of the project, purging can be performed either by traditional methods (purging several full well volumes), or by the low stress/low flow method. Once purging is complete, samples are collected using a sampling device that does not affect the integrity or representativeness of the sample.

Health and Safety: Sampling activity should only be conducted in accordance with an approved Site Health and Safety Plan. Electric generators must be grounded to prevent possible electrical shock.

Interferences and Potential Problems: The primary problems associated with groundwater sampling are the collection of non-representative samples, and sample contamination from equipment or the environment. These can be eliminated or minimized through implementation of strict well purging and sample collection and handling procedures, and by the use of qualified personnel.

To safeguard against collecting non-representative stagnant water, the following guidelines and techniques should be adhered to during sampling:

- Monitoring wells should be pumped or bailed prior to sampling. This should be done in a manner that minimizes alterations to the water chemistry.
- The well should be sampled as soon as possible after purging and stabilization of indicator field parameters.
- Analytical parameters typically dictate whether the sample should be collected through the purging device or through separate sampling equipment.
- Portions of water that have been tested with a field meter probe will not be collected for chemical analysis.
- Excessive pre-pumping of the well should be avoided.

Personnel Qualifications: Sampling personnel will be trained and certified as hazardous site workers per Title 29 Code of Federal Regulations, Part 1910.120e [29 CFR 1910.120(e)]. If applicable, additional qualification requirements will be specified by the Bristol Quality Control Manager prior to any on-site sampling activity.

Equipment and Materials: Prior to deployment in the field, the requisite sampling equipment and materials will be identified, secured, and inspected for signs of damage or potential contamination.

- Ideally, purging and sample withdrawal equipment should be completely inert, economical, easily cleaned, reusable, able to operate at remote sites in the absence of power resources, and capable of delivering variable rates for sample collection. Adjustable rate, submersible and peristaltic pumps are preferred. Peristaltic pumps are only effective if groundwater depths are approximately 25 feet below the ground surface or shallower. When sampling for volatile contaminants, a pump that minimizes or eliminates volatilization should be selected. The use of inertial pumps is discouraged because of their tendency to cause greater disturbance during purging and sampling.
- Sampling and purging equipment (e.g., bailers, bladders, pumps, and tubing) should be made from stainless steel, Teflon®, polypropylene, or glass.
- The use of 1/4 or 3/8-inch inner diameter tubing is preferred. Clean, pharmaceutical grade tubing should be used in drawing and sampling groundwater. Water level measuring devices should be capable of measuring to 0.01-foot accuracy.
- In addition to groundwater sampling equipment, sampling support equipment may include water level indicators, depth sounder, water quality meter (such as YSI), keys for well caps, organic vapor screening device (such as photoionization detector [PID]), plastic sheeting, tubing, pre-cleaned sample containers, sample preservatives, decontamination supplies and equipment, safety equipment, logbooks, field forms, camera, chain- of-custody forms and seals, coolers and ice packs, and labeling, packaging, and shipping supplies. Sample containers will be of the type and size specified in the governing Quality Assurance Project Plans (QAPPs).

Field Preparation: Perform the following steps before any purging or sampling activities:

1. Pre-label and ready all the required sample containers.
2. To the extent known, plan to sample wells in order of increasing contamination.
3. Check the well for security damage or evidence of tampering, and record observations.
4. Record location, time of day, and date in field notebook.
5. Remove locking well cap and well casing cap.
6. Screen well headspace with a PID or equivalent, to determine the presence or absence of volatile organic compounds. Record instrument readings in the field logbook or field form.
7. Lower a water-level measuring device into the well until water surface is encountered and the instrument alarms.
8. Measure distance from water surface to reference measuring point on well casing or protective barrier post, and record in the field logbook or on the field form. If there is no reference point, measure from the top of the steel casing, top of PVC riser pipe, from ground surface, or some other position on the wellhead, and <u>note</u> in the field logbook or field form.

9. Measure the total depth of the well and record in the field logbook or field form. Measure well depth either the day before sampling or after all sampling in that well has been completed. Take care to minimize disturbance of the water column.
10. Calculate the volume of water in the well using the following calculations and data reduction:

    Well volume: $V = 0.041d^2h$

    V = volume of one well casing of water in *gallons*

    d = inner diameter of the well casing in *inches*

    h = total height of the water column in *feet*

    Based on this equation, one well volume can be calculated simply by multiplying the height of the water column in feet by the appropriate conversion factor, which is based on the casing diameter as follows:

Diameter	2-inch	3-inch	4-inch	5-inch	6-inch
Volume (gal/ft.):	0.1632	0.3672	0.6528	1.02	1.4688

11. Select the appropriate purging and sampling equipment based on requirements in the site-specific QAPP.

Purging: To ensure that a representative groundwater sample is collected, a well is typically purged prior to sample collection. Well purging is accomplished either by using low-flow procedures or removing a prescribed volume of water from the well (usually a minimum of three to five well volumes). During both purging methods, water quality parameters should be monitored for stabilization.

Purging may be performed by using bailers or pumping mechanisms. In general, a pump is preferred over a bailer for purging and sampling because it will not stress the well like dropping a bailer into the well. If using a pump, select a low removal rate in order to not stress the well. Tubing should remain filled with water, so as to minimize possible changes in water chemistry upon contact with the atmosphere.

If possible, avoid purging wells to dryness by slowing the purge rate. If the well has a poor recharge rate and is purged dry, sample the well once the water level has recovered sufficiently to collect the appropriate volumes for all required analyses. Record in the field logbook or on the field form that samples were collected, even though water quality parameters did not stabilize or the required volume of water was not removed.

If water quality parameters have not stabilized after 1 hour of purging, options include continued purging until stabilization is achieved, or collecting samples although stabilization has not been achieved. Record all actions taken in the field logbook or field form.

Once the purging requirements have been met, the groundwater sample can be collected. Collect and dispose of purge water and solid investigation-derived waste (IDW) as prescribed in the site-specific QAPP.

These procedures are used for sampling events that require purging prior to sampling. For some projects, sampling may be performed without purging the well first. Refer to the non-purge sampling procedures.

Low-flow purging

For low-flow purging and sampling, the Region 1 U.S. EPA Low Flow Guidance Document [*Low Stress (low flow) Purging and Sampling Procedure for the Collection of Ground Water Samples from Monitoring Wells*, July 30, 1996, Revision 2] will be followed, and is summarized below.

1. After the water level and total well depth have been measured, lower the submersible pump or tubing (Teflon, polyethylene, or other approved material) for peristaltic pump slowly (to minimize disturbance) into the well to the middle of the submerged, screened interval of the well, or appropriate depth based on site-specific conditions. Placing the pump or tubing in this manner will reduce the risk of drawing down the water table to below the pump intake, thus preventing the introduction of air into the sample tubing.
2. Before starting the pump, measure the water level and record it on the Groundwater Low Flow Purging Form.
3. Start the pump at its lowest speed setting and slowly increase the speed until discharge occurs. Check water level. Adjust pump speed until there is little or no water level drawdown (less than 0.3 feet). If the minimal drawdown that can be achieved exceeds 0.3 feet, but remains stable, continue purging until indicator field parameters stabilize (described in Number 5, below).
4. Monitor and record water level and pumping rate every 3 to 5 minutes during purging. If a flow rate meter is present, record the pumping rate every 3 to 5 minutes as well. Record any pumping rate adjustments (both time and flow rate). Pumping rates should, as needed, be reduced to the minimum capabilities of the pump to ensure stabilization of indicator parameters. Adjustments are best made in the first 15 minutes of pumping. The final purge volume must be greater than the stabilized drawdown, plus the extraction tubing volume.
5. Monitor indicator field parameters every 3 to 5 minutes during purging, with a calibrated combination type meter (i.e., YSI, etc.). The following field parameters will be monitored: turbidity, temperature, specific conductance, pH, oxidation-reduction potential (ORP), and dissolved oxygen (DO). All measurements, except turbidity, must be obtained using a flow-through cell. Transparent flow-through cells are preferred. This allows the field personnel to watch particulate buildup within the cell. If the cell needs to be cleaned during purging, continue pumping and disconnect the cell for cleaning. Then reconnect and continue monitoring.

6. Groundwater samples can be collected after the field parameters stabilize within the following limits:
   - Turbidity: +/- 10% for values greater than 1 nephelometric turbidity units (NTUs)
   - DO: +/- 10 %. Note: DO may not stabilize unless using a flow-thru cell. If not using a flow-thru cell, disregard this parameter for the purpose of establishing stability
   - Specific conductance: +/- 3%
   - Temperature: +/- 3%
   - pH: +/- 0.1 pH units
   - ORP: +/- 10 millivolts

Purging is considered complete and sampling may begin when all of the above indicator field parameters have stabilized. Do not change the flow rate of the pump prior to sampling. Remove the flow through cell prior to collecting the groundwater samples, and collect directly from the pump discharge.

General well purging – removing specified volume of water

During general well purging, a specified minimum volume of water (usually three to five well casing volumes) should be purged prior to sampling. Water temperature, pH, turbidity, DO, ORP, and specific conductance should be periodically measured during purging using a calibrated combination type meter (i.e., YSI, etc.). These parameters should be measured and recorded approximately every three to five minutes, or after each well volume is removed. The sample can be collected after the required volume of water has been purged and the parameters have stabilized within the limits described above in Number 6 of the low-flow purging section.

Purging Methods

Pumping mechanisms – peristaltic pumps, submersible pumps, non-contact gas bladder pumps, and suction pumps, etc.

1. Assemble the pumping unit. For more information on pump assembly and operation, refer to the specific user's manual for the type of pump used.
2. Lower the tubing (peristaltic pump) or pump/tubing assembly (submersible pumps) into the well to the midpoint of the zone to be sampled. If possible, keep the tubing or pump intake at least 2 feet above the bottom of the well, to minimize mobilization of particulates present in the bottom of the well.
3. Attach a water quality meter to the outlet tubing to monitor water quality parameters.
4. If required, attach a flow meter to the outlet tubing to measure the volume and rate of water purged.

5. Attach the power supply (typically a battery, generator, etc.). Use a ground fault circuit interrupter (GFCI), or ground the generator to avoid electric shock.
6. Start the pump at its lowest speed setting and slowly increase the speed until discharge occurs. Adjust the pump speed until there is little or no water level drawdown (less than 0.3 feet). If the minimal drawdown that can be achieved exceeds 0.3 feet, but remains stable, continue purging until indicator field parameters stabilize.
7. During purging, monitor water quality parameters and water level drawdown.
8. After water parameters have stabilized, disconnect the water quality meter and flow meter, then collect sample.

Bailer purging

1. Attach the line to the bailer and slowly lower until completely submerged, be careful not to drop the bailer to the water, which would cause turbulence and the possible loss of volatile contaminants.
2. Pull bailer out, while ensuring that the line either falls onto a clean area of the plastic sheeting or that it never touches the ground.
3. Empty the bailer into a pail of known volume (for example, a five-gallon bucket, preferably graduated). Use the volume of the pail to estimate the amount of water removed.
4. During purging, monitor water quality parameters.
5. Remove the required amount of water.
6. If water quality parameters have stabilized, the sample can be collected. If parameters have not stabilized, continue purging until stabilization has been achieved, or collect sample if directed to do so by the project manager.

Sampling: Sampling may be accomplished using pumping mechanisms or bailers. Care must be exercised during the use of bailers because of their tendency to disturb sediment, leading to increased turbidity.

General procedures

1. If using a pumping mechanism, do not change the flow rate maintained during purging.
2. Remove the water quality and flow rate meters, if used.
3. If using a pumping mechanism, collect non-filtered samples directly from the outlet tubing into the sample bottle. For filtered samples, connect the pump outlet tubing directly to the filter unit. The pump pressure should remain decreased so that the pressure buildup on the filter does not blow out the pump bladder, or displace the filter.
4. For certain projects, sampling may be performed without purging the well first,

typically using a bailer. It is preferable to record the water quality parameters (turbidity, DO, specific conductance, temperature, pH, and ORP) before the sample is collected. Non-purge sampling will be performed in accordance with the steps below.

5. If using a bailer, lower the bailer slowly and gently into the well, taking care not shake the casing sides or to splash the bailer into the water. Stop lowering at a point adjacent to the screen. Allow the bailer to fill and then slowly and gently retrieve the bailer from the well, avoiding contact with the casing, so as not to knock flakes of rust or other foreign materials into the bailer. If the bailer comes with a Bottom Emptying Devise (BED), place the BED into the bottom of the bailer. Fill the sample containers from the BED. A specific BED for volatile samples is recommended because it reduces the outflow to a very low laminar rate. This device is typically purchased separately from the bailers.
6. Collect samples in appropriate containers in order of volatility, with the most volatile samples collected first. Containers should be either pre-labeled or labeled immediately after sample collection. For collecting volatile samples using the zero-headspace procedure, follow procedures specified at the end of this section.
7. Fill containers slowly (avoid turbulence).
8. Filter and preserve samples as specified in the site-specific QAPP.
9. If duplicate samples, split samples, or other quality assurance/quality control (QA/QC) samples are required, collect them at the same time as the primary sample.
10. Cap sample containers tightly and place into a sample cooler. Samples must be chilled and maintained at a temperature of 4 degrees Celsius. Do not allow samples to freeze.
11. Replace the well cap.
12. Log all samples in the field notebook or on field forms.
13. Package samples and complete requisite paperwork.
14. Dispose of all liquid and solid IDW in accordance with project planning documents.

Volatile sampling using zero-headspace procedure

1. Open the sample vial, set cap in clean place, and fill the vial just to overflowing. Do not rinse the vial or allow excessive overflowing. There should be a meniscus on the top of the filled vial.
2. Check that the cap has not been contaminated and carefully cap the vial. Slide the cap directly over the top and screw down firmly. Do not over tighten because the cap may break.

3. Invert the vial and tap gently. It is imperative that no air is entrapped in the sample vial. If an air bubble appears that is smaller than approximately 1.0 millimeter, the sample is still viable. If the bubble(s) are larger, discard the sample and begin again.
4. Place the vial in a protective foam sleeve, and then place into the cooler.

Quality Control: The following procedures apply:

- Samples will be packaged, handled, and shipped as prescribed in BERS-03 *Sample Management Standard Operating Procedure.*
- Equipment will be operated and used in accordance with the manufacturer's instructions, unless otherwise specified in the site-specific QAPP.
- Equipment examination activities should occur prior to field deployment, and they should be documented. It is especially important to check that the correct number and type of sample bottles are being sent/taken to the field prior to starting the field activities.
- Depending on the needs of the project, if using non-disposable equipment, collect an equipment rinsate blank to evaluate the potential for cross contamination from the purging or sampling equipment. Collect equipment rinsate blanks by pouring analyte-free water over the decontaminated sampling equipment.
- Depending on the needs of the project, a field blank may be required per matrix and for each sampling event to evaluate whether contaminants have been introduced into the samples during the sampling process. Field blank samples will be obtained by pouring laboratory-grade, certified organic-free water (for organics) or deionized water (for metals) into a sampling container at the sampling point.
- One trip blank per cooler is required when submitting samples for volatile organic analysis. Trip blanks for water and soil samples are prepared and sealed by the laboratory. They are transported to the field and returned, unopened, to the laboratory in the same cooler as the samples collected for volatile organic compound (VOC) analysis.
- Blanks will be collected at the frequency and locations specified in the site-specific QAPP. Blanks are analyzed for the same target analytes as the associated field samples. Each blank receives a unique sample number and is submitted blind to the laboratory.

BRISTOL ENVIRONMENTAL REMEDIATION SERVICES, LLC

Anchorage, Alaska

SAMPLE MANAGEMENT

STANDARD OPERATING PROCEDURE BERS-03

Record of Changes

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0	01/15/08	B. Allen	S. Ruth
1	2/23/2010	M. Faust	B. Allen

SAMPLE MANAGEMENT

STANDARD OPERATING PROCEDURE

Method Summary: To ensure the quality and integrity of analytical data, samples will be managed in accordance with rigorous sample handling, shipping, and custody protocols at all times. Pertinent protocols will be determined prior to initiation of field sampling activity and will apply to sampling, transport, and analysis activities.

Health and Safety: Sampling activity should only be conducted in accordance with an approved Site Health and Safety Plan.

Interferences and Potential Problems: Improper sample management may result in a number of problems, including, but not limited to:

- Inability to collect samples during the field event due to lack of appropriate sample containers and/or preservatives.
- Contamination and/or loss of samples or sample constituents through improper storage and handling, tampering, or breakage.
- Inability to validate resulting data.
- Development of erroneous conclusions regarding site contamination based on inaccurate data and/or problems correlating data and sample locations at the site.
- Mishandling of residual sample material following analysis.

Personnel Qualifications: Sample management personnel will be trained and certified as hazardous site workers per Title 29 Code of Federal Regulations, Part 1910.120(e) [29 CFR 19 10.120(e)] and trained in applicable DOT sample shipping regulations of 49 CFR Part 172, Subpart H. If applicable, additional qualification requirements will be specified in the site-specific Quality Assurance Project Plan (QAPP) and met by designated personnel.

Equipment and Materials: Equipment selection will be based on the objectives of the sampling program and the analytes of concern. Prior to deployment in the field, the requisite sampling equipment and materials will be identified, secured, and inspected for signs of damage or potential contamination.

Sample Identification and Labeling: Sample identification and labeling protocols will follow the procedures specified in the governing program QAPP.

Each collected sample will be assigned a unique sample identification number. The designated sample number will be included on the sample label and referenced on associated sample tags, field logbooks, chain-of-custody forms, analysis request forms, and all data reports related to the samples.

To prevent misidentification of samples, the field team will affix legible labels to each sample container. The labels will be sufficiently durable, and an indelible pen will be used to record data on the labels, so that sample identification information remains legible even when wet. Markers should never be used for sample labeling, as they can be a source of volatile compounds and potential contamination of the sample. Additional labeling requirements will be presented in the site-specific QAPP.

Information that is generally included on the container label and/or sample tag includes:

- Sample identification number;
- Sample collector's name or initials;
- Date and time of sample collection;
- Chemical/physical preservatives used;
- Type of sample (composite, grab, filtered); and
- Analytical parameters requested

Sample Containers and Coolers: Sample containers will be selected, prepared, cleaned, and controlled in accordance with EPA Office of Solid Waste and Emergency Response (OSWER) Directive #9240.0-05A *Specifications and Guidance for Contaminant-Free Sample Containers* (EPA *540/R-93/05* 1, December 1992), and as specified in the governing program QAPP. In advance of each sampling event, the subcontract laboratory should prepare a complete set of precleaned sample containers.

Prior to field activity, field personnel will implement the following steps:

1. Check all sample containers against the specifications of the site-specific QAPP. Ensure that the sample containers and caps are in good condition and free of obvious contamination, constructed of the appropriate material (i.e., plastic or glass), contain appropriate preservative solutions, and will hold sufficient volume for planned analyses, if specified.
2. Verify that sample identification labels are properly affixed to each container.
3. Verify that an adequate quantity of each type and volume of sample container is available for the anticipated environmental and quality control samples. Verify that extra containers are readily available to field staff as contingency for damaged or potentially contaminated containers, and for collecting samples of opportunity.
4. Ensure that containers and coolers are stored in clean areas to prevent exposure to fuels, solvents, and other potential contaminants.

Sample Collection: Field personnel will collect samples as prescribed in the governing QAPP. Samples should be transferred in the field from the sampling equipment directly into a container

that has been specifically prepared for that sample (based on the analytes of concern, preservation requirements, and the type of analysis to be performed).

To minimize the potential for cross-contamination and loss of sample constituents, sample fractions should be collected and containerized in the order of volatilization sensitivity of the analytes of interest. The following sample collection order is recommended:

- Volatile organic compounds (VOCs)
- Purgeable organic carbon
- Purgeable organic halogens
- Total organic halogens
- Total organic carbon
- Extractable organic compounds
- Metals
- Phenols
- Cyanide
- Sulfate and chloride
- Turbidity
- Nitrate and ammonia
- Radionuclides
- Ignitability
- Corrosivity
- Reactivity

As the samples are being collected, or immediately thereafter, the field sampling team will document the date and time of sample collection, pertinent field information (e.g., sampling depth), and the identity of sampling personnel, on each container label. Additional detail on the sampling event may be documented in the site logbook as appropriate.

Sample Custody: BERS will ensure the integrity and security of all samples under their control, using a stringent chain-of-custody protocol. This will be supplemented as needed to meet all work assignment requirements.

During the sampling event, field personnel will prepare a chain-of-custody form documenting each sample collected as follows:

- Sample numbers, date and time of collection, sampling location, name of the person who collected the samples, preservatives used, and the analyses requested.
- Document each sample transfer on the custody sheet. Ensure that this form remains with the samples until they arrive at, and are processed by, the laboratory.
- When samples are relinquished to a commercial carrier for transport to the laboratory, sign the chain-of-custody form under "Relinquished By," enter the name of the carrier organization under "Received By," and document the date and time of transfer. Upon receipt of the samples, the laboratory sample custodian will similarly sign and date the chain-of-custody form.

Under no circumstance is there to be a break in custody.

Sample Packaging: Unless otherwise specified in the site-specific QAPP, field personnel will implement the following steps when packaging environmental samples for shipment:

- Tighten all sample lids. Verify that all containers are labeled and intact. Verify that all container labels are secure, legible, and complete.
- Bag samples individually in appropriate-sized plastic bags (e.g., Ziploc®) and seal. Up to 3 VOC vials may be packed together in container bags.
- Secure and tape the drain plug on the cooler with fiber or duct tape.
- Spread inert packing material (rubber foam, air pillows, or "bubble" wrap) in the bottom of the bag inside the cooler and place sample bags on top of the packing material.
- Include a temperature blank (a small container filled with water) to be used by the laboratory to determine the internal temperature of the cooler upon receipt at the laboratory.
- Place ice packs (e.g., blue ice) into cooler. If ice packs are unavailable, place ice into doubled heavy-duty polyethylene bags and seal with tape. Put double-bagged ice on top of, and in between, samples. Fill in remaining space with packing material.
- Place the chain-of-custody record into a plastic sealable bag (e.g., Ziploc), seal the bag, and tape it to the inside of the cooler lid.
- Close the cooler and tape the top of the cooler shut. Affix custody seals to the top and sides of the cooler, such that the cooler cannot be opened without breaking at least one seal.
- Mark the cooler with "This End Up" and arrows to indicate the proper upward position.
- Tape a label containing the name and address of the destination to the outside of the cooler.

Sample Scheduling, Delivery, and Holding Times: In work assignments where analytical services are procured from a subcontractor laboratory, the laboratory will be required to designate a point of contact (POC) for both normal business hours, and for emergency situations during off-hours. In addition, the laboratory will be required to designate a sample custodian, who will be notified by the BERS field sampling supervisor each time samples are shipped.

Unless otherwise approved, samples will be delivered to, and received by, the laboratory within 24 hours of collection.

Sample holding time tracking begins with the collection of samples, and continues until the analysis is complete. The site-specific QAPP will specify holding time requirements for each analyte of interest to the project.

Quality Control: No additional QC procedures apply.

Data Management and Records Management: Sampling records will be generated and maintained as prescribed in this procedure and the governing QA plans. Sampling data will be documented on field data sheets or in the logbooks.

BRISTOL ENVIRONMENTAL REMEDIATION SERVICES, LLC

Anchorage, Alaska

FIELD MEASUREMENT AND TEST EQUIPMENT

STANDARD OPERATING PROCEDURE BERS-04

Record of Changes

Revision No.	Date	Prepared by	Approved by
0	01/15/09	B. Allen	L. Maserjian
1	2/5/10	M. Hannah	B. Allen

FIELD MEASUREMENT AND TEST EQUIPMENT

STANDARD OPERATING PROCEDURE

Summary: Various types of instruments are used to measure the physical and chemical characteristics of a sample in the field. In general, field measurement and test equipment (M&TE) are maintained and operated according to the manufacturer's instructions specific to each instrument. Field M&TE are inspected for function and damage on a regular basis and prior to each use. All findings are recorded in the appropriate logbook. Field M&TE are calibrated in accordance with the manufacturer's specifications. Calibrations are checked on a regular basis and prior to and after use in the field. When daily calibrations are required, calibrations and/or checks are performed at the beginning and end of the day, and the results are recorded in the field logbook. When daily calibrations are not required during field use, checks against appropriate standards are performed.

Health and Safety: Field activities will only be conducted in accordance with an approved Site Health and Safety Plan.

Interferences and Potential Problems: When multiple measurements are taken from the same sample material, the order in which the measurements are made becomes very important. Conductivity may be affected by temperature of the measured solution; therefore, temperature of the sample should be read first, so that appropriate adjustments can be made in accordance with the manufacturer's instructions.

Personnel Qualifications: Field personnel will be trained and certified as hazardous site workers per Title 29 Code of Federal Regulations, Part 1910.120(e) [29 CFR 1910.120(e)]. If applicable, additional qualification requirements will be specified in the site Quality Assurance Project Plan (QAPP).

Equipment and Materials: Prior to deployment in the field, the appropriate equipment and materials will be identified, secured, and inspected for signs of damage or potential contamination. Manufacturer's instructions and specifications for each instrument used will be maintained in the project files. Materials used for calibration of instrumentation, such as standard solutions, must be traceable to relevant, recognized performance standards.

Planning Considerations: Procedures used for the maintenance and use of field equipment, including those performed by subcontractors and suppliers, will be outlined preceding field activities and in accordance with the procedures outlined in this SOP. Equipment must be inspected prior to use in the field for damage and function. Calibration and maintenance of field equipment will be performed according the manufacturer's instructions for that particular instrument. The required frequency of calibration varies between instruments. While some instrumentation must be calibrated only annually or semi-annually, other instrumentation must be calibrated daily during use in the field. Instrumentation that does not require field calibration usually requires a check against a standard. Attention should be paid to specific requirements for

each instrument used in the field, and it is important to remember that the requirements for each instrument may differ.

Instructions for the Maintenance and Use of Field Equipment: Refer to the following sections for instructions on the proper calibration, maintenance, and use of field instrumentation used to measure physical/chemical properties of sample material:

Multi-parameter Water Quality Meter: Many water quality meters are capable of measuring several parameters, such as temperature, conductivity, pH, dissolved oxygen (DO), and oxygen reduction potential (ORP). The following sections provide general instructions for calibrating each parameter. The field personnel will adhere to the calibration instructions for the each instrument used.

Temperature

Temperature, defined as a measure of hotness or coldness on a defined scale, is measured using a thermometer. Three types of thermometers are commercially available: digital (thermocouple) thermistor; glass bulb, mercury-filled thermometer; and bi-metal strip dial indicator thermometer.

Calibration

Thermometers will be calibrated in accordance with the manufacturer's instructions or calibrated semi-annually against a National Institute of Standards and Technology (NIST)-certified thermometer. Thermistors should be checked against a mercury bulb thermometer in water prior to use, and should agree within ± 0.5° degree Celsius (°C).

Maintenance

All thermometers should be inspected regularly and prior to use for leaks, cracks, and function.

Use

Measurements should be made in situ, when possible. To measure the temperature of sample material, perform the following steps:

1. Clean the probe with deionized water, and immerse into the sample.
2. Swirl the thermometer in the sample.
3. Allow the thermometer to equilibrate with the sample.
4. Suspend the thermometer away from the sides and bottom to observe the reading.
5. In a logbook, record the reading to the nearest 0.5° C.
6. Report results to the nearest 0.5° C.

Conductivity: Conductivity, the quality or power of conducting or transmitting, is typically measured using the Wheatstone bridge meter. Conductivity is measured in millisiemens per centimeter (mS/cm) at 25° C. While the sample temperature may be lower, nearly all conductivity meters will convert specific conductance (which is not corrected for temperature) to conductivity.

Calibration

Conductivity will be calibrated in accordance with the manufacturer's instructions. During use in the field, checks against a one-point standard will be performed to ensure the accuracy of the meter, and results will be recorded in a field logbook. The following steps will be implemented both before and after use of the meter to measure the conductivity of sample material in the field:

1. Check and record the temperature of the standard solutions.
2. Rinse the probe with analyte-free water before immersing it in the standards solution.
3. Turn the probe on, immerse it in the standard solution, and record the results.
4. If the meter is not accurate to within ± 10% of the standards, correct the problem before proceeding.

Maintenance

All conductivity meters should be inspected regularly and prior to use for damage and function. Conductivity sensors may become fouled with minerals or other materials, and may require cleaning in the field. Cleaning is accomplished by passing a nylon brush along the sensor surface in a light scrubbing motion, until a metallic shine appears on the sensor. Follow up the cleaning with a fresh or deionized water rinse. DO NOT use a metal brush to clean the sensor surface.

Use

1. Collect the sample and record its temperature.
2. Correct the instrument's temperature adjustment to the temperature of the sample (if necessary).
3. Immerse the probe in the sample. Keep the probe away from the sides and bottom of the container, and ensure that the sensor is in full contact with the sample.
4. Record the results in a logbook.
5. Rinse the probe.
6. Report results to the nearest ten units for readings below 1,000 mS/cm at 25° C and the nearest one hundred units for readings above 1000 mS/cm at 25° C.

Hydrogen Ion Concentration (pH): The pH of a solution is defined as the negative logarithm of the effective hydrogen ion concentration in gram equivalents per liter. The pH is used to

measure acidity and alkalinity on a scale ranging from 0 to 14, with 7 representing neutrality. Orion and YSI Water Quality Monitoring System meters are examples of commercially available meters used to measure the pH of liquid-state material.

Calibration

Any pH meter will be calibrated in accordance with the manufacturer's instructions. During use in the field, a two-point or three-point standard will be used to ensure the accuracy of the meter. Results will be recorded in a field logbook. The expected pH of the sample to be collected, estimated from either historical data or by using four-color pH paper, should fall between the two buffering points. Both prior to and after use in the field, the following procedures should be followed as a minimum:

1. Remove the meter from storage and allow it to equilibrate to ambient temperature.
2. Select either pH 4 and pH 7, or pH 7 and pH 10, as the appropriate standard solutions as described above.
3. Use a thermometer to determine the temperature of the buffering solutions, and record the temperature.
4. Rinse the probe with analyte-free water, and immerse it into the pH 7 buffer and set the meter to 7. If the solution temperature is not at 25°C, a table with corrected pH values can be found on the calibration solution bottle or in the operations manual.
5. Rinse the probe with analyte-free water and immerse it into the second buffer, and record the reading.
6. Rinse and store the probe in a container filled with analyte-free water.

Maintenance

All pH meters should be inspected for damage and function regularly and prior to use. During use, periodically check the calibration of the meter by rinsing it with analyte-free water and immersing it into the pH 7 buffer solution.

Use

Follow these steps when measuring the pH of a sample:

1. If measuring temperature, record temperature prior to measuring pH.
2. Immerse the probe in the sample, keeping it away from the sides and bottom of the container. Allow the probe to equilibrate with the sample material.
3. With the probe suspended away from the container surface, record the pH.
4. Rinse the probe with analyte-free water and store in a container filled with analyte-free water until the next sample is ready.
5. Record results to the nearest 0.1 Standard Unit (SU).

Storage

After use, rinse the unit with fresh water or Alconox®, followed by fresh water, at contaminated sites. Leave a small amount (20mL) of pH 4 solution in the storage cup before sealing the unit in order to keep the pH sensor moist during storage.

Dissolved Oxygen (DO): The membrane/electrode (ME) is the most commonly used instrument for measuring the dissolved oxygen present in a sample.

Calibration

Calibrate the DO probe according to the manufacturer's instructions, either in air-saturated water, or in a water-saturated air environment.

Maintenance

The DO probe should be inspected regularly and prior to use for damage and function. The membrane of the DO meter should be inspected for air bubbles, holes, and dryness. If the membrane is dry, replace and soak it in analyte-free water prior to calibration of the meter. If the metallic sensor is discolored, or does not appear shiny, use the fine-grit sandpaper (supplied with the DO sensor replacement kit) and buff the metal surface in a circular pattern until the surface shines. Rinse the sensor with deionized water before installing a new membrane.

Use

When measuring DO in situ with a field probe, follow these steps:

1. Allow the DO reading to stabilize.
2. Read the dial to the nearest 0.1 mg/L, and record the measurement.

Oxygen Reduction Potential (ORP): ORP, also known as redox potential, is the tendency of a chemical species to acquire electrons and thereby be reduced. Each species has its own intrinsic reduction potential; the more positive the potential, the greater the species' affinity for electrons and tendency to be reduced.

Calibration

Calibrate the ORP probe according to the manufacturer's instructions in a standardized calibration solution. The ORP is affected by temperature. Refer to the calibration solution or operations manual to correct for temperature during calibration.

Maintenance

The ORP probe should be inspected regularly and prior to use for damage and function.

Use

When measuring ORP in situ with a field probe, follow these steps:

1. Immerse the probe in the sample, keeping it away from the sides and bottom of the container. Allow the probe to equilibrate with the sample material.
2. With the probe suspended away from the container surface, record the ORP to the nearest 1.0 millivolt.
3. Rinse the probe with analyte-free water and store in a container filled with analyte-free water until the next sample is ready. Do not store the unit in deionized water.

Turbidity Meter: A nephelometer/turbidmeter is used to measure the turbidity of a liquid sample by determining how much light can pass through it. The Hach® Turbidimeter is the most commonly used commercially available meter for measuring the turbidity of a sample. Turbidity is measured in nephelometric turbidity units (NTUs).

Calibration

Calibration of turbidity meters will be performed in accordance with manufacturer's instructions. Any turbidity meter must be calibrated at both the beginning and end of the day during use in the field, and results will be recorded in a field logbook. The following procedures will be used to calibrate a turbidity meter in the field:

1. Turn the meter "ON" and allow 2 minutes for the lamp to stabilize.
2. Rinse the sample cell with organic-free or deionized water.
3. To "zero" the calibration, fill the cell to the fill line with organic-free or deionized water and then cap the cell.
4. Use lens paper to wipe off excess water and streaks from the outside of the cell.
5. Open the cover and insert the cell (arrow to the front) into the unit and close the cover.
6. Press "Blank" and wait for the "light bulb" icon to go off. Record the reading.
7. Hach turbidity meters require calibration with known standards. Refer to the operations manual for information on calibrating the meter.
8. Using the Gelex Turbidity Standards, repeat steps 4, 5, and 6. Record all findings.

Maintenance

Turbidity meters should be inspected regularly and prior to use for damage and function. During use, periodic checks should be performed using the standards to ensure continued proper calibration of the instrument. If error codes appear on the unit display, refer to the owner's manual to resolve the error.

Use

Follow these steps to measure the turbidity of a sample:

1. Pour sample material into the cell to the fill line and replace the cap on the cell.
2. Wipe excess water and any streaks from the outside of the cell with lens paper.
3. Place the cell inside the measurement chamber with the arrow towards the front and close the cover.
4. Press "READ" and wait for the "light bulb" icon to turn off
5. Record the reading.
6. Empty the cell and rinse with organic or analyte-free water.

Quality Control: The following procedures apply:

- Equipment will be operated and used in accordance with the manufacturer's instructions, unless otherwise specified in the site-specific work plan or its equivalent.
- Equipment examination activities will occur prior to field deployment, and they should be documented.

Calculations and Data Reduction: Does not apply.

Data Management and Records Management: Equipment calibration and maintenance records will be generated and maintained as prescribed in the governing QAPPs.

BRISTOL ENVIRONMENTAL REMEDIATION SERVICES, LLC

Anchorage, Alaska

EQUIPMENT DECONTAMINATION

STANDARD OPERATING PROCEDURE BERS-05

Record of Changes

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1	10/14/09	B. Allen	L. Maserjian
2	2/23/10	L. Maserjian	B. Allen

EQUIPMENT DECONTAMINATION

STANDARD OPERATING PROCEDURE

Summary: Disposable tools and equipment should be used when possible. However, where non-disposable items are used, appropriate decontamination will be accomplished according to the type of equipment being used and the type of samples being collected. In general, field equipment will be decontaminated by means of the following steps:

1. Perform non-phosphate detergent and tap water wash, using a brush if necessary.
2. Perform tap-water rinse.

When sampling for trace organic compounds, the following step will be added:

3. Perform deionized/distilled water rinse.

Health and Safety: Field activities should only be conducted in accordance with an approved Site Health and Safety Plan. Decontamination hazards and precautions include the following:

- Hazardous substances may be incompatible with decontamination materials. For example, the decontamination solution may react with contaminants to produce heat, explosion, or toxic products. Also, vapors from decontamination solutions may pose a direct health hazard to workers by inhalation, contact, fire, or explosion. The Site Health and Safety Plan will provide procedures and identify responsibilities to ensure that incompatible materials are identified and segregated from each other.
- The Site Health and Safety Plan will specify the use of personal protective equipment (PPE) that is appropriate for both the contaminants of concern and the decontamination chemicals used. The PPE selection will take into account that decontamination materials may degrade protective clothing or equipment, and that some solvents can permeate protective clothing.
- Solvent rinsing operations will be performed in well-ventilated areas.
- Investigation-derived waste (IDW) generated from decontamination activities will be managed as prescribed in SOP BERS-09: *IDW Management.*
- Material Safety Data Sheets (MSDS) will be kept with all decontamination solvents or solutions as required by the Hazard Communication Standard.
- Phosphate-containing detergents will not be used in jurisdictions where they are banned.

Interferences and Potential Problems: Potential problems related to equipment decontamination can be eliminated by the use of appropriate materials, reagents, and techniques.

- The use of distilled and/or deionized water commonly available from commercial vendors may be acceptable for decontamination of sampling equipment.

- The use of an untreated potable water supply is not an acceptable substitute for tap water. Tap water may be used from any municipal or industrial water treatment system.
- If acids or solvents are utilized in decontamination, they raise health and safety and waste disposal concerns.
- Washing complex and sophisticated sampling equipment with acids or solvents can damage the equipment.
- If not used immediately, cleaned equipment will be stored to prevent recontamination.
- PVC and plastic items will not be rinsed with solvents.

Personnel Qualifications: Field personnel will be trained and certified as hazardous site workers per Title 29 Code of Federal Regulations, Part 1910.120(e) [29 CFR 1910.120(e)]. If applicable, additional qualification requirements will be specified in the site Quality Assurance Project Plan (QAPP).

Equipment Requirements: Prior to deployment in the field, the requisite sampling equipment and materials will be identified, secured, and inspected for signs of damage or potential contamination. Decontamination equipment, materials, and supplies are generally selected based on availability. Other considerations include the ease of decontaminating or disposing of the equipment.

The following standard materials and equipment are recommended for decontamination activities:

- Non-phosphate detergent.
- Tap water.
- Distilled/deionized water
- Pesticide grade solvent
- Long- and short-handled brushes
- Bottle brushes
- Drop cloth/plastic sheeting
- Paper towels
- Plastic or galvanized tubs or buckets
- Pressurized sprayers (H_20)
- Solvent sprayer with Teflon nozzle
- Aluminum foil
- Plastic sheeting

- PPE
- Trash bags
- Trash containers
- 55-gallon drums
- Metal/plastic buckets/containers for storage and disposal of decontamination solutions.

The appropriate materials and equipment will be selected as needed on a site-specific basis.

Planning Considerations: Equipment decontamination activities, including those performed by subcontractors and suppliers, will be planned in advance of field activities and in consultation with program health and safety personnel.

Decontamination: Depending on the nature of the work, field equipment requiring decontamination may include heavy equipment, downhole equipment, sampling equipment, and groundwater pumping equipment.

Heavy Equipment Decontamination: Heavy equipment includes the drilling rig and backhoe. Field personnel will implement the following steps to decontaminate heavy equipment:

1. Set up a decontamination pad that is large enough to fully contain the equipment to be cleaned. Use one or more layers of heavy plastic sheeting to cover the ground surface.
2. Spray areas of the equipment that may have been exposed to contaminated soils using steam or high-pressure sprayer and detergent. Be sure to spray down all surfaces, including the rear area of the undercarriage.
3. Rinse the equipment with potable water.
4. Remove equipment from the decontamination pad and allow to air dry.

Downhole Equipment Decontamination: Downhole equipment includes hollow-stem augers and drill pipes. Well casings and screens will be decontaminated as decribed under "Sampling Equipment". Field personnel will implement the following steps to decontaminate downhole equipment:

1. Set up a centralized decontamination area, if possible. This area should be set up to contain contaminated rinse waters, and to minimize the spread of airborne spray.
2. Set up a "clean" area upwind of the decontamination area to receive cleaned equipment for air drying. At minimum, clean plastic sheeting must be used to cover the ground, tables, or other surfaces where decontaminated equipment is to be placed.
3. Wearing the required PPE, use a high-pressure sprayer or steam unit and detergent to clean the contaminated equipment. Aim downward to avoid spraying outside the decontamination area. Be sure to spray inside corners and gaps. If necessary, use a brush to dislodge dirt or debris.

4. Rinse the equipment using potable water.
5. Remove the equipment from the decontamination area and place in the clean area to air dry.
6. Cover the equipment to prevent contamination if the equipment is not used immediately.
7. Collect all contaminated waters, plastic sheeting, and disposable gloves, boots, and clothing in the designated containers. Receptacles containing contaminated items must be properly labeled for disposal. Containerize liquids and solids separately.

Sampling Equipment Decontamination: Sampling equipment includes split spoon samplers, spatulas, compositing bowls, and other utensils that come into direct contact with samples.

Field personnel will collect disposable sampling equipment in the designated containers and dispose of them as prescribed in the Site Health and Safety Plan and SOP BERS-09: *IDW Management.* Field personnel will implement the following steps to decontaminate non-disposable equipment:

1. Set up a decontamination line on plastic sheeting. The decontamination line should progress from dirty to clean, and end with an area for drying decontaminated equipment. At minimum, use clean, plastic sheeting to cover the ground, tables, or other surfaces on which decontaminated equipment will be placed. Set up a containment system for collecting wash/rinse waste.
2. Wash the item thoroughly in a bucket of soapy water. Use a stiff-bristle brush to dislodge dirt or debris. Before washing, disassemble items that might trap contaminants internally. Do not re-assemble until decontamination is complete.
3. Rinse the item in potable water. Rinse water should be replaced as needed, generally when cloudy.
4. Allow to air dry.
5. Collect all contaminated waters, plastic sheeting, and disposable gloves, boots, and clothing in the designated containers. Receptacles containing contaminated items must be properly labeled for disposal. Liquids and solids must be drummed separately.

Groundwater Sampling Pumping Equipment Decontamination: Field personnel will implement the following steps to decontaminate sampling pumps:

1. Set up a decontamination area and a separate clean storage area using plastic sheeting to cover the ground, tables, and other porous surfaces where decontaminated equipment will be placed. Set up three clean containers of the appropriate size and shape for immersing the pump assembly. Fill the first container with dilute, non-foaming soapy water, and the second with potable water. Use the third container for waste discharge.

2. If decontaminating an electric submersible pump (e.g., Grundfos® Redi-Flo), remove the bottom screw plug to flush the cooling water. Replace this water with deionized water after the decontamination process is complete.
3. Set up the pump assembly in the same configuration as used for sampling. Submerge pump intake and all downhole wetted parts (tubing, piping, and foot valve) in the soapy water container. Place the discharge outlet in the waste container above the level of wastewater. Pump soapy water through the pump assembly until it discharges to the waste container.
4. Move the pump assembly to the rinse water container while leaving discharge outlet in the waste container. Ensure that all downhole wetted parts are immersed in the potable water rinse. Pump potable water through the pump assembly until it runs clear.
5. Pump a sufficient amount of analyte-free water through the hose to flush out the tap water, then purge with the pump in reverse mode. Rinse the outside of the pump using analyte-free water. Decontaminate the discharge outlet by hand following the steps for decontamination of sampling equipment.
6. Remove the decontaminated pump assembly to the clean area and allow to air-dry.
7. Cover intake and outtake orifices with aluminum foil to prevent the entry of airborne contaminants or particles.
8. Place pump in clean plastic bag.

Quality Control: The following procedures apply:

- Equipment will be operated and used in accordance with the manufacturer's instructions, unless otherwise specified in the site-specific work plan or its equivalent.
- Equipment examination activities should occur prior to field deployment, and should be documented.
- After decontamination activities, the field personnel should make a record of the equipment type, date, time, and method of decontamination in the field logbook.
- If sampling equipment requires the use of plastic tubing, dispose of it as contaminated. Replace with clean tubing before conducting additional sampling.

Calculations and Data Reduction: Does not apply.

Data Management and Records Management: Generate and maintain decontamination records as prescribed in the governing QAPPs.

BRISTOL ENVIRONMENTAL REMEDIATION SERVICES, LLC

Anchorage, Alaska

WATER LEVEL MEASUREMENT

STANDARD OPERATING PROCEDURE BERS-08

Record of Changes

Revision No.	Date	Prepared by	Approved by
0	01/15/08	B. Allen	S. Ruth
1	2/23/10	M. Faust	B. Allen

WATER LEVEL MEASUREMENT

STANDARD OPERATING PROCEDURE

Purpose and Scope: The purpose of this document is to provide sufficient and appropriate instructions for the determination of the depth-to-water and floating chemical product (i.e., gasoline, kerosene) in an open borehole, cased borehole, monitoring well, or piezometer.

Summary: Prior to measurement, water levels in piezometers and monitoring wells are allowed to stabilize for a minimum of 24 hours after well construction and development. A survey mark is placed on the casing for use as a reference point for measurement. The distance from water surface to reference point on well casing is measured at least twice and recorded.

Health and Safety: Field activities should only be conducted in accordance with an approved Site Health and Safety Plan.

Interferences and Potential Problems: Generally, water level measurements taken in boreholes, piezometers, or monitoring wells are used to construct water table or potentiometric surface maps, and to determine flow direction, as well as many other aquifer characteristics. Situations that may impact the accuracy of water level measurements include:

- The magnitude of the observed changes between wells appears too large;
- Atmospheric pressure changes;
- Aquifers that are tidally influenced;
- Aquifers affected by river stage, impoundments, and/or unlined ditches;
- Aquifers stressed by intermittent pumping of production wells;
- Aquifers being actively recharged due to precipitation event;
- Occurrence of pumping; and
- During storm events over a shallow aquifer where recharge is rapid.

Additional sources of error may include the following:

- The chalk used on steel tape may contaminate the well.
- Cascading water may obscure the water mark, or cause it to be inaccurate.
- Many types of electric sounders use metal indicators at 5-foot intervals around a conducting wire. To ensure accuracy, these intervals should be checked with a survey tape (preferably with units divided in hundredths of a foot).
- If there is product or oil present on the water, it can insulate the contacts of the probe on an electric sounder, or give false readings due to thickness of the oil. If this situation is

suspected, it is recommended that interface probes be used to determine the thickness and density of the oil layer in order to determine the correct water level.

- Turbulence in the well and/or cascading water can make water level determination difficult with either an electric sounder or steel tape.

Personnel Qualifications: Field personnel will be trained and certified as hazardous site workers per Title 29 Code of Federal Regulations, Part 1910.120(e) [29 CFR 1910.120(e)]. If applicable, additional qualification requirements will be specified in the site-specific Quality Assurance Project Plan (QAPP) and will be met.

Equipment and Materials: Prior to deployment in the field, the requisite sampling equipment and materials will be identified, secured, and inspected for signs of damage or potential contamination.

There are a number of devices that can be used to measure water levels. The device must be capable of attaining an accuracy of 0.02 feet, and calibrated on a regular basis.

Field equipment for performing water level measurements include:

- Air monitoring equipment (e.g., photoionization detector [PID] or flame ionization detector [FID])
- Well depth measurement device
- Electronic water level indicator
- Metal tape measure
- Chalk
- Ruler
- Watch
- Logbook
- Paper towels
- Groundwater water level data forms
- pH meter (optional)
- Specific conductivity meter (optional)
- Thermometer (optional).

Site Preparation: The following steps will be followed before measurement activities are performed:

- Determine the extent of the sampling effort, the sampling methods to be employed, and the types and amounts of equipment and supplies needed.

- Obtain necessary sampling and monitoring equipment.
- Decontaminate or pre-clean equipment, and ensure that it is in working order.
- Perform a general site survey prior to site entry in accordance with the Site-Specific Health and Safety Plan.
- Identify and mark all sampling locations.

Water Level Measurement: A survey mark should be placed on the north side of the casing for use as a reference point for measurement. Generally, the reference point is marked on the top of the well casing, and is established at the time the well is surveyed. The measuring point should be documented in the site logbook and on a groundwater level data form. Every attempt should be made to notify future field personnel of such reference points in order to ensure comparable data and measurements.

Prior to measurement, water levels in piezometers and monitoring wells should be allowed to stabilize for a minimum of 24 hours after well construction/development. In low-yield situations, recovery may take longer. Measurements should be made to the closest 0.01 feet.

The following procedures will be followed to determine groundwater elevation:

1. Make sure that water level measuring equipment is in good operating condition.
2. To the extent known, measure wells in order of increasing contamination.
3. Clean all equipment entering the well.
4. Remove locking well cap, note well ID, time of day, elevation (top of casing) and date in site logbook or an appropriate groundwater level data form.
5. Remove well casing cap.
6. If required by site-specific conditions, monitor headspace of well with a PID or FID to determine presence of volatile organic compounds, and record in site logbook.
7. Lower electric water level measuring device or equivalent into the well until water surface is encountered.
8. Measure the distance from the water surface to the reference measuring point on the well casing or protective barrier post, and record in the site logbook. In addition, note that the water level measurement was from the top of the steel casing, the top of the PVC riser pipe, the ground surface, or some other position on the wellhead.
9. Groundwater level data should be documented as follows:
    - Logger Name – Person taking field notes;
    - Site Name;
    - Date the water levels are measured;
    - Location – Monitor well number and physical location;

- Time (24-hour clock) at which the water level measurement was recorded;
- Depth to Water – Water level measurement in feet, tenths, or hundredths of feet, depending on the equipment used. Two measurements are required to ensure accuracy;
- Comments – Any information the field personnel deems applicable may be included here;
- Measuring Point – Marked measuring point on PVC riser pipe, protective steel casing, or concrete pad surrounding well casing, from which all water level measurements for individual wells should be measured. This provides consistency in future water level measurements.

10. Measure total depth of well (at least twice to confirm measurement) and record in field logbook or on groundwater level data form.
11. Remove all downhole equipment; replace well casing cap and locking steel caps.
12. Rinse all downhole equipment and store for transport to next well.
13. Decontaminate all equipment.
14. Note any physical changes, such as erosion or cracks in protective concrete pad or variation in total depth of well, in field logbook and on groundwater level data form.

Quality Control: The following procedures apply:

- Equipment will be operated and used in accordance with the manufacturer's instructions, unless otherwise specified in the site-specific work plan or its equivalent.
- Equipment examination activities should occur prior to field deployment, and they should be documented.
- Each well should be tested at least twice in order to compare results.

Calculations and Data Reduction: Calculations and data reduction will be performed using the following equations and rules:

Groundwater elevation above mean sea level: $E_w = E - D$

where:

E_w = Elevation of water above mean sea level or local datum (feet or meters)

E = Elevation above sea level or local datum at point of measurement (feet or meters)

D = Depth to water (feet or meters)

BRISTOL ENVIRONMENTAL REMEDIATION SERVICES, LLC

Anchorage, Alaska

INVESTIGATION-DERIVED WASTE (IDW) MANAGEMENT

STANDARD OPERATING PROCEDURE BERS-09

Record of Changes

Revision No.	Date	Prepared by	Approved by
0	01/15/09	B. Allen	L. Maserjian
1	02/23/10	L. Maserjian	B. Allen

IDW MANAGEMENT

STANDARD OPERATING PROCEDURE

Summary: Investigation-derived waste (IDW) includes any material discarded after use during a field investigation at a hazardous waste site, and it includes personal protective equipment (PPE), disposable equipment, such as sampling equipment, drilling mud, soil cuttings, purge, or well-development water. IDW is classified as either hazardous or nonhazardous, depending on the properties of the waste. Whenever feasible, all IDW will be disposed of on site at active facilities.

If IDW is suspected to be hazardous, the material will be tested for proper classification. If the test determines the material to indeed be hazardous, it will be stored on site no longer than 90 days and then disposed of at a permitted treatment or disposal facility. Alternatively, it will be placed in the facility's waste treatment system, if appropriate. Whenever possible, nonhazardous IDW will be disposed of in the facility's Dumpster, waste treatment system, or on the ground in or near the source area, as appropriate. If on-site disposal is not feasible, nonhazardous IDW will be disposed of in a Dumpster or landfill.

Health and Safety: Field activities should only be conducted in accordance with an approved Site Health and Safety Plan.

Interferences and Potential Problems: Care should be taken to ensure segregation of hazardous 1DW from nonhazardous materials. The volume of spent solvent generated from field equipment decontamination procedures should be kept to a minimum, by applying only the minimum amount of solvent necessary and capturing it separately from the wash water. All hazardous waste will be containerized. Project planning will address procedures and responsibilities for the proper handling and disposal of project IDW.

Personnel Qualifications: Field personnel will be trained and certified as hazardous site workers per Title 29 Code of Federal Regulations, Part 1910.120(e) [29 CFR 19 10.120(e)]. If applicable, additional qualification requirements will be specified in the site Quality Assurance Project Plan (QAPP) and will be met.

Equipment and Materials: Prior to deployment in the field, the materials necessary for the management of IDW wastes in the field, such as 55-gallon drums and 5-gallon buckets, will be identified and secured.

Types of IDW: Materials which may become IDW include, but are not limited to, the following:

- PPE, including disposable coveralls, gloves, booties, respirator canisters, splash suits, etc.
- Disposable equipment, including plastic ground and equipment covers, aluminum foil, conduit pipe, composite liquid waste samplers, tubing, and broken or unused sample containers, sample container boxes, or tape, etc.
- Soil cuttings from drilling or hand augering activities.

- Drilling mud or water used for water rotary drilling.
- Groundwater obtained through well development or well purging.
- Cleaning fluids, such as spent solvents and wash water.

Management of Hazardous IDW: The site QAPP will specify disposal practices for hazardous or suspected hazardous IDW. If appropriate, these wastes will be disposed of on site by placement into the facility's waste treatment system, or they will be disposed of in the source area from which they originated, if doing so does not endanger human health or the environment. If on-site disposal is not possible, appropriate tests will be performed to characterize the waste for proper disposal. If the wastes are determined to be hazardous, they will be properly contained and labeled, and then stored on site for a maximum of ninety days before they are manifested and shipped to a permitted treatment or disposal facility.

The generation of hazardous IDW will be kept to a minimum. Nonhazardous materials will be segregated from hazardous materials to prevent cross-contamination. The most commonly produced type of IDW will probably be spent solvent from decontamination procedures and purged groundwater. Segregating the solvent from the wash water during equipment decontamination procedures will minimize the volume of spent solvent IDW generated during field activities.

Field personnel will implement the following procedures when managing hazardous IDW from specific practices:

- Disposable PPE – Containerize in 5-gallon bucket with tight-fitting lid. Identify and leave on site with permission of site operator. Otherwise, arrange for proper off-site disposal.
- Reusable PPE – Decontaminate following procedures described in the SOP BERS-05: *Equipment Decontamination*. Otherwise, follow procedures for disposable PPE.
- Spent Solvents – Containerize in original containers with contents clearly identified. Leave on site with permission of site operator.
- Soil Cuttings – Containerize in 55-gallon drum with a tight-fitting lid. Identify and leave onsite with permission of site operator.
- Groundwater – Containerize in 55-gallon drum with a tight-fitting lid. Identify and leave on site with permission of site operator. Otherwise, arrange for testing and proper off-site disposal.
- Decontamination Water – Containerize in 55-gallon drum with a tight-fitting lid. Identify and leave on site with permission of site operator. Otherwise, arrange for testing and proper off-site disposal.
- Disposable Equipment – Containerize in 55-gallon drum or 5-gallon bucket with a tight-fitting lid. Identify and leave on site with permission of site operator. Otherwise, arrange for testing and proper off-site disposal.

Management of Nonhazardous IDW: The site QAPP will specify disposal practices for nonhazardous IDW. If the waste site is active, permission will be sought from the site operator for on-site disposal of nonhazardous PPE, disposable equipment, and/or paper/cardboard wastes in the facility's Dumpsters. If on-site disposal is not feasible, the materials will be taken to a nearby permitted landfill.

If the facility is active, permission will be sought to place nonhazardous IDW, including drill cuttings, purge or well-development water, decontamination wash water, and drilling mud, etc., in the facility's waste treatment system. When appropriate, nonhazardous drill cuttings will be spread around the borehole, or, if they were removed for a temporary well, they will be placed back into the borehole. Otherwise, cuttings, purge water, and development water will be placed in a pit in or near the source area. Nonhazardous monitoring well purge or development water may also be poured onto the ground downgradient of the monitoring well. Purge water from functioning private potable wells will be discharged directly onto the ground surface. If on-site disposal is not feasible, these items will be placed into a unit with an environmental permit, such as a landfill or sanitary sewer. These types of materials will not be placed in Dumpsters.

Field personnel will implement the following procedures when managing nonhazardous IDW from specific practices:

- Disposable PPE – Place waste in double bag, and place in site Dumpster, with permission of site operator. Otherwise arrange for testing and disposal.
- Reusable PPE - Decontaminate following procedures described in the SOP BERS-05: *Equipment Decontamination.*
- Soil Cuttings – Containerize in 55-gallon drum with a tight-fitting lid. Identify and leave on site with permission of site operator. Otherwise, arrange for testing and disposal.
- Groundwater – Containerize in 55-gallon drum with a tight-fitting lid. Identify and leave on site with permission of site operator. Otherwise, arrange for testing and disposal.
- Decontamination Water – Containerize in 55-gallon drum with a tight-fitting lid. Identify and leave on site with permission of site operator. Otherwise, arrange for testing and disposal.
- Disposable Equipment – Containerize in 55-gallon drum or 5-gallon bucket with tight-fitting lid. Identify and leave on site with permission of site operator. Otherwise, arrange for testing and disposal.
- Trash – Place waste in double bag, and place in site Dumpster with permission of site operator. Otherwise, arrange for proper disposal.

Quality Control: The following procedures apply:

- Proper handling and disposal activities will be planned prior to commencement of field activities. All planning decisions will be documented in the site QAPP.
- IDW will be handled, stored, and disposed of in accordance with the site QAPP and relevant facility plans.

Calculations and Data Reduction: N/A

Data Management and Records Management: Records concerning the management of IDW will be generated and maintained as prescribed in the governing QA plans.

BRISTOL ENVIRONMENTAL REMEDIATION SERVICES, LLC

Anchorage, Alaska

GENERAL AIR MONITORING AND SAMPLING

STANDARD OPERATING PROCEDURE BERS-10

Record of Changes

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1	02/23/10	L. Maserjian	B. Allen

GENERAL AIR MONITORING AND SAMPLING

STANDARD OPERATING PROCEDURE

Summary: *Air monitoring* is defined as the use of direct-reading instruments, and other screening or monitoring equipment and techniques that provide instantaneous (real-time) data on the levels of airborne contaminants. Examples of air monitoring equipment include hand-held photoionization detectors (PID), flame-ionization detectors (FID), oxygen/combustible gas detectors, and remote optical sensors.

Air sampling is defined as sampling and analytical techniques that require either off- or on-site laboratory analysis, and therefore do not provide immediate results. Typically, air sampling occurs after the use of real-time air-monitoring equipment has narrowed the number of possible contaminants, and has provided some qualitative measurement of contaminant concentration. Air sampling techniques provide more accurate information than most air monitoring technologies in detecting, identifying, and quantifying specific chemical compounds. Examples of air sampling equipment include sampling bags, sorbent tubes and cartridges, and impingers.

Health and Safety: Sampling activity should only be conducted in accordance with an approved Site Health and Safety Plan.

Interference and Potential Problems: The primary potential problem associated with air monitoring/sampling is non-representative sampling. Representative air samples will accurately reflect the concentrations of contaminants of concern at a given time, and the selected time period will be representative of either "typical" or "worst case" conditions.

To ensure that air monitoring/sampling activities are representative, the site-specific sampling strategy must be developed and implemented to minimize potential interference. An adequately developed sampling strategy will generate sufficient information to identify sources of contaminant emissions, establish either natural background or upwind conditions, establish baseline concentrations of contaminants (i.e., prior to intrusive activities), identify contaminants of concern, and document ranges of contaminant concentrations on site and downwind.

- Factors affecting the representativeness of samples and measurements collected at a site include:
- Meteorology and topography of sampling locations.
- Distinction between meteorology during the sampling period and typical meteorology during the entire period of concern.
- Number of distinct sampling events and duration of sampling activities as compared to the anticipated length of exposure.
- Type of release (e.g., sampling during a drum rupture or instantaneous release; sampling a continuous release from contaminated soil).

- Timing of sampling activities with respect to expected "ambient" or "worst case" emissions (e.g., increased volatile emissions during warmer daylight hours).
- Suspected upwind emissions sources (e.g., burning of fossil fuels, emissions from vehicular traffic, exhaust from smoke stacks, and natural sources of pollution).
- Analytes of concern (e.g., photo-reactivity of certain parameters of concern with non-related compounds).

Personnel Qualifications: Sampling personnel will be trained and certified as hazardous site workers per Title 29 Code of Federal Regulations, Part 1910.120(e) [29 CFR 1910.120(e)]. If applicable, additional qualification requirements will be specified in the site QAPP and will be met.

Equipment & Material: Equipment selection will be based on the objectives of the sampling program, whether air monitoring or air sampling is required, and the analytes of concern. Prior to deployment in the field, the requisite sampling equipment and materials will be identified, secured, calibrated, and inspected for signs of damage or potential contamination.

Air monitoring equipment includes portable screening devices and specialized analytical instruments to provide continuous or sequential, direct air concentrations for a specific location or area in either a real-time or semi-real-time mode. Portable monitoring devices, which provide *qualitative* information on airborne contamination, include:

- PID (sensitive to aromatic and olefinic compounds);
- FID (sensitive to volatile organic compounds [VOCs]);
- Combustible gas indicators (to test for potentially explosive atmospheres);
- Compound-specific toxic atmosphere analyzers;
- Aerosol/particulate monitors;
- Colorimetric chemical detector tubes;
- Radiation meters;
- Gold film monitors for hydrogen sulfide and mercury vapors; and
- Infrared detectors.

Specialized analytical instruments used for *quantitative* air monitoring include direct air sampling portable gas chromatographs, trace atmospheric gas analyzers based on mass spectrometry, and remote optical sensing equipment.

Specific analytical methods have been developed for air samples. These methods typically specify equipment requirements for sampling. Common air sampling equipment include total suspended particulate samplers (variable based on size of particulates to be measured), area and

personal sampling pumps, and canister sampling systems (relying on pressure differentials for sample collection).

Common air sampling media and devices include SUMMA canisters (for VOCs and permanent gas analysis); Tedlar® sampling bags (for VOCs, fixed gases, and methane); polyurethane foam sorbent (for pesticides, polychlorinated biphenyls [PCBs], dioxins, furans, and polynuclear aromatic hydrocarbons [PAHs]; impingers (for bubbling air samples through solution); sorbent tubes and cartridges; particulate filters; and passive dosimeters.

In addition to the equipment and media listed above, air monitoring and sampling support equipment may include the following: data loggers compatible with selected monitoring and sampling devices (to minimize the amount of time workers spend on site), site logbook, camera, small screwdriver set, aluminum foil, Teflon® tape, inert tubing, glass cracker, calibration and decontamination supplies and equipment, chain-of-custody forms, and labeling, packaging, and shipping supplies. Extension cords and multiple plug outlet may also be needed based on the air monitoring/sampling devices selected.

Air monitoring and air sampling equipment and supplies will be further specified in the governing Quality Assurance Project Plans (QAPPs).

Air Monitoring

Initial Air Monitoring Survey

The initial air monitoring survey involves collection of preliminary data on airborne contaminant concentrations at hazardous waste sites. An organic vapor analyzer is typically used during this survey. When warranted, intrinsically safe or explosion-proof instruments should be used.

Sufficient data should be obtained with real-time instruments during the initial survey to screen the site for various contaminants. Preliminary data may be used to determine appropriate levels of personal protection, establish site work zones, and map candidate areas for more thorough qualitative and quantitative studies involving air sampling. The initial survey may also indicate the need for a more comprehensive evaluation of hazards and analyses for specific compounds.

On Site Air Monitoring

Because site activities and weather conditions change, a continuous and ongoing program to monitor the ambient atmosphere must be established. This program should remain active, as necessary, during all on site activity.

Offsite Monitoring

Perimeter monitoring is typically conducted with the same instruments employed for onsite monitoring. Because air is a dynamic matrix, physical boundaries like property lines and fences do not necessarily delineate the site boundary or area influenced by a release. Whenever

possible, atmospheric hazards in the areas adjacent to the hazardous waste site should be monitored with direct-reading instruments.

Air monitoring data should be obtained at breathing-zone height in three or four locations downwind of the source. Monitoring at varying locations off site will provide useful information regarding pollutant migration. Negative instrument readings off site should not be interpreted as the complete absence of all airborne toxic substances; rather, it is possible that the particular compound or class of compounds, to which the monitoring instrument responds, is not present or the concentration of the compound is below the instrument's detection limit.

Air Sampling

Introductory Considerations

The goal of air sampling is to accurately assess a site's effect on air quality. This effect is expressed in terms of overall average and/or maximum air concentrations. Unlike soil concentrations, air concentrations at points of interest can vary by orders of magnitude throughout the period of concern. This variability is a major consideration in designing an air sampling strategy. Determining the location of potential sources is essential to the selection of sampling locations.

Downwind air concentration is determined by the amount of material being released from the site into the air (i.e., the emission rate), and by the degree to which the contamination dilutes as it is transported. On-site activities and site meteorology greatly influence contaminant emission rates, while local meteorology and topography govern downwind dilution.

Air Sampling Strategy

The sampling strategy must be developed and documented in the site QAPP prior to initiating on-site sampling activity to ensure that representative data are obtained. Sampling objectives should be fully detailed to ensure collection of appropriate data and achievement of adequate data quality.

The sampling strategy typically requires that the concentration of contaminants at the source or area of concern, as well as background, contributions be quantified. It is important to establish background levels of contaminants in order to develop a reference point from which to evaluate the source data. Field blanks and lot blanks, as well as various other types of quality control samples, can be utilized to determine other sources. The impact of extraneous sources on sampling results can frequently be accounted for by placing samplers upwind, downwind, and crosswind from the subject sources.

Location and Number of Individual Sampling Points

Choose the number and location of sampling points according to the sensitivity of the sampling and analytical methods being used, the variability of contaminant concentration over time at the site, the level of precision required, and cost limitations.

Determine the number of locations and placement of samplers by considering the nature of the response, local terrain, meteorological conditions, location of the site (with respect to other conflicting background sources), size of the site, and the number, size, and relative proximity of separate on-site or upwind emission sources. Avoid natural obstructions when choosing air sampling station locations, and account for channeled air flow around those obstructions.

Consider the duration of sampling activities when choosing the location and number of samples to be collected. For example, if the sampling period is limited to a few hours, one or two upwind and several downwind samples would typically be adequate, especially around major emission sources. For longer term sampling events, consider moving upwind and downwind sampling locations daily, based on weather forecasts. Weather monitoring becomes critical where complex terrain and local meteorological effects frequently change wind direction.

Sampling sites must be secure from vandals and mishap. Secure all sampling locations to maintain chain of custody, to prevent tampering with samples or loss of sampling units. High-volume sampling methods often require the use of 110 VAC electric power. When portable generators are used, the power quality may affect sampler operation. Also, be aware that the generators themselves could be a potential pollution source if their placement is not carefully considered.

Air quality dispersion models can be used to place samplers. The models incorporate source information, surrounding topography, and meteorological data to predict the general distance and directions of maximum ambient concentrations. Modeling results should be used to select sampling locations in areas of maximum pollutant concentrations. Additional site-specific detail on selecting sampling locations will be included in the site QAPP.

Time, Duration, and Frequency of Sampling Events

After choosing appropriate sampling or monitoring locations, determine appropriate sampling times, duration, and frequency.

The time of day, duration, and frequency of sampling events is governed by factors, such as schedule of typical activity at the site, timing of emissions from the site and surrounding pollutant sources, diurnal meteorological effects on downwind dispersion, the time period of concern as defined by the project objective, and cost and other logistical considerations.

The duration or period of air sampling is commonly divided into two categories: (1) instantaneous or "grab" samples that are usually collected in less than five minutes, and (2) average or integrated samples that are collected over a significantly longer period of time. Integrated samples are not suited to determining cyclical releases of contaminants, because periodic or cyclical events are averaged out by the proportionally long sampling duration.

The schedule and duration of site activity is the primary factor in determining the tie, duration, and frequency of samples. If the site will be undergoing removal activities 24 hours a day, continuous air sampling may be warranted. If site activities will be conducted for only eight

hours a day, and no emissions are likely to occur during the remaining 16 hours, sampling duration could be limited to the workday, but off-peak air samples should be collected to ensure that emissions are not persisting after the conclusion of daily cleanup activities. For some sites, emissions are still a factor several hours after daily site activities have been completed. Because of the typically decreased downwind dispersion in the evening, higher downwind concentrations than were present during daytime site activities may be detected. For sites where this is possible, the sampling duration needs to be lengthened accordingly.

Sampling duration and flow rate dictate the volume of air collected, and to a major degree, the detection limit. The analytical method selected will provide a reference to flow rate and volume. Flow rates are limited to the capacity of the pumps being employed and the contact time required by the collection media.

Air quality dispersion models can predict the maximum air contaminant concentration expected from a source. The meteorological and site conditions expected to cause the highest concentration are known as worst-case conditions, and can be identified by analyzing the modeling results.

Additional site-specific detail on selecting air sampling locations will be included in the site QAPP.

Quality Control

The following procedures apply:

- The manufacturer's instructions should be reviewed prior to instrument use. Instruments must be utilized in accordance with manufacturer's instructions. Equipment checkout must occur prior to and after monitoring/sampling, and results must be documented.
- Equipment examination and calibration activities should occur prior to field deployment and after each monitoring/sampling event. All results and findings, as well as any corrective actions, should be documented.
- All samples must be recorded on an Air Sampling Worksheet.
- Blanks will be collected at the frequency and locations specified in the site QAPP. Blanks are analyzed for the same target analytes as the associated field samples. Each blank receives a unique sample number, and is submitted blind to the laboratory.

Calculations and Data Reduction: Volume is obtained by multiplying the sample time in minutes by the flow rate. Sample volume should be indicated on the chain-of-custody record. Adjustments for temperature and pressure differences may be required. Results are usually provided in parts per million, parts per billion, milligrams per cubic meter, or micrograms per cubic meter. Refer to the analytical method or regulatory guidelines for other applicable calculations.

BRISTOL ENVIRONMENTAL REMEDIATION SERVICES, LLC

Anchorage, Alaska

FIELD DOCUMENTATION

STANDARD OPERATING PROCEDURE BERS-11

Record of Changes

Revision No.	Date	Prepared by	Approved by
0	01/05/10	L. Maserjian	B. Allen

FIELD DOCUMENTATION

STANDARD OPERATING PROCEDURE

Method Summary: To ensure the quality and integrity of field and analytical data, field activities will be documented in the project field notebook. In the event that more than one person is working on the site and performing different activities, more than one field notebook will be designated for the site. When the field notebook is filled, a new notebook will be started. Pertinent protocols for documenting field activities are provided below.

Notebook Cover: The cover of each field notebook will contain the following information:

- Job title
- Job number
- Name of company
- Name of personnel in charge of notebook
- Date of field activities covered in the notebook.

First Page of Each Day: The following information must be provided in the beginning of each day of work:

- Job title
- Names of all personnel on site
- Weather conditions
- Location, if multiple sites
- Health and Safety meeting notes.

Each Page of Notebook: The following information must be provided on each page of the field notebook:

- Date
- Initials or signature of person taking notes (bottom of page)
- Location, if you have changed during the day
- Page number, if not on the notebook.

Required General Information for Field Notebooks:

- Do not erase mistakes/errors – draw a line through the deletion and initial it.
- Do not leave pages blank. If a page is skipped, draw a diagonal line across the page and initial the line.

- Record persons arriving and leaving site (guests to site, clients, regulatory agency personnel).
- Record health and safety issues that arise (close calls or accidents should also be documented on required forms).
- Note photographs taken and direction in which photograph was taken.
- Take an overview photograph of site before digging/drilling, etc.
- Include a photograph of the site after it is restored (if applicable).

Required Documentation for Sample Collection Activities:

- Instrument name;
- Calibration record (when, by whom, results, gas type);
- Sampling location map with North arrow (field-screening and analytical samples);
- Sample ID, with description of soil material;
- Duplicate information;
- Sample time, each sample;
- Sample depth;
- List what analyses sample will be analyzed for;
- Field-screening measurements;
- Type of machinery used if not already recorded on field forms (Macro-Core sampler, split spoon, pumps, sampling meters);
- If Global Positioning System (GPS) is used, make note of where it was used;
- Delivery or pick-up information (airway bill #, Fed Ex tracking #, Fed Ex pick up information).

Required Documentation for Underground Storage Tank (UST)/Aboveground Storage Tank (AST) Removal Activities:

- UST or AST dimensions;
- Dimensions of tank excavations, depth to groundwater, and depth of excavation;
- Footage of fuel piping (how many feet from dispenser to tanks);
- Where vent lines, fill ports, dispensers and pipe runs are located;
- Location of piping joints;

- Amount of sludge/water removed from tanks prior to decommissioning;
- Amount of contaminated soil/media (cubic yards of stockpiles);
- Amount of contaminated soil or debris hauled from site (number of truckloads);
- Amount of clean fill brought to the site;
- Type of machinery used.

Required Documentation for Monitoring Well/Soil Boring Activities (This list does not include the documentation that will be provided on a boring log and groundwater sample collection form.):

- Always collect swing-tie measurements to monitoring wells (even if you have a GPS);
- If drillers add water during well installation, note how much was added;
- Well screen slot size;
- Well filter sand pack size;
- Depth of top and bottom of well screen;
- Total depth of well;
- Amount of well construction materials used for each well (e.g., bags of silica sand, concrete, amount of screened casing, and amount of blank casing);
- Location of sand filter pack, bentonite seal, and grout used;
- Amount of water removed during development (unless you are using a well development form);
- Drill rig type;
- Changes in level of the water table/ aquifer.

Interferences and Potential Problems: Improper documentation of field activities may result in a number of problems, including, but not limited to:

- Inability to find sample collection locations that is needed for maps or finding areas for further assessment/excavation;
- Inability to create an as-built map;
- Inability to legally support data due to poor documentation;
- Development of erroneous conclusions regarding site contamination based on inaccurate data and/or problems correlating data and sample locations at the site;
- Difficulty in writing thorough reports due to poor documentation.

BRISTOL ENVIRONMENTAL REMEDIATION SERVICES, LLC

Anchorage, Alaska

EXCAVATION/TRENCHING

STANDARD OPERATING PROCEDURE BERS-12

Record of Changes

Revision No.	Date	Prepared by	Approved by
0	03/9/10	C. Croley	G. Jarrell
1	4/20/10	M. Faust	P. Curl

EXCAVATION/TRENCHING

STANDARD OPERATING PROCEDURE

Summary: The standards covering excavation and trenching safety are included in Title 29 Code of Federal Regulations, Part 1926.650-652 (Subpart P) [29 CFR 1926.650-652, subpart P], and U.S. Army Corps of Engineer's Safety and Health Requirements Manual 385-1-1 (15 September 2008). The Federal Standards require protective systems to be in place when anyone enters an excavation or trench that is more than 5 feet (1.5 meters) in depth. Bristol Environmental Remediation Services, LLC (Bristol), as a member of the Bristol Alliance of Companies, through their Corporate Health and Safety Manual, follows a more conservative guideline of requiring protective systems to be in place for excavations or trenches of 4 feet (1.2 meters) in depth.

Definitions:

1. A "Protective System" means a method of protecting employees from cave-ins, from material that could fall or roll from an excavation face or into an excavation, or from collapse of adjacent structures. Protective systems include support systems, sloping and benching systems, shield systems, and other systems that provide the necessary protection.
2. An "Excavation" means any man-made cut, cavity, trench, or depression in an earth surface, formed by earth removal. Bristol's use of excavations is normally in conjunction with the installation or removal of underground storage tank facilities.
3. A "Trench" (trench excavation) means a narrow excavation (in relation to its length) made below the surface of the ground. In general, the depth is greater than the width, but the width of a trench (measured at the bottom) is not greater than 15 feet (4.6 meters). Trenching is normally used in conjunction with contaminated site assessments where samples are collected for field screening or analysis, or when piping is being installed or removed.
4. A "Confined or Enclosed Space" means any space having a limited means of egress, which is subject to the accumulation of toxic or flammable contaminants or has an oxygen deficient atmosphere. Confined or enclosed spaces include, but are not limited to, storage tanks, process vessels, bins, boilers, ventilation or exhaust ducts, sewers, underground utility vaults, tunnels, pipelines, and open-top spaces more than 4 feet in depth, such as trenches, pits, tubs, vaults, and vessels.

Personnel Qualifications: All personnel associated with trenching and excavation will be trained in the safe practices applicable to excavating and trenching. Personnel will be trained in the applicable elements of 29 CFR1926.651, 1926.652 and subpart P. Additional training may be required for trenches that are considered to be a confined space, or present other work-related hazards.

Intent: It is not intended that Bristol personnel routinely conduct work activities in any excavation or trench.

Excavation/Trenching Plans: Written plans, although not always required, are suggested as an effective checklist prior to beginning excavation/trenching activities. Any excavation/trenching activities that fall under the USACE 385-1-1 safety guidelines require a written and approved plan prior to the start of work.

Work Permit: Excavations will require a Confined Space Work Permit when the depth of an excavation exceeds 4 feet, and personnel will access the excavation (Attachment 1).

Equipment and Materials: Prior to deployment in the field, the requisite trenching equipment and materials will be identified, secured, and inspected for signs of damage or potential contamination. General equipment requirements for trenching include.

- Excavator or backhoe.
- Materials required to demark the excavation/trench and equipment from the general public.
- Pre-engineered protective system (i.e., trench box) if personnel are to be entering an excavation/trench in excess of four feet in depth.
- Manufactured materials and equipment used for protective systems must be used and maintained in a manner that is consistent with the recommendations of the manufacturer, and in a manner that will prevent personnel exposure to hazards.
- Materials and equipment used for protective systems must be free from damage or defects that might impair their proper function.

Health and Safety Requirements: Excavation/Trenching should only be conducted in accordance with an approved site health and safety plan. General safety requirements are listed below:

- Prior to the commencement of trenching activities, all locations must be verified free and clear of underground and overhead utilities.
- Each person in an excavation must be protected from cave-ins by an adequate protective system, except when:
  - Excavations are made entirely in stable rock; or
  - Excavations are less than 4 feet in depth and examination of the ground provides no indication of a potential cave-in.
- Spoil piles should be kept a minimum of 2 feet from any edge of an excavation/trench, no matter what the sidewall angle of repose may be.
- Protective systems must have the capacity to resist without failure all loads that are intended or could reasonably be expected to be applied or transmitted to the system.

- Daily inspections of excavations, the adjacent areas, and protective systems, must be made for evidence of a situation that could result in possible cave-ins, indications of failure of protective systems, hazardous atmospheres, or other hazardous conditions. An inspection must be conducted prior to the start of work and as needed throughout the shift. Inspections must also be made after every rainstorm or other hazard-increasing occurrence.
- Adequate barrier physical protection must be provided at all trenches. During excavation, appropriate warning signs, flagging, or barricading shall be in place as fall protection. Upon completion of exploration and similar operations, trenches must be backfilled.
- Excavations located in close proximity to recognized roadways must be barricaded on the traffic side with illuminated or reflective materials barricades.
- Walkways or bridges with standard guardrails must be provided where personnel or equipment are to cross over trenches that are 4 feet in depth or greater.
- While the excavation is open, underground installations must be protected, supported, or removed as necessary to safeguard personnel.
- A stairway, ladder, ramp, or other safe means of egress must be located in shored trench excavations that are 4 feet or more in depth, so as to require no more than 25 feet of lateral travel for personnel.
- Personnel are not permitted underneath loads handled by lifting or digging equipment. Personnel are required to stand away from any vehicle being loaded or unloaded to avoid being struck by any spilled or falling materials. Operators may remain in the cabs of vehicles being loaded or unloaded when the vehicles are equipped to provide adequate protection for the operator during loading and unloading operations.
- Where oxygen-deficiency (atmospheres containing less than 19.5% oxygen) or a hazardous atmosphere exists, or could reasonably be expected to exist, such as in trenches in landfill areas or in areas where hazardous substances are stored nearby, the atmospheres in the excavation must be tested before personnel enter excavations regardless of depth.
- If the stability of adjoining buildings, walls, or other structures is endangered by excavation operations, support systems, such as shoring, bracing, or underpinning, must be provided (and inspected and approved by a Professional Engineer) to ensure the stability of such structures for the protection of personnel.
- Personnel may not work in trenches in which there is accumulated water, or where water is accumulating, unless adequate precautions have been taken to protect personnel against the hazards posed by water accumulation. The precautions necessary to protect personnel adequately vary with each situation, but could include special support or shield systems to protect from cave-ins, water removal to control the level of accumulating water, or use of a safety harness and lifeline.

- If evidence of a situation that could result in possible cave-ins, slides, failure of protective systems, hazardous atmospheres, or other hazardous conditions is identified, exposed workers shall be removed from the hazard and all work in the excavation/trench stopped until all necessary safety precautions have been implemented.
- Adequate protection must be provided to protect personnel from loose rock or soil that could pose a hazard by falling or rolling from an excavation face. Such protection must consist of scaling to remove loose material; installation of protective barricades at intervals as necessary on the face to stop and contain falling material; or other means that provide equivalent protection.
- The slopes and configurations of sloping and benching systems must be selected and constructed by the employer or his designee and must be in accordance with the requirements of the following:
  - Soil type must be determined utilizing the guidelines set forth in CFR 1926 Subpart P.
  - Benching and sloping requirements will be based on the determination of soil type and are listed in CFR 1926 subpart P.
  - If benching and sloping will not be utilized, then a pre-engineered shoring system shall be utilized to protect personnel from cave-in.
    - If trench boxes are used, the top of the trench box must extend a minimum of 18 inches above the point where the vertical soil wall meets the soil slope.

ATTACHMENT 1

Confined Space Entry Permit

Bristol **Confined Space Entry (CSE) Permit** **Display at Site**

Client:		Location:	
Date/Time Issued:		Date/Time Expires:	
Permit Initiator:		Entry Supervisor:	
Purpose for CSE:		Work to be Performed	

Standby Personnel:	1. 2. 3. 4.	Authorized Entrants:	1. 2. 3. 4.

Atmospheric Check (Prior to Entry) **Tester's Signature:** _____

Time:	% Oxygen:	% LEL:	Toxic ppm:

Energy Isolation Complete: yes no **Signature:** _____

Ventilation: Mechanical Natural

Atmospheric Check (During Entry) **Tester's Signature:** _____

Time:	% Oxygen:	% LEL:	Toxic ppm:
Time:	% Oxygen:	% LEL:	Toxic ppm:
Time:	% Oxygen:	% LEL:	Toxic ppm:
Time:	% Oxygen:	% LEL:	Toxic ppm:

Communication Procedures: _____

Rescue Procedures: _____

Rescue Equipment: _____

PPE Required: _____

Entry Supervisor Signature: _____

CSE Owner/Client signature: _____

Debrief required: yes no Return form to project manager when CSE complete.

BRISTOL ENVIRONMENTAL REMEDIATION SERVICES, LLC

Anchorage, Alaska

BACKFILL AND COMPACTION

STANDARD OPERATING PROCEDURE BERS-13

Record of Changes

Revision No.	Date	Prepared by	Approved by
0	03/9/10	C. Croley	G. Jarrell

GENERAL BACKFILL AND COMPACTION

STANDARD OPERATING PROCEDURE

Summary: After an excavation or trench has been completed, it will be backfilled and compacted. Proper backfill and compaction are important for maintaining the integrity of the ground surface. Compaction is defined as the method of mechanically increasing the density of soil. Backfill and compaction is commonly associated with underground storage tank (UST) removals and contaminated soil excavation. Backfill and compaction criteria will be based on the final use of the finished grade, i.e., foundation, traffic, or non-traffic areas. Backfill and compaction procedures for sites where density testing is not required are described in this Standard Operating Procedure.

There are five principle reasons to compact soil:

- Increases the load-bearing capacity;
- Prevents soil settlement and frost damage;
- Provides stability;
- Reduces water seepage, swelling, and contraction; and
- Reduces settling of soil.

Personnel Qualifications: Personnel will be trained and certified as hazardous site workers per 29 CFR 1910.120(e). Lead field personnel will have at least two years field experience with supervision of heavy equipment operators. If applicable, additional qualification requirements will be specified in the site QA Project Plan and met.

General Procedures for Backfill and Compaction:

Backfill material will be specified in the site work plan or QA plan. Generally, common fill from a local supplier will be used with the goal of using non-frost susceptible (NSF) materials, if possible, when working in cold climates.

The backfill material will be placed into the excavation or trench and spread into one foot lifts. If possible, each lift will be wetted. Each lift will be compacted using the heavy equipment (tracks or bucket). By following this procedure, compaction densities of 90% or greater are typically achieved. The surface backfill will be slightly mounded to provide positive drainage. Reseeding requirements will be specified in the site work plan or QA plan.

If clean sand and/or pea gravel is used as backfill for the excavation/trench compaction is not necessary.

If a clean, fine-grained soil (sand) is used for backfill in an excavation/trench, that is in native soil that has large, clean properties (coarse clean gravel), a filter fabric may have to be placed in the bottom of the excavation/trench, prior to backfilling operations to prevent soil migration, which would result in settlement.

Health and Safety Requirements: Backfilling should only be conducted in accordance with an approved site health and safety plan. General safety requirements are listed below.

- Personnel will stay clear of heavy equipment during operation
- The bucket of the excavator will be put on the ground while not in use
- All site personnel will wear specified personal protective equipment (PPE)/reflective vests
- Backup alarms will be required on all heavy equipment

Interferences and Potential Problems: Improper compaction may cause settlement of the soil, which may result in unnecessary maintenance costs where structures are present. Improper compaction can cause erosion problems.

BRISTOL ENVIRONMENTAL REMEDIATION SERVICES, LLC

Anchorage, Alaska

DOCUMENT CONTROL SYSTEM

STANDARD OPERATING PROCEDURE BERS-15

Record of Changes

Revision No.	Date	Prepared by	Approved by
0	01/14/10	L. Pheasant	P. Curl

DOCUMENT CONTROL SYSTEM

When preparing a report, plan, or client deliverable, schedule the formatting and editing of the document with the Document Production Manager. If, at any time, you have questions about where your document is in the process, the Document Production Manager will be able to assist you and answer any questions you may have.

At a minimum, a discussion between the Project Manager (PM) or Primary Author (PA) and the Document Production Manager should take place to decide how the document should be processed. Mutual understanding about time/budget considerations, special needs, client requirements, reasons for deviations from the norm, etc., will prevent much frustration for author, editor, and Document Production Team.

Schedule work as far in advance of the client deadline as possible.

Document Production Checklist

When the document is ready for formatting and editing, fill out a Document Production Checklist (green sheet) (Attachment 1), attach it to your document, and give it to the Document Production Manager. The Document Production Manager will add the deliverable to the Document Production Schedule, located on the Intranet, where it can be tracked. The green sheet is the record of who reviewed the document, along with what was done and provides information on number of copies and distribution. The green sheet should be kept with the project files as a record of the document production.

Document Tracking

All documents must have specific deadlines. Once the document has been submitted, the Document Production Manager will present it to the Document Processor for formatting. The document will then be given to the Editor. After the document has been edited, and the Editor has resolved any discrepancies with the PM/PA, the Editor will return the document to the Document Processor. The Document Processor will make the necessary redline changes. After final edits are made, the document will go to the PM/PA for final approval. Once the PM/PA has reviewed the document, it will be returned to the Document Production Manager for reproduction.

The written content of the document must be at least 90 to 95 percent complete before submission to the Document Production Manager. If there are sections to be added/changed after submitting it to the Document Production Team, submit them via e-mail, in a separate document, and explain where the information is to be inserted. Do not make electronic changes to the document until it has been returned to you for review. If changes must be made, use Track Changes, so that the Editor knows which changes to review.

This precaution is taken to ensure that documents maintain their integrity (particularly large documents), and that the Document Production Manager and/or Editor are aware of any changes made after the document has been submitted.

The physical content of documents submitted for formatting/editing should be complete. This means all text, figures, forms, photographs, inserts, etc., must be provided. (If the figures, photographs, tables, etc., are not ready, a placeholder must be inserted and edited when available).

Document Labeling and Location

The Document Production Manager will insert the file name and path in the footer on the last page of every document (font size will be 6 or 7 point). This will ensure that the document can be located at a later date/time. The contract number and Bristol job number will be inserted in the header of the document. An unbound reproduction-ready original of the document will be placed in the project files. An electronic copy of the final document will be placed in the project file on the Bristol computer network, which is backed up daily.

ATTACHMENT 1

Document Production Checklist

DOCUMENT PRODUCTION CHECKLIST

Job No. _____ Phase Code _____ Job Name: _____

Project Manager: _____ Deliverable Type (report, plan, tech memo, etc.): _____

Primary Author: _____ File Path: _____

(File Path Cont.) _____

ACTION	TO BE DONE BY	DATE DUE	DATE COMPLETED/INITIALS
Document Set-up/Templates	Document Processor	Date Document Submitted ➔	
DOCUMENT PREPARATION			
Formatting	Document Processor		
Technical Edit	Editor		
FINAL REVIEW			
Content	PM		
Tech Edit/Comment Resolution	Editor		
Redline Changes	Document Processor		
Approval for Production	PM		
PRODUCTION			
Production/Printing	Document Production Asst.		
Approval for Release to Client	PM		
DUE DATE			← **Date Due To Client**

FLY SHEETS: Colored _____ Card Stock _____ **BOUND**: Comb-bound _____ Unbound _____
3-Ring Binder _____ CD: _____

NO. OF COPIES: _____ Project File _____ Field _____

Special Client Requirements (example: special format, single-sided, etc.):

_____

_____

Notes/Comments:

_____

_____

_____

_____

_____

Additional notes may be written on back of form

BRISTOL ENVIRONMENTAL REMEDIATION SERVICES, LLC

Anchorage, Alaska

TRIMBLE GEOXH® GLOBAL POSITIONING SYSTEMS

STANDARD OPERATING PROCEDURE BERS-17

Record of Changes

Revision No.	Date	Prepared by	Approved by
0	01/04/2010	R. James	
1	01/24/2011	R. James	

TRIMBLE GEOXH® GLOBAL POSITIONING SYSTEMS

STANDARD OPERATING PROCEDURE

Summary: The Global Positioning System (GPS) is a satellite-based navigation system consisting of satellites placed into a precise orbit around Earth. GPS receivers/units provide the means to communicate with the orbiting satellites in order to determine one's position through triangulation. GPS satellites are continuously transmitting signals which take time to travel to space and arrive at a GPS unit. A GPS unit compares the time a signal was transmitted by the satellite to the time it was received by the unit and determines a distance between the satellite and the GPS unit. By locking on to multiple satellite signals, the unit can determine its 3-dimensional location (latitude, longitude, and altitude). Additional information regarding the principles behind GPS technology can be found at the following website: http://www.trimble.com/gps/index.shtml.

Although there are a variety of different GPS units at the company's disposal, this Standard Operating Procedure (SOP) will focus on the Trimble GeoXH®. Bristol Environmental Remediation Services, LLC (Bristol) primarily utilizes Trimble GeoXH units for the purpose of capturing positional data on a variety of features including environmental sample locations, excavation boundaries, general site locations/boundaries, natural or anthropogenic site features (e.g. shorelines, building corners, monuments, outcrops, etc.), and any other features deemed necessary by the Bristol team, its subcontractors and/or clients. Resulting data are often used in Geographic Information System (GIS) software for digital mapping purposes. In some instances, Bristol will utilize Trimble GeoXH units for navigational purposes.

Health and Safety: GPS activities should be conducted in accordance with an approved Site Health and Safety Plan.

Personnel Qualifications: GPS personnel will have knowledge on how to properly operate the Trimble GeoXH data logger and all necessary software required for the successful capture of GPS positions. Two pieces of software, in particular TerraSync™ and GPS Pathfinder ® Office, are utilized for the successful collection, subsequent download and processing of GPS data, the manuals for which can be obtained on Bristol's network in the following directory: O:\Common\BERS EQUIPMENT\Equipment Manuals.

Pre-project Planning: A Bristol Project Manager (PM) or field team leader should consult a member of the GIS department regarding requisition of the Trimble GeoXH unit. At this point, GPS project objectives can be determined and the GIS department can setup the unit as necessary to most suitably achieve those objectives. It is recommended that during this stage, the PM or field team leader request a customized data dictionary. A data dictionary is an electronic field form used to control the collection of features and attributes. The data dictionary contains a list of features that will be collected in the field as well as the attribute data associated with each feature. It can be structured to fit the needs of any project in order to streamline the data collection process and ensure data integrity. For example, Spatial Data Standards for Facilities, Infrastructure and Environment (SDSFIE) compliant data can be established in a data

dictionary prior to field work, thus minimizing time spent processing the data following collection.

It is very important during the planning stages to ensure that the appropriate datum and projection are set in the field software. This should remain consistent between projects, but it is recommended that GIS personnel double check the coordinate system setup in the Terrasync software. In most cases data will be collected in the World Geodetic System dating from 1984 (WGS 84) with geographic coordinates expressed in latitude and longitude. Although the unit can be setup to display/collect in different coordinate systems, using this standard should help eliminate error and confusion.

Post-Processing – Following the completion of field activities and GPS collection, the data must be post-processed by Bristol's GIS personnel in order to achieve the highest possible accuracy. The unit should be returned to the GIS department for the completion of post-processing. Post-processing will be performed using GPS Pathfinder Office software. Data collected with the Trimble GeoXH unit can be manipulated and exported to a variety of formats via GPS Pathfinder Office software.

Equipment and Materials: Prior to deployment in the field, the GeoXH unit, ancillary equipment and materials will be identified, secured, and inspected for signs of damage. The unit should be inspected to ensure that the appropriate software is installed and functioning properly. Equipment and materials include:

- **Trimble GeoXH -** The Trimble GeoXH unit should be fully charged and all appropriate software should be installed prior to field deployment.
- **Secure Digital (SD) Flash Memory Card –** Bristol currently maintains a 16 Gigabyte (GB) SD card for storing GPS or project related data (i.e. aerial imagery, background files, reference files, etc.)
- **Cradle/Dock –** The GPS unit requires a docking station/cradle in order to charge the battery and to transfer data to the computer. This is included in the unit's carrying case.
- **Universal Serial Bus (USB) Cable –** One end of the USB cable plugs into the cradle while the other end plugs into the computer. This cable is used to transfer data from the unit to the computer and should be included with the unit in the carrying case. The Trimble GeoXH unit must be docked in the cradle in order to transfer data to the field or office computer.
- **Power Cord –** The power cable plugs into an electrical outlet and supplies power to the cradle. When the unit is docked in the cradle while the power supply is plugged in, the battery will charge.
- **User Guides and Manuals –** User manuals for Terrasync and GPS Pathfinder Office reside on the Bristol network in the following directory: O:\Common\BERS EQUIPMENT\Equipment Manuals. The user guide for the series of units into which the Trimble GeoXH falls can be found online at the following Trimble website:

http://trl.trimble.com/docushare/dsweb/Get/Document-414964/GeoExpl2008_100C_%20UserGde_ENG.pdf. This document can also be found alongside the software manuals located on Bristol's network in the equipment manuals' directory. Manuals can be viewed electronically or printed at the field personnel's convenience.

- **Carrying Case –** The Trimble GeoXH units are housed in hard-cover cases. Within the case will reside all of the above listed equipment.

Battery Charging

The batteries should be charged the day prior to field deployment and each night following a day's use. Charge the battery by docking the GPS unit in the cradle, plugging the power cord into an electrical outlet and attaching the power chord to the cradle. For additional information consult the Geoexplorer 2008 Series Quick Start Guide located at Trimble's website: http://trl.trimble.com/docushare/dsweb/Get/Document-414960/GeoExplorer_2008_QSG_ENG_Ltr.pdf. Or consult the GeoExplorer 2008 series User Guide located at Trimble's website: http://trl.trimble.com/docushare/dsweb/Get/Document-414964/GeoExpl2008_100C_%20UserGde_ENG.pdf. These documents are also located on Bristol's network in the following directory: O:\Common\BERS EQUIPMENT\Equipment Manuals.

Troubleshooting

For troubleshooting issues, please consult Bristol's GIS department or refer to Section D of the Terrasync software Getting Started Guide. This document is located on Bristol's network in the following directory: O:\Common\BERS EQUIPMENT\Equipment Manuals\TerraSyncGettingStartedGuide.pdf.

Maintenance

The Trimble GeoXH is designed to withstand the elements. It has an operating temperature that falls between -4 degrees Fahrenheit (°F) and 140 °F. The casing is dust-proof, shock resistant to 4 feet, and resistant to heavy wind-driven rain. Bristol will maintain a screen protector on the color liquid crystal display (LCD) touch screen to protect from scratches and other damage. The units will be stored within foam-lined, hard plastic cases when not in use.

Accessories

The Trimble GeoXH is equipped to handle a range of optional accessories such as laser range finders and external antennae. All accessories will be connected according to manufacturer's instruction/recommendations.

ATTACHMENT 2

Field Forms

Groundwater Low Flow Purging Form

Groundwater Sampling Information
To accompany Low Flow Purge Form

Water Level Form

Well Development Form

Photograph Log

Sample Label

Sample Record Log

TestAmerica Chain-of-Custody (blank)

Bristol
ENVIRONMENTAL
REMEDIATION SERVICES, LLC

GROUNDWATER LOW-FLOW PURGING FORM

Job Name NE Cape HTRW RAs
Job Number 34110008
Company Bristol

Well No.: _____
Well Type: ☐ Monitor ☐ Extraction ☐ Other _____
Well Material ☐ PVC ☐ St. Steel ☐ Other _____
Date _____ Time: _____

Purged by _____ _____
(Signature)

WELL PURGING

PURGE VOLUME

Casing Diameter (D in inches):

☐ 2-inch ☐ 4-inch ☐ 6-inch ☐ Other _____

Total Depth of Casing (TD in feet BTOC): _____

Water Level Depth (WL in feet BTOC): _____

_____

PURGE METHOD

☐ Pump – Type: _____

☐ Submersible ☐ Centrifugal ☐ Bladder ☐ Peristaltic.

☐ Other – Type: _____

PUMP INTAKE SETTING

☐ Near Bottom ☐ Near Top ☐ Other

Depth in feet (BTOC): _____ Screen Interval in Feet (BTOC)

PURGE TIME

_____ Start _____ Stop _____ Elapsed

PURGE RATE

Initial _____ gpm Final _____ gpm

ACTUAL PURGE VOLUME

_____ gallons

FIELD PARAMETER MEASUREMENT

Minutes Since Pumping Began	Water Depth below MP	Pump Dial	Purge Rate (ml/min)	T ☐ °C ☐ °F	Specific Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Cumulative Volume Purged

GROUNDWATER LOW-FLOW PURGING FORM (continued)

FIELD PARAMETER MEASUREMENT (Continued)

Minutes Since Pumping Began	Water Depth below MP	Pump Dial	Purge Rate (ml/min)	T ☐ °C ☐ °F	Specific Cond. (µS/cm)	pH	ORP (mV)	DO (mg/L)	Turbidity (NTU)	Cumulative Volume Purged

GROUNDWATER SAMPLING FORM
(To Accompany Low-Flow Purging Form)

Bristol
ENVIRONMENTAL
REMEDIATION SERVICES, LLC

Job Name NE Cape HTRW RAs

Job Number 34110008 Date _____ Time: _____

Recorded by _____ Sampled by _____
(Signature)

WELL INFORMATION

Well Number _____ **Well Location** _____

Casing Diameter (D in inches):

☐ 2-inch ☐ 4-inch ☐ 6-inch ☐ Other _____

Total Depth of Casing (TD in feet BTOC):

Water Level Depth (WL in feet BTOC):

WELL SAMPLING

SAMPLING METHOD

☐ Bailer – Type: _____ ☐ Grab – Type _____

☐ Submersible ☐ Centrifugal ☐ Bladder _____ ☐ Other – Type: _____

SAMPLING DISTRIBUTION

Sample No.	Volume	Analysis Requested	Preservatives	Lab	Comments

QUALITY CONTROL SAMPLES

Duplicate Samples

Original Sample No.	Duplicate Sample No.

Blank Samples

Type	Sample No.

Other Samples

Type	Sample No.

Bristol
ENVIRONMENTAL
REMEDIATION SERVICES, LLC

WATER LEVEL FORM

Project: _____ Date: _____

Personnel: _____ Water Level Instrument: _____

Well Name	Measurement Time	Measuring Point	Depth to Water	Elevation of Measuring Point	Water Level Elevation	Comments

Bristol
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REMEDIATION SERVICES, LLC

WATER LEVEL FORM

Well Name	Measurement Time	Measuring Point	Depth to Water	Elevation of Measuring Point	Water Level Elevation	Comments

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WATER LEVEL FORM

Well Name	Measurement Time	Measuring Point	Depth to Water	Elevation of Measuring Point	Water Level Elevation	Comments

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REMEDIATION SERVICES, LLC

WELL DEVELOPMENT FORM

Project: _____ Well No.: _____

Personnel: _____ Development Method _____ Date: _____

Time	Depth to Water (ft.)	Gallons Removed	Turbidity (Ntu)	pH	Temp ºC	Conduct-ivity	Recovery Rate Inches/min	Recovery Rate gpm	Observations

Total Gallons Removed _____

PHOTOGRAPH LOG

DATE	TIME	LOCATION	DESCRIPTION OF PHOTOGRAPH	VIEW DIRECTION	PHOTOGRAPHER/COMMENTS

SAMPLE LABEL

2011 NE Cape HTRW Remedial Actions
Contract No. W911-KB-06-D-0007

Analysis:_____Preservation:_____

Date:_____Time:_____

Collector:_____

Sample No.:_____

Bristol
ENVIRONMENTAL
REMEDIATION SERVICES, LLC

SAMPLE RECORD LOG

Sample Identification	Sample Location (LOCID)	Date	Time	Matrix	Depth (ft)	Sampler	Field Screening (ppm)	Analyses & Preservative						Sample Type (Project or Duplicate)	MS/MSD Collected	COC #	Sample Shipping Date		Comments

Tacoma
5755 8th Street East

Tacoma, WA 98424
phone 253.922.2310 fax 253.922.5047

Chain of Custody Record

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Laboratories, Inc.

Client Contact	**Project Manager:**	**Site Contact:**	**Date:**	COC No:
Your Company Name here	**Tel/Fax:**	**Lab Contact:**	**Carrier:**	_____ of _____ COCs
Address	**Analysis Turnaround Time**			Job No.
City/State/Zip	Calendar (C) or Work Days (W) _____			
(xxx) xxx-xxxx Phone	TAT if different from Below _____			
(xxx) xxx-xxxx FAX	☐ 2 weeks			SDG No.
Project Name:	☐ 1 week			
Site:	☐ 2 days			
P O #	☐ 1 day			

Sample Identification	**Sample Date**	**Sample Time**	**Sample Type**	**Matrix**	**# of Cont.**	**Filtered Sample**																		Sample Specific Notes:

Preservation Used: 1= Ice, 2= HCl; 3= H2SO4; 4=HNO3; 5=NaOH; 6= Other _____

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* *Poison B* ☐ *Unknown* ☐

Sample Disposal (A fee may be assessed if samples are retained longer than 1 month)
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For _____ Months*

Special Instructions/QC Requirements & Comments:

Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:
Relinquished by:	Company:	Date/Time:	Received by:	Company:	Date/Time:

ATTACHMENT 3

TestAmerica Laboratories, Inc.
Quality Assurance Manual and
ELAP Certification

Quality Assurance Manual

Document Uncontrolled When Printed

Cover Page:

Quality Assurance Manual

TestAmerica Seattle
5755 8th Avenue East
Tacoma, WA 98424
Phone No. (253) 922-2310
Fax No. (253) 922-5047

www.testamericainc.com

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Quality Assurance Manual
Approval Signatures

Signatures on File

Laboratory Director – Kathy Kreps	Date
Quality Assurance Manager - Dave Wunderlich	Date
Environmental Health & Safety/Metal Technical Director – Stan Palmquist	Date
Client Services Manager – Terri Torres	Date
Operations Manager – Heather Prater	Date
Inorganic Technical Director – Anthony Ocana	Date
Semivolatile Technical Director – Sonya Palmer	Date
Volatile Technical Director – Tiffany Ryan	Date

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4	Summary of Calibration, QC Procedures and Corrective Action	Appendix 4-1	8/30/2010

REFERENCED CORPORATE SOPs AND POLICIES

SOP / Policy Reference	Title
CA-Q-S-001	Solvent and Acid Lot Testing and Approval
CA-Q-S-002	Acceptable Manual Integration Practices
CA-Q-S-004	Method Compliance & Data Authenticity Audits
CA-Q-S-006	Detection Limits
CA-Q-S-008	Management Systems Review
CW-Q-S-001	Corporate Document Control and Archiving
CW-Q-S-002	Writing a Standard Operating Procedure (SOPs)
CA-L-S-001	Internal Investigation of Potential Data Discrepancies and Determination for Data Recall
CA-L-S-002	Subcontracting Procedures
CA-L-P-001	Ethics Policy
CA-L-P-002	Contract Compliance Policy
CW-F-P-002	Authorization Matrix
CW-F-P-004	Procurement and Contracts Policy
CA-C-S-001	Work Sharing Process
CA-T-P-001	Qualified Products List
CW-F-S-007	Controlled Purchases Policy
CW-F-S-018	Vendor Selection
CA-Q-M-002	Corporate Quality Management Plan
CW-E-M-001	Corporate Environmental Health & Safety Manual

REFERENCED LABORATORY SOPs

SOP Reference	Title
TA-QA-0528	Document Control
TA-QA-0529	Complaint Resolution
TA-QA-0530	Management of Change
TA-QA-0506	Archiving Reports and Report File Maintenance
TA-QA-0608	Employee Training Procedures
TA-QA-0500	Standard Operating Procedures
TA-QA-0617	Analyst Demonstration of Capability
TA-QA-0602	Method Detection Limit Studies and Limits of Detection
TA-QA-0028	Subsampling of Solid Samples
TA-QA-0001	Sample Receipt & Login

SECTION 3

INTRODUCTION *(NELAC 5.1 - 5.3)*

3.1 INTRODUCTION AND COMPLIANCE REFERENCES

TestAmerica Seattle's Quality Assurance Manual (QAM) is a document prepared to define the overall policies, organization objectives and functional responsibilities for achieving TestAmerica's data quality goals. TestAmerica Seattle maintains a local perspective in its scope of services and client relations and maintains a national perspective in terms of quality.

The QAM has been prepared to assure compliance with the 2003 National Environmental Laboratory Accreditation Conference (NELAC) standards and ISO/IEC Guide 17025 *(2005)*. In addition, the policies and procedures outlined in this manual are compliant with TestAmerica's Corporate Quality Management Plan (CQMP) and the various accreditation and certification programs listed in Appendix 3. The CQMP provides a summary of TestAmerica's quality and data integrity system. It contains requirements and general guidelines under which all TestAmerica facilities shall conduct their operations.

The QAM has been prepared to be consistent with the requirements of the following documents:

- EPA 600/4-88/039, Methods for the Determination of Organic Compounds in Drinking Water, EPA, Revised July 1991.
- EPA 600/R-95/131, *Methods for the Determination of Organic Compounds in Drinking Water,* Supplement III, EPA, August 1995.
- EPA 600/4-79-019, *Handbook for Analytical Quality Control in Water and Wastewater Laboratories,* EPA, March 1979.
- ***Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008***.
- Federal Register, 40 CFR Parts 136, 141, 172, 173, 178, 179 and 261.
- APHA, *Standard Methods for the Examination of Water and Wastewater,* 18th Edition, 19th, 20th and 21st Edition.
- ***U.S. Department of Defense, Quality Systems Manual for Environmental Laboratories, Version 4.1, April 2009***.
- Marine Protection, Research, and Sanctuaries Act (MPRSA).
- Toxic Substances Control Act (TSCA).

3.2 TERMS AND DEFINITIONS

A Quality Assurance Program is a company-wide system designed to ensure that data produced by TestAmerica Seattle conforms to the standards set by state and/or federal regulations. The program functions at the management level through company goals and management policies, and at the analytical level through Standard Operating Procedures (SOPs) and quality control. The TestAmerica program is designed to minimize systematic error,

encourage constructive, documented problem solving, and provide a framework for continuous improvement within the organization.

Refer to Appendix 2 for the Glossary/Acronyms.

3.3 SCOPE / FIELDS OF TESTING

TestAmerica Seattle analyzes a broad range of environmental and industrial samples every month. Sample matrices vary among drinking water, effluent water, groundwater, hazardous waste, sludge, sediment, and soils. The Quality Assurance Program contains specific procedures and methods to test samples of differing matrices for chemical and physical parameters. The Program also contains guidelines on maintaining documentation of analytical process, reviewing results, servicing clients and tracking samples through the laboratory. The technical and service requirements of all requests to provide analyses are thoroughly evaluated before commitments are made to accept the work. Measurements are made using published reference methods or methods developed and validated by the laboratory.

The methods covered by this manual include the most frequently requested methodologies needed to provide analytical services in the United States and its territories. The specific list of test methods used by the laboratory can be found in LIMS. The approach of this manual is to define the minimum level of quality assurance and quality control necessary to meet requirements. All methods performed by TestAmerica Seattle shall meet these criteria as appropriate. In some instances, quality assurance project plans (QAPPs), project specific data quality objectives (DQOs) or local regulations may require criteria other than those contained in this manual. In these cases, the laboratory will abide by the requested criteria following review and acceptance of the requirements by the Laboratory Director and the Quality Assurance (QA) Manager. In some cases, QAPPs and DQOs may specify less stringent requirements. The Laboratory Director and the QA Manager must determine if it is in the lab's best interest to follow the less stringent requirements.

3.4 MANAGEMENT OF THE MANUAL

3.4.1 Review Process

This manual is reviewed annually by senior laboratory management to assure that it reflects current practices and meets the requirements of the laboratory's clients and regulators as well as the CQMP. Occasionally, the manual may need changes in order to meet new or changing regulations and operations. The QA Manager will review the changes in the normal course of business and incorporate changes into revised sections of the document. All updates will be reviewed by the senior laboratory management staff. The laboratory updates and approves such changes according to our Document Control procedures (refer to SOP No. TA-QA-0528).

SECTION 4

ORGANIZATION AND MANAGEMENT *(NELAC 5.4.1)*

4.1 OVERVIEW

TestAmerica Seattle is a local operating unit of TestAmerica Laboratories, Inc. The organizational structure, responsibilities and authorities of the corporate staff of TestAmerica Laboratories, Inc. are presented in the CQMP. The laboratory has day-to-day independent operational authority overseen by corporate officers (e.g., President, Chief Operating Officer, Corporate Quality Assurance, etc.). The laboratory operational and support staff work under the direction of the Laboratory Director. The organizational structure for both Corporate & TestAmerica Seattle is presented in Figure 4-1.

4.2 ROLES AND RESPONSIBILITIES

In order for the Quality Assurance Program to function properly, all members of the staff must clearly understand and meet their individual responsibilities as they relate to the quality program. The following descriptions briefly define each role in its relationship to the Quality Assurance Program.

4.2.1 Quality Assurance Program

The responsibility for quality lies with every employee of the laboratory. All employees have access to the QAM, are trained to this manual, and are responsible for upholding the standards therein. Each person carries out his/her daily tasks in a manner consistent with the goals and in accordance with the procedures in this manual and the laboratory's SOPs. Role descriptions for Corporate personnel are defined in the CQMP. This manual is specific to the operations of TestAmerica's Seattle laboratory.

4.2.2 Laboratory Director

TestAmerica Seattle's Laboratory Director is responsible for the overall quality, safety, financial, technical, human resource and service performance of the whole laboratory and reports to their respective GM. The Laboratory Director provides the resources necessary to implement and maintain an effective and comprehensive Quality Assurance and Data Integrity Program.

Specific responsibilities include, but are not limited to:

- Provides one or more technical directors for the appropriate fields of testing. The name(s) of the Technical Director will be included in the national database. If the Technical Director is absent for a period of time exceeding 15 consecutive calendar days, the Laboratory Director must designate another full time staff member meeting the qualifications of the Technical Director to temporarily perform this function. If the absence exceeds 65 consecutive calendar days, the primary accrediting authority must be notified in writing.
- Ensures that all analysts and supervisors have the appropriate education and training to properly carry out the duties assigned to them and ensures that this training has been documented.

- Ensures that personnel are free from any commercial, financial and other undue pressures that might adversely affect the quality of their work.
- Ensures TestAmerica's human resource policies are adhered to and maintained.
- Ensures that sufficient numbers of qualified personnel are employed to supervise and perform the work of the laboratory.
- Ensures that appropriate corrective actions are taken to address analyses identified as requiring such actions by internal and external performance or procedural audits. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs may be temporarily suspended by the Laboratory Director.
- Reviews and approves the laboratory specific QAM, policies, SOPs prior to their implementation and ensures all approved procedures are implemented and adhered to.
- Pursues and maintains appropriate laboratory certification and contract approvals. Supports ISO 17025 requirements. Organizes bid activities for prospective new projects and clients.
- Ensures client specific reporting and quality control requirements are met.
- Captains the management team, consisting of the QA Manager, the Technical Director(s), and the Operations Manager as direct reports.
- Annually assesses the effectiveness of the QMP and QAM within the laboratory.

4.2.3 Quality Assurance (QA) Manager

The QA Manager has responsibility and authority to ensure the continuous implementation of the quality system based on ISO 17025.

The QA Manager reports directly to the Laboratory Director and has access to Corporate QA for advice and resources. This position is able to evaluate data objectively and perform assessments without outside (i.e., managerial) influence. Corporate QA may be used as a resource in dealing with regulatory requirements, certifications and other quality assurance related items. The QA Manager's responsibilities include, but are not limited to:

- *Ensuring communication & monitoring standards of performance to ensure that systems are in place to produce the level of quality as defined in this document.*
- *Notifying laboratory management of deficiencies in the quality system and ensuring corrective action is taken. Procedures that do not meet the standards set forth in the QAM or laboratory SOPs are temporarily suspended following the procedures outlined in Section 11.*
- *Evaluation of the thoroughness and effectiveness of training.*
- ***Compliance with ISO 17025.***
- Having functions independent from laboratory operations for which he/she has quality assurance oversight.
- Maintaining and updating the QAM.
- Monitoring and evaluating laboratory certifications; scheduling proficiency testing samples.
- Monitoring and communicating regulatory changes that may affect the laboratory to management.

- Training and advising the laboratory staff on quality assurance/quality control procedures that are pertinent to their daily activities. Reviewing and approving documentation of analyst training records.
- Arranging for or conducting internal audits on quality systems and the technical operation.
- The laboratory QA Manager will maintain records of all ethics-related training, including the type and proof of attendance.
- Maintain, improve, and evaluate the corrective action database and the corrective and preventive action systems. Reviews corrective actions and recommends resolution for recurring non-conformances within the laboratory.
- Coordinating of document control of SOPs, MDLs, control limits, and miscellaneous forms and information.
- Review a percentage of all final data reports for internal consistency. Review of Chain of Custody (COC), correspondence with the analytical request, batch QC status, completeness of any corrective action statements, 5% of calculations, format, holding time, sensibility and completeness of the project file contents.
- Follow-up with audits to ensure client QAPP requirements are met.
- Establishment of reporting schedule and preparation of various quality reports for the Laboratory Director, clients and/or Corporate QA.
- Reviews subcontractors' certifications and qualifications as requested or as required.
- Has the final authority to accept or reject data and to stop work in progress in the event that procedures or practices compromise the validity and integrity of analytical data.

4.2.4 Technical Directors

The Technical Directors report directly to the Laboratory Director ***and are responsible for compliance with the ISO 17025 Standard***. With respect to the Standard, they are accountable for all analyses and analysts. The scope of responsibility ranges from the new-hire process and existing technology through the ongoing training and development programs for existing analysts and second- and third-generation instrumentation. Specific responsibilities include, but are not limited to:

- Coordinating, writing, and reviewing preparation of all test methods, i.e., SOPs, with regard to quality, integrity, regulatory and optimum and efficient production techniques, and subsequent analyst training and interpretation of the SOPs for implementation and unusual project samples. He/she insures that the SOPs are properly managed and adhered to at the bench. He/she develops standard costing of SOPs to include supplies, labor, overhead, and capacity (design vs. demonstrated versus first-run yield) utilization.
- Reviewing and approving, with input from the QA Manager, proposals from marketing, in accordance with an established procedure for the review of requests and contracts. This procedure addresses the adequate definition of methods to be used for analysis and any limitations, the laboratory's capability and resources, the client's expectations. Differences are resolved before the contract is signed and work begins. A system documenting any significant changes is maintained, as well as pertinent discussions with the client regarding their requirements or the results of the analyses during the performance of the contract. All work subcontracted by the laboratory must be approved by the client. Any deviations from

the contract must be disclosed to the client. Once the work has begun, any amendments to the contract must be discussed with the client and so documented.

- Monitoring the quality control, quality assurance, and validity of the analyses performed and data generated in the laboratory. This activity begins with reviewing and supporting all new business contracts, insuring data quality, analyzing internal and external non-conformances to identify root cause issues and implementing the resulting corrective and preventive actions, facilitating the data review process (training, development, and accountability at the bench), and providing technical and troubleshooting expertise on routine and unusual or complex problems.
- Providing training and development programs to applicable laboratory staff as new hires and, subsequently, on a scheduled basis. Training includes instruction on calculations, instrumentation management to include troubleshooting and preventive maintenance.
- Enhancing efficiency and improving quality through technical advances and improved LIMS utilization. Capital forecasting and instrument life cycle planning for second generation methods and instruments as well as asset inventory management.
- Coordinating sample management from “cradle to grave,” insuring that no time is lost in locating samples.
- Scheduling all QA/QC-related requirements for compliance, e.g., MDLs, etc.
- Coordinates audit responses with QA Manager.
- Evaluates the level of internal/external non-conformances for all departments.
- Continuously evaluates production capacity and improves capacity utilization.
- Continuously evaluates turnaround time and addresses any problems that may hinder meeting the required and committed turnaround time from the various departments.
- Develops and improves the training of all analysts in cooperation with the Technical Director and QA Manager and in compliance with regulatory requirements.
- Works with the Preventive Maintenance Coordinator to ensure that scheduled instrument maintenance is completed.
- Is responsible for efficient utilization of supplies.
- Constantly monitors and modifies the processing of samples through the departments.
- Fully supports the quality system and, if called upon in the absence of the QA Manager, serves as her substitute in the interim.

4.2.5 Operations Manager

The Operations Manager manages and directs the analytical production sections of the laboratory. She reports directly to the Laboratory Director. He/She assists the Technical Director in determining the most efficient instrument utilization. More specifically, he/she:

- Evaluates the level of internal/external non-conformances for all departments.
- Continuously evaluates production capacity and improves capacity utilization.
- Continuously evaluates turnaround time and addresses any problems that may hinder meeting the required and committed turnaround time from the various departments.

- Develops and improves the training of all analysts in cooperation with the Technical Directors and QA Manager and in compliance with regulatory requirements.
- Works with the Department Managers to ensure that scheduled instrument maintenance is completed.
- Is responsible for efficient utilization of supplies.
- Constantly monitors and modifies the processing of samples through the departments.
- Fully supports the quality system and, if called upon in the absence of the QA Manager, serves as his substitute in the interim.

4.2.6 LIMS Administration/IT Support

LIMS Administration and IT support are managed at the corporate level. In general, the duties of the corporate LIMS administration team consist of:

- Establishes and maintains the laboratory information system (LIMS) for tracking all samples in the laboratory.
- Updates and enhances LIMS.
- Develops expertise in the requirements described in Good Automated Laboratory Practices (GALP) EPA 2185, 1995 Edition, in order to ensure compliance.
- Programs and tests software modifications/changes.
- Coordinates testing to ensure that all LIMS software accurately performs its intended functions. Testing is performed and documented after installation or when modifications/ changes are made.
- Maintains historical files of software, software operating procedures (manuals), software changes/modifications (Change Log) and software version numbers.
- Maintains log of repairs and service performed on LIMS hardware.
- Develops and verifies security practices to assure the integrity of LIMS data. Identifies threats, potential threats, and future threats.
- Maintains awareness of any environmental conditions of the facility housing the LIMS that may compromise LIMS raw data and informs management.
- LIMS database back-up once daily.

4.2.7 Hazardous Waste Coordinator

The Hazardous Waste Coordinator reports directly to the Laboratory Director. The duties consist of:

- Managing laboratory generated hazardous waste in accordance with appropriate regulations.
- Staying current with the hazardous waste regulations.
- Continuing training on hazardous waste issues.

- Reviewing and updating annually the Hazardous Waste Contingency Plan in the Environmental Health & Safety Manual.
- Auditing the staff with regard to compliance with the Hazardous Waste Contingency Plan.
- Contacting the hazardous waste subcontractors for review of procedures and opportunities

4.2.8 Department Managers

The Department Manager duties at TestAmerica Seattle are performed by the Technical Directors. The responsibilities of the department managers are listed below:

- Ensure that analysts in their department adhere to applicable SOPs and the QA Manual. They perform frequent SOP and QA Manual review to determine if analysts are in compliance and if new, modified, and optimized measures are feasible and should be added to these documents.
- With regard to analysts, participates in the selection, training (as documented in Section 8.1), development of performance objectives and standards of performance, appraisal (measurement of objectives), scheduling, counseling, discipline, and motivation of analysts and documents these activities in accordance with systems developed by the QA and Personnel Departments. They evaluate staffing sufficiency and overtime needs. Training consists of familiarization with SOP, QC, Safety, and computer systems.
- Encourage the development of analysts to become cross-trained in various methods and/or operate multiple instruments efficiently while performing maintenance and documentation, self-supervise, and function as a department team.
- Provide guidance to analysts in resolving problems encountered daily during sample prep/analysis in conjunction with the QA Manager. Each is responsible for 100% of the data review and documentation, non-conformance and CPAR issues, the timely and accurate completion of performance evaluation samples and MDLs, for his/her department.
- Works with the Project Managers and Analysts/Technicians to ensure that the requirements of project are met in a timely manner.
- Ensure all logbooks are maintained, current, and properly labeled or archived.
- Responsible for meeting quality requirements and reporting all non-conformance conditions to the QA Manager and/or Laboratory Director.
- Ensure that preventive maintenance is performed and documented on instrumentation as detailed in the QA Manual or SOPs. He is responsible for developing and implementing a system for preventive maintenance, troubleshooting, and repairing or arranging for repair of instruments.
- Maintain adequate and valid inventory of reagents, standards, spare parts, and other relevant resources required to perform daily analysis.
- Achieve optimum turnaround time on analyses and compliance with holding times.
- Conduct efficiency and cost control evaluations on an ongoing basis to determine optimization of labor, supplies, overtime, first-run yield, capacity (designed vs. demonstrated), second- and third-generation production techniques/instruments, and long-term needs for budgetary planning.

- Develop, implement, and enhance calibration programs.
- Provide written responses and facilitates implementing corrective actions for external and internal audit issues.

4.2.9 Laboratory Analysts

Laboratory analysts are responsible for conducting analysis and performing all tasks assigned to them by the group leader or supervisor. The responsibilities of the analysts are listed below:

- Perform analyses by adhering to analytical and quality control protocols prescribed by current SOPs, this QA Manual, and project-specific plans honestly, accurately, timely, safely, and in the most cost-effective manner.
- Document standard and sample preparation, instrument calibration and maintenance, data calculations, sample matrix effects, and any observed non-conformance on worklists, benchsheets, lab notebooks and/or the Non-Conformance Database.
- Report all non-conformance situations, instrument problems, matrix problems and QC failures, which might affect the reliability of the data, to their supervisor, the Technical Director, and/or the QA Manager or member of QA staff.
- Ensures sample and data integrity by adhering to internal chain-of-custody procedures.
- Perform 100% review of the data generated prior to entering and submitting for secondary level review.
- Suggest method improvements to their supervisor, the Technical Director, and the QA Manager. These improvements, if approved, will be incorporated. Ideas for the optimum performance of their assigned area, for example, through the proper cleaning and maintenance of the assigned instruments and equipment, are encouraged.
- Work cohesively as a team in their department to achieve the goals of accurate results, optimum turnaround time, cost effectiveness, cleanliness, complete documentation, and personal knowledge of environmental analysis.

4.2.10 Safety Officer

The Safety Officer reports to the Laboratory Director and ensures that systems are maintained for the safe operation of the laboratory. The Safety Officer is responsible to:

- Conduct ongoing, necessary safety training and conduct new employee safety orientation.
- Assist in developing and maintaining the Chemical Hygiene/Safety Manual.
- Administer dispersal of all Material Safety Data Sheet (MSDS) information.
- Perform regular chemical hygiene and housekeeping instruction.
- Give instruction on proper labeling and practice.
- Serve as chairman of the laboratory safety committee.
- Provide and train personnel on protective equipment.
- Oversee the inspection and maintenance of general safety equipment – fire extinguishers, safety showers, eyewash fountains, etc. and ensure prompt repairs as needed.

- Supervise and schedule fire drills and emergency evacuation drills.
- Determine what initial and subsequent exposure monitoring, if necessary to determine potential employee exposure to chemicals used in the laboratory.
- When determined necessary, conduct exposure monitoring assessments.
- Determine when a complaint of possible over-exposure is "reasonable" and should be referred for medical consultation.
- Assist in the internal and external coordination of the medical consultation/monitoring program conducted by TestAmerica's medical consultants.
- Manages facility maintenance.

4.2.11 Sample Receiving Staff

The Sample Receiving Technicians report to the Sample Receiving Supervisor; the Supervisor reports to the Customer Service Manager. The responsibilities are outlined below:

- Ensures implementation of proper sample receipt procedures, including maintenance of chain-of-custody.
- Reports nonconformances associated with condition-upon-receipt of samples.
- Logs incoming samples into the LIMS.
- Ensures that all samples are stored in the proper environment.
- Ensure the verification of data entry from login.
- Responsible for meeting quality requirements including documenting preservation.
- Responsible for ensuring the timely and correct shipment of sample containers, including proper preservatives and instructions, to clients
- Assists Environmental Health and Safety staff with sample disposal.

4.2.12 Customer Service Manager

The Customer Service Manager reports to the Laboratory Director and serves as the interface between the laboratory's technical departments and the laboratory's clients. The staff consists of the Project Management team. With the overall goal of total client satisfaction, the functions of this position are outlined below:

- Technical training and growth of the Project Management team.
- Technical liaison for the Project Management team.
- Human resource management of the Project Management team.
- Has signature authority for laboratory reports.
- Assesses and assures customer satisfaction.
- Provides feedback to management on changing customer needs.
- Works with the Department Managers and/or Analysts/Technicians to ensure the requirements of projects are met in a timely manner.

- Organizes bid activities for prospective new projects and clients.

4.2.13 Project Managers

The Project Managers report to the Customer Service Manager and serve as the interface between the laboratory and the clients. With the overall goal of total client satisfaction, the functions of this position are outlined below:

- Responsible to ensure that clients receive the proper sampling supplies.
- Accountable for response to client inquiries concerning sample status.
- Responsible for assistance to clients regarding the resolution of problems concerning COC.
- Ensuring that client specifications, when known, are met by communicating project and quality assurance requirements to the laboratory. Prepares a Quality Assurance Summary (QAS) or equivalent summary form as needed.
- Notifying the supervisors of incoming projects and sample delivery schedules.
- Accountable to clients for communicating sample progress in daily status meeting with agreed-upon due dates.
- Approves customer requested variances to methods and to standard laboratory protocols.
- Responsible for discussing with client any project-related problems, resolving service issues, and coordinating technical details with the laboratory staff.
- Reports client inquiries involving data quality issues or data acceptability to the facility, CSM, Laboratory Director, QA Manager, and to the appropriate staff.
- Responsible for staff familiarization with specific quotes, sample log-in review, and final report completeness.
- Monitor the status of all data package projects in-house to ensure timely and accurate delivery of reports. Reviews project data packages for completeness and compliance to client needs and have signature authority for final reports.
- Inform clients of data package-related problems and resolve service issues.
- Coordinate requests for sample containers and other services (data packages).
- Prepares re-issue requests for project data.
- Organizes bid activities for prospective new projects and clients.
- Has signature authority for laboratory reports.

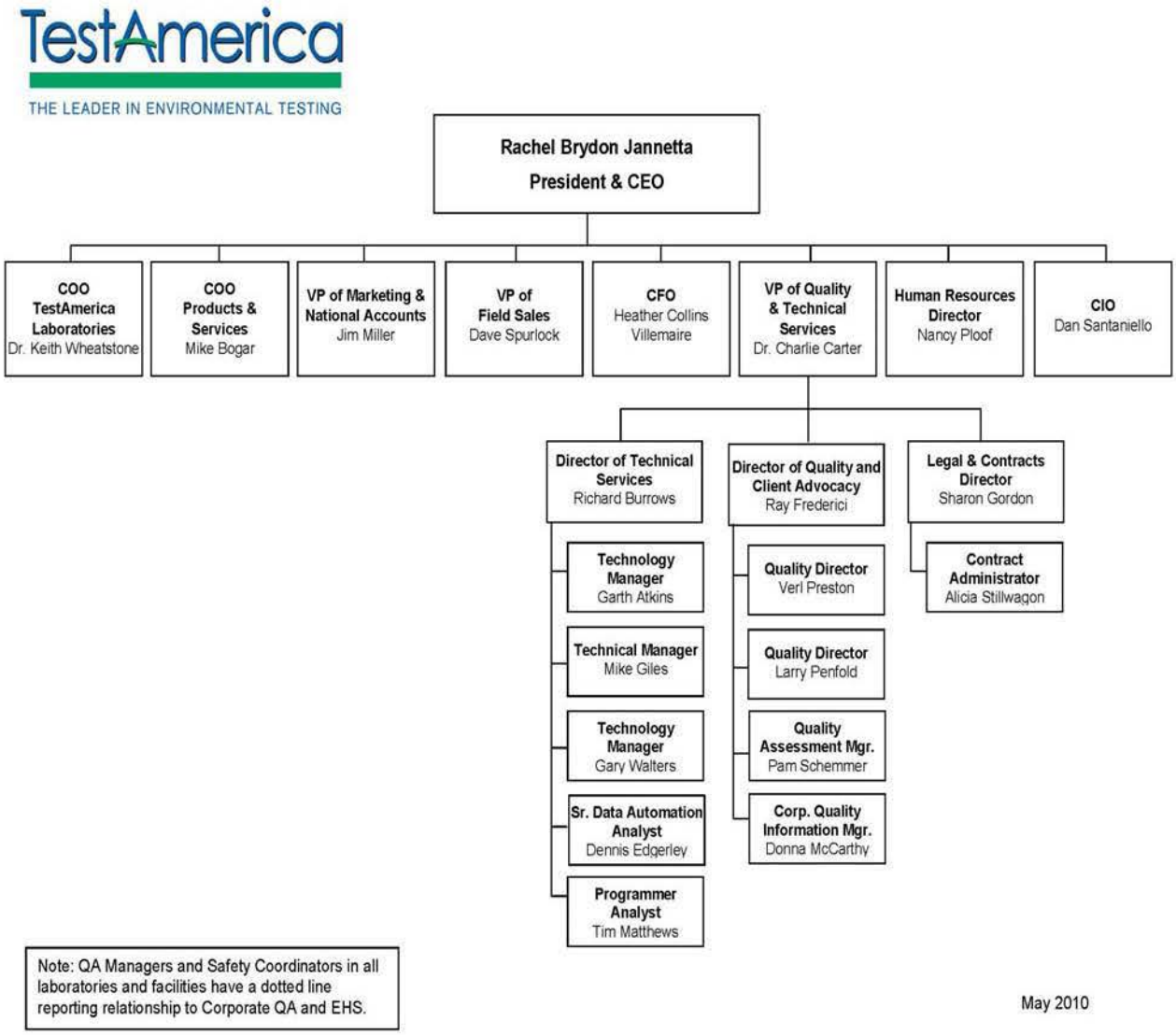
4.3 DEPUTIES

The following table defines who assumes the responsibilities of key personnel in their absence:

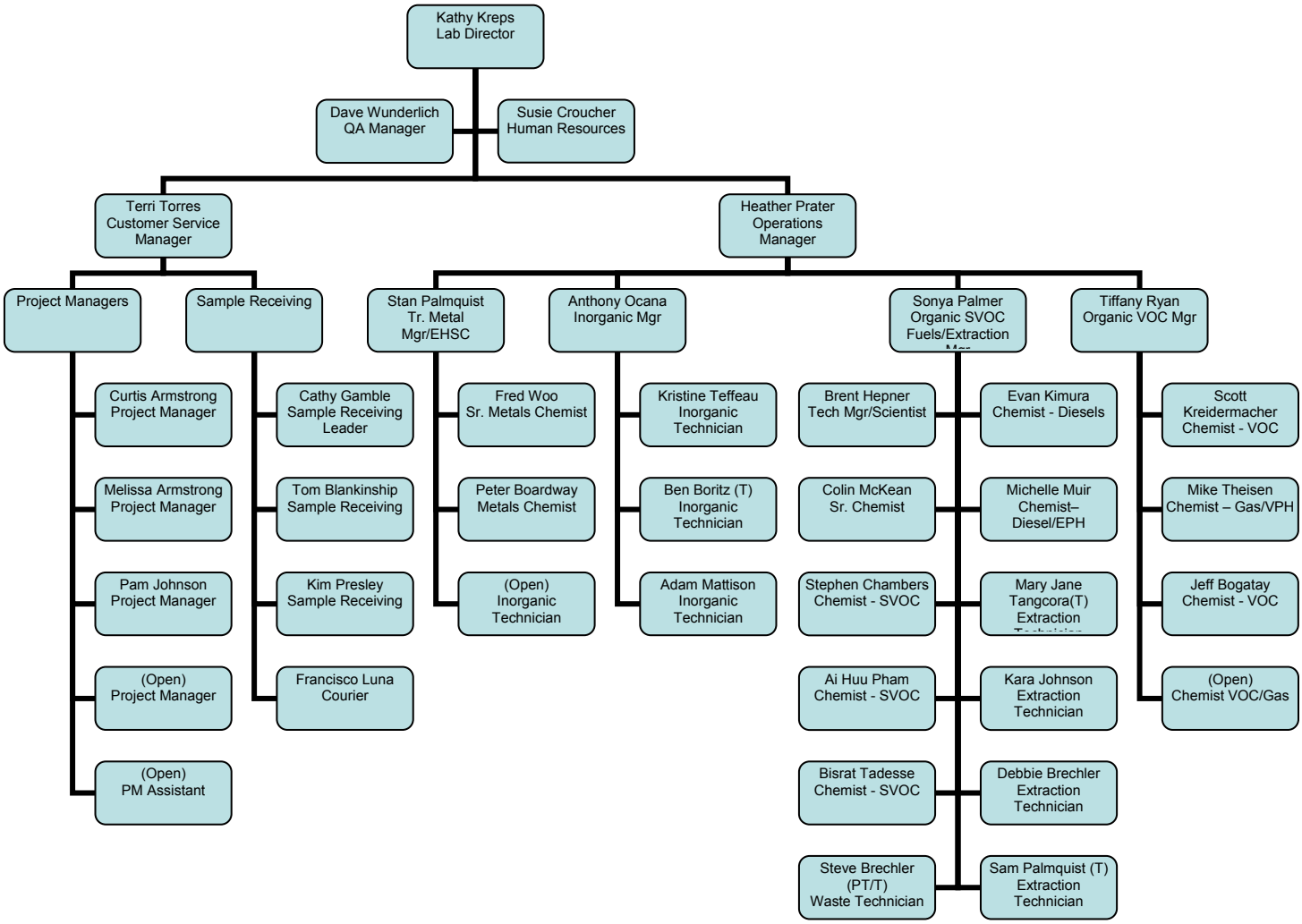
Key Personnel	Deputy
Laboratory Director	Customer Service Manager, and Operations Manager
QA Manager	Laboratory Director

Key Personnel	Deputy
Operations Manager	Laboratory Director
Metal Technical Director	QA Manager
Inorganic Technical Director	QA Manager
Semivolatile Technical Director	QA Manager
Volatile Technical Director	QA Manager
EHS Coordinator	Laboratory Director
Customer Services Manager	Laboratory Director

Figure 4-1. Corporate and Laboratory Organization Charts



TestAmerica Seattle
Organization Chart



SECTION 5

QUALITY SYSTEM *(NELAC 5.4.2)*

5.1 QUALITY POLICY STATEMENT

It is TestAmerica's Policy to:

- Provide data of known quality to its clients by adhering to approved methodologies, regulatory requirements and the QA/QC protocols.
- Effectively manage all aspects of the laboratory and business operations by the highest ethical standards.
- Continually improve systems and provide support to quality improvement efforts in laboratory, administrative and managerial activities. TestAmerica recognizes that the implementation of a quality assurance program requires management's commitment and support as well as the involvement of the entire staff.
- Provide clients with the highest level of professionalism and the best service practices in the industry.
- ***To comply with the ISO/IEC 17025:2005 International Standard and to continually improve the effectiveness of the management system*.**

Every staff member at the laboratory plays an integral part in quality assurance and is held responsible and accountable for the quality of their work. It is, therefore, required that all laboratory personnel are trained and agree to comply with applicable procedures and requirements established by this document.

5.2 ETHICS AND DATA INTEGRITY

TestAmerica is committed to ensuring the integrity of its data and meeting the quality needs of its clients. The elements of TestAmerica's Ethics and Data Integrity Program include:

- An Ethics Policy (Corporate Policy No. CA-L-P-001) and Employee Ethics Statements.
- Ethics and Compliance Officers (ECOs).
- A Training Program.
- Self-governance through disciplinary action for violations.
- A Confidential mechanism for anonymously reporting alleged misconduct and a means for conducting internal investigations of all alleged misconduct. (Corporate SOP No. CA-L-S-001.)
- Procedures and guidance for recalling data if necessary (Corporate SOP No. CA-L-S-001).
- Effective external and internal monitoring system that includes procedures for internal audits (Section 15).

- Produce results, which are accurate and include QA/QC information that meets client pre-defined Data Quality Objectives (DQOs).
- Present services in a confidential, honest and forthright manner.
- Provide employees with guidelines and an understanding of the Ethical and Quality Standards of our Industry.
- Operate our facilities in a manner that protects the environment and the health and safety of employees and the public.
- Obey all pertinent federal, state and local laws and regulations and encourage other members of our industry to do the same.
- Educate clients as to the extent and kinds of services available.
- Assert competency only for work for which adequate personnel and equipment are available and for which adequate preparation has been made.
- Promote the status of environmental laboratories, their employees, and the value of services rendered by them.

5.3 QUALITY SYSTEM DOCUMENTATION

The laboratory's Quality System is communicated through a variety of documents.

- Quality Assurance Manual – Each laboratory has a lab specific quality assurance manual.
- Corporate SOPs and Policies - Corporate SOPs and Policies are developed for use by all relevant laboratories. They are incorporated into the laboratory's normal SOP distribution, training and tracking system. Corporate SOPs may be general or technical.
- Work Instructions - A subset of procedural steps, tasks or forms associated with an operation of a management system (e.g., checklists, preformatted bench sheets, forms).
- Laboratory SOPs – General and Technical
- Corporate Quality Policy Memorandums
- Laboratory QA/QC Policy Memorandums

5.3.1 Order of Precedence

In the event of a conflict or discrepancy between policies, the order of precedence is as follows:

- Corporate Quality Policy Memorandum
- Corporate Quality Management Plan (CQMP)
- Corporate SOPs and Policies
- Laboratory QA/QC Policy Memorandum
- Laboratory Quality Assurance Manual (QAM)
- Laboratory SOPs and Policies
- Other (Work Instructions (WI), memos, flow charts, etc.)

Note: The laboratory has the responsibility and authority to operate in compliance with regulatory requirements of the jurisdiction in which the work is performed. Where the CQMP conflicts with those regulatory requirements, the regulatory requirements of the jurisdiction shall hold primacy. The laboratory's QAM shall take precedence over the CQMP in those cases.

5.4 QA/QC OBJECTIVES FOR THE MEASUREMENT OF DATA

Quality Assurance (QA) and Quality Control (QC) are activities undertaken to achieve the goal of producing data that accurately characterize the sites or materials that have been sampled. Quality Assurance is generally understood to be more comprehensive than Quality Control. Quality Assurance can be defined as the integrated system of activities that ensures that a product or service meets defined standards.

Quality Control is generally understood to be limited to the analyses of samples and to be synonymous with the term *"analytical quality control"*. QC refers to the routine application of statistically based procedures to evaluate and control the accuracy of results from analytical measurements. The QC program includes procedures for estimating and controlling precision and bias and for determining reporting limits.

Request for Proposals (RFPs) and Quality Assurance Project Plans (QAPP) provide a mechanism for the client and the laboratory to discuss the data quality objectives in order to ensure that analytical services closely correspond to client needs. The client is responsible for developing the QAPP. In order to ensure the ability of the laboratory to meet the Data Quality Objectives (DQOs) specified in the QAPP, clients are advised to allow time for the laboratory to review the QAPP before being finalized. Additionally, the laboratory will provide support to the client for developing the sections of the QAPP that concern laboratory activities.

Historically, laboratories have described their QC objectives in terms of precision, accuracy, representativeness, comparability, completeness, selectivity and sensitivity (PARCCSS).

5.4.1 Precision

The laboratory objective for precision is to meet the performance for precision demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Precision is defined as the degree of reproducibility of measurements under a given set of analytical conditions (exclusive of field sampling variability). Precision is documented on the basis of replicate analysis, usually duplicate or matrix spike (MS) duplicate samples.

5.4.2 Accuracy

The laboratory objective for accuracy is to meet the performance for accuracy demonstrated for the methods on similar samples and to meet data quality objectives of the EPA and/or other regulatory programs. Accuracy is defined as the degree of bias in a measurement system. Accuracy may be documented through the use of laboratory control samples (LCS) and/or MS. A statement of accuracy is expressed as an interval of acceptance recovery about the mean recovery.

5.4.3 Representativeness

The laboratory objective for representativeness is to provide data which is representative of the sampled medium. Representativeness is defined as the degree to which data represent a characteristic of a population or set of samples and is a measurement of both analytical and field sampling precision. The representativeness of the analytical data is a function of the procedures used in procuring and processing the samples. The representativeness can be documented by the relative percent difference between separately procured, but otherwise identical samples or sample aliquots.

The representativeness of the data from the sampling sites depends on both the sampling procedures and the analytical procedures. The laboratory may provide guidance to the client regarding proper sampling and handling methods in order to assure the integrity of the samples.

5.4.4 Comparability

The comparability objective is to provide analytical data for which the accuracy, precision, representativeness and reporting limit statistics are similar to these quality indicators generated by other laboratories for similar samples, and data generated by the laboratory over time.

The comparability objective is documented by inter-laboratory studies carried out by regulatory agencies or carried out for specific projects or contracts, by comparison of periodically generated statements of accuracy, precision and reporting limits with those of other laboratories.

5.4.5 Completeness

The completeness objective for data is 90% (or as specified by a particular project), expressed as the ratio of the valid data to the total data over the course of the project. Data will be considered valid if they are adequate for their intended use. Data usability will be defined in a QAPP, project scope or regulatory requirement. Data validation is the process for reviewing data to determine its usability and completeness. If the completeness objective is not met, actions will be taken internally and with the data user to improve performance. This may take the form of an audit to evaluate the methodology and procedures as possible sources for the difficulty or may result in a recommendation to use a different method.

5.4.6 Selectivity

Selectivity is defined as: The capability of a test method or instrument to respond to a target substance or constituent in the presence of non-target substances. Target analytes are separated from non-target constituents and subsequently identified/detected through one or more of the following, depending on the analytical method: extractions (separation), digestions (separation), interelement corrections (separation), use of matrix modifiers (separation), specific retention times (separation and identification), confirmations with different columns or detectors (separation and identification), specific wavelengths (identification), specific mass spectra (identification), specific electrodes (separation and identification), etc.

5.4.7 Sensitivity

Sensitivity refers to the amount of analyte necessary to produce a detector response that can be reliably detected (Method Detection Limit) or quantified (Reporting Limit).

5.5 CRITERIA FOR QUALITY INDICATORS

The laboratory maintains quality control limits in the Laboratory Information Management System that summarize the precision and accuracy acceptability limits for performed analyses. This summary includes an effective date, is updated each time new limits are generated and are managed by the laboratory's QA department. Unless otherwise noted, limits within these tables are laboratory generated. Some acceptability limits are derived from US EPA methods when they are required. Where US EPA method limits are not required, TestAmerica Seattle has developed limits from evaluation of data from similar matrices. Criteria for development of control limits are contained in SOP TA-QA-0600 Control Charting and Establishing Method Warning and Action Limits.

5.6 STATISTICAL QUALITY CONTROL

Statistically-derived precision and accuracy limits are required by selected methods (such as SW-846) and programs [such as the Ohio Voluntary Action Plan (VAP)]. TestAmerica Seattle routinely utilizes statistically-derived limits to evaluate method performance and determine when corrective action is appropriate. The analysts are instructed to use the current limits in the laboratory (dated and approved by the Technical Director and QA Manager) and entered into the Laboratory Information Management System (LIMS). The Quality Assurance department maintains an archive of all limits used within the laboratory via the LIMS. If a method defines the QC limits, the method limits are used.

If a method requires the generation of historical limits, the lab develops such limits from recent data in the QC database of the LIMS following the guidelines described in Section 24. All calculations and limits are documented and dated when approved and effective. On occasion, a client requests contract-specified limits for a specific project.

Surrogate recoveries are determined for a specific time period as defined above. The resulting ranges are entered in LIMS.

Current QC limits are entered and maintained in the LIMS analyte database. As sample results and the related QC are entered into LIMS, the sample QC values are compared with the limits in LIMS to determine if they are within the acceptable range. The analyst then evaluates if the sample needs to be rerun or re-extracted/rerun or if a comment should be added to the report explaining the reason for the QC outlier.

5.6.1 QC Charts

As the QC limits are calculated, QC charts are generated showing warning and control limits for the purpose of evaluating trends. The QA Manager evaluates these to determine if adjustments need to be made or for corrective actions to methods. All findings are documented and kept on file. (Refer to SOP TA-QA-0600 Control Charting and Establishing Method Warning and Action Limits.)

5.7 QUALITY SYSTEM METRICS

In addition to the QC parameters discussed above, the entire Quality System is evaluated on a monthly basis through the use of specific metrics (refer to Section 16). These metrics are used to drive continuous improvement in the laboratory's Quality System.

SECTION 6

DOCUMENT CONTROL *(NELAC 5.4.3)*

6.1 OVERVIEW

The QA Department is responsible for the control of documents used in the laboratory to ensure that approved, up-to-date documents are in circulation and out-of-date (obsolete) documents are archived or destroyed. The following documents, at a minimum, must be controlled:

- Laboratory Quality Assurance Manual
- Laboratory Standard Operating Procedures (SOP)
- Laboratory Policies
- Work Instructions and Forms
- Corporate Policies and Procedures distributed outside the intranet

Corporate Quality posts Corporate Manuals, SOPs, Policies, Work Instructions, White Papers and Training Materials on the company intranet site. These Corporate documents are only considered controlled when they are read on the intranet site. Printed copies are considered uncontrolled unless the laboratory physically distributes them as controlled documents. A detailed description of the procedure for issuing, authorizing, controlling, distributing, and archiving official documents and records is found in Corporate SOP No. CW-Q-S-001, Corporate Document Control and Archiving and laboratory specific SOPs TA-QA-0506 Archiving Reports and Report File Maintenance and SOP TA-QA-0605, Archiving Logbooks.

The laboratory QA Department also maintains access to various references and document sources integral to the operation of the laboratory. This includes reference methods and regulations. Instrument manuals (hard or electronic copies) are also maintained by the laboratory.

The laboratory maintains control of records for raw analytical data and supporting records such as audit reports and responses, logbooks, standard logs, training files, MDL studies, Proficiency Testing (PT) studies, certifications and related correspondence, and nonconformance memos/corrective action reports. Raw analytical data consists of bound logbooks, instrument printouts, any other notes, magnetic media, electronic data and final reports.

6.2 DOCUMENT APPROVAL AND ISSUE

The pertinent elements of a document control system for each document include a unique document title and number, the number of pages of the item, the effective date, revision number and the laboratory's name. The QA personnel are responsible for the maintenance of this system.

Controlled documents are authorized by the QA Department. In order to develop a new document, a manager submits an electronic draft to the QA Department for suggestions and approval before use. Upon approval, QA personnel add the identifying version information to the document and retain the official document on file. The official document is provided to all applicable operational units (may include electronic access). Controlled documents are

identified as such and records of their distribution are kept by the QA Department. Document control may be achieved by either electronic or hardcopy distribution.

The QA Department maintains a list of the official versions of controlled documents.

Quality System Policies and Procedures will be reviewed at a minimum of annually and revised as appropriate. Changes to documents occur when a procedural change warrants.

6.3 PROCEDURES FOR DOCUMENT CONTROL POLICY

For changes to the QA Manual, refer to SOP No. TA-QA-0528 Document Control. Uncontrolled copies must not be used within the laboratory. Previous revisions and back-up data are stored by the QA department. Electronic copies are stored on the Public server in the QAM folder for the applicable revision.

For changes to SOPs, refer to SOP No. TA-QA-0500, Standard Operating Procedures. The SOP identified above also defines the process of changes to SOPs.

Forms, worksheets, work instructions and information are organized by department in the QA office. There is a table of contents. Electronic versions are kept on the Public server in the QA folders; hard copies are kept in QA files.

6.4 OBSOLETE DOCUMENTS

All invalid or obsolete documents are removed, or otherwise prevented from unintended use. The laboratory has specific procedures as described above to accomplish this. In general, obsolete documents are collected from employees according to distribution lists and are marked obsolete on the cover or destroyed. At least one copy of the obsolete document is archived according to SOP No. TA-QA-0528 Document Control.

SECTION 7

SERVICE TO THE CLIENT *(NELAC 5.4.7)*

7.1 OVERVIEW

TestAmerica Seattle has established procedures for the review of work requests and contracts, oral or written. The procedures include evaluation of the laboratory's capability and resources to meet the contract's requirements within the requested time period. All requirements, including the methods to be used, must be adequately defined, documented and understood. For many environmental sampling and analysis programs, testing design is site or program specific and does not necessarily "fit" into a standard laboratory service or product. It is TestAmerica Seattle's intent to provide both standard and customized environmental laboratory services to our clients.

A thorough review of technical and QC requirements contained in contracts is performed to ensure project success. The appropriateness of requested methods, and the lab's capability to perform them must be established. Projects, proposals and contracts are reviewed for adequately defined requirements and TestAmerica Seattle's capability to meet those requirements. Alternate test methods that are capable of meeting the clients' requirements may be proposed by the lab. A review of the lab's capability to analyze non-routine analytes is also part of this review process.

All projects, proposals and contracts are reviewed for the client's requirements in terms of compound lists, test methodology requested, sensitivity (detection and reporting levels), accuracy, and precision requirements (% Recovery and RPD). The reviewer ensures that the laboratory's test methods are suitable to achieve these regulatory and client requirements and that the laboratory holds the appropriate certifications and approvals to perform the work. The laboratory and any potential subcontract laboratories must be certified, as required, for all proposed tests.

The laboratory must determine if it has the necessary physical, personnel and information resources to meet the contract, and if the personnel have the expertise needed to perform the testing requested. Each proposal is checked for its impact on the capacity of the laboratory's equipment and personnel. As part of the review, the proposed turnaround time will be checked for feasibility.

Electronic or hard copy deliverable requirements are evaluated against the laboratory's capacity for production of the documentation.

If the laboratory cannot provide all services but intends to subcontract such services, whether to another TestAmerica facility or to an outside firm, this will be documented and discussed with the client prior to contract approval. (Refer to Section 8 for Subcontracting Procedures.)

The laboratory informs the client of the results of the review if it indicates any potential conflict, deficiency, lack of accreditation, or inability of the lab to complete the work satisfactorily. Any discrepancy between the client's requirements and TestAmerica Seattle's capability to meet those requirements is resolved in writing before acceptance of the contract. It is necessary that

the contract be acceptable to both the laboratory and the client. Amendments initiated by the client and/or TestAmerica, are documented in writing.

All contracts, QAPPs, Sampling and Analysis Plans (SAPs), contract amendments, and documented communications become part of the project record.

The same contract review process used for the initial review is repeated when there are amendments to the original contract by the client, and the participating personnel are informed of the changes.

7.2 REVIEW SEQUENCE AND KEY PERSONNEL

Appropriate personnel will review the work request at each stage of evaluation.

For routine projects and other simple tasks, a review by the Project Manager (PM) is considered adequate. The PM confirms that the laboratory has any required certifications, that it can meet the clients' data quality and reporting requirements and that the lab has the capacity to meet the clients turn around needs. It is recommended that, where there is a sales person assigned to the account, an attempt should be made to contact that sales person to inform them of the incoming samples.

For new, complex or large projects, the proposed contract is given to the National Account Director, who will decide which lab will receive the work based on the scope of work and other requirements, including certification, testing methodology, and available capacity to perform the work. The contract review process is outlined in TestAmerica's Corporate SOP No. CA-L-P-002**,** Contract Compliance Policy.

This review encompasses all facets of the operation. The scope of work is distributed to the appropriate personnel, as needed based on scope of contract, to evaluate all of the requirements shown above (not necessarily in the order below):

- Legal & Contracts Director
- General Manager
- Corporate Information Technology Director
- Customer Services Manager
- Laboratory Technical Directors
- Regional and/or National Account representatives
- Laboratory Quality Assurance Manager
- Laboratory Environmental Health and Safety Managers/Directors
- The Laboratory Director reviews the formal laboratory quote and makes final acceptance for their facility.

The National Account Director, Legal Contracts Director, or local account representative then submits the final proposal to the client.

In the event that one of the above personnel is not available to review the contract, his or her back-up will fulfill the review requirements.

The Legal & Contracts Director maintains copies of all signed contracts. The Laboratory Director also maintains copies of all signed contracts on site.

7.3 DOCUMENTATION

Appropriate records are maintained for every contract or work request by the Laboratory Director. All stages of the contract review process are documented and include records of any significant changes.

The contract will be distributed to and maintained by the appropriate sales/marketing personnel and the Regional Account Manager. A copy of the contract and formal quote will be filed with the laboratory PM and the Lab Director.

Records are maintained of pertinent discussions with a client relating to the client's requirements or the results of the work during the period of execution of the contract. The PM keeps a phone log of conversations with the client and all actions agreed upon between the PM and the client are officially documented with a follow-up email.

7.3.1 Project-Specific Quality Planning

Communication of contract specific technical and QC criteria is an essential activity in ensuring the success of site specific testing programs. To achieve this goal, TestAmerica Seattle assigns a PM to each client. It is the PM's responsibility to ensure that project-specific technical and QC requirements are effectively evaluated and communicated to the laboratory personnel before and during the project. QA department involvement may be needed to assist in the evaluation of custom QC requirements.

PM's are the primary client contact and they ensure resources are available to meet project requirements. Although PM's do not have direct reports or staff in production, they coordinate opportunities and work with laboratory management and supervisory staff to ensure available resources are sufficient to perform work for the client's project. Project management is positioned between the client and laboratory resources.

Prior to work on a new project, the dissemination of project information and/or project opening meetings may occur to discuss schedules and unique aspects of the project. Items to be discussed may include the project technical profile, turnaround times, holding times, methods, analyte lists, reporting limits, deliverables, sample hazards, or other special requirements. The PM introduces new projects to the laboratory staff through project kick-off meetings or to the supervisory staff during production meetings. These meetings provide direction to the laboratory staff in order to maximize production and client satisfaction, while maintaining quality. In addition, project notes may be associated with each sample batch as a reminder upon sample receipt and analytical processing.

During the project, any change that may occur within an active project is agreed upon between the client/regulatory agency and the PM/laboratory. These changes (e.g., use of a non-standard method or modification of a method) and approvals must be documented prior to implementation. Documentation pertains to any document, e.g., letter, e-mail, variance, contract addendum, which has been signed by both parties.

Such changes are also communicated to the laboratory during production status meetings. Such changes are updated to the project notes and are introduced to the managers at these meetings. The laboratory staff is then introduced to the modified requirements via the PM or the individual laboratory Department Manager. After the modification is implemented into the laboratory process, documentation of the modification is made in the case narrative of the data report(s).

TestAmerica Seattle strongly encourages client visits to the laboratory and for formal/informal information sharing session with employees in order to effectively communicate ongoing client needs as well as project specific details for customized testing programs.

7.4 SPECIAL SERVICES

TestAmerica Seattle cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. It is the laboratory's goal to meet all client requirements in addition to statutory and regulatory requirements. The laboratory has procedures to ensure confidentiality to clients (Sections 15 and 25). TestAmerica Seattle also affords clients or their representative cooperation to clarify the client requests.

The laboratory's standard procedures for reporting data are described in Section 25. Special services are also available and provided upon request. These services include:

- Reasonable access for our clients or their representatives to the relevant areas of the laboratory for the witnessing of tests performed for the client.
- Assist client-specified third party data validators as specified in the client's contract.
- Supplemental information pertaining to the analysis of their samples. Note: An additional charge may apply for additional data/information that was not requested prior to the time of sample analysis or previously agreed upon.

7.5 CLIENT COMMUNICATION

Project managers are the primary communication link to the clients. They shall inform their clients of any delays in project completion as well as any non-conformances in either sample receipt or sample analysis. Project management will maintain ongoing client communication throughout the entire client project.

Technical Directors and the QA Manager are available to discuss any technical questions or concerns that the client may have.

7.6 REPORTING

The laboratory works with our clients to produce any special communication reports required by the contract.

7.7 CLIENT SURVEYS

The laboratory assesses both positive and negative client feedback. The results are used to improve overall laboratory quality and client service. TestAmerica's Sales and Marketing teams periodically develops lab and client specific surveys to assess client satisfaction.

SECTION 8

SUBCONTRACTING OF TESTS *(NELAC 5.4.5)*

8.1 OVERVIEW

For the purpose of this quality manual, the phrase subcontract laboratory refers to a laboratory external to the TestAmerica laboratories. The phrase "work sharing" refers to internal transfers of samples between the TestAmerica laboratories. The term outsourcing refers to the act of subcontracting tests.

When contracting with our clients, the laboratory makes commitments regarding the services to be performed and the data quality for the results to be generated. When the need arises to outsource testing for our clients because project scope, changes in laboratory capabilities, capacity or unforeseen circumstances, we must be assured that the subcontractors or work sharing laboratories understand the requirements and will meet the same commitments we have made to the client. Refer to TestAmerica's Corporate SOP's on Subcontracting Procedures (CA-L-S-002) and the Work Sharing Process (CA-C-S-001).

When outsourcing analytical services, the laboratory will assure, to the extent necessary, that the subcontract or work sharing laboratory maintains a program consistent with the requirements of this document, the requirements specified in NELAC/ISO 17025 and/or the client's Quality Assurance Project Plan (QAPP). All QC guidelines specific to the client's analytical program are transmitted to the subcontractor and agreed upon before sending the samples to the subcontract facility. Additionally, work requiring accreditation will be placed with an appropriately accredited laboratory. The laboratory performing the subcontracted work will be identified in the final report, as will non-NELAC accredited work where required.

Project Managers (PMs), Customer Service Managers (CSM), or Regional Account Executives (RAE) for the Export Lab are responsible for obtaining client approval prior to outsourcing any samples. The laboratory will advise the client of a subcontract or work sharing arrangement in writing and when possible approval from the client shall be retained in the project folder.

The US Army Corps of Engineers and USDA require notification prior to placing such work. Notification of subcontracting of tests is authorized by the USACE during the bidding process.

For DOD projects, the subcontractor laboratories used must have an established and documented laboratory quality system that complies with DoD QSM requirements. The subcontractor laboratories are evaluated following the procedures outlined below and as seen in Figure 8-1. The subcontractor laboratory must receive project-specific approval from the DoD client before any samples are analyzed.

The QSM has 5 specific requirements for subcontracting:

1. Subcontractor laboratories must have an established laboratory quality system that complies with the QSM.
2. Subcontractor laboratories must be approved by the specific DoD Component laboratory approval process.

3. Subcontractor laboratories must demonstrate the ability to generate acceptable results from the analysis of PT samples, subject to availability, using each applicable method, in the specified matrix, and provide appropriate documentation to the DoD client.
4. Subcontractor laboratories must receive project-specific approval from the DoD client before any samples are analyzed.

Subcontractor laboratories are subject to project-specific, on-site assessments by the DoD client or their designated representatives.

8.2 QUALIFYING AND MONITORING SUBCONTRACTORS

Whenever a PM or Customer Service Manager becomes aware of a client requirement or laboratory need where samples must be outsourced to another laboratory, the other laboratory(s) shall be selected based on the following:

- The first priority is to attempt to place the work in a qualified TestAmerica laboratory;
- Firms specified by the client for the task (Documentation that a subcontractor was designated by the client must be maintained with the project file. This documentation can be as simple as placing a copy of an e-mail from the client in the project folder);
- Firms listed as pre-qualified and currently under a subcontract with TestAmerica: A listing of all approved subcontracting laboratories and supporting documentation is available on the TestAmerica intranet site. Verify necessary accreditation, where applicable, (e.g., on the subcontractors NELAC, A2LA accreditation or State Certification).
- Firms identified in accordance with the company's Small Business Subcontracting program as small, women-owned, veteran-owned and/or minority-owned businesses;
- NELAC or A2LA accredited laboratories.
- In addition, the firm must hold the appropriate certification to perform the work required.

All TestAmerica laboratories are pre-qualified for work sharing provided they hold the appropriate accreditations, can adhere to the project/program requirements, and the client approved sending samples to that laboratory. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented). The originating laboratory is responsible for communicating all technical, quality, and deliverable requirements as well as other contract needs. (Corporate SOP No. CA-C-S-001, Work Sharing Process).

When the potential sub-contract laboratory has not been previously approved, PMs may nominate a laboratory as a subcontractor based on need. The decision to nominate a laboratory must be approved by the Laboratory Director. The Laboratory Director requests that the QA Manager begin the process of approving the subcontract laboratory as outlined in Corporate SOP No. CA-L-S-002, Subcontracting Procedures. The client must provide acknowledgement that the samples can be sent to that facility (an e-mail is sufficient documentation or if acknowledgement is verbal, the date, time, and name of person providing acknowledgement must be documented).

8.2.1 Once the appropriate accreditation and legal information is received by the laboratory, it is evaluated for acceptability (where applicable) and forwarded to Corporate Contracts for formal contracting with the laboratory. They will add the lab to the approved list on the intranet site along with the associate documentation and notify the finance group for JD Edwards.

8.2.2 The client will assume responsibility for the quality of the data generated from the use of a subcontractor they have requested the lab to use. The qualified subcontractors on the intranet site are known to meet minimal standards. TestAmerica does not certify laboratories. The subcontractor is on our approved list and can only be recommended to the extent that we would use them.

8.2.3 The status and performance of qualified subcontractors will be monitored periodically by the Corporate Contracts and/or Quality Departments. Any problems identified will be brought to the attention of TestAmerica's Corporate Finance or Corporate Quality personnel.

- Complaints shall be investigated. Documentation of the complaint, investigation and corrective action will be maintained in the subcontractor's file on the intranet site. Complaints are posted using the Vendor Performance Report.
- Information shall be updated on the intranet when new information is received from the subcontracted laboratories.
- Subcontractors in good standing will be retained on the intranet listing. The QA Manager will notify all TestAmerica laboratories, Corporate Quality and Corporate Contracts if any laboratory requires removal from the intranet site. This notification will be posted on the intranet site and e-mailed to all Lab Directors/Managers, QA Managers and Sales Personnel.

8.3 OVERSIGHT AND REPORTING

The PM must request that the selected subcontractor be presented with a subcontract, if one is not already executed between the laboratory and the subcontractor. The subcontract must include terms which flow down the requirements of our clients, either in the subcontract itself or through the mechanism of work orders relating to individual projects. A standard subcontract and the Lab Subcontractor Vendor Package (posted on the intranet) can be used to accomplish this, and the Legal & Contracts Director can tailor the document or assist with negotiations, if needed. The PM or CSM responsible for the project must advise and obtain client consent to the subcontract as appropriate, and provide the scope of work to ensure that the proper requirements are made a part of the subcontract and are made known to the subcontractor.

Prior to sending samples to the subcontracted laboratory, the PM confirms their certification status to determine if it's current and scope-inclusive. The information is documented on a Subcontracted Sample Form (Figure 8-1) and the form is retained in the project folder. For TestAmerica laboratories, certifications can be viewed on the company's TotalAccess Database.

The Sample Control department is responsible for ensuring compliance with QA requirements and applicable shipping regulations when shipping samples to a subcontracted laboratory.

All subcontracted samples must be accompanied by a Chain of Custody (COC). A copy of the original COC sent by the client must be included with all samples subbed within TestAmerica.

Through communication with the subcontracted laboratory, the PM monitors the status of the subcontracted analyses, facilitates successful execution of the work, and ensures the timeliness and completeness of the analytical report.

Non-NELAC accredited work must be identified in the subcontractor's report as appropriate. If NELAC accreditation is not required, the report does not need to include this information.

Reports submitted from subcontractor laboratories are not altered and are included in their original form in the final project report. This clearly identifies the data as being produced by a subcontractor facility. If subcontract laboratory data is incorporated into the laboratories EDD (i.e., imported), the report must explicitly indicate which lab produced the data for which methods and samples.

Note: The results submitted by a TestAmerica work sharing laboratory may be transferred electronically and the results reported by the TestAmerica work sharing lab are identified on the final report. The report must explicitly indicate which lab produced the data for which methods and samples. The final report must include a copy of the completed COC for all work sharing reports.

8.4 CONTINGENCY PLANNING

The Laboratory Director may waive the full qualification of a subcontractor process temporarily to meet emergency needs. In the event this provision is utilized, Corporate QA must be informed, and the QA Manager will be required to verify adequacy of proficiency scores and certifications. The laboratory must also request a copy of the raw data to support the analytical results for the first project submitted to the subcontract laboratory unless the laboratory has NELAC accreditation. The raw data is reviewed by the QA Manager and the PM to ensure that the results meet the client's needs. The QA Manager will request full documentation and qualify the subcontractor under the provisions above. The approval process should be completed within 30 calendar days of subcontracting.

Figure 8-1.

Example - Subcontracted Sample Form

Date/Time: _____

Subcontracted Laboratory Information:

- Subcontractor's Name: _____
- Subcontractor Point of Contact: _____
- Subcontractor's Address: _____
- Subcontractor's Phone: _____
- Analyte/Method: _____
- Certified for State of Origin: _____
- NELAC Certified: Yes_____No_____
- USDA Permit (__Domestic __ Foreign) Yes_____No_____
- A2LA (or ISO 17025) Certified: Yes_____No_____
- CLP-like Required: Yes_____No_____
  (Full doc required)
- Requested Sample Due Date: _____
  (Must be put on COC)

Project Manager: _____

Laboratory Sample # Range: _____
(Only of Subcontracted Samples)

Laboratory Project Number (Billing Control #): _____

All subcontracted samples are to be sent via bonded carrier and Priority Overnight. Please attach tracking number below and maintain these records in the project files.

PM Signature_____**Date**_____

SECTION 9

PURCHASING SERVICES AND SUPPLIES *(NELAC 5.4.6)*

9.1 OVERVIEW

Evaluation and selection of suppliers and vendors is performed, in part, on the basis of the quality of their products, their ability to meet the demand for their products on a continuous and short term basis, the overall quality of their services, their past history, and competitive pricing. This is achieved through evaluation of objective evidence of quality furnished by the supplier, which can include certificates of analysis, recommendations, and proof of historical compliance with similar programs for other clients. *To ensure that quality critical consumables and equipment conform to specified requirements, which may affect quality,* all purchases from specific vendors are approved by a member of the supervisory or management staff. Capital expenditures are made in accordance with TestAmerica's Corporate Controlled Purchases Procedure, SOP No. CW-F-S-007.

Contracts will be signed in accordance with TestAmerica's Corporate Authorization Matrix Policy, Policy No. CW-F-P-002. Request for Proposals (RFP's) will be issued where more information is required from the potential vendors than just price. Process details are available in TestAmerica's Corporate Procurement and Contracts Policy (Policy No. CW-F-P-004). RFP's allow TestAmerica to determine if a vendor is capable of meeting requirements such as supplying all of the TestAmerica facilities, meeting required quality standards and adhering to necessary ethical and environmental standards. The RFP process also allows potential vendors to outline any additional capabilities they may offer.

9.2 GLASSWARE

Glassware used for volumetric measurements must be Class A or verified for accuracy according to laboratory procedure. Pyrex (or equivalent) glass should be used where possible. For safety purposes, thick-wall glassware should be used where available.

9.3 REAGENTS, STANDARDS & SUPPLIES

Purchasing guidelines for equipment and reagents must meet the requirements of the specific method and testing procedures for which they are being purchased. Solvents and acids are pre-tested in accordance with TestAmerica's Corporate SOP on Solvent & Acid Lot Testing & Approval, SOP No. CA-Q-S-001.

9.3.1 Purchasing

Chemical reagents, solvents, glassware, and general supplies are ordered as needed to maintain sufficient quantities on hand. Materials used in the analytical process must be of a known quality. The wide variety of materials and reagents available makes it advisable to specify recommendations for the name, brand, and grade of materials to be used in any determination. This information is contained in the method SOP. The analyst should complete the Material Request Sheet when requesting reagents, standards, or supplies that are not stocked in on-site consignment system that contains items approved for laboratory use.

The analyst must provide the vendor, item number, item description, package size, and the quantity needed as well as the date needed and department number. If an item being ordered is not the exact item requested, approval must be obtained from the Technical Director prior to placing the order. The purchasing manager places the order.

9.3.2 Receiving

It is the responsibility of the purchasing manager to receive the shipment. It is the responsibility of the analyst who ordered the materials to date the material when received. Once the ordered reagents or materials are received, the analyst compares the information on the label or packaging to the original order to ensure that the purchase meets the quality level specified. Material Safety Data Sheets (MSDSs) are available online through the Company's intranet website. Anyone may review these for relevant information on the safe handling and emergency precautions of on-site chemicals.

9.3.3 Specifications

All methods in use in the laboratory specify the grade of reagent that must be used in the procedure. If the quality of the reagent is not specified, it may be assumed that it is not significant in that procedure and, therefore, any grade reagent may be used. It is the responsibility of the analyst to check the procedure carefully for the suitability of grade of reagent.

Chemicals must not be used past the manufacturer's expiration date and must not be used past the expiration time noted in a method SOP. If expiration dates are not provided, the laboratory may contact the manufacturer to determine an expiration date.

The laboratory assumes a five year expiration date on inorganic dry chemicals unless noted otherwise by the manufacturer or by the reference source method. Chemicals should not be used past the manufacturer's or SOPs expiration date unless 'verified' (refer to item 3 listed below).

- An expiration date can not be extended if the dry chemical is discolored or appears otherwise physically degraded, the dry chemical must be discarded.

- Expiration dates can be extended if the dry chemical is found to be satisfactory based on acceptable performance of quality control samples (Continuing Calibration Verification (CCV), Blanks, Laboratory Control Sample (LCS), etc.).

- If the dry chemical is used for the preparation of standards, the expiration dates can be extended 6 months if the dry chemical is compared to an unexpired independent source in performing the method and the performance of the dry chemical is found to be satisfactory. The comparison must show that the dry chemical meets CCV limits. The comparison studies are maintained in the QA office.

Wherever possible, standards must be traceable to national or international standards of measurement or to national or international reference materials. Records to that effect are available to the user.

Compressed gases in use are checked for pressure and secure positioning daily. The minimum total pressure must be 500 psig or the tank must be replaced. The quality of the gases must meet method or manufacturer specification or be of a grade that does not cause any analytical interference.

Water used in the preparation of standards or reagents must have a specific conductivity of less than 1- mmho/cm (or specific resistivity of greater than 1.0 megaohm-cm) at 25°C. The specific conductivity is checked and recorded daily. If the water's specific conductivity is greater than the specified limit, the Facility Manager and appropriate Department Managers/Supervisors must be notified immediately in order to notify all departments, decide on cessation (based on intended use) of activities, and make arrangements for correction.

The laboratory may purchase reagent grade (or other similar quality) water for use in the laboratory. This water must be certified "clean" by the supplier for all target analytes or otherwise verified by the laboratory prior to use. This verification is documented.

Standard lots are verified before first time use if the laboratory switches manufacturers or has historically had a problem with the type of standard.

Purchased VOA vials must be certified clean and the certificates must be maintained. If uncertified VOA vials are purchased, all lots must be verified clean prior to use. This verification must be maintained.

Records of manufacturer's certification and traceability statements are stored *as scanned images in the LIMS Reagent module*. These records include date of receipt, lot number (when applicable), and expiration date (when applicable). Incorporation of the item into the record indicates that the analyst has compared the new certificate with the previous one for the same purpose and that no difference is noted, unless approved and so documented by the Technical Director or QA Manager.

9.3.4 Storage

Reagent and chemical storage is important from the aspects of both integrity and safety. Light-sensitive reagents may be stored in brown-glass containers. Storage conditions are per the Corporate Environmental Health & Safety Manual (Corp. Doc. No. CW-E-M-001) and method SOPs or manufacturer instructions.

9.4 PURCHASE OF EQUIPMENT/INSTRUMENTS/SOFTWARE

When a new piece of equipment is needed, either for additional capacity or for replacing inoperable equipment, *the analyst makes a supply request to the Technical Director* and Laboratory Director. If they agree with the request, the procedures outlined in TestAmerica's Corporate Policy No. CA-T-P-001, Qualified Products List, are followed. A decision is made as to which piece of equipment can best satisfy the requirements. The appropriate written requests are completed and purchasing places the order.

Upon receipt of a new or used piece of equipment, an identification name is assigned and added to the equipment list. IT must also be notified so that they can synchronize the instrument for back-ups. Its capability is assessed to determine if it is adequate or not for the

specific application. For instruments, a calibration curve is generated, followed by MDLs, Demonstration of Capabilities (DOCs), and other relevant criteria (refer to Section 19). For software, its operation must be deemed reliable and evidence of instrument verification must be retained by the QA Department. Software certificates supplied by the vendors are filed with the LIMS Administrator. The manufacturer's operation manual is retained at the bench.

9.5 SERVICES

Service to analytical instruments (except analytical balances) is performed on an as needed basis. Routine preventative maintenance is discussed in Section 20. The need for service is determined by analysts and/or Department Managers. The service providers that perform the services are approved by the Department Managers/Technical Directors.

9.6 SUPPLIERS

TestAmerica selects vendors through a competitive proposal / bid process, strategic business alliances or negotiated vendor partnerships (contracts). This process is defined in the Corporate Finance documents on Vendor Selection (SOP No. CW-F-S-018) and Procurement & Contracts Policy (Policy No. CW-F-P-004). The level of control used in the selection process is dependent on the anticipated spending amount and the potential impact on TestAmerica business. Vendors that provide test and measuring equipment, solvents, standards, certified containers, instrument related service contracts or subcontract laboratory services shall be subject to more rigorous controls than vendors that provide off-the-shelf items of defined quality that meet the end use requirements. The JD Edwards purchasing system includes all suppliers/vendors that have been approved for use.

Evaluation of suppliers is accomplished by ensuring the supplier ships the product or material ordered and that the material is of the appropriate quality. This is documented by signing off on packing slips or other supply receipt documents. The purchasing documents contain the data that adequately describe the services and supplies ordered.

Any issues of vendor performance are to be reported immediately by the laboratory staff to the Corporate Purchasing Group by completing a Vendor Performance Report.

The Corporate Purchasing Group will work through the appropriate channels to gather the information required to clearly identify the problem and will contact the vendor to report the problem and to make any necessary arrangements for exchange, return authorization, credit, etc.

As deemed appropriate, the Vendor Performance Reports will be summarized and reviewed to determine corrective action necessary, or service improvements required by vendors

The laboratory has access to a listing of all approved suppliers of critical consumables, supplies and services. This information is provided through the JD Edwards purchasing system.

9.6.1 New Vendor Procedure

TestAmerica employees who wish to request the addition of a new vendor must complete a J.D. Edwards Vendor Add Request Form.

New vendors are evaluated based upon criteria appropriate to the products or services provided as well as their ability to provide those products and services at a competitive cost. Vendors are also evaluated to determine if there are ethical reasons or potential conflicts of interest with TestAmerica employees that would make it prohibitive to do business with them as well as their financial stability. The QA Department and/or the Technology Director are consulted with vendor and product selection that have an impact on quality.

SECTION 10

COMPLAINTS *(NELAC 5.4.8)*

10.1 OVERVIEW

The laboratory considers an effective client complaint handling processes to be of significant business and strategic value. Listening to and documenting client concerns captures 'client knowledge' that enables our operations to continually improve processes and client satisfaction. An effective client complaint handling process also provides assurance to the data user that the laboratory will stand behind its data, service obligations and products.

A client complaint is any expression of dissatisfaction with any aspect of our business services (e.g., communications, responsiveness, data, reports, invoicing and other functions) expressed by any party, whether received verbally or in written form. Client inquiries, complaints or noted discrepancies are documented, communicated to management, and addressed promptly and thoroughly.

The laboratory has procedures for addressing both external and internal complaints with the goal of providing satisfactory resolution to complaints in a timely and professional manner.

The nature of the complaint is identified, documented and investigated, and an appropriate action is determined and taken. In cases where a client complaint indicates that an established policy or procedure was not followed, the QA Department must evaluate whether a special audit must be conducted to assist in resolving the issue. A written confirmation or letter to the client, outlining the issue and response taken is recommended as part of the overall action taken.

The process of complaint resolution and documentation utilizes the procedures outlined in Section 12 (Corrective Actions) and is documented following SOP TA-QA-0529.

10.2 EXTERNAL COMPLAINTS

An employee that receives a complaint initiates the complaint resolution process by first documenting the complaint according to SOP TA-QA-0529.

Complaints fall into two categories: correctable and non-correctable. An example of a correctable complaint would be one where a report re-issue would resolve the complaint. An example of a non-correctable complaint would be one where a client complains that their data was repeatedly late. Non-correctable complaints should be reviewed for preventive action measures to reduce the likelihood of future occurrence and mitigation of client impact.

The general steps in the complaint handling process are:

- Receiving and Documenting Complaints
- Complaint Investigation and Service Recovery
- Process Improvement

The laboratory shall inform the initiator of the complaint of the results of the investigation and the corrective action taken, if any.

10.3 INTERNAL COMPLAINTS

Internal complaints include, but are not limited to: errors and non-conformances, training issues, internal audit findings, and deviations from methods. Corrective actions may be initiated by any staff member who observes a nonconformance and shall follow the procedures outlined in Section 12. In addition, Corporate Management, Sales and Marketing and IT may initiate a complaint by contacting the laboratory or through the corrective action system described in Section 12.

10.4 MANAGEMENT REVIEW

The number and nature of client complaints is reported by the QA Manager to the laboratory and QA Director in the QA Monthly report. Monitoring and addressing the overall level and nature of client complaints and the effectiveness of the solutions is part of the Annual Management Review (Section 16).

SECTION 11

CONTROL OF NON-CONFORMING WORK *(NELAC 5.4.9)*

11.1 OVERVIEW

When data discrepancies are discovered or deviations and departures from laboratory SOPs, policies and/or client requests have occurred, corrective action is taken immediately. First, the laboratory evaluates the significance of the nonconforming work. Then, a corrective action plan is initiated based on the outcome of the evaluation. If it is determined that the nonconforming work is an isolated incident, the plan could be as simple as adding a qualifier to the final results and/or making a notation in the case narrative. If it is determined that the nonconforming work is a systematic or improper practices issue, the corrective action plan could include a more in depth investigation and a possible suspension of an analytical method. In all cases, the actions taken are documented using the laboratory's corrective action system (refer to Section 12).

Due to the frequently unique nature of environmental samples, sometimes departures from documented policies and procedures are needed. When an analyst encounters such a situation, the problem is presented to the supervisor for advice. The supervisor may elect to discuss it with the Technical Director or have a representative contact the client to decide on a logical course of action. Once an approach is agreed upon, the analyst documents it using the laboratories corrective action system described in *Section 12*. This information can then be supplied to the client in the form of a footnote or a case narrative with the report.

Project Management may encounter situations where a client may request that a special procedure be applied to a sample that is not standard lab practice. Based on a technical evaluation, the lab may accept or opt to reject the request based on technical or ethical merit. An example might be the need to report a compound that the lab does not normally report. The lab would not have validated the method for this compound following the procedures in *Section 19*. The client may request that the compound be reported based only on the calibration. Such a request would need to be approved by the Technical Director and QA Manager, documented and included in the project folder. Deviations **must** also be noted on the final report with a statement that the compound is not reported in compliance with NELAC (or the analytical method) requirements and the reason. Data being reported to a non-NELAC state would need to note the change made to how the method is normally run.

11.2 RESPONSIBILITIES AND AUTHORITIES

TestAmerica's Corporate SOP entitled *Internal Investigation of Potential Data Discrepancies and Determination for Data Recall* (SOP No. CA-L-S-001) outlines the general procedures for the reporting and investigation of data discrepancies and alleged incidents of misconduct or violations of TestAmerica's data integrity policies as well as the policies and procedures related to the determination of the potential need to recall data.

Under certain circumstances, the Laboratory Director, Technical Director, or QA Manager may authorize departures from documented procedures or policies. The departures may be a result of procedural changes due to the nature of the sample; a one-time procedure for a client; QC failures with insufficient sample to reanalyze, etc.. In most cases, the client will be informed of the departure prior to the reporting of the data. Any departures must be well documented using

the laboratory's corrective action procedures. This information may also be documented in logbooks and/or data review checklists as appropriate. Any impacted data must be referenced in a case narrative and/or flagged with an appropriate data qualifier.

Any misrepresentation or possible misrepresentation of analytical data discovered by any laboratory staff member must be reported to facility Senior Management within 24-hours. The Senior Management staff is comprised of the Laboratory Director, the QA Manager, and the Department Managers. The reporting of issues involving alleged violations of the company's Data Integrity or Manual Integration procedures must be conveyed to an Ethics and Compliance Officer (ECO), Director of Quality & Client Advocacy and the laboratory's Quality Director within 24 hours of discovery.

Whether an inaccurate result was reported due to calculation or quantitation errors, data entry errors, improper practices, or failure to follow SOPs, the data must be evaluated to determine the possible effect.

The Laboratory Director, QA Manager, ECOs, Corporate Quality, the COO, General Managers and the Quality Directors have the authority and responsibility to halt work, withhold final reports, or suspend an analysis for due cause as well as authorize the resumption of work.

11.3 EVALUATION OF SIGNIFICANCE AND ACTIONS TAKEN

For each nonconforming issue reported, an evaluation of its significance and the level of management involvement needed is made. This includes reviewing its impact on the final data, whether or not it is an isolated or systematic issue, and how it relates to any special client requirements.

TestAmerica's Corporate Data Investigation & Recall Procedure (SOP No. CA-L-S-001) distinguishes between situations when it would be appropriate for laboratory management to make the decision on the need for client notification (written or verbal) and data recall (report revision) and when the decision must be made with the assistance of the ECOs and Corporate Management. Laboratory level decisions are documented and approved using the laboratory's standard nonconformance/corrective action reporting in lieu of the data recall determination form contained in TestAmerica's Corporate SOP No. CA-L-S-001.

11.4 PREVENTION OF NONCONFORMING WORK

If it is determined that the nonconforming work could recur, further corrective actions must be made following the laboratory's corrective action system. On a monthly basis, the QA Department evaluates non-conformances to determine if any nonconforming work has been repeated multiple times. If so, the laboratory's corrective action process may be followed.

11.5 METHOD SUSPENSION/RESTRICTION (STOP WORK PROCEDURES)

In some cases, it may be necessary to suspend/restrict the use of a method or target compound which constitutes significant risk and/or liability to the laboratory. Suspension/restriction procedures can be initiated by any of the persons noted in Section 11.2, Paragraph 5.

Prior to suspension/restriction, confidentiality will be respected, and the problem with the required corrective and preventive action will be stated in writing and presented to the Laboratory Director and Operations Manager.

The Laboratory Director and/or Operations Manager shall arrange for the appropriate personnel to meet with the QA Manager as needed. This meeting shall be held to confirm that there is a problem, that suspension/restriction of the method is required and will be concluded with a discussion of the steps necessary to bring the method/target or test fully back on line. In some cases, that may not be necessary if all appropriate personnel have already agreed there is a problem and there is agreement on the steps needed to bring the method, target or test fully back on line.

The QA Manager will also initiate a corrective action report as described in Section 12 if one has not already been started. A copy of any meeting notes and agreed upon steps should be faxed or e-mailed by the laboratory to the appropriate General Manager and member of Corporate QA. This fax/e-mail acts as notification of the incident.

After suspension/restriction, the lab will hold all reports to clients pending review. No faxing, mailing or distributing through electronic means may occur. The report must not be posted for viewing on the internet. It is the responsibility of the Laboratory Director to hold all reporting and to notify all relevant laboratory personnel regarding the suspension/restriction (e.g., Project Management, Log-in, etc…). Clients will NOT generally be notified at this time. Analysis may proceed in some instances depending on the non-conformance issue.

Within 72 hours, the QA Manager will determine if compliance is now met and reports can be released, OR determine the plan of action to bring work into compliance, and release work. A team, with all principals involved (Laboratory Director, Operations Manager, Technical Director, QA Manager) can devise a start-up plan to cover all steps from client notification through compliance and release of reports. Project Management and the Directors of Client Services and Sales and Marketing must be notified if clients must be notified or if the suspension/restriction affects the laboratory's ability to accept work. The QA Manager must approve start-up or elimination of any restrictions after all corrective action is complete. This approval is given by final signature on the completed corrective action report.

SECTION 12

CORRECTIVE ACTION *(NELAC 5.4.10)*

12.1 OVERVIEW

A major component of TestAmerica's Quality Assurance (QA) Program is the problem investigation and feedback mechanism designed to keep the laboratory staff informed on quality related issues and to provide insight to problem resolution. When nonconforming work or departures from policies and procedures in the quality system or technical operations are identified, the corrective action procedure provides a systematic approach to assess the issues, restore the laboratory's system integrity, and prevent reoccurrence. Corrective actions are documented using Non-Conformance Memoranda (NCM*) and Corrective Action Reports (CAR)* (refer to Figure 12-1).

12.2 GENERAL

Problems within the quality system or within analytical operations may be discovered in a variety of ways, such as QC sample failures, internal or external audits, proficiency testing (PT) performance, client complaints, staff observation, etc.

The purpose of a corrective action system is to:

- Identify non-conformance events and assign responsibility(s) for investigating.
- Resolve non-conformance events and assign responsibility for any required corrective action.
- Identify Systematic Problems before they become serious.
- Identify and track client complaints and provide resolution.

12.2.1 Non-Conformance Memorandum (NCM) - is used to document the following types of corrective actions:

- Deviations from an established procedure or SOP
- QC outside of limits (non-matrix related)
- Isolated reporting / calculation errors
- Client complaints
- ***Discrepancies in materials / goods received vs. manufacturer packing slips***

12.2.2 Corrective Action Report (CAR) - is used to document the following types of corrective actions:

- Questionable trends that are found in the monthly review of NCMs.
- Issues found while reviewing NCMs that warrant further investigation.
- Internal and External Audit Findings.
- Failed or Unacceptable PT results.
- Corrective actions that cross multiple departments in the laboratory.

- Systematic Reporting / Calculation Errors
- Health and Safety Violations

12.3 CLOSED LOOP CORRECTIVE ACTION PROCESS

Any employee in the company can initiate a corrective action. There are four main components to a closed-loop corrective action process once an issue has been identified: Cause Analysis, Selection and Implementation of Corrective Actions (both short and long term), Monitoring of the Corrective Actions, and Follow-up.

12.3.1 Cause Analysis

- Upon discovery of a non-conformance event, the event must be defined and documented. An NCM or CAR must be initiated, someone is assigned to investigate the issue and the event is investigated for cause. Table 12-1 provides some general guidelines on determining responsibility for assessment.
- The cause analysis step is the key to the process as a long term corrective action cannot be determined until the cause is determined.
- If the cause is not readily obvious, the Supervisor, Technical Director, Laboratory Director or QA Manager is consulted.

12.3.2 Selection and Implementation of Corrective Actions

- Where corrective action is needed, the laboratory shall identify potential corrective actions. The action(s) most likely to eliminate the problem and prevent recurrence are selected and implemented. Responsibility for implementation is assigned.
- Corrective actions shall be to a degree appropriate to the magnitude of the problem identified through the cause analysis.
- Whatever corrective action is determined to be appropriate, the laboratory shall document and implement the changes. The NCM or CAR is used for this documentation.

12.3.3 Root Cause Analysis

Root Cause Analysis is a class of problem solving (investigative) methods aimed at identifying the basic or causal factor(s) that underlie variation in performance or the occurrence of a significant failure. The root cause may be buried under seemingly innocuous events, many steps preceding the perceived failure. At first glance, the immediate response is typically directed at a symptom and not the cause. Typically, root cause analysis would be best with three or more incidents to triangulate a weakness.

Systematically analyze and document the Root Causes of the more significant problems that are reported. Identify, track, and implement the corrective actions required to reduce the likelihood of recurrence of significant incidents. Trend the Root Cause data from these incidents to identify Root Causes that, when corrected, can lead to dramatic improvements in performance by eliminating entire classes of problems.

Identify the one event associated with problem and ask why this event occurred. Brainstorm the root causes of failures by asking why events occurred or conditions existed; and then why

the cause occurred 5 consecutive times until you get to the root cause. For each of these sub events or causes, ask why it occurred. Repeat the process for the other events associated with the incident.

Root cause analysis does not mean the investigation is over. Look at technique, or other systems outside the normal indicators. Often creative thinking will find root causes that ordinarily would be missed, and continue to plague the laboratory or operation.

12.3.4 Monitoring of the Corrective Actions

- The Department Manager and QA Manager are responsible to ensure that the corrective action taken was effective.
- Ineffective actions are documented and re-evaluated until acceptable resolution is achieved. Department Managers are accountable to the Laboratory Director to ensure final acceptable resolution is achieved and documented appropriately.
- Each NCR and CAR is entered into a database for tracking purposes and a monthly summary of all corrective actions is printed out for review to aid in ensuring that the corrective actions have taken effect.
- The QA Manager reviews monthly NCMs and CARs for trends. Highlights are included in the QA monthly report (refer to Section 16). If a significant trend develops that adversely affects quality, an audit of the area is performed and corrective action implemented.
- Any out-of-control situations that are not addressed acceptably at the laboratory level may be reported to the Corporate Quality Director by the QA Manager, indicating the nature of the out-of-control situation and problems encountered in solving the situation.

12.3.5 Follow-up Audits

- Follow-up audits may be initiated by the QA Manager and shall be performed as soon as possible when the identification of a nonconformance casts doubt on the laboratory's compliance with its own policies and procedures, or on its compliance with state or federal requirements.
- These audits often follow the implementation of the corrective actions to verify effectiveness. An additional audit would only be necessary when a critical issue or risk to business is discovered.

(Also refer to *Section 15.1.4*, Special Audits.)

12.4 TECHNICAL CORRECTIVE ACTIONS

In addition to providing acceptance criteria and specific protocols for technical corrective actions in the method SOPs, the laboratory has general procedures to be followed to determine when departures from the documented policies and procedures and quality control have occurred (refer to Section 11). The documentation of these procedures is through the use of an NCM.

Table 12-1 includes examples of general technical corrective actions. For specific criteria and corrective actions, refer to the analytical methods or specific method SOPs.

Table 12-1 provides some general guidelines for identifying the individual(s) responsible for assessing each QC type and initiating corrective action. The table also provides general guidance on how a data set should be treated if associated QC measurements are unacceptable. Specific procedures are included in Method SOPs and Appendix 4, QAM Sections 19 and 20. All corrective actions are reviewed monthly, at a minimum, by the QA Manager and highlights are included in the QA monthly report.

To the extent possible, samples shall be reported only if all quality control measures are acceptable. If the deficiency does not impair the usability of the results, data will be reported with an appropriate data qualifier and/or the deficiency will be noted in the case narrative. Where sample results may be impaired, the Project Manager is notified by an NCM and appropriate corrective action (e.g., reanalysis) is taken and documented**.**

12.5 BASIC CORRECTIONS

When mistakes occur in records, each mistake shall be crossed-out, [not obliterated (e.g. no white-out)], and the correct value entered alongside. All such corrections shall be initialed (or signed) and dated by the person making the correction. In the case of records stored electronically, the original “uncorrected” file must be maintained intact and a second “corrected” file is created.

This same process applies to adding additional information to a record. All additions made later than the initial must also be initialed (or signed) and dated.

When corrections are due to reasons other than obvious transcription errors, the reason for the corrections (or additions) shall also be documented.

Figure 12-1.
Example - Non Conformance Memo

01/09/2008 **NonConformance Memo Report** Page 1 of 1

NCM ID: 580-5190 **Date Opened:** 11/30/2007
NCM Type: CCV - %D, High, Sample ND **Date Closed:**
Lab Section: Pesticides and PCBs **Date Verified:**

Narrative

The closing continuing calibration verification (CCV) for Endosulfan II recovered above the upper control limit. The samples associated with this CCV were non-detects for the affected analytes; therefore, the data have been reported.

Affected Items

Description	Project Manager
580-8247-E-1-A	Curbow, Heather
LCS 580-26165/2-A	Curbow, Heather
580-8247-C-2-A	Curbow, Heather
580-8247-E-1-A	Curbow, Heather
LCS 580-26165/2-A	Curbow, Heather
MB 580-26165/1-A	Curbow, Heather
LCSD 580-26165/3-A	Curbow, Heather
580-8247-C-2-A	Curbow, Heather
MB 580-26165/1-A	Curbow, Heather
LCSD 580-26165/3-A	Curbow, Heather

Notifications

User Full Name	Date Received	Date	Notice Level	Verification Type
Mott, Christina M	11/30/2007		Level 1	Review

Job Case Narratives

Job: 580-J8247-1

Job Narrative
580-J8247-1

Comments
No additional comments.

Receipt
All samples were received in good condition within temperature requirements.

GC/MS VOA
No analytical or quality issues were noted.

GC/MS Semi VOA
No analytical or quality issues were noted.

GC Semi VOA
Method 8081: The RPD between the results of the two columns for heptachlor and DDT was >40%. This is due to matrix effect; the lower of the two values (presumably free from matrix interference) is reported as primary.

No other analytical or quality issues were noted.

Metals
No analytical or quality issues were noted.

General Chemistry
No analytical or quality issues were noted.

Organic Prep
No analytical or quality issues were noted.

No analytical or quality issues were noted.

Table 12-1.

Example – General Corrective Action Procedures

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Initial Instrument Blank *(Analyst)*	- Instrument response < MDL.	- Prepare another blank. - If same response, determine cause of contamination: reagents, environment, instrument equipment failure, etc..
Initial Calibration Standards *(Analyst, Supervisor)*	- Correlation coefficient > 0.99 or standard concentration value. - % Recovery within acceptance range. - See details in Method SOP.	- Reanalyze standards. - If still unacceptable, remake standards and recalibrate instrument.
Independent Calibration Verification (Second Source) *(Analyst, Supervisor)*	- % Recovery within control limits.	- Remake and reanalyze standard. - If still unacceptable, then remake calibration standards or use new primary standards and recalibrate instrument.
Continuing Calibration Standards *(Analyst, Data Reviewer)*	% Recovery within control limits.	- Reanalyze standard. - If still unacceptable, then recalibrate and rerun affected samples.
Matrix Spike / Matrix Spike Duplicate (MS/MSD) *(Analyst, Data Reviewer)*	- % Recovery within limits documented in LIMS.	- If the acceptance criteria for duplicates or matrix spikes are not met because of matrix interferences, the acceptance of the analytical batch is determined by the validity of the LCS. - If the LCS is within acceptable limits the batch is acceptable. - The results of the duplicates, matrix spikes and the LCS are reported with the data set.
Laboratory Control Sample (LCS) *(Analyst, Data Reviewer)*	- % Recovery within limits specified in LIMS.	- Batch must be re-prepared and re-analyzed. **Note:** If there is insufficient sample or the holding time cannot be met, contact client and report with flags.
Surrogates *(Analyst, Data Reviewer)*	- % Recovery within limits of method or within three standard deviations of the historical mean.	- Individual sample must be repeated. Place comment in LIMS.
Method Blank (MB_ *(Analyst, Data Reviewer)*	< Reporting Limit [1]	- Reanalyze blank. - If still positive, determine source of contamination. If necessary, reprocess (i.e. digest or extract) entire sample batch. Report blank results.

QC Activity ***(Individual Responsible for Initiation/Assessment)***	**Acceptance Criteria**	**Recommended Corrective Action**
Proficiency Testing (PT) Samples *(QA Manager, Department Manager)*	- Criteria supplied by PT Supplier.	- Any failures or warnings must be investigated for cause. Failures may result in the need to repeat a PT sample to show the problem is corrected.
Internal / External Audits *(QA Manager, Department Manager, Laboratory Director)*	- Defined in Quality System documentation such as SOPs, QAM, etc.	- Non-conformances must be investigated through CAR system and necessary corrections must be made.
Reporting / Calculation Errors (Depends on issue – possible individuals include: Analysts, Data Reviewers, Project Managers, Department Manager, QA Manager, Corporate QA, Corporate Management)	- SOP CA-L-S-001, Internal Investigation of Potential Data Discrepancies and Determination for Data Recall.	- Corrective action is determined by type of error. Follow the procedures in SOP TA-QA-0610 Laboratory Corrective Action Procedures.
Client Complaints *(Project Managers, Lab Director, Sales and Marketing)*	-	- Corrective action is determined by the type of complaint. For example, a complaint regarding an incorrect address on a report will result in the report being corrected and then follow-up must be performed on the reasons the address was incorrect (e.g., database needs to be updated).
QA Monthly Report (Refer to Section 16 for an example) (QA Manager, Lab Director, Department Managers)	- QAM, SOPs.	- Corrective action is determined by the type of issue. For example, CARs for the month are reviewed and possible trends are investigated.
Health and Safety Violation (Safety Officer, Lab Director, Department Manager)	- Environmental Health and Safety (EHS) Manual.	- Non-conformance is investigated and corrected through CAR system.

Note:

1. Except as noted below for certain compounds, the method blank should be below the detection limit or for DoD projects the method blank should be below ½ the RL. Concentrations up to five times the reporting limit will be allowed for the ubiquitous laboratory and reagent contaminants: methylene chloride, toluene, acetone, 2-butanone and phthalates **provided** they appear in similar levels in the reagent blank and samples. This allowance presumes that the detection limit is significantly below any regulatory limit to which the data are to be compared and that blank subtraction will not occur. For benzene and ethylene dibromide (EDB) and other analytes for which regulatory limits are extremely close to the detection limit, the method blank must be below the method detection limit.

SECTION 13

PREVENTIVE ACTION *(NELAC 5.4.11)*

13.1 OVERVIEW

The laboratory's preventive action programs improve, or eliminate potential causes of nonconforming product and/or nonconformance to the quality system. This preventive action process is a proactive continuous process improvement activity that can be initiated through feedback from clients, employees, business providers, and affiliates. The QA Department has the overall responsibility to ensure that the preventive action process is in place, and that relevant information on actions is submitted for management review.

Dedicating resources to an effective preventive action system emphasizes TestAmerica Seattle's commitment to its Quality Program. It is beneficial to identify and address negative trends before they develop into complaints, problems and corrective actions. Additionally, customer service and satisfaction can be improved through continuous improvements to laboratory systems.

Opportunities for improvement may be discovered during management reviews, the QA Metrics Report, internal or external audits, proficiency testing performance, client complaints, staff observation, etc.

The monthly QA Metrics Report shows performance indicators in all areas of the quality system. These areas include revised reports, corrective actions, audit findings, internal auditing and data authenticity audits, client complaints, PT samples, holding time violations, SOPs, ethics training, etc. These metrics are used to help evaluate quality system performance on an ongoing basis and provide a tool for identifying areas for improvement.

The laboratory's corrective action process is integral to implementation of preventive actions. A critical piece of the corrective action process is the implementation of actions to prevent further occurrence of a non-compliance event. Historical review of corrective action provides a valuable mechanism for identifying preventive action opportunities.

13.1.1 The following elements are part of a preventive action system:

- Identification of an opportunity for preventive action.
- Process for the preventive action.
- Define the measurements of the effectiveness of the process once undertaken.
- Execution of the preventive action.
- Evaluation of the plan using the defined measurements.
- Verification of the effectiveness of the preventive action.
- Close-Out by documenting any permanent changes to the Quality System as a result of the Preventive Action. Documentation of Preventive Action is incorporated into the monthly QA reports, corrective action process and management review.

13.1.2 Any Preventive Actions undertaken or attempted shall be taken into account during the Annual Management Review (Section 16). A highly detailed recap is not required; a simple

recount of success and failure within the preventive action program will provide management a measure for evaluation.

13.2 MANAGEMENT OF CHANGE

The Management of Change process is designed to manage significant events and changes that occur within the laboratory. Through these procedures, the potential risks inherent with a new event or change are identified and evaluated. The risks are minimized or eliminated through pre-planning and the development of preventive measures. The types of changes covered under this system include: Facility Changes, Major Accreditation Changes, Addition or Deletion to Division's Capabilities or Instrumentation, Key Personnel Changes, Laboratory Information Management System (LIMS) changes. This process is discussed in further detail in SOP TA-QA-0530, Management of Change.

SECTION 14

CONTROL OF RECORDS *(NELAC 5.4.12)*

TestAmerica Seattle maintains a record system appropriate to its needs and that complies with applicable standards or regulations as required. The system produces unequivocal, accurate records that document all laboratory activities. The laboratory retains all original observations, calculations and derived data, calibration records and a copy of the analytical report for a minimum of five years after it has been issued.

14.1 OVERVIEW

The laboratory has established procedures for identification, collection, indexing, access, filing, storage, maintenance and disposal of quality and technical records. A record index is listed in Table 14-1. Quality records are maintained by the QA Manager in a database, which is backed up as part of the regular network backup. Records are of two types; either electronic or hard copy paper formats depending on whether the record is computer or hand generated (some records may be in both formats). Technical records are maintained by the Department Managers.

Table 14-1. Example - Record Index[1]

	Record Types [1]:	**Retention Time:**
Technical Records	- Raw Data - Logbooks[2] - Standards - Certificates - Analytical Records - Lab Reports	5 Years from analytical report issue*
Official Documents	- Quality Assurance Manual (QAM) - Work Instructions - Policies - SOPs - Manuals	5 Years from document retirement date*
QA Records	- Internal & External Audits/Responses - Certifications - Corrective/Preventive Actions - Management Reviews - Method & Software Validation / Verification Data - Data Investigation	5 Years from archival* **Data Investigation:** 5 years or the life of the affected raw data storage whichever is greater (beyond 5 years if ongoing project or pending investigation)
Project Records	- Sample Receipt & COC Documentation - Contracts and Amendments - Correspondence - QAPP - SAP - Telephone Logbooks - Lab Reports	5 Years from analytical report issue*

	Record Types [1]:	Retention Time:
Administrative Records	Finance and Accounting	10 years
	EH&S Manual, Permits, Disposal Records	7 years
	Employee Handbook	Indefinitely
	Personnel files, Employee Signature & Initials, Administrative Training Records (e.g., Ethics)	7 Years (HR Personnel Files must be maintained indefinitely)
	Administrative Policies Technical Training Records	7 years

[1] Record Types encompass hardcopy and electronic records.
[2] Examples of Logbook types: Maintenance, Instrument Run, Preparation (standard and samples), Standard and Reagent Receipt, Archiving, Balance Calibration, Temperature (hardcopy or electronic records).
* Exceptions listed in Table 14-2.

14.1.1 All records are stored and retained in such a way that they are secure and readily retrievable at the laboratory facility the Iron Mountain data storage facility that provides a suitable environment to prevent damage or deterioration and to prevent loss. All records shall be protected against fire, theft, loss, environmental deterioration, and vermin. In the case of electronic records, electronic or magnetic sources, storage media are protected from deterioration caused by magnetic fields and/or electronic deterioration.

Access to the data is limited to laboratory and company employees**.** Records archived off-site are stored in a secure location where a record is maintained of any entry into the storage facility. Whether on-site or off-site storage is used, logs are maintained in each storage box to note removal and return of records. Retention of records is maintained on-site at the laboratory for at least 6 months after their generation and moved offsite for the remainder of the required storage time. Records are maintained for a minimum of five years unless otherwise specified by a client or regulatory requirement.

For raw data and project records, record retention shall be calculated from the date the project report is issued. For other records, such as Controlled Documents, QA, or Administrative Records, the retention time is calculated from the date the record is formally retired. Records related to the programs listed in Table 14-2 have lengthier retention requirements and are subject to the requirements in Section 14.1.3.

14.1.2 Programs with Longer Retention Requirements

Some regulatory programs have longer record retention requirements than the standard record retention time. These are detailed in Table 14-2 with their retention requirements. In these cases, the longer retention requirement is enacted. If special instructions exist such that client data cannot be destroyed prior to notification of the client, the container or box containing that data is marked as to who to contact for authorization prior to destroying the data.

Table 14-2. Example: Special Record Retention Requirements

Program	[1]Retention Requirement
Drinking Water – All States	10 years (project records)
Drinking Water Lead and Copper Rule	12 years (project records)
Alaska	10 years
Navy Facilities Engineering Service Center (NFESC)	10 years
TSCA - 40 CFR Part 792	10 years after publication of final test rule or negotiated test agreement

[1]Note: Extended retention requirements must be noted with the archive documents or addressed in facility-specific records retention procedures.

14.1.3 The laboratory has procedures to protect and back-up records stored electronically and to prevent unauthorized access to or amendment of these records. All analytical data is maintained as hard copy or in a secure readable electronic format. For analytical reports that are maintained as copies in PDF format, refer to *Section 19.14.1* for more information. Additional information can also be reference in SOP TA-QA-0506 Archiving Data and Reports.

14.1.4 The record keeping system allows for historical reconstruction of all laboratory activities that produced the analytical data, as well as rapid recovery of historical data. The history of the sample from when the laboratory took possession of the samples must be readily understood through the documentation. This shall include inter-laboratory transfers of samples and/or extracts.

- The records include the identity of personnel involved in sampling, sample receipt, preparation, or testing. All analytical work contains the initials (at least) of the personnel involved. The laboratory's copy of the COC is stored with the invoice and the work order sheet generated by the LIMS in a job folder. The chain of custody would indicate the name of the sampler. If any sampling notes are provided with a work order, they are kept with this package.

- All information relating to the laboratory facilities equipment, analytical test methods, and related laboratory activities, such as sample receipt, sample preparation, or data verification are documented.

- The record keeping system facilitates the retrieval of all working files and archived records for inspection and verification purposes (e.g., set format for naming electronic files, set format for what is included with a given analytical data set as per SOP TA-QA-0506 Archiving Reports and Report File Maintenance). Instrument data is stored sequentially by instrument. A given day's analyses are maintained in the order of the analysis. Run logs are maintained for each instrument or method; a copy of each day's run long or instrument sequence is stored with the data to aid in re-constructing an analytical sequence. Where an analysis is performed without an instrument, bound logbooks or bench sheets are used to record and file data. Standard and reagent information is recorded in logbooks or entered into the LIMS for each method as required.

- Changes to hardcopy records shall follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

- The reason for a signature or initials on a document is clearly indicated in the records such as “sampled by,” “prepared by,” “reviewed by”, or “analyzed by”.

- All generated data except those that are generated by automated data collection systems, are recorded directly, promptly and legibly in permanent dark ink.

- Hard copy data may be scanned into PDF format for record storage as long as the scanning process can be verified in order to ensure that no data is lost and the data files and storage media must be tested to verify the laboratory’s ability to retrieve the information prior to the destruction of the hard copy that was scanned. The procedure for this verification can be found in SOP TA-QA-0506 Archiving Reports and Report File Maintenance.

- Also refer to Section *19.14.1* ‘Computer and Electronic Data Related Requirements’**.**

14.2 TECHNICAL AND ANALYTICAL RECORDS

14.2.1 The laboratory retains records of original observations, derived data and sufficient information to establish an audit trail, calibration records, staff records and a copy of each analytical report issued, for a minimum of five years unless otherwise specified by a client or regulatory requirement. The records for each analysis shall contain sufficient information to enable the analysis to be repeated under conditions as close as possible to the original. The records shall include the identity of laboratory personnel responsible for the performance of each analysis and review of results.

14.2.2 Observations, data and calculations are recorded real-time and are identifiable to the specific task.

14.2.3 Changes to hardcopy records shall follow the procedures outlined in Section 12 and 19. Changes to electronic records in LIMS or instrument data are recorded in audit trails.

The essential information to be associated with analysis, such as strip charts, tabular printouts, computer data files, analytical notebooks, and run logs, include:

- laboratory sample ID code**;**
- Date of analysis; Time of Analysis is also required if the holding time is seventy-two (72) hours or less, or when time critical steps are included in the analysis (e.g., drying times, incubations, etc.); instrumental analyses have the date and time of analysis recorded as part of their general operations. Where a time critical step exists in an analysis, location for such a time is included as part of the documentation in LIMS.
- Instrumentation identification and instrument operating conditions/parameters. Operating conditions/parameters are typically recorded in specific method SOPs or instrument maintenance logs where available.
- analysis type**;**
- all manual calculations and manual integrations**;**

- analyst's or operator's initials/signature;
- sample preparation including cleanup, separation protocols, incubation periods or subculture, ID codes, volumes, weights, instrument printouts, meter readings, calculations, reagents;
- test results;
- standard and reagent origin, receipt, preparation, and use;
- calibration criteria, frequency and acceptance criteria;
- data and statistical calculations, review, confirmation, interpretation, assessment and reporting conventions;
- quality control protocols and assessment;
- electronic data security, software documentation and verification, software and hardware audits, backups, and records of any changes to automated data entries; and
- Method performance criteria including expected quality control requirements. These are indicated both in the LIMS and on specific analytical report formats.

14.3 LABORATORY SUPPORT ACTIVITIES

In addition to documenting all the above-mentioned activities, the following are retained QA records and project records (previous discussions in this section relate where and how these data are stored):

- all original raw data, whether hard copy or electronic, for calibrations, samples and quality control measures, including analysts' work sheets and data output records (chromatograms, strip charts, and other instrument response readout records);
- a written description or reference to the specific test method used which includes a description of the specific computational steps used to translate parametric observations into a reportable analytical value;
- copies of final reports;
- archived SOPs;
- correspondence relating to laboratory activities for a specific project;
- all corrective action reports, audits and audit responses;
- proficiency test results and raw data; and
- results of data review, verification, and crosschecking procedures

14.3.1 Sample Handling Records

Records of all procedures to which a sample is subjected while in the possession of the laboratory are maintained. These include but are not limited to records pertaining to:

- sample preservation including appropriateness of sample container and compliance with holding time requirement;
- sample identification, receipt, acceptance or rejection and login;

- sample storage and tracking including shipping receipts, sample transmittal / COC forms; and
- procedures for the receipt and retention of samples, including all provisions necessary to protect the integrity of samples.

14.4 ADMINISTRATIVE RECORDS

The laboratory also maintains the administrative records in either electronic or hard copy form. Refer to Table 14-1.

14.5 RECORDS MANAGEMENT, STORAGE AND DISPOSAL

14.5.1 All records (including those pertaining to test equipment), certificates and reports are safely stored, held secure and in confidence to the client. Certification related records are available upon request.

14.5.2 All information necessary for the historical reconstruction of data is maintained by the laboratory. Records that are stored only on electronic media must be supported by the hardware and software necessary for their retrieval.

14.5.3 Records that are stored or generated by computers or personal computers have hard copy, write-protected backup copies, or an electronic audit trail controlling access**.**

14.5.4 TestAmerica Seattle has a record management system (a.k.a., document control) for control of laboratory notebooks, instrument logbooks, standards logbooks, and records for data reduction, validation, storage and reporting. Laboratory notebooks are issued on a per analysis basis, and are numbered sequentially. All data are recorded sequentially within a series of sequential notebooks. Bench sheets are filed sequentially. *Standards are maintained in the LIMS – no logbooks are used to record that data***. Note:** if a standard that is generated from a logbook is also used in the TALS reagent module then it is be linked to the TALS reagent number or code. Records are considered archived when noted as such in the records management system (a.k.a., document control).

14.5.5 Transfer of Ownership

In the event that the laboratory transfers ownership or goes out of business, TestAmerica Seattle shall ensure that the records are maintained or transferred according to client's instructions. Upon ownership transfer, record retention requirements shall be addressed in the ownership transfer agreement and the responsibility for maintaining archives is clearly established. In addition, in cases of bankruptcy, appropriate regulatory and state legal requirements concerning laboratory records must be followed. In the event of the closure of the laboratory, all records will revert to the control of the corporate headquarters. Should the entire company cease to exist, as much notice as possible will be given to clients and the accrediting bodies who have worked with the laboratory during the previous 5 years of such action.

14.5.6 Records Disposal

14.5.6.1 Records are removed from the archive and destroyed after 5 years unless otherwise specified by a client or regulatory requirement. On a project specific or program basis, clients may need to be notified prior to record destruction. Records are destroyed in a manner that ensures their confidentiality such as shredding, mutilation or incineration. (Refer to Tables 14-1 and 14-2).

14.5.6.2 Electronic copies of records must be destroyed by erasure or physically damaging off-line storage media so no records can be read.

14.5.6.3 If a third party records management company is hired to dispose of records, a "Certificate of Destruction" is required.

SECTION 15

AUDITS *(NELAC 5.4.13)*

15.1 INTERNAL AUDITS

Internal audits are performed to verify that laboratory operations comply with the requirements of the lab's quality system and with the external quality programs under which the laboratory operates. Audits are planned and organized by the QA staff. Personnel conducting the audits should be independent of the area being evaluated. Auditors will have sufficient authority, access to work areas, and organizational freedom necessary to observe all activities affecting quality and to report the assessments to laboratory management and when requested to corporate management.

Audits are conducted and documented as described in the TestAmerica Corporate SOP on performing Internal Audits, SOP No. CA-Q-S-004. The types and frequency of routine internal audits are shown in Table 16-1. Special or ad hoc assessments may be conducted as needed under the direction of the QA staff.

Table 15-1. Types of Internal Audits and Frequency

Description	Performed by	Frequency
Quality Systems	QA Department or Designee	All areas of the laboratory annually
QA Technical Audits - Evaluate raw data versus final reports - Analyst integrity - Data authenticity	QA Department or Designee	All methods within a 2-year period, with at least 15% of methods every quarter
SOP Method Compliance	Technical Director	- All SOPs within a 2-year period - All new analysts or new analyst/methods within 3 months of IDOC
Special	QA Department or Designee	Surveillance or spot checks performed as needed
Performance Testing	Analysts with QA oversight	Two successful per year for each NELAC field of testing or as dictated by regulatory requirements

15.1.1 Annual Quality Systems Audit

An annual quality systems audit is required to ensure compliance to analytical methods and SOPs, the laboratory's Data Integrity and Ethics Policies, NELAC quality systems, client and state requirements, and the effectiveness of the internal controls of the analytical process, including but not limited to data review, quality controls, preventive action and corrective action. The completeness of earlier corrective actions is assessed. The audit is divided into modules for each operating or support area of the lab, and each module is comprehensive for a given

area. The area audits may be done on a rotating schedule throughout the year to ensure adequate coverage of all areas. This schedule may change as situations in the laboratory warrant.

15.1.2 QA Technical Audits

QA technical audits are based on client projects, associated sample delivery groups, and the methods performed. Reported results are compared to raw data to verify the authenticity of results. The validity of calibrations and QC results are compared to data qualifiers, footnotes, and case narratives. Documentation is assessed by examining run logs and records of manual integrations. Manual calculations are checked. The Audit Miner function in Chrom is used to identify unusual manipulations of the data deserving closer scrutiny. QA technical audits will include all methods within a two-year period.

15.1.3 SOP Method Compliance

Compliance of all SOPs with the source methods and compliance of the operational groups with the SOPs will be assessed by the Technical Director at least every two years. The work of each newly hired analyst is assessed within 3 months of working independently, (e.g., completion of method IDOC). In addition, as analysts add methods to their capabilities, (new IDOC) reviews of the analyst work products will be performed within 3 months of completing the documented training.

15.1.4 Special Audits

Special audits are conducted on an as needed basis, generally as a follow up to specific issues such as client complaints, corrective actions, PT results, data audits, system audits, validation comments, regulatory audits or suspected ethical improprieties. Special audits are focused on a specific issue, and report format, distribution, and timeframes are designed to address the nature of the issue.

15.1.5 Performance Testing

The laboratory participates semi-annually in performance audits conducted through the analysis of PT samples provided by a third party. The laboratory generally participates in the following types of PT studies: Drinking Water, Non Potable Water, and Soil.

It is TestAmerica's policy that PT samples be treated as typical samples in the production process. Furthermore, where PT samples present special or unique problems, in the regular production process they may need to be treated differently, as would any special or unique request submitted by any client. The QA Manager must be consulted and in agreement with any decisions made to treat a PT sample differently due to some special circumstance.

Written responses to unacceptable PT results are required. In some cases it may be necessary for blind QC samples to be submitted to the laboratory to show a return to control.

15.2 EXTERNAL AUDITS

External audits are performed when certifying agencies or clients conduct on-site inspections or submit performance testing samples for analysis. It is TestAmerica's policy to cooperate fully with regulatory authorities and clients. The laboratory makes every effort to provide the auditors with access to personnel, documentation, and assistance. Laboratory supervisors are responsible for providing corrective actions to the QA Manager who coordinates the response for any deficiencies discovered during an external audit. Audit responses are due in the time allotted by the client or agency performing the audit. *When requested, a* copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

The laboratory cooperates with clients and their representatives to monitor the laboratory's performance in relation to work performed for the client. The client may only view data and systems related directly to the client's work. All efforts are made to keep other client information confidential.

15.2.1 Confidential Business Information (CBI) Considerations

During on-site audits, auditors may come into possession of information claimed as business confidential. A business confidentiality claim is defined as "a claim or allegation that business information is entitled to confidential treatment for reasons of business confidentiality or a request for a determination that such information is entitled to such treatment." When information is claimed as business confidential, the laboratory must place on (or attach to) the information at the time it is submitted to the auditor, a cover sheet, stamped or typed legend or other suitable form of notice, employing language such as "trade secret", "proprietary" or "company confidential". Confidential portions of documents otherwise non-confidential must be clearly identified. CBI may be purged of references to client identity by the responsible laboratory official at the time of removal from the laboratory. However, sample identifiers may not be obscured from the information. Additional information regarding CBI can be found in within the 2003 NELAC standards.

15.3 AUDIT FINDINGS

Audit findings are documented using the corrective action process and database. The laboratory's corrective action responses for both types of audits may include action plans that could not be completed within a predefined timeframe. In these instances, a completion date must set and agreed to by operations management and the QA Manager.

Developing and implementing corrective actions to findings is the responsibility of the Department Manager where the finding originated. Findings that are not corrected by specified due dates are reported monthly to management in the QA monthly report. . *When requested, a* copy of the audit report and the labs corrective action plan will be forwarded to Corporate Quality.

If any audit finding casts doubt on the effectiveness of the operations or on the correctness or validity of the laboratory's test results, the laboratory shall take timely corrective action, and shall notify clients in writing if the investigations show that the laboratory results have been affected. Once corrective action is implemented, a follow-up audit is scheduled to ensure that the problem has been corrected.

Clients must be notified promptly in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any test report or amendment to a test report. The investigation must begin within 24-hours of discovery of the problem and all efforts are made to notify the client within two weeks after the completion of the investigation.

SECTION 16

MANAGEMENT REVIEWS *(NELAC 5.4.14)*

16.1 QUALITY ASSURANCE REPORT

A comprehensive QA Report shall be prepared each month by the laboratory's QA Manager and forwarded to the Laboratory Director, *Technical Directors, Operation Manager,* their Quality Director as well as the General Manager. All aspects of the QA system are reviewed to evaluate the suitability of policies and procedures. During the course of the year, the Laboratory Director, General Manager or Corporate QA may request that additional information be added to the report.

On a monthly basis, Corporate QA compiles information from all the monthly laboratory reports. The Corporate Quality Directors prepare a report that includes a compilation of all metrics and notable information and concerns regarding the QA programs within the laboratories. The report also includes a listing of new regulations that may potentially impact the laboratories. This report is presented to the Senior Management Team and General Managers.

16.2 ANNUAL MANAGEMENT REVIEW

The senior lab management team (Laboratory Director, Technical Directors, QA Manager) conducts a review annually of its quality systems and LIMS to ensure its continuing suitability and effectiveness in meeting client and regulatory requirements and to introduce any necessary changes or improvements. It will also provide a platform for defining quality goals & objectives. Corporate Operations and Corporate QA personnel are be included in this meeting at the discretion of the Laboratory Director. The LIMS review consists of examining any audits, complaints or concerns that have been raised through the year that are related to the LIMS. The laboratory will summarize any critical findings that can not be solved by the lab and report them to Corporate IT.

This management *systems review (Corporate SOP No. CA-Q-S-008 &* Work Instruction No. CA-Q-WI-020) uses information generated during the preceding year to assess the "big picture" by ensuring that routine actions taken and reviewed on a monthly basis are not components of larger systematic concerns. The monthly review should keep the quality systems current and effective, therefore, the annual review is a formal senior management process to review specific existing documentation. Significant issues from the following documentation are compiled or summarized by the QA Manager prior to the review meeting:

- Matters arising from the previous annual review
- Prior Monthly QA Reports issues
- Laboratory QA Metrics
- Review of report reissue requests
- Review of client feedback and complaints
- Issues arising from any prior management or staff meetings
- Minutes from prior senior lab management meetings; Issues that may be raised from these meetings include:

- Adequacy of staff, equipment and facility resources
- Adequacy of policies and procedures
- Future plans for resources and testing capability and capacity.

- The annual internal double blind PT program sample performance (if performed),
- Compliance to the Ethics Policy and Data Integrity Plan. Including any evidence/incidents of inappropriate actions or vulnerabilities related to data Integrity.

A report is generated by the QA Manager and management. The report is distributed to the appropriate General Manager and the Quality Director. The report includes, but is not limited to:

- The date of the review and the names and titles of participants.
- A reference to the existing data quality related documents and topics that were reviewed.
- Quality system or operational changes or improvements that will be made as a result of the review [e.g., an implementation schedule including assigned responsibilities for the changes (Action Table)].

Changes to the quality systems requiring update to the laboratory QA Manual shall be included in the next revision of the QA Manual.

16.3 POTENTIAL INTEGRITY RELATED MANAGERIAL REVIEWS

Potential integrity issues (data or business related) must be handled and reviewed in a confidential manner until such time as a follow-up evaluation, full investigation, or other appropriate actions have been completed and issues clarified. TestAmerica's Corporate Data Investigation/Recall SOP shall be followed (SOP No. CA-L-S-001). All investigations that result in finding of inappropriate activity are documented and include any disciplinary actions involved, corrective actions taken, and all appropriate notifications of clients.

TestAmerica's COO, VP of Client & Technical Services, General Managers and Quality Directors receive a monthly report from the Director of Quality & Client Advocacy summarizing any current data integrity or data recall investigations. The General Manager's are also made aware of progress on these issues for their specific labs.

SECTION 17

PERSONNEL *(NELAC 5.5.2)*

17.1 OVERVIEW

TestAmerica Seattle's management believes that its highly qualified and professional staff is the single most important aspect in assuring a high level of data quality and service. The staff consists of professionals and support personnel as outlined in the organization chart in Figure 4-1.

All personnel must demonstrate competence in the areas where they have responsibility. Any staff that is undergoing training shall have appropriate supervision until they have demonstrated their ability to perform their job function on their own. Staff shall be qualified for their tasks based on appropriate education, training, experience and/or demonstrated skills as required.

The laboratory employs sufficient personnel with the necessary education, training, technical knowledge and experience for their assigned responsibilities.

All personnel are responsible for complying with all QA/QC requirements that pertain to the laboratory and their area of responsibility. Each staff member must have a combination of experience and education to adequately demonstrate a specific knowledge of their particular area of responsibility. Technical staff must also have a general knowledge of lab operations, test methods, QA/QC procedures and records management.

Laboratory management is responsible for formulating goals for lab staff with respect to education, training and skills and ensuring that the laboratory has a policy and procedures for identifying training needs and providing training of personnel. The training shall be relevant to the present and anticipated responsibilities of the lab staff.

The laboratory only uses personnel that are employed by or under contract to, the laboratory. Contracted personnel, when used, must meet competency standards of the laboratory and work in accordance to the laboratory's quality system.

17.2 EDUCATION AND EXPERIENCE REQUIREMENTS FOR TECHNICAL PERSONNEL

TestAmerica Seattle makes every effort to hire analytical staffs that possess a college degree (AA, BA, BS) in an applied science with some chemistry in the curriculum. Exceptions can be made based upon the individual's experience and ability to learn. Selection of qualified candidates for laboratory employment begins with documentation of minimum education, training, and experience prerequisites needed to perform the prescribed task. Minimum education and training requirements for TestAmerica employees are outlined in job descriptions and are generally summarized for analytical staff in the table below.

The laboratory maintains job descriptions for all personnel who manage, perform or verify work affecting the quality of the environmental testing the laboratory performs. Job Descriptions are located on the TestAmerica intranet site's Human Resources web-page (Also see Section 4 for position descriptions/responsibilities).

Experience and specialized training are occasionally accepted in lieu of a college degree (basic lab skills such as using a balance, colony counting, aseptic or quantitation techniques, etc., are also considered).

As a general rule for analytical staff:

Specialty	Education	Experience
Extractions, Digestions, some electrode methods (pH, DO, Redox, etc.), or Titrimetric and Gravimetric Analyses	H.S. Diploma	On the job training (OJT)
CVAA, Single component or short list Chromatography (e.g., Fuels, BTEX-GC, IC	A college degree in an applied science or 2 years of college and at least 1 year of college chemistry	Or 2 years prior analytical experience is required
ICP, ICPMS, Long List or complex chromatography (e.g., Pesticides, PCB, Herbicides, HPLC, etc.), GCMS	A college degree in an applied science or 2 years of college chemistry	or 5 years of prior analytical experience
Spectra Interpretation	A college degree in an applied science or 2 years of college chemistry	And 2 years relevant experience Or 5 years of prior analytical experience
Technical Directors/Department Managers – **General**	Bachelors Degree in an applied science or engineering with 24 semester hours in chemistry An advanced (MS, PhD.) degree may substitute for one year of experience	And 2 years experience in environmental analysis of representative analytes for which they will oversee
Technical Director – **Wet Chem** only (no advanced instrumentation)	Associates degree in an applied science or engineering or 2 years of college with 16 semester hours in chemistry	And 2 years relevant experience

When an analyst does not meet these requirements, they can perform a task under the direct supervision of a qualified analyst, peer reviewer or Department Manager, and are considered an analyst in training. The person supervising an analyst in training is accountable for the quality of the analytical data and must review and approve data and associated corrective actions.

17.3 TRAINING

TestAmerica Seattle is committed to furthering the professional and technical development of employees at all levels.

Orientation to the laboratory's policies and procedures, in-house method training, and employee attendance at outside training courses and conferences all contribute toward employee proficiency. Below are examples of various areas of required employee training:

Required Training	Time Frame	Employee Type
Environmental Health & Safety	Prior to lab work	All
Ethics – New Hires	1 week of hire	All
Ethics – Comprehensive	90 days of hire	All
Data Integrity	30 days of hire	Technical and PMs
Quality Assurance	90 days of hire	All
Ethics – Comprehensive Refresher	Annually	All
Initial Demonstration of Capability (DOC)	Prior to unsupervised method performance	Technical

The laboratory maintains records of relevant authorization/competence, education, professional qualifications, training, skills and experience of technical personnel (including contracted personnel) as well as the date that approval/authorization was given. These records are kept on file at the laboratory. Also refer to "Demonstration of Capability" in Section 19.

The training of technical staff is kept up to date by:

- Each employee must have documentation in their training file that they have read, understood and agreed to follow the most recent version of the laboratory QA Manual and SOPs in their area of responsibility. This documentation is updated as SOPs are updated.
- Documentation from any training courses or workshops on specific equipment, analytical techniques or other relevant topics are maintained in their training file.
- Documentation of proficiency (refer to Section 19).
- An Ethics Agreement signed by each staff member (renewed each year) and evidence of annual ethics training.
- A Confidentiality Agreement signed by each staff member signed at the time of employment.
- Human Resources maintains documentation and attestation forms on employment status & records; benefit programs; timekeeping/payroll; and employee conduct (e.g., ethics). This information is maintained in the employee's secured personnel file.

Evidence of successful training could include such items as:

- Adequate documentation of training within operational areas, including one-on-one technical training for individual technologies, and particularly for people cross-trained.
- Analysts knowledge to refer to QA Manual for quality issues.
- Analysts following SOPs, i.e., practice matches SOPs.
- Analysts regularly communicate to supervisors and QA if SOPs need revision, rather than waiting for auditors to find problems.

Further details of the laboratory's training program are described in the Employee Training SOP (TA-QA-0608).

17.4 DATA INTEGRITY AND ETHICS TRAINING PROGRAM

Establishing and maintaining a high ethical standard is an important element of a Quality System. Ethics and data integrity training is integral to the success of TestAmerica and is provided for each employee at TestAmerica. It is a formal part of the initial employee orientation within 1 week of hire *followed by technical data integrity training within 30 days*, comprehensive training within 90 days, and an annual refresher for all employees. Senior management at each facility performs the ethics training for their staff.

In order to ensure that all personnel understand the importance TestAmerica places on maintaining high ethical standards at all times; TestAmerica has established a Corporate Ethics Policy (Policy No. CA-L-P-001) and an Ethics Statement. All initial and annual training is documented by signature on the signed Ethics Statement demonstrating that the employee has participated in the training and understands their obligations related to ethical behavior and data integrity.

Violations of this Ethics Policy will not be tolerated. Employees who violate this policy will be subject to disciplinary actions up to and including termination. Criminal violations may also be referred to the Government for prosecution. In addition, such actions could jeopardize TestAmerica's ability to do work on Government contracts, and for that reason, TestAmerica has a Zero Tolerance approach to such violations.

Employees are trained as to the legal and environmental repercussions that result from data misrepresentation. Key topics covered in the presentation include:

- Organizational mission and its relationship to the critical need for honesty and full disclosure in all analytical reporting.
- Ethics Policy
- How and when to report ethical/data integrity issues. Confidential reporting.
- Record keeping.
- Discussion regarding data integrity procedures.
- Specific examples of breaches of ethical behavior (e.g. peak shaving, altering data or computer clocks, improper macros, etc., accepting/offering kickbacks, illegal accounting practices, unfair competition/collusion)
- Internal monitoring. Investigations and data recalls.
- Consequences for infractions including potential for immediate termination, debarment, or criminal prosecution.
- Importance of proper written narration / data qualification by the analyst and project manager with respect to those cases where the data may still be usable but are in one sense or another partially deficient.

Additionally, a data integrity hotline (1-800-736-9407) is maintained by TestAmerica and administered by the Corporate Quality Department.

SECTION 18

ACCOMMODATIONS AND ENVIRONMENTAL CONDITIONS *(NELAC 5.5.3)*

18.1 OVERVIEW

TestAmerica Seattle is a 20,000 ft^2 secure laboratory facility with controlled access and designed to accommodate an efficient workflow and to provide a safe and comfortable work environment for employees. All visitors sign in and are escorted by laboratory personnel. Access is controlled by various measures.

The laboratory is equipped with structural safety features. Each employee is familiar with the location, use, and capabilities of general and specialized safety features associated with their workplace. The laboratory provides and requires the use of protective equipment including safety glasses, protective clothing, gloves, etc., OSHA and other regulatory agency guidelines regarding required amounts of bench and fume hood space, lighting, ventilation (temperature and humidity controlled), access, and safety equipment are met or exceeded.

Traffic flow through sample preparation and analysis areas is minimized to reduce the likelihood of contamination. Adequate floor space and bench top area is provided to allow unencumbered sample preparation and analysis space. Sufficient space is also provided for storage of reagents and media, glassware, and portable equipment. Ample space is also provided for refrigerated sample storage before analysis and archival storage of samples after analysis. Laboratory HVAC and deionized water systems are designed to minimize potential trace contaminants.

The laboratory is separated into specific areas for sample receiving, sample preparation, volatile organic sample analysis, non-volatile organic sample analysis, inorganic sample analysis, and administrative functions.

18.2 ENVIRONMENT

Laboratory accommodation, test areas, energy sources, lighting are adequate to facilitate proper performance of tests. The facility is equipped with heating, ventilation, and air conditioning (HVAC) systems appropriate to the needs of environmental testing performed at this laboratory.

The environment in which these activities are undertaken does not invalidate the results or adversely affect the required accuracy of any measurements.

The laboratory provides for the effective monitoring, control and recording of environmental conditions that may affect the results of environmental tests as required by the relevant specifications, methods, and procedures. Such environmental conditions include temperature levels in the laboratory.

When any of the method or regulatory required environmental conditions change to a point where they may adversely affect test results, analytical testing will be discontinued until the environmental conditions are returned to the required levels.

Environmental conditions of the facility housing the computer network and LIMS are regulated to protect against raw data loss.

18.3 WORK AREAS

There is effective separation between neighboring areas when the activities therein are incompatible with each other. Examples include:

- Volatile organic chemical handling areas, including sample preparation and waste disposal, and volatile organic chemical analysis areas.

Access to and use of all areas affecting the quality of analytical testing is defined and controlled by secure access to the laboratory building as described below in the Building Security section.

Adequate measures are taken to ensure good housekeeping in the laboratory and to ensure that any contamination does not adversely affect data quality. These measures include regular cleaning to control dirt and dust within the laboratory.

Work areas are available to ensure an unencumbered work area. Work areas include:

- Access and entryways to the laboratory.
- Sample receipt areas.
- Sample storage areas.
- Chemical and waste storage areas.
- Data handling and storage areas.
- Sample processing areas.
- Sample analysis areas.

18.4 FLOOR PLAN

A floor plan can be found in Appendix 1.

18.5 BUILDING SECURITY

Building keys are distributed to employees as necessary.

Visitors to the laboratory sign in and out in a visitor's logbook. A visitor is defined as any person who visits the laboratory who is not an employee of TestAmerica Seattle. In addition to signing into the laboratory, the Environmental, Health and Safety Manual contains requirements for visitors and vendors. There are specific safety forms that must be reviewed and signed.

Visitors (with the exception of company employees) are escorted by laboratory personnel at all times, or the location of the visitor is noted in the visitor's logbook.

SECTION 19

TEST METHODS AND METHOD VALIDATION *(NELAC 5.5.4)*

19.1 OVERVIEW

TestAmerica Seattle uses methods that are appropriate to meet our clients' requirements and that are within the scope of the laboratory's capabilities. These include sampling, handling, transport, storage and preparation of samples, and, where appropriate, an estimation of the measurement of uncertainty as well as statistical techniques for analysis of environmental data.

Instructions are available in the laboratory for the operation of equipment as well as for the handling and preparation of samples. All instructions, Standard Operating Procedures (SOPs), reference methods and manuals relevant to the working of the laboratory are readily available to all staff. Deviations from published methods are documented (with justification) in the laboratory's approved SOPs. SOPs are submitted to clients for review at their request. Significant deviations from published methods require client approval and regulatory approval where applicable.

19.2 STANDARD OPERATING PROCEDURES (SOPS)

TestAmerica Seattle maintains SOPs that accurately reflect all phases of the laboratory such as assessing data integrity, corrective actions, handling customer complaints as well as all analytical methods and sampling procedures. The method SOPs are derived from the most recently promulgated/approved, published methods and are specifically adapted to the laboratory facility. Modifications or clarifications to published methods are clearly noted in the SOPs. All SOPs are controlled in the laboratory.

- All SOPs contain a revision number, effective date, and appropriate approval signatures. Controlled copies are available to all staff.
- Procedures for writing an SOP are incorporated by reference to the laboratory's SOP TA-QA-0500 Standard Operating Procedures.
- SOPs are reviewed at a minimum of every 2 years (annually for Drinking Water and DoD SOPs), and where necessary, revised to ensure continuing suitability and compliance with applicable requirements.

19.3 LABORATORY METHODS MANUAL

For each test method, the laboratory shall have available the published referenced method as well as the laboratory developed SOP.

Note: If more stringent standards or requirements are included in a mandated test method or regulation than those specified in this manual, the laboratory shall demonstrate that such requirements are met. If it is not clear which requirements are more stringent, the standard from the method or regulation is to be followed. Any exceptions or deviations from the referenced methods or regulations are noted in the specific analytical SOP.

The laboratory maintains an SOP Index for both technical and non-technical SOPs. Technical SOPs are maintained to describe a specific test method. Non-technical SOPs are maintained to describe functions and processes not related to a specific test method.

19.4 SELECTION OF METHODS

Since numerous methods and analytical techniques are available, continued communication between the client and laboratory is imperative to assure the correct methods are utilized. Once client methodology requirements are established, this and other pertinent information is summarized by the Project Manager. These mechanisms ensure that the proper analytical methods are applied when the samples arrive for log-in. For non-routine analytical services (e.g., special matrices, non-routine compound lists), the method of choice is selected based on client needs and available technology. The methods selected should be capable of measuring the specific parameter of interest, in the concentration range of interest, and with the required precision and accuracy.

19.4.1 Sources of Methods

Routine analytical services are performed using standard EPA-approved methodology. In some cases, modification of standard approved methods may be necessary to provide accurate analyses of particularly complex matrices. When the use of specific methods for sample analysis is mandated through project or regulatory requirements, only those methods shall be used.

When clients do not specify the method to be used or methods are not required, the methods used will be clearly validated and documented in an SOP and available to clients and/or the end user of the data.

The analytical methods used by the laboratory are those currently accepted and approved by the U. S. EPA and the state or territory from which the samples were collected. Reference methods include:

- *Guidelines Establishing Test Procedures for the Analysis of Pollutants Under the Clean Water Act, and Appendix A-C; 40 CFR Part 136, USEPA Office of Water. Revised as of July 1, 1995, Appendix A to Part 136 - Methods for Organic Chemical Analysis of Municipal and Industrial Wastewater (EPA 600 Series)*
- *Methods for Chemical Analysis of Water and Wastes, EPA 600 (4-79-020), 1983.*
- *Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93/100, August 1993.*
- *Methods for the Determination of Metals in Environmental Samples, EPA/600/4-91/010, June 1991. Supplement I: EPA-600/R-94/111, May 1994.*
- *Methods for the Determination of Organic Compounds in Drinking Water, EPA-600/4-88-039, December 1988, Revised, July 1991, Supplement I, EPA-600-4-90-020, July 1990, Supplement II, EPA-600/R-92-129, August 1992. Supplement III EPA/600/R-95/131 - August 1995 (EPA 500 Series) (EPA 500 Series methods)*
- *Technical Notes on Drinking Water Methods, EPA-600/R94-173, October 1994*
- *NIOSH Manual of Analytical Methods, 4th ed., August 1994.*

- *Standard Methods for the Examination of Water and Wastewater, 18th/19th /20th/ on-line edition; Eaton, A.D. Clesceri, L.S. Greenberg, A.E. Eds; American Water Works Association, Water Pollution Control Federation, American Public Health Association: Washington, D.C.*
- *Test Methods for Evaluating Solid Waste Physical/Chemical Methods (SW846), Third Edition, September 1986, Final Update I, July 1992, Final Update IIA, August 1993, Final Update II, September 1994; Final Update IIB, January 1995; Final Update III, December 1996; Final Update IV, January 2008.*
- *Annual Book of ASTM Standards, American Society for Testing & Materials (ASTM), Philadelphia, PA.*
- *National Status and Trends Program, National Oceanographic and Atmospheric Administration, Volume I-IV, 1985-1994.*
- *Manual for the Certification of Laboratories Analyzing Drinking Water (EPA 815-R-05-004, January 2005)*
- *Code of Federal Regulations (CFR) 40, Parts 136, 141, 172, 173, 178, 179 and 261*
- *Plumb, Jr., R.H. 1981, Procedures for Handling and Chemical Analysis of Sediment and Water Samples, Technical Report EPA/C E-81-1. US Army Engineering Waterways Experiment Station, Vicksburg, MS.*
- *Recommended Protocols for Measuring Conventional Sediment Variables in Puget Sound, April 2003.*
- *Recommended Guidelines for Measuring Organic Compounds in Puget Sound Waters, Sediment and Tissue Samples, April 1997.*
- *Recommended Guidelines for Measuring Metals in Puget Sound Waters, Sediment and Tissue Samples, April 1997.*

The laboratory reviews updated versions to all the aforementioned references for adaptation based upon capabilities, instrumentation, etc., and implements them as appropriate. As such, the laboratory strives to perform only the latest versions of each approved method as regulations allow or require.

Other reference procedures for non-routine analyses may include methods established by specific states (e.g., Underground Storage Tank methods), ASTM or equipment manufacturers. Sample type, source, and the governing regulatory agency requiring the analysis will determine the method utilized.

The laboratory shall inform the client when a method proposed by the client may be inappropriate or out of date. After the client has been informed, and they wish to proceed contrary to the laboratory's recommendation, it will be documented.

19.4.2 Demonstration of Capability

Before the laboratory may institute a new method and begin reporting results, the laboratory shall confirm that it can properly operate the method. In general, this demonstration does not test the performance of the method in real world samples, but in an applicable and available clean matrix sample. If the method is for the testing of analytes that are not conducive to spiking, demonstration of capability may be performed on quality control samples.

19.4.2.1 A demonstration of capability (Analyst DOC, Lab SOP # TA-QA-0617) is performed whenever there is a change in instrument type (e.g., new instrumentation), method or personnel.

19.4.2.2 The initial demonstration of capability must be thoroughly documented and approved by the Technical Director and QA Manager prior to independently analyzing client samples. All associated documentation must be retained in accordance with the laboratories archiving procedures.

19.4.2.3 The laboratory must have an approved SOP, demonstrate satisfactory performance, and conduct an MDL study (when applicable). There may be other requirements as stated within the published method or regulations (i.e., retention time window study).
Note: In some instances, a situation may arise where a client requests that an unusual analyte be reported using a method where this analyte is not normally reported. If the analyte is being reported for regulatory purposes, the method must meet all procedures outlined within this QA Manual (SOP, MDL, and Demonstration of Capability). If the client states that the information is not for regulatory purposes, the result may be reported as long as the following criteria are met:

- The instrument is calibrated for the analyte to be reported using the criteria for the method and ICV/CCV criteria are met (unless an ICV/CCV is not required by the method or criteria are per project DQOs).
- The laboratory's nominal or default reporting limit (RL) is equal to the quantitation limit (QL), must be at or above the lowest non-zero standard in the calibration curve and must be reliably determined. Project RLs are client specified reporting levels which may be higher than the QL. Results reported below the QL must be qualified as estimated values. Also see Section 19.6.1.3, Relationship of Limit of Detection (LOD) to Quantitation Limit (QL).
- The client request is documented and the lab informs the client of its procedure for working with unusual compounds. The final report must be footnoted: *Reporting Limit based on the low standard of the calibration curve.*

19.4.3 <u>Initial Demonstration of Capability (IDOC) Procedures</u>

19.4.3.1 The spiking standard used must be prepared independently from those used in instrument calibration.

19.4.3.2 The analyte(s) shall be diluted in a volume of clean matrix sufficient to prepare four aliquots at the concentration specified by a method or the laboratory SOP.

19.4.3.3 At least four aliquots shall be prepared (including any applicable clean-up procedures) and analyzed according to the test method (either concurrently or over a period of days).

19.4.3.4 Using all of the results, calculate the mean recovery in the appropriate reporting units and the standard deviations for each parameter of interest.

19.4.3.5 When it is not possible to determine the mean and standard deviations, such as for presence, absence and logarithmic values, the laboratory will assess performance against criteria described in the Method SOP.

19.4.3.6 Compare the information obtained above to the corresponding acceptance criteria for precision and accuracy in the test method (if applicable) or in laboratory generated acceptance criteria (LCS or interim criteria) if there is no mandatory criteria established. If any one of the parameters do not meet the acceptance criteria, the performance is unacceptable for that parameter.

19.4.3.7 When one or more of the tested parameters fail at least one of the acceptance criteria, the analyst must proceed according to either option listed below:

- Locate and correct the source of the problem and repeat the test for all parameters of interest beginning with 19.4.3.3 above.
- Beginning with 19.4.3.3 above, repeat the test for all parameters that failed to meet criteria. Repeated failure, however, will confirm a general problem with the measurement system. If this occurs, locate and correct the source of the problem and repeat the test for all compounds of interest beginning with 19.4.3.1 above.

Note: Results of successive LCS analyses can be used to fulfill the DOC requirement.

A certification statement (refer to Figure 19-1 as an example) shall be used to document the completion of each initial demonstration of capability. A copy of the certification is archived in the analyst's training folder.

Methods on line prior to the effective date of this Section shall be updated to the procedures outlined above as new analysts perform their demonstration of capability. A copy of the new record will replace that which was used for documentation in the past. At a minimum, the precision and accuracy of four mid-level laboratory control samples must have been compared to the laboratory's quality control acceptance limits.

19.5 LABORATORY DEVELOPED METHODS AND NON-STANDARD METHODS

Any new method developed by the laboratory must be fully defined in an SOP and validated by qualified personnel with adequate resources to perform the method. Method specifications and the relation to client requirements must be clearly conveyed to the client if the method is a non-standard method (not a published or routinely accepted method). The client must also be in agreement to the use of the non-standard method.

19.6 VALIDATION OF METHODS

Validation is the confirmation by examination and the provision of objective evidence that the particular requirements for a specific intended use are fulfilled.

All non-standard methods, laboratory designed/developed methods, standard methods used outside of their scope, and major modifications to published methods must be validated to confirm they are fit for their intended use. The validation will be as extensive as necessary to meet the needs of the given application. The results are documented with the validation procedure used and contain a statement as to the fitness for use.

19.6.1 Method Validation and Verification Activities for All New Methods

While method validation can take various courses, the following activities can be required as part of method validation. Method validation records are designated QC records and are archived accordingly.

19.6.1.1 Determination of Method Selectivity

Method selectivity is the demonstrated ability to discriminate the analyte(s) of interest from other compounds in the specific matrix or matrices from other analytes or interference. In some cases to achieve the required selectivity for an analyte, a confirmation analysis is required as part of the method.

19.6.1.2 Determination of Method Sensitivity

Sensitivity can be both estimated and demonstrated. Whether a study is required to estimate sensitivity depends on the level of method development required when applying a particular measurement system to a specific set of samples. Where estimations and/or demonstrations of sensitivity are required by regulation or client agreement, such as the procedure in 40 CFR Part 136 Appendix B, under the Clean Water Act, these shall be followed.

19.6.1.3 Relationship of Limit of Detection (LOD) to the Quantitation Limit (QL)

An important characteristic of expression of sensitivity is the difference in the LOD and the QL. The LOD is the minimum level at which the presence of an analyte can be reliably concluded. The QL is the minimum concentration of analyte that can be quantitatively determined with acceptable precision and bias. For most instrumental measurement systems, there is a region where semi-quantitative data is generated around the LOD (both above and below the estimated MDL or LOD) and below the QL. In this region, detection of an analyte may be confirmed but quantification of the analyte is unreliable within the accuracy and precision guidelines of the measurement system. When an analyte is detected below the QL, and the presence of the analyte is confirmed by meeting the qualitative identification criteria for the analyte, the analyte can be reliably reported, but the amount of the analyte can only be estimated. If data is to be reported in this region, it must be done so with a qualification that denotes the semi-quantitative nature of the result.

19.6.1.4 Determination of Interferences

A determination that the method is free from interferences in a blank matrix is performed.

19.6.1.5 Determination of Range

Where appropriate to the method, the quantitation range is determined by comparison of the response of an analyte in a curve to established or targeted criteria. Generally the upper quantitation limit is defined by highest acceptable calibration concentration. The lower quantitation limit or QL cannot be lower than the lowest non-zero calibration level, and can be constrained by required levels of bias and precision.

19.6.1.6 Determination of Accuracy and Precision

Accuracy and precision studies are generally performed using replicate analyses, with a resulting percent recovery and measure of reproducibility (standard deviation, relative standard deviation) calculated and measured against a set of target criteria.

19.6.1.7 Documentation of Method

The method is formally documented in an SOP. If the method is a minor modification of a standard laboratory method that is already documented in an SOP, an SOP Attachment describing the specific differences in the new method is acceptable in place of a separate SOP.

19.6.1.8 Continued Demonstration of Method Performance

Continued demonstration of Method Performance is addressed in the SOP. Continued demonstration of method performance is generally accomplished by batch specific QC samples such as LCS, method blanks or PT samples.

19.7 METHOD DETECTION LIMITS (MDL)/ LIMITS OF DETECTION (LOD)

Method detection limits (MDL) are initially determined in accordance with 40 CFR Part 136, Appendix B or alternatively by other technically acceptable practices that have been accepted by regulators. MDL is also sometimes referred to as Limit of Detection (LOD). The MDL theoretically represents the concentration level for each analyte within a method at which the Analyst is 99% confident that the true value is not zero. The MDL is determined for each analyte initially during the method validation process and updated as required in the analytical methods, whenever there is a significant change in the procedure or equipment, or based on project specific requirements. Generally, the analyst prepares at least seven replicates of solution spiked at one to five times the estimated method detection limit (most often at the lowest standard in the calibration curve) into the applicable matrix with all the analytes of interest. Each of these aliquots is extracted (including any applicable clean-up procedures) and analyzed in the same manner as the samples. Where possible, the seven replicates should be analyzed over 2-4 days to provide a more realistic MDL.

Refer to the laboratory's SOP No. TA-QA-0602 for details on the laboratory's MDL process.

19.8 INSTRUMENT DETECTION LIMITS (IDL)

19.8.1 The IDL is sometimes used to assess the reasonableness of the MDLs or in some cases required by the analytical method or program requirements. IDLs are most used in metals analyses but may be useful in demonstration of instrument performance in other areas.

19.8.2 IDLs are calculated to determine an instrument's sensitivity independent of any preparation method. IDLs are calculated either using 7 replicate spike analyses, like MDL but without sample preparation, or by the analysis of 10 instrument blanks and calculating 3 x the absolute value of the standard deviation.

19.8.3 If IDL is > than the MDL, it may be used as the reported MDL.

19.9 VERIFICATION OF DETECTION AND REPORTING LIMITS

19.9.1 Once the MDL is determined, it must be verified on each instrument used for the given method. TestAmerica defines the DoD QSM Detection Limit (DL) as being equal to the MDL. TestAmerica also defines the DoD QSM Limit of Detection (LOD) as being equal to the lowest concentration standard that successfully verifies the MDL, also referred to as the MDLV standard. MDL and MDLV standards are extracted/digested and analyzed through the entire analytical process. The MDL and MDLV determinations do not apply to methods that are not readily spiked (e.g. pH, turbidity, etc.) or where the lab does not report to the MDL. If the MDLV standard is not successful, then the laboratory will redevelop their MDL. Initial and quarterly verification is required for all methods listed in the laboratory's DoD ELAP Scope of Accreditation. Refer to the laboratory SOP TA-QA-0602 Method Detection Limits (MDLs/DLs) for further details.

19.9.2 The laboratory quantitation limit is equivalent to the DoD Limit of Quantitation (LOQ), which is at a concentration equal to or greater than the lowest non-zero calibration standard. The DoD QSM requires the laboratory to perform an initial characterization of the bias and precision at the LOQ and quarterly LOQ verifications thereafter. If the quarterly verification results are not consistent with three-standard deviation confidence limits established initially, then the bias and precision will be reevaluated and clients contacted for any on-going projects. For DoD projects, TestAmerica makes a distinction between the Reporting Limit (RL) and the LOQ. The RL is a level at or above the LOQ that is used for specific project reporting purposes, as agreed to between the laboratory and the client. The RL cannot be lower than the LOQ concentration, but may be higher.

19.10 RETENTION TIME WINDOWS

Most organic analyses and some inorganic analyses use chromatography techniques for qualitative and quantitative determinations. For every chromatography analysis or as specific in the reference method, each analyte will have a specific time of elution from the column to the detector. This is known as the analyte's retention time. The variance in the expected time of elution is defined as the retention time window. As the key to analyte identification in chromatography, retention time windows must be established on every column for every analyte used for that method. These records are kept with the files associated with an instrument for later quantitation of the analytes. Complete details are available in the laboratory method SOPs.

19.11 EVALUATION OF SELECTIVITY

The laboratory evaluates selectivity by following the checks within the applicable analytical methods, which include mass spectral tuning, second column confirmation, ICP interelement interference checks, chromatography retention time windows, sample blanks, spectrochemical, co-precipitation evaluations and specific electrode response factors.

19.12 ESTIMATION OF UNCERTAINTY OF MEASUREMENT

19.12.1 Uncertainty is "a parameter associated with the result of a measurement, that characterizes the dispersion of the values that could reasonably be attributed to the measurand" (as defined by the International Vocabulary of Basic and General Terms in Metrology, ISO Geneva, 1993, ISBN 92-67-10175-1). Knowledge of the uncertainty of a measurement provides additional confidence in a result's validity. Its value accounts for all the factors which could

possibly affect the result, such as adequacy of analyte definition, sampling, matrix effects and interferences, climatic conditions, variances in weights, volumes, and standards, analytical procedure, and random variation. Some national accreditation organizations require the use of an "expanded uncertainty": the range within which the value of the measurand is believed to lie within at least a 95% confidence level with the coverage factor k=2.

19.12.2 Uncertainty is not error. Error is a single value, the difference between the true result and the measured result. On environmental samples, the true result is never known. The measurement is the sum of the unknown true value and the unknown error. Unknown error is a combination of systematic error, or bias, and random error. Bias varies predictably, constantly, and independently from the number of measurements. Random error is unpredictable, assumed to be Gaussian in distribution, and reducible by increasing the number of measurements.

19.12.3 The minimum uncertainty associated with results generated by the laboratory can be determined by using the Laboratory Control Sample (LCS) accuracy range for a given analyte. The LCS limits are used to assess the performance of the measurement system since they take into consideration all of the laboratory variables associated with a given test over time (except for variability associated with the sampling and the variability due to matrix effects). The percent recovery of the LCS is compared either to the method-required LCS accuracy limits or to the statistical, historical, in-house LCS accuracy limits.

19.12.4 To calculate the uncertainty for the specific result reported, multiply the result by the decimal of the lower end of the LCS range percent value for the lower end of the uncertainty range, and multiply the result by the decimal of the upper end of the LCS range percent value for the upper end of the uncertainty range. These calculated values represent a 99%-certain range for the reported result. As an example, suppose that the result reported is 1.0 mg/l, and the LCS percent recovery range is 50 to 150%. The uncertainty range would be 0.5 to 1.5 mg/l, which could also be written as 1.0 +/- 0.5 mg/l.

19.12.5 In the case where a well recognized test method specifies limits to the values of major sources of uncertainty of measurement (e.g., 525, etc.) and specifies the form of presentation of calculated results, no further discussion of uncertainty is required.

19.13 SAMPLE REANALYSIS GUIDELINES

Because there is a certain level of uncertainty with any analytical measurement, a sample reanalysis may result in either a higher or lower value from an initial sample analysis. There are also variables that may be present (e.g., sample homogeneity, analyte precipitation over time, etc.) that may affect the results of a reanalysis. Based on the above comments, the laboratory will reanalyze samples at a client's request with the following caveats. Client-specific Contractual Terms & Conditions for reanalysis protocols may supersede the following items.

- Homogenous samples: If a reanalysis agrees with the original result to within the RPD limits for MS/MSD or Duplicate analyses, or within $\pm$ 1 reporting limit for samples $\leq$ 5x the reporting limit, the original analysis will be reported. At the client's request, both results may be reported on the same report but not on two separate reports.

- If the reanalysis does not agree (as defined above) with the original result, then the laboratory will investigate the discrepancy and reanalyze the sample a third time for confirmation if sufficient sample is available.

- Any potential charges related to reanalysis are discussed in the contract terms and conditions or discussed at the time of the request. The client will typically be charged for reanalysis unless it is determined that the lab was in error.

- Due to the potential for increased variability, reanalysis may not be applicable to Non-homogenous, Encore, and Sodium Bisulfate preserved samples. See the Area Supervisor or Laboratory Director if unsure.

19.14 CONTROL OF DATA

The laboratory has policies and procedures in place to ensure the authenticity, integrity, and accuracy of the analytical data generated by the laboratory.

19.14.1 Computer and Electronic Data Related Requirements

The three basic objectives of our computer security procedures and policies are shown below. More detail is outlined in SOP TA-IT-0523 Data Integrity and Security. The laboratory is currently running the TALS system which is a custom in-house developed LIMS system that has been highly customized to meet the needs of TestAmerica Seattle. It is referred to as LIMS for the remainder of this section. The LIMS utilizes Sequel Server which is an industry standard relational database platform. It is referred to as Database for the remainder of this section.

19.14.1.1 Maintain the Database Integrity: Assurance that data is reliable and accurate through data verification (review) procedures, password-protecting access, anti-virus protection, data change requirements, as well as an internal LIMS permissions procedure.

- LIMS Database Integrity is achieved through data input validation, internal user controls, and data change requirements.
- Spreadsheets and other software developed in-house must be verified with documentation through hand calculations prior to use.

19.14.1.2 Ensure Information Availability: Protection against loss of information or service is ensured through scheduled back-ups, stable file server network architecture, secure storage of media, line filter, Uninterruptible Power Supply (UPS), and maintaining older versions of software as revisions are implemented.

19.14.1.3 Maintain Confidentiality: Ensure data confidentiality through physical access controls when electronically transmitting data.

19.14.2 Data Reduction

The complexity of the data reduction depends on the analytical method and the number of discrete operations involved (e.g., extractions, dilutions, instrument readings and concentrations). The analyst calculates the final results from the raw data or uses appropriate computer programs to assist in the calculation of final reportable values.

For manual data entry, e.g., Wet Chemistry, the data is reduced by the analyst and then verified by the Department Manager or alternate analyst prior to updating the data in LIMS. The spreadsheets, or any other type of applicable documents, are signed by both the analyst and alternate reviewer to confirm the accuracy of the manual entry(s).

Manual integration of peaks will be documented and reviewed and the raw data will be flagged in accordance with the TestAmerica Corporate SOP No. CA-Q-S-002, *Acceptable Manual Integration Practices*.

Analytical results are reduced to appropriate concentration units specified by the analytical method, taking into account factors such as dilution, sample weight or volume, etc. Blank correction will be applied only when required by the method or per manufacturer's indication; otherwise, it should not be performed. Calculations are independently verified by appropriate laboratory staff. Calculations and data reduction steps for various methods are summarized in the respective analytical SOPs or program requirements.

19.14.2.1 All raw data must be retained in the worklist folder, computer file (if appropriate), and/or runlog. All criteria pertinent to the method must be recorded. The documentation is recorded at the time observations or calculations are made and must be signed or initialed/dated (month/day/year). It must be easily identifiable who performed which tasks if multiple people were involved.

19.14.2.2 In general, concentration results are reported in milligrams per liter (mg/l) or micrograms per liter (µg/l) for liquids and milligrams per kilogram (mg/kg) or micrograms per kilogram (µg/kg) for solids. For values greater than 10,000 mg/l, results can be reported in percent, i.e., 10,000 mg/l = 1%**.** Units are defined in each lab SOP.

19.14.2.3 In reporting, the analyst or the instrument output records the raw data result using values of known certainty plus one uncertain digit. If final calculations are performed external to LIMS, the results should be entered in LIMS with at least three significant figures. In general, results are reported to 2 significant figures on the final report.

19.14.2.4 For those methods that do not have an instrument printout or an instrumental output compatible with the LIMS System, the raw results and dilution factors are entered directly into LIMS by the analyst, and the software calculates the final result for the analytical report. LIMS has a defined significant figure criterion for each analyte.

19.14.2.5 The laboratory strives to import data directly from instruments or calculation spreadsheets to ensure that the reported data are free from transcription and calculation errors. For those analyses with an instrumental output compatible with the LIMS, the raw results and dilution factors are transferred into LIMS electronically after reviewing the quantitation report, and removing unrequested or poor spectrally-matched compounds. The analyst prints a copy of what has been entered to check for errors. This printout and the instrument's printout of calibrations, concentrations, retention times, chromatograms, and mass spectra, if applicable, are retained with the data file. The data file is stored in a monthly folder on the instrument computer; periodically, this file is transferred to the server and, eventually, to a tape file.

19.14.3 Logbook / Worksheet Use Guidelines

Logbooks and worksheets are filled out 'real time' and have enough information on them to trace the events of the applicable analysis/task. (e.g. calibrations, standards, analyst, sample ID, date, time on short holding time tests, temperatures when applicable, calculations are traceable, etc.)

- Corrections are made following the procedures outlined in Section 12.
- Logbooks are controlled by the QA department. A record is maintained of all logbooks in the lab.
- Unused portions of pages must be "Z"'d out, signed and dated.
- Worksheets are created with the approval of the Technical Director/QA Manager at the facility. The QA Manager controls all worksheets following the procedures in Section 6.

19.14.4 Review / Verification Procedures

19.14.5 Review / Verification Procedures

Review procedures are out lined in method specific SOPs and SOP TA-QSM-0635 Procedure for Peer Review of Analytical Data and Project Management Review of Reports to ensure that reported data are free from calculation and transcription errors, that QC parameters have been reviewed and evaluated before data is reported. The laboratory also utilizes the corporate SOP CA-Q-S-002 Acceptable Manual Integration Practices discussing Manual Integrations to ensure the authenticity of data. The general review concepts are discussed below, more specific information can be found in the SOPs.

19.14.5.1 The data review process at the laboratory starts at the Sample Control level. Sample Control personnel review chain-of-custody forms and input the sample information and required analyses into a computer LIMS. The Sample Control Supervisor reviews the transaction of the chain-of-custody forms and the inputted information. The Project Managers perform final review of the chain-of-custody forms and inputted information.

19.14.5.2 The next level of data review occurs with the Analysts. As results are generated, analysts review their work to ensure that the results generated meet QC requirements and relevant EPA methodologies. The Analysts transfer the data into the LIMS and add data qualifiers if applicable. To ensure data compliance, a different analyst performs a second level of review. Second level review is accomplished by checking reported results against raw data and evaluating the results for accuracy. During the second level review, blank runs, QA/QC check results, *initial and* continuing calibration results, laboratory control samples, sample data, qualifiers and spike information are evaluated. *Where calibration is not required on a daily basis, secondary review of the initial calibration results may be conducted at the time of calibration*. Approximately 15% of all sample data from manual methods and from automated methods, all GC/MS spectra and all manual integrations are reviewed. Manual integrations are also electronically reviewed utilizing auditing software to help ensure compliance to

ethics and manual integration policies. Issues that deem further review include the following:

- QC data are outside the specified control limits for accuracy and precision
- Reviewed sample data does not match with reported results
- Unusual detection limit changes are observed
- Samples having unusually high results
- Samples exceeding a known regulatory limit
- Raw data indicating some type of contamination or poor technique
- Inconsistent peak integration
- Transcription errors
- Results outside of calibration range

19.14.5.3 Unacceptable analytical results may require reanalysis of the samples. Any problems are brought to the attention of the Laboratory Director, Project Manager, Quality Assurance Manager, Technical Director, or Supervisor for further investigation. Corrective action is initiated whenever necessary.

19.14.5.4 The results are then entered or directly transferred into the computer database and a hard copy (or .pdf) is printed for the client.

19.14.5.5 As a final review prior to the release of the report, the Project Manager reviews the results for appropriateness and completeness. This review and approval ensures that client requirements have been met and that the final report has been properly completed. The process includes, but is not limited to, verifying that chemical relationships are evaluated, COC is followed, cover letters/ narratives are present, flags are appropriate, and project specific requirements are met.

19.14.5.6 Any project that requires a data package is subject to a tertiary data review for transcription errors and acceptable quality control requirements. The Project Manager then signs the final report. The accounting personnel also check the report for any clerical or invoicing errors. When complete, the report is sent out to the client.

19.14.5.7 A visual summary of the flow of samples and information through the laboratory, as well as data review and validation, is presented in Figure 19-2.

19.14.6 Manual Integrations

Computerized data systems provide the analyst with the ability to re-integrate raw instrument data in order to optimize the interpretation of the data. Though manual integration of data is an invaluable tool for resolving variations in instrument performance and some sample matrix problems, when used improperly, this technique would make unacceptable data appear to meet quality control acceptance limits. Improper re-integrations lead to legally indefensible data, a poor reputation, or possible laboratory decertification. Because guidelines for re-integration of data are not provided in the methods and most methods were written prior to widespread

implementation of computerized data systems, the laboratory trains all analytical staff on proper manual integration techniques using TestAmerica's Corporate SOP (CA-Q-S-002).

19.14.6.1 The analyst must adjust baseline or the area of a peak in some situations, for example when two compounds are not adequately resolved or when a peak shoulder needs to be separated from the peak of interest. The analyst must use professional judgment and common sense to determine when manual integrating is required. Analysts are encouraged to ask for assistance from a senior analyst or manager when in doubt.

19.14.6.2 Analysts shall not increase or decrease peak areas to for the sole purpose of achieving acceptable QC recoveries that would have otherwise been unacceptable. The intentional recording or reporting of incorrect information (or the intentional omission of correct information) is against company principals and policy and is grounds for immediate termination.

19.14.6.3 Client samples, performance evaluation samples, and quality control samples are all treated equally when determining whether or not a peak area or baseline should be manually adjusted.

19.14.6.4 All manual integrations receive a second level review. Manual integrations must be indicated on an expanded scale "after" chromatograms such that the integration performed can be easily evaluated during data review. Expanded scale "before" chromatograms are also required for all manual integrations on QC parameters (calibrations, calibration verifications, laboratory control samples, internal standards, surrogates, etc.) unless the laboratory has another documented corporate approved procedure in place that can demonstrate an active process for detection and deterrence of improper integration practices.

Figure 19-1.
Example - Demonstration of Capability Documentation

TestAmerica Seattle
Analyst Demonstration of Capability-Certification Statement

Initial: _____
Continuing: _____

Date of Preparation: _____ Date of Analysis: _____
Analyst: _____ Analyst: _____

Matrix: Water Soil Sediment Other (Specify):_____

Reference method:_____

Reference SOP:_____

Parameters:_____

We, the undersigned, CERTIFY that:

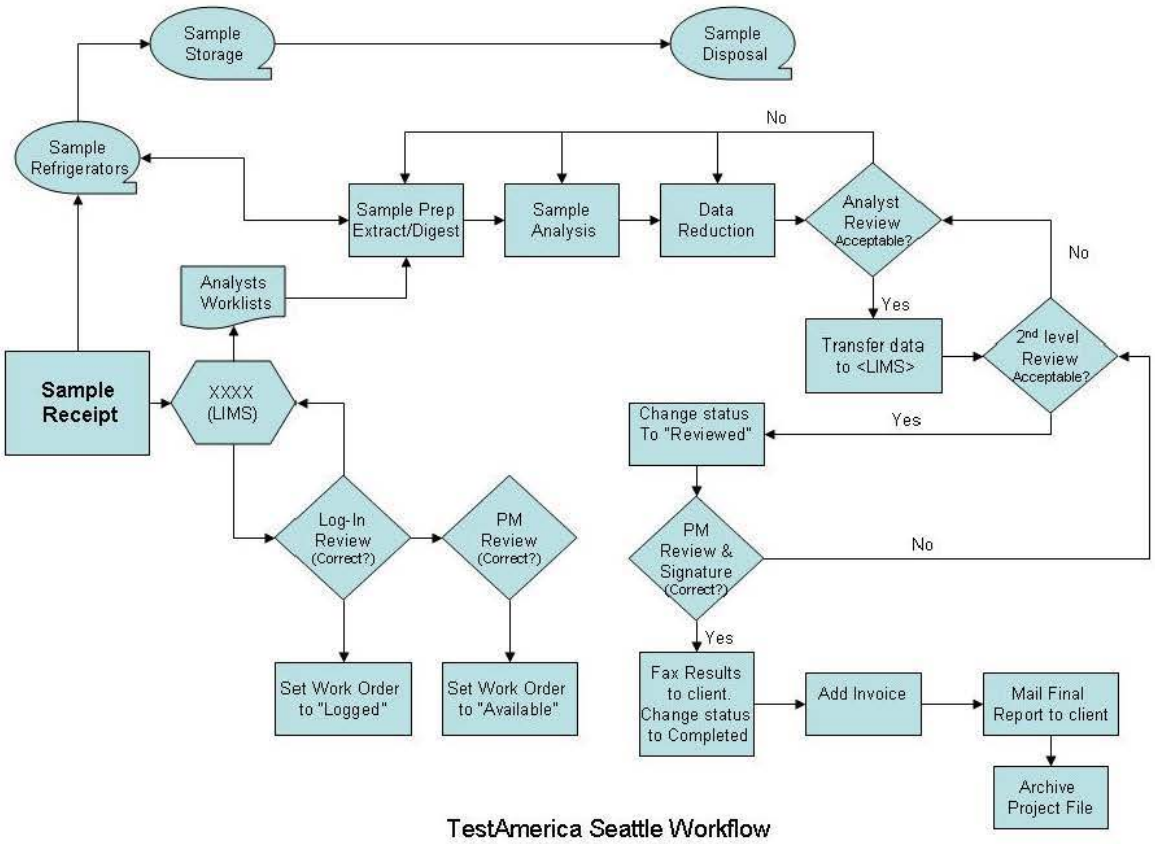
- ❑ The analyst identified above, using the cited test method with the specification in the cited SOP, which is in use at this facility for the analyses of samples under the Nation Environmental Laboratory Accreditation Program, have met Demonstration of Capability.
- ❑ The test method was performed by the analyst identified on this certification following the TestAmerica Seattle SOP.
- ❑ A copy of the laboratory specific SOP is available for all personnel on-site.
- ❑ The data associated with the demonstration of capability are true, accurate, complete, and self-explanatory (*).
- ❑ All raw data including a copy of this certification form) necessary to reconstruct and validate these analyses have been retained at the facility, and that the associated information is well organized and available for review by authorized assessors.

Name	Analyst, Signature	Date
Name	Technical Director, Signature	Date
Name	QA Manager, Signature	Date

* True: consistent with supporting data
Accurate: Based on good laboratory practices with sound scientific principles/practices
Complete: includes the results of all supporting performance testing
Self-explanatory: Data properly labeled and stored so that the results are clean and require no additional explanation.

Figure 19-2

Example: Work Flow



SECTION 20

EQUIPMENT (AND CALIBRATIONS) *(NELAC 5.5.5)*

20.1 OVERVIEW

TestAmerica Seattle purchases the most technically advanced analytical instrumentation for sample analyses. Instrumentation is purchased on the basis of accuracy, dependability, efficiency and sensitivity. Each laboratory is furnished with all items of sampling, preparation, analytical testing and measurement equipment necessary to correctly perform the tests for which the laboratory has capabilities. Each piece of equipment is capable of achieving the required accuracy and complies with specifications relevant to the method being performed. Before being placed into use, the equipment (including sampling equipment) is calibrated and checked to establish that it meets its intended specification. The calibration routines for analytical instruments establish the range of quantitation. Calibration procedures are specified in laboratory SOPs. A list of laboratory instrumentation is presented in Table 20-1.

Equipment is only operated by authorized and trained personnel. Manufacturer's instructions for equipment use are readily accessible to all appropriate laboratory personnel.

20.2 PREVENTIVE MAINTENANCE

20.2.1 TestAmerica Seattle follows a well-defined maintenance program to ensure proper equipment operation and to prevent the failure of laboratory equipment or instrumentation during use. This program of preventive maintenance helps to avoid delays due to instrument failure.

20.2.2 Routine preventive maintenance procedures and frequency, such as cleaning and replacements, should be performed according to the procedures outlined in the manufacturer's manual. Qualified personnel must also perform maintenance when there is evidence of degradation of peak resolution, a shift in the calibration curve, loss of sensitivity, or failure to continually meet one of the quality control criteria.

20.2.3 Table 20-2 lists examples of scheduled routine maintenance. It is the responsibility of each Department Manager to ensure that instrument maintenance logs are kept for all equipment in his/her department. Preventative maintenance procedures may be / are also outlined in analytical SOPs or instrument manuals. (Note: for some equipment, the log used to monitor performance is also the maintenance log. Multiple pieces of equipment may share the same log as long as it is clear as to which instrument is associated with an entry.)

20.2.4 Instrument maintenance logs are controlled and are used to document instrument problems, instrument repair and maintenance activities. Maintenance logs shall be kept for all major pieces of equipment. Instrument maintenance logs may also be used to specify instrument parameters.

20.2.4.1 Documentation must include all major maintenance activities such as contracted preventive maintenance and service and in-house activities such as the replacement of electrical components, lamps, tubing, valves, columns, detectors, cleaning and adjustments.

20.2.4.2 Each entry in the instrument log includes the Analyst's initials, the date, a detailed description of the problem (or maintenance needed/scheduled), a detailed explanation of the solution or maintenance performed, and a verification that the equipment is functioning properly (state what was used to determine a return to control. e.g. CCV run on *'date'* was acceptable, or instrument recalibrated on 'date' with acceptable verification, etc.) must also be documented in the instrument records.

20.2.4.3 When maintenance or repair is performed by an outside agency, service receipts detailing the service performed can be affixed into the logbooks adjacent to pages describing the maintenance performed. This stapled in page must be signed across the page entered and the logbook so that it is clear that a page is missing if only half a signature is found in the logbook.

20.2.5 If an instrument requires repair (subjected to overloading or mishandling, gives suspect results, or otherwise has shown to be defective or outside of specified limits) it shall be taken out of operation and tagged as out-of-service or otherwise isolated until such a time as the repairs have been made and the instrument can be demonstrated as operational by calibration and/or verification or other test to demonstrate acceptable performance. The laboratory shall examine the effect of this defect on previous analyses.

20.2.6 In the event of equipment malfunction that cannot be resolved, service shall be obtained from the instrument vendor manufacturer, or qualified service technician, if such a service can be tendered. If on-site service is unavailable, arrangements shall be made to have the instrument shipped back to the manufacturer for repair. Back up instruments, which have been approved, for the analysis shall perform the analysis normally carried out by the malfunctioning instrument. If the back up is not available and the analysis cannot be carried out within the needed timeframe, the samples shall be subcontracted.

20.2.7 If an instrument is sent out for service or transferred to another facility, it must be recalibrated and verified (including new initial MDL study) prior to return to lab operations.

20.3 SUPPORT EQUIPMENT

This section applies to all devices that may not be the actual test instrument, but are necessary to support laboratory operations. These include but are not limited to: balances, ovens, refrigerators, freezers, incubators, water baths, temperature measuring devices, thermal/pressure sample preparation devices and volumetric dispensing devices if quantitative results are dependent on their accuracy, as in standard preparation and dispensing or dilution into a specified volume. All raw data records associated with the support equipment are retained to document instrument performance.

20.3.1 Weights and Balances

The accuracy of the balances used in the laboratory is checked every working day, before use. All balances are placed on stable counter tops.

Each balance is checked prior to initial serviceable use with at least two certified ASTM type 1 weights spanning its range of use (weights that have been calibrated to ASTM type 1 weights may also be used for daily verification). ASTM type 1 weights used only for calibration of other

weights (and no other purpose) are inspected for corrosion, damage or nicks at least annually and if no damage is observed, they are calibrated at least every 5 years by an outside calibration laboratory. Any weights (including ASTM Type 1) used for daily balance checks or other purposes are recalibrated/recertified annually to NIST standards (this may be done internally if laboratory maintains "calibration only" ASTM type 1 weights).

All balances are serviced annually by a qualified service representative, who supplies the laboratory with a certificate that identifies traceability of the calibration to the NIST standards.

All of this information is recorded in logs, and the recalibration/recertification certificates are kept on file in the QA office. Refer to SOP TA-QA-0014 Selecting and Using Balances for details.

20.3.2 pH, Conductivity, and Turbidity Meters

The pH meters used in the laboratory are accurate to ± 0.1 pH units, and have a scale readability of at least 0.05 pH units. The meters automatically compensate for the temperature, and are calibrated with at least two working range buffer solutions before each use.

Conductivity meters are also calibrated before each use with a known standard to demonstrate the meters do not exceed an error of 1% or one umhos/cm.

Turbidity meters are also calibrated before each use. All of this information is documented in logs.

Consult pH and Conductivity, and Turbidity SOPs for further information.

20.3.3 Thermometers

All thermometers are calibrated on an annual basis with a NIST-traceable thermometer. IR thermometers, digital probes and thermocouples are calibrated quarterly.

The NIST thermometer is recalibrated every five years (unless thermometer has been exposed to temperature extremes or apparent separation of internal liquid) by an approved outside service and the provided certificate of traceability is kept on file. The NIST thermometer(s) have increments of 1 degree (0.5 degree or less increments are required for drinking water microbiological laboratories), and have ranges applicable to method and certification requirements. The NIST traceable thermometer is used for no other purpose than to calibrate other thermometers.

All of this information is documented in logbooks. Monitoring method-specific temperatures, including incubators, heating blocks, water baths, and ovens, is documented in method-specific logbooks. More information on this subject can be found in the SOP TA-QA-0024 Use, Calibration, and Maintenance of Laboratory Thermometers.

20.3.4 Refrigerators/Freezer Units, Waterbaths, Ovens and Incubators

The temperatures of all refrigerator units and freezers used for sample and standard storage are monitored each working day. (Sample storage is monitored 7 days a week for DoD labs).

Ovens, water baths, and incubators are monitored on days of use.

All of this equipment has a unique identification number, and is assigned a unique thermometer for monitoring.

Sample storage refrigerator temperatures are kept between > 0ºC and ≤ 6 ºC.

Specific temperature settings/ranges for other refrigerators, ovens water baths, and incubators can be found in method specific SOPs.

All of this information is documented in Daily Temperature Logbooks and method-specific logbooks.

20.3.5 Autopipettors, Dilutors, and Syringes

Mechanical volumetric dispensing devices including burettes (except Class A Glassware) are given unique identification numbers and the delivery volumes are verified gravimetrically, at a minimum, on a quarterly basis. Glass micro-syringes are considered the same as Class A glassware.

For those dispensers that are not used for analytical measurements, a label is / can be applied to the device stating that it is not calibrated. Any device not regularly verified can not be used for any quantitative measurements. Refer to SOP TA-QA-0016 Volumetric Verification.

Micro-syringes are purchased from Hamilton Company. Each syringe is traceable to NIST. The laboratory keeps on file an “Accuracy and Precision Statement of Conformance” from Hamilton attesting established accuracy.

20.4 INSTRUMENT CALIBRATIONS

Calibration of analytical instrumentation is essential to the production of quality data. Strict calibration procedures are followed for each method. These procedures are designed to determine and document the method detection limits, the working range of the analytical instrumentation and any fluctuations that may occur from day to day.

Sufficient raw data records are retained to allow an outside party to reconstruct all facets of the initial calibration. Records contain, but are not limited to, the following: calibration date, method, instrument, analyst(s) initials or signatures, analysis date, analytes, concentration, response, type of calibration (Avg RF, curve, or other calculations that may be used to reduce instrument responses to concentration.)

Sample results must be quantitated from the initial calibration and may not be quantitated from any continuing instrument calibration verification unless otherwise required by regulation, method or program.

If the initial calibration results are outside of the acceptance criteria, corrective action is performed and any affected samples are reanalyzed if possible. If the reanalysis is not possible, any data associated with an unacceptable initial calibration will be reported with appropriate data qualifiers (refer to Section 11).

Note: Instruments are calibrated initially and as needed after that and at least annually.

20.4.1 CALIBRATION STANDARDS

20.4.1.1 Calibration standards are prepared using the procedures indicated in the Reagents and Standards section of the determinative method SOP.

20.4.1.2 Standards for instrument calibration are obtained from a variety of sources. All standards are traceable to national or international standards of measurement, or to national or international standard reference materials.

20.4.1.3 The lowest concentration calibration standard that is analyzed during an initial calibration must be at or below the stated reporting limit for the method based on the final volume of extract (or sample).

20.4.1.4 The other concentrations define the working range of the instrument/method or correspond to the expected range of concentrations found in actual samples that are also within the working range of the instrument/method. Results of samples not bracketed by initial instrument calibration standards (within calibration range to 3 significant figures) must be reported as having less certainty, e.g., defined qualifiers or flags (additional information may be included in the case narrative). The exception to these rules is ICP methods or other methods where the referenced method does not specify two or more standards.

20.4.1.5 All initial calibrations are verified with a standard obtained from a second source and traceable to a national standard, when available (or vendor certified different lot if a second source is not available). This verification occurs immediately after the calibration curve has been analyzed, and before the analysis of any samples.

20.4.2 Calibration Verification

The calibration relationship established during the initial calibration must be verified *initially and* at least daily as specified in the laboratory method SOPs in accordance with the referenced analytical methods and NELAC (2003) standard, Section 5.5.5.10. The process of calibration verification applies to both external standard and internal standard calibration techniques, as well as to linear and non-linear calibration models. Initial calibration verification is with a standard source secondary (second source standard) to the calibration standards, but continuing calibration verifications may use the same source standards as the calibration curve.

Note: The process of calibration verification referred to here is fundamentally different from the approach called "calibration" in some methods. As described in those methods, the calibration factors or response factors calculated during calibration are used to update the calibration factors or response factors used for sample quantitation. This approach, while employed in other EPA programs, amounts to a daily single-point calibration.

All target analytes and surrogates, including those reported as non-detects, must be included in periodic calibration verifications for purposes of retention time confirmation and to demonstrate that calibration verification criteria are being met, i.e., RPD, per NELAC (2003) Standard, Section 5.5.5.10.

All samples must be bracketed by periodic analyses of standards that meet the QC acceptance criteria (e.g., calibration and retention time). The frequency is found in the determinative methods or SOPs.

Generally, the initial calibrations must be verified at the beginning of each 12-hour analytical shift during which samples are analyzed. (Some methods may specify more or less frequent verifications). The 12-hour analytical shift begins with the injection of the calibration verification standard (or the MS tuning standard in MS methods). The shift ends after the completion of the analysis of the last sample, QC, or standard that can be injected within 12 hours of the beginning of the shift.

A continuing instrument calibration verification (CCV) must be repeated at the beginning and, for methods that have quantitation by external calibration models, at the end of each analytical batch. Some methods have more frequent CCV requirements (see specific SOPs). Most Inorganic methods require the CCV to be analyzed after ever 10 samples or injections, including matrix or batch QC samples.

Note: If an internal standard calibration is being used (basically GCMS) then bracketing standards are not required, only daily verifications are needed. The results from these verification standards must meet the calibration verification criteria and the retention time criteria (if applicable).

20.4.2.1 Verification of Linear and Non-Linear Calibrations

Calibration verification for calibrations involves the calculation of the percent drift or the percent difference of the instrument response between the initial calibration and each subsequent analysis of the verification standard. (These calculations are available in the laboratory method SOPs.) Verification standards are evaluated based on the % Difference from the average CF or RF of the initial calibration or based on % Drift or % Recovery if a linear or quadratic curve is used.

Regardless of whether a linear or non-linear calibration model is used, if initial verification criterion is not met, then no sample analyses may take place until the calibration has been verified or a new initial calibration is performed that meets the specifications listed in the method SOPs. If the calibration cannot be verified after the analysis of a single verification standard, then adjust the instrument operating conditions and/or perform instrument maintenance, and analyze another aliquot of the verification standard. If the calibration cannot be verified with the second standard, then a new initial calibration is performed.

- When the acceptance criteria for the calibration verification are exceeded high, i.e., high bias, and there are associated samples that are non-detects, then those non-detects may be reported. Otherwise, the samples affected by the unacceptable calibration verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted.

When the acceptance criteria for the calibration verification are exceeded low, i.e., low bias, those sample results may be reported if they exceed a maximum regulatory limit/decision level. Otherwise, the samples affected by the unacceptable verification shall be reanalyzed after a new calibration curve has been established, evaluated and accepted. Alternatively, a reporting limit standard may be analyzed to demonstrate that the laboratory can still support non-detects at their reporting limit.

20.5 TENTATIVELY IDENTIFIED COMPOUNDS (TICS) – GC/MS ANALYSIS

For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification will be determined by the purpose of the analyses being conducted. Data system library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other.

Note: If the TIC compound is not part of the client target analyte list but is calibrated by the laboratory and is both qualitatively and/or quantitatively identifiable, it should not be reported as a TIC. If the compound is reported on the same form as true TICs, it should be qualified and/or narrated that the reported compound is qualitatively and quantitatively (if verification in control) reported compared to a known standard that is in control (where applicable).

For example, the RCRA permit or waste delisting requirements may require the reporting of non-target analytes. Only after visual comparison of sample spectra with the nearest library searches may the analyst assign a tentative identification.

20.6 GC/MS TUNING

Prior to any GCMS analytical sequence, including calibration, the instrument parameters for the tune and subsequent sample analyses within that sequence must be set.

Prior to tuning/auto-tuning the mass spec, the parameters may be adjusted within the specifications set by the manufacturer or the analytical method. These generally don't need any adjustment but it may be required based on the current instrument performance. If the tune verification does not pass it may be necessary to clean the source or perform additional maintenance. Any maintenance is documented in the maintenance log.

Table 20-1. Instrument List

GC	GC/MS	Ion Trap GC/MS/MS	ICP	ICPMS	CVAA	AutoAnalyzer	IC	TOC
15	15	2	2	2	2	2	2	2

Table 20-2. Example: Schedule of Routine Maintenance

Instrument	Procedure	Frequency
Leeman Mercury Analyzer	Check tubing for wear Fill rinse tank with 10% HCl Change drying tube Fill reductant bottle with 10% Stannous Chloride	Daily Daily As required Daily
ICP	Check pump tubing Check liquid argon supply Check fluid level in waste container Check filters Clean or replace filters Check torch Check sample spray chamber for debris Clean and align nebulizer Check entrance slit for debris Change printer ribbon Replace pump tubing	Daily Daily Daily Weekly As required Daily Monthly Monthly Monthly As required As required
ICP MS	Change pump tubing Clean torch Check / clean nebulizer Clean cones Check air filters Check multiplier voltages & do cross calibration Replace sample uptake tubing Check rotary pump oil Check oil mist filters Check chiller water level	Weekly Weekly Weekly Daily Weekly Weekly Monthly Monthly Monthly Monthly
Ion chromatograph	Check seals for leakage Replace seals/valves/lamps Replace suppressor Replace column Clean source/analyzer	Daily As required As required As required As required
UV-Vis Spectrophotometer	Clean ambient flow cell Precision check/alignment of flow cell Wavelength verification check	As required As required Semi-annually
TOC Analyzer	Check gas flow Check fluid level (IC reservoirs) Replace “O” rings Check needle Replace scrubbers (halogen and CO_2) Replace catalyst	Daily Daily As required Daily Yearly As required
Auto Analyzers	Clean sampler Check all tubing Clean inside of colorimeter Clean pump well and pump rollers Clean wash fluid receptacle Oil rollers/chains/side rails Clean optics and cells	Daily Daily Daily Quarterly Weekly Weekly Quarterly

Instrument	Procedure	Frequency
Hewlett Packard GC/MS	Ion gauge tube degassing Pump oil-level check Pump oil changing Analyzer bake-out Analyzer cleaning Resolution adjustment COMPUTER SYSTEM AND PRINTER: Air filter cleaning Change data system air filter Printer head carriage lubrication Paper sprocket cleaning Drive belt lubrication	As required Monthly Annually As required As required As required As required As required As required As required As required
Gas Chromatograph	Compare standard response to previous day or since last initial calibration Check carrier gas flow rate in column Check temp. of detector, inlet, column oven Septum replacement Check system for gas leaks with SNOOP Check for loose/frayed wires and insulation ½"Bake injector/column Change/remove sections of guard column Replace connectors/liners Change/replace column(s)	Daily Daily via use of known compound retention Daily As required W/cylinder change as required Monthly As Required As Required As Required As Required
Electron Capture Detector (ECD)	Detector wipe test (Ni-63) Detector cleaning	Semi-annually As required
Flame Ionization Detector (FID)	Detector cleaning	As required
Balances	Class "S" traceable weight check Clean pan and check if level Field service	Daily, when used Daily At least Annually
Conductivity Meter	0.01M KCl calibration Conductivity cell cleaning	Daily As required
Turbidimeter	Check light bulb	Daily, when used
Deionized/Distilled Water	Conductivity Point Sources Daily conductivity check Check deionizer light Monitor for VOA's System cleaning Replace cartridge & large mixed bed resins	Water Quality SOP UQA-035 Daily Daily As required As required
Drying Ovens	Temperature monitoring Temperature adjustments	Daily As required
Refrigerators/ Freezers	Temperature monitoring Temperature adjustment Defrosting/cleaning	Daily As required As required
Vacuum Pumps/ Air Compressor	Drained Belts checked Lubricated	Weekly Monthly Semi-annually
pH/Specific Ion Meter	Calibration/check slope Clean electrode	Daily As required

Instrument	Procedure	Frequency
BOD Incubator	Temperature monitoring Coil and incubator cleaning	Daily Monthly
Centrifuge	Check brushes and bearings	Every 6 months or as needed
Water baths	Temperature monitoring Water replaced	Daily Monthly or as needed
Zero Headspace Extractors	Verify rotation speed Check for leakage Vendor repair	As required Annually As required
TCLP Extractors	Verify rotation speed	Quarterly

SECTION 21

MEASUREMENT TRACEABILITY *(NELAC 5.5.6)*

21.1 OVERVIEW

Traceability of measurements shall be assured using a system of documentation, calibration, and analysis of reference standards. Laboratory equipment that are peripheral to analysis and whose calibration is not necessarily documented in a test method analysis or by analysis of a reference standard shall be subject to ongoing certifications of accuracy. At a minimum, these must include procedures for checking specifications of ancillary equipment: balances, thermometers, temperature, Deionized (DI) and Reverse Osmosis (RO) water systems, automatic pipettes and other volumetric measuring devices. (Refer to Section 20.3). With the exception of Class A Glassware (including glass microliter syringes that have a certificate of accuracy), quarterly accuracy checks are performed for all mechanical volumetric devices. Wherever possible, subsidiary or peripheral equipment is checked against standard equipment or standards that are traceable to national or international standards. Class A Glassware should be routinely inspected for chips, acid etching or deformity. If the Class A glassware is suspect, the accuracy of the glassware will be assessed prior to use.

21.2 NIST-TRACEABLE WEIGHTS AND THERMOMETERS

Reference standards of measurement shall be used for calibration only and for no other purpose, unless it can be shown that their performance as reference standards would not be invalidated.

For NIST-traceable weights and thermometers, the laboratory requires that all calibrations be conducted by a calibration laboratory accredited by A2LA, NVLAP (National Voluntary Laboratory Accreditation Program), APLAC (Asia-Pacific Laboratory Accreditation Cooperation), or EA (European Cooperation for Accreditation). A certificate and scope of accreditation is kept on file at the laboratory.

21.3 REFERENCE STANDARDS / MATERIALS

Reference standards/materials, where commercially available, are traceable to certified reference materials. Commercially prepared standard materials are purchased from vendors accredited by A2LA, NVLAP, ISO, RvA, and/or ANSI-RAB with an accompanying Certificate of Analysis that documents the standard purity. If a standard cannot be purchased from a vendor that supplies a Certificate of Analysis, the purity of the standard is documented by analysis. The receipt of all reference standards must be documented. Reference standards are labeled with a unique Standard Identification Number and expiration date. All documentation received with the reference standard is retained as a QC record and references the Standard Identification Number.

All reference, primary and working standards/materials, whether commercially purchased or laboratory prepared, must be checked regularly to ensure that the variability of the standard or material from the ‘true’ value does not exceed method requirements. The accuracy of calibration standards is checked by comparison with a standard from a second source. In cases where a second standard manufacturer is not available, a vendor certified different lot is acceptable for

use as a second source. The appropriate Quality Control (QC) criteria for specific standards are defined in laboratory SOPs. In most cases, the analysis of an Initial Calibration Verification (ICV) or LCS (where there is no sample preparation) is used as the second source confirmation. These checks are generally performed as an integral part of the analysis method (e.g. calibration checks, laboratory control samples).

All standards and materials must be stored and handled according to method or manufacturer's requirements in order to prevent contamination or deterioration. Refer to the Corporate Environmental Health & Safety Manual or laboratory SOPs. For safety requirements, please refer to method SOPs and the laboratory Environmental Health and Safety Manual.

21.4 DOCUMENTATION AND LABELING OF STANDARDS, REAGENTS, AND REFERENCE MATERIALS

Reagents must be at a minimum the purity required in the test method. The date of reagent receipt and the expiration date are documented. The lots for most of the common solvents and acids are tested for acceptability prior to company wide purchase. (Refer to TestAmerica's Corporate SOP (CA-Q-S-001), Solvent and Acid Lot Testing and Approval.)

All manufacturer or vendor supplied Certificate of Analysis or Purity must be retained, stored appropriately, and readily available for use and inspection. These records are maintained in binders in each lab area. Records must be kept of the date of receipt and date of expiration of standards, reagents and reference materials. In addition, records of preparation of laboratory standards, reagents, and reference materials must be retained, stored appropriately, and be readily available for use and inspection. For detailed information on documentation and labeling, please refer to SOP TA-QA-0619, Preparation, Storage, and Verification of Standards.

Commercial materials purchased for preparation of calibration solutions, spike solutions, etc.., are usually accompanied with an assay certificate or the purity is noted on the label. If the assay purity is 96% or better, the weight provided by the vendor may be used without correction. If the assay purity is less than 96% a correction will be made to concentrations applied to solutions prepared from the stock commercial material.

21.4.1 All standards, reagents, and reference materials must be labeled in an unambiguous manner. Standards are logged into the laboratory's LIMS system or logbooks assigned by QA, and are assigned a unique identification number. The following information is typically recorded in the electronic database within the LIMS.

- Standard ID
- Description of Standard
- Department
- Preparer's name
- Final volume and number of vials prepared
- Solvent type and lot number
- Preparation Date
- Expiration Date
- Standard source type (stock or daughter)

- Standard type (spike, surrogate, other)
- Parent standard ID (if applicable)
- Parent Standard Analyte Concentration (if applicable)
- Parent Standard Amount used (if applicable)
- Component Analytes
- Final concentration of each analyte
- Comment box (text field)

Records are maintained electronically and in logbooks for standard and reference material preparation. These records show the traceability to purchased stocks or neat compounds. These records also include method of preparation, date of preparation, expiration date and preparer's name or initials. Preparation procedures are provided in the Method SOPs.

21.4.2 All standards, reagents, and reference materials must be clearly labeled with a minimum of the following information:

- Expiration Date (include prep date for reagents)
- Standard ID
- Special Health/Safety warnings if applicable

21.4.3 In addition, the following information may be helpful:

- Date of receipt for commercially purchased items or date of preparation for laboratory prepared items
- Date opened (for multi-use containers, if applicable)
- Description of standard (if different from manufacturer's label or if standard was prepared in the laboratory)
- Concentration (if applicable)
- Initials of analyst preparing standard or opening container

All containers of prepared reagents must include a preparation date, expiration date and an ID number to trace back to preparation.

Procedures for preparation of reagents can be found in the Method SOPs.

Standard ID numbers must be traceable through associated logbooks, worksheets and raw data.

All reagents and standards must be stored in accordance to the following priority: 1) with the manufacturer's recommendations; 2) with requirements in the specific analytical methods as specified in the laboratory SOP TA-QA-0619, Preparation, Storage, and Verification of Standards.

SECTION 22

SAMPLING *(NELAC 5.5.7)*

22.1 OVERVIEW

TestAmerica Seattle does not provide sampling services. The laboratory's responsibility in the sample collection process lies in supplying the sampler with the necessary coolers, reagent water, sample containers, preservatives, sample labels, custody seals, COC forms, ice, and packing materials required to properly preserve, pack, and ship samples to the laboratory

22.2 SAMPLING CONTAINERS

The laboratory offers clean sampling containers for use by clients. These containers are obtained from reputable container manufacturers and meet EPA specifications as required. Any certificates of cleanliness that are provided by the supplier are maintained at the laboratory.

22.2.1 Preservatives

Upon request, preservatives are provided to the client in pre-cleaned sampling containers. In some cases containers may be purchased pre-preserved from the container supplier. Whether prepared by the laboratory or bought pre-preserved, the grades of the preservatives are at a minimum:

- Hydrochloric Acid – Reagent ACS (Certified VOA Free) or equivalent
- Methanol – Purge and Trap grade
- Nitric Acid – Instra-Analyzed or equivalent
- Sodium Bisulfate – ACS Grade or equivalent
- Sodium Hydroxide – Instra-Analyzed or equivalent
- Sulfuric Acid – Instra-Analyzed or equivalent
- Sodium Thiosulfate – ACS Grade or equivalent

22.3 DEFINITION OF HOLDING TIME

The date and time of sampling documented on the COC form establishes the day and time zero. As a general rule, when the maximum allowable holding time is expressed in "days" (e.g., 14 days, 28 days), the holding time is based on calendar day measured. Holding times expressed in "hours" (e.g., 6 hours, 24 hours, etc.) are measured from date and time zero. The first day of holding time ends twenty-four hours after sampling. Holding times for analysis include any necessary reanalysis. However there are some programs that determine holding time compliance based on the date and specific time of analysis compared to the time of sampling regardless of how long the holding time is. For example, the state of Alaska requires that all holding times be measured to the exact time of sampling – not the day.

22.4 SAMPLING CONTAINERS, PRESERVATION REQUIREMENTS, HOLDING TIMES

The preservation and holding time criteria specified in the following tables are derived from the source documents for the methods. If method required holding times or preservation requirements are not met, the reports will be qualified using a flag, footnote or case narrative. As soon as possible or "ASAP" is an EPA designation for tests for which rapid analysis is advised, but for which neither EPA nor the laboratory have a basis for a holding time.

22.5 SAMPLE ALIQUOTS / SUBSAMPLING

Taking a representative sub-sample from a container is necessary to ensure that the analytical results are representative of the sample collected in the field. The size of the sample container, the quantity of sample fitted within the container, and the homogeneity of the sample need consideration when sub-sampling for sample preparation. It is the laboratory's responsibility to take a representative subsample or aliquot of the sample provided for analysis.

Analysts should handle each sample as if it is potentially dangerous. At a minimum, safety glasses, gloves, and lab coats must be worn when preparing aliquots for analysis.

Guidelines on taking sample aliquots & subsampling are located SOP TA-QA-0001 Sample Receiving and Login.

SECTION 23

HANDLING OF SAMPLES *(NELAC 5.5.8)*

Sample management procedures at TestAmerica Seattle ensure that sample integrity and custody are maintained and documented from sampling/receipt through disposal.

23.1 CHAIN OF CUSTODY (COC)

The COC form is the written documented history of any sample and is initiated when bottles are sent to the field, or at the time of sampling. This form is completed by the sampling personnel and accompanies the samples to the laboratory where it is received and stored under the laboratory's custody. The purpose of the COC form is to provide a legal written record of the handling of samples from the time of collection until they are received at the laboratory. It also serves as the primary written request for analyses from the client to the laboratory. The COC form acts as a purchase order for analytical services when no other contractual agreement is in effect. An example of a COC form may be found in Figure 23-1.

23.1.1 Field Documentation

The information the sampler needs to provide at the time of sampling on the container label is:

- Sample identification
- Date and time
- Preservative

During the sampling process, the COC form is completed and must be legible (see Figure 23-1). This form includes information such as:

- Client name, address, phone number and fax number (if available)
- Project name and/or number
- The sample identification
- Date, time and location of sampling
- Sample collectors name
- The matrix description
- The container description
- The total number of each type of container
- Preservatives used
- Analysis requested
- Requested turnaround time (TAT)
- Any special instructions
- Purchase Order number or billing information (e.g. quote number) if available
- The date and time that each person received or relinquished the sample(s), including their signed name.

The samples are stored in a cooler with ice, as applicable, and remain solely in the possession of the client's field technician until the samples are delivered to the laboratory. The sample collector must assure that each container is in his/her physical possession or in his/her view at all times, or stored in such a place and manner to preclude tampering. The field technician relinquishes the samples in writing on the COC form to the sample control personnel at the laboratory or to a TestAmerica courier. Samples are only considered to be received by lab when personnel at the laboratory have physical contact with the samples.

Note: Independent couriers are not required to sign the COC form. The COC is usually kept in the sealed sample cooler. The receipt from the courier is stored in log-in by date; it lists all receipts each date.

23.2 SAMPLE RECEIPT

Samples are received at the laboratory by designated sample receiving personnel and a unique laboratory project identification number is assigned. Each sample container shall be assigned a unique sample identification number that is cross-referenced to the client identification number such that traceability of test samples is unambiguous and documented. Each sample container is affixed with a durable sample identification label. Sample acceptance, receipt, tracking and storage procedures are summarized in the following sections.

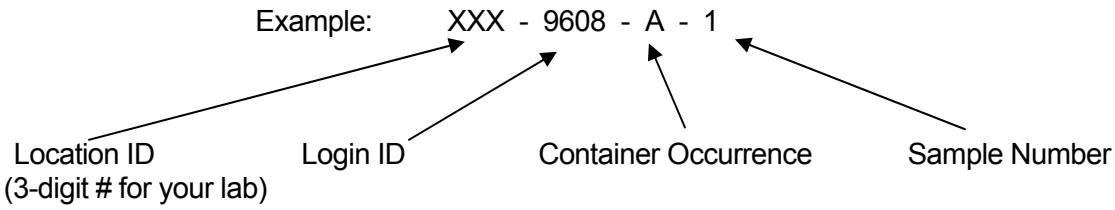
23.2.1 Laboratory Receipt

When samples arrive at the laboratory, sample receiving personnel inspect the coolers and samples. The integrity of each sample must be determined by comparing sample labels or tags with the COC and by visual checks of the container for possible damage. Any non-conformance, irregularity, or compromised sample receipt must be documented in an NCM or the login Checklist in LIMS and brought to the immediate attention of the client. The COC, shipping documents, documentation of any non-conformance, irregularity, or compromised sample receipt, record of client contact, and resulting instructions become part of the project record.

23.2.1.1 Unique Sample Identification

All samples that are processed through the laboratory receive a unique sample identification to ensure that there can be no confusion regarding the identity of such samples at anytime. This system includes identification for all samples, subsamples and subsequent extracts and/or digestates.

The laboratory assigns a unique identification (e.g., Sample ID) code to each sample container received at the laboratory. This Primary ID is made up of the following information (consisting of 4 components):



The above example states that TestAmerica <location> Laboratory (Location XXX). Login ID is 9608 (unique to a particular client/job occurrence). The container code indicates it is the first container ("A") of Sample #1.

If the primary container goes through a prep step that creates a "new" container, then the new container is considered secondary and gets another ID. An example of this being a client sample in a 1-Liter amber bottle is sent through a Liquid/Liquid Extraction and an extraction vial is created from this step. The vial would be a SECONDARY container. The secondary ID has 5 components.

Example: XXX - 9608 - A - 1 - **A** ←——— **Secondary Container Occurrence**

Example: 220-9608-A-1-A, would indicate the PRIMARY container listed above that went through a step that created the 1st occurrence of a Secondary container.

With this system, a client sample can literally be tracked throughout the laboratory in every step from receipt to disposal.

23.3 SAMPLE ACCEPTANCE POLICY

The laboratory has a written sample acceptance policy (Figure 23-2) that clearly outlines the circumstances under which samples shall be accepted or rejected. These include:

- a COC filled out completely;
- samples must be properly labeled;
- proper sample containers with adequate volume for the analysis (Sampling Guide) and necessary QC;
- samples must be preserved according to the requirements of the requested analytical method (Sampling Guide);
- sample holding times must be adhered to (Sampling Guide);
- the project manager will be notified if any sample is received in damaged condition.

Data from samples which do not meet these criteria are flagged and the nature of the variation from policy is defined. A copy of the sample acceptance policy is provided to each client prior to shipment of samples.

23.3.1.1 After inspecting the samples, the sample receiving personnel sign and date the COC form, make any necessary notes of the samples' conditions and store them in appropriate refrigerators or storage locations.

23.3.1.2 Any deviations from these checks that question the suitability of the sample for analysis, or incomplete documentation as to the tests required will be resolved by consultation with the client. If the sample acceptance policy criteria are not met, the laboratory shall either:

- Retain all correspondence and/or records of communications with the client regarding the disposition of rejected samples, or

- Fully document any decision to proceed with sample analysis that does not meet sample acceptance criteria.

Once sample acceptance is verified, the samples are logged into the LIMS according SOP TA-QA-0001 Sample Receiving and Login.

23.4 SAMPLE STORAGE

In order to avoid deterioration, contamination or damage to a sample during storage and handling, from the time of receipt until all analyses are complete, samples are stored in refrigerators suitable for the sample matrix. *Aqueous samples for metals testing are typically stored at ambient temperature*. In addition, samples to be analyzed for volatile organic parameters are stored in separate refrigerators designated for volatile organic parameters only. Samples are never to be stored with reagents, standards or materials that may create contamination.

To ensure the integrity of the samples during storage, refrigerator blanks are maintained in the volatile sample refrigerators and analyzed every two weeks. The refrigerator blanks are logged into the LIMS and treated as normal samples with the data stored and archived in the LIMS.

Analysts and technicians retrieve the sample container allocated to their analysis from the designated refrigerator and place them on carts, analyze the sample, and return the remaining sample or empty container to the refrigerator from which it originally came. Empty containers are placed in the sample archive area. All unused portions of samples are returned to the secure sample control area. All samples are kept in the refrigerators for two to four weeks after analysis, which meets or exceeds most sample holding times. After two to four weeks the samples are moved to dry room temperature, sample archive area where they are stored for an additional four weeks before they are disposed of. This eight week holding period allows samples to be checked if a discrepancy or question arises. Special arrangements may be made to store samples for longer periods of time. This extended holding period allows additional metal analyses to be performed on the archived sample and assists clients in dealing with legal matters or regulatory issues.

Access to the laboratory is controlled such that sample storage need not be locked at all times unless a project specifically demands it. Samples are accessible to laboratory personnel only. Visitors to the laboratory are prohibited from entering the refrigerator and laboratory areas unless accompanied by an employee of TestAmerica.

23.5 FOREIGN SOILS

To minimize exposure to personnel and to avoid potential accidents, foreign soil samples are stored in a designated, segregated area. Foreign soil samples are placed in boxes specifically labeled “Foreign Soil” and place on shelves in the walk-in cooler designated for foreign soils. Foreign soil samples are sent out for incineration by a USDA-approved waste disposal facility.

23.6 SAMPLE SHIPPING

In the event that the laboratory needs to ship samples, the samples are placed in a cooler with enough ice to ensure the samples remain just above freezing and at or below 6.0°C during

transit. The samples are carefully surrounded by packing material to avoid breakage (yet maintain appropriate temperature). A trip blank is enclosed for those samples requiring water/solid volatile organic analyses (see Note). The chain-of-custody form is signed by the sample control technician and attached to the shipping paperwork. Samples are generally shipped overnight express or hand-delivered by a TestAmerica courier to maintain sample integrity. All personnel involved with shipping and receiving samples must be trained to maintain the proper chain-of-custody documentation and to keep the samples intact and on ice. The Environmental, Health and Safety Manual contains additional shipping requirements.

Note: If a client does not request trip blank analysis on the COC or other paperwork, the laboratory will not analyze the trip blanks that were supplied. However, in the interest of good client service, the laboratory will advise the client at the time of sample receipt that it was noted that they did not request analysis of the trip blank; and that the laboratory is providing the notification to verify that they are not inadvertently omitting a key part of regulatory compliance testing.

23.7 SAMPLE DISPOSAL

Samples should be retained for a minimum of 30 days after the project report is sent, however, provisions may be made for earlier disposal of samples once the holding time is exceeded. Some samples are required to be held for longer periods based on regulatory or client requirements (e.g., 60 days after project report is sent). The laboratory must follow the longer sample retention requirements where required by regulation or client agreement. Several possibilities for sample disposal exist: the sample may be consumed completely during analysis, the sample may be returned to the customer or location of sampling for disposal, or the sample may be disposed of in accordance with the laboratory's waste disposal procedures (SOP: TA-EHS-0036. All procedures in the laboratory Environmental, Health and Safety Manual are followed during disposal. Samples are normally maintained in the laboratory no longer than ninety days from receipt unless otherwise requested. Unused portions of samples found or suspected to be hazardous according to state or federal guidelines may be returned to the client upon completion of the analytical work.

If a sample is part of a known litigation, the affected legal authority, sample data user, and/or submitter of the sample must participate in the decision about the sample's disposal. All documentation and correspondence concerning the disposal decision process must be kept on file. Pertinent information includes the date of disposal, nature of disposal (such as sample depletion, hazardous waste facility disposal, return to client), names of individuals who conducted the arrangements and physically completed the task. The laboratory will remove or deface sample labels prior to disposal unless this is accomplished through the disposal method (e.g., samples are incinerated). A Waste Disposal Record should be completed.

Figure 23-1.

Example: Chain of Custody (COC)

[redacted]

Chain of Custody Record

Temperature on Receipt _____

Drinking Water? Yes ☐ No ☐

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TAL-4124 (1007)

Client	Project Manager	Date	Chain of Custody Numbe 05178
Address	Telephone Number (Area Code)/Fax Number	Lab Number	Page _____ o
City / State / Zip Code	Site Contact / Lab Contact	Analysis (Attach list if more space is needed)	
Project Name and Location (State)	Carrier/Waybill Number		Special Instr Conditions of
Contract/Purchase Order/Quote No.	Matrix / Containers & Preservatives		

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Air	Aqueous	Sod.	Soil	Unpres.	H2SO4	HNO3	HCl	NaOH	ZnAc/ NaOH												

Possible Hazard Identification
☐ *Non-Hazard* ☐ *Flammable* ☐ *Skin Irritant* ☐ *Poison B* ☐ *Unknown*

Sample Disposal
☐ *Return To Client* ☐ *Disposal By Lab* ☐ *Archive For* _____ *Months* *(A fee may be assessed if samples are retain longer than 1 month)*

Turn Around Time Required
☐ *24 Hours* ☐ *48 Hours* ☐ *7 Days* ☐ *14 Days* ☐ *21 Days* ☐ *Other*_____

QC Requirements (Specify)

	Date	Time		Date	Time
1. Relinquished By			*1. Received By*		
2. Relinquished By			*2. Received By*		
3. Relinquished By			*3. Received By*		

Comments

DISTRIBUTION: *WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy*

104459

GBS

Figure 23-2

Example: Sample Acceptance Policy

All incoming work will be evaluated against the criteria listed below. Where applicable, data from any samples that do not meet the criteria listed below will be noted on the laboratory report defining the nature and substance of the variation. In addition the client will be notified either by telephone, fax or e-mail ASAP after the receipt of the samples.

1) Samples must arrive with labels intact with a Chain of Custody filled out completely. The following information must be recorded.
   - *Client name, address, phone number and fax number (if available)*
   - *Project name and/or number*
   - *The sample identification*
   - *Date, time and location of sampling*
   - *The collectors name*
   - *The matrix description*
   - *The container description*
   - *The total number of each type of container*
   - *Preservatives used*
   - *Analysis requested*
   - *Requested turnaround time (TAT)*
   - *Any special instructions*
   - *Purchase Order number or billing information (e.g. quote number) if available*
   - *The date and time that each person received or relinquished the sample(s), including their signed name.*
   - **Information must be legible**

2) Samples must be properly labeled.
   - Use durable labels (labels provided by TestAmerica are preferred)
   - Include a unique identification number
   - Include sampling date and time & sampler ID
   - Include preservative used.
   - Use indelible ink
   - **Information must be legible**

3) Proper sample containers with adequate volume for the analysis and necessary QC are required for each analysis requested. See Lab Sampling Guide.

4) Samples must be preserved according to the requirements of the requested analytical method (See Sampling Guide**.**
5) Most analytical methods require chilling samples to 4° C (other than water samples for metals analysis). For these methods, the criteria are met if the samples are chilled to below 6° C and above freezing (0°C). For methods with other temperature criteria (e.g. some bacteriological methods require $\leq$ 10 ^{o}C), the samples must arrive within $\pm$ 2° C of the required temperature or within the method specified range. **Note:** Samples that are hand delivered to the laboratory immediately after collection may not have had time to cool sufficiently. In this case the samples will be considered acceptable as long as there is evidence that the chilling process has begun (arrival on ice).

- Chemical preservation (pH) will be verified prior to analysis and the project manager will be notified immediately if there is a discrepancy. If analyses will still be performed, all affected results will be flagged to indicate improper preservation.

- For Volatile Organic analyses in drinking water (Methods 502.2 or 524.2). Residual chlorine must be neutralized prior to preservation. If there is prior knowledge that the samples are not chlorinated, state it on the COC and use the VOA vials pre-preserved with HCl. The following are other options for a sampler and laboratory where the presence of chlorine is not known:
  - 1. Test for residual chlorine in the field prior to sampling.
    - If no chlorine is present, the samples are to be preserved using HCl as usual.
    - If chlorine is present, add either ascorbic acid or sodium thiosulfate prior to adding HCl.
  - 2. Use VOA vials pre-preserved with sodium thiosulfate or ascorbic acid and add HCl after filling the VOA vial with the sample.
- **FOR WATER SAMPLES TESTED FOR CYANIDE (by Standard Methods or EPA 335)**
  - In the Field: Samples are to be tested for Sulfide using lead acetate paper prior to the addition of Sodium Hydroxide (NaOH). If sulfide is present, the sample must be treated with Cadmium Chloride and filtered prior to the addition of NaOH.

    - If the sulfide test and treatment is not performed in the field, the lab will test the samples for sulfide using lead acetate paper at the time of receipt and if sulfide is present in the sample, the client will be notified and given the option of retaking the sample and treating in the field per the method requirements or the laboratory can analyze the samples as delivered and qualify the results in the final report.

  - It is the responsibility of the client to notify the laboratory if thiosulfate, sulfite, or thiocyanate are known or suspected to be present in the sample. This notification may be on the chain of custody. The samples may need to be subcontracted to a laboratory that performs a UV digestion. If the lab does not perform the UV digestion on samples that contain these compounds, the results must be qualified in the final report.

  - The laboratory must test the sample for oxidizing agents (e.g. Chlorine) prior to analysis and treat according to the methods prior to distillation. (ascorbic acid or sodium arsenite are the preferred choice).

6) Sample Holding Times
   - TestAmerica will make every effort to analyze samples within the regulatory holding time. Samples must be received in the laboratory with enough time to perform the sample analysis. Except for short holding time samples (< 48hr HT) sample must be received with at least 48 hrs (working days) remaining on the holding time for us to ensure analysis.

   - Analyses that are designated as “field” analyses (Odor, pH, Dissolved Oxygen, Disinfectant Residual; a.k.a. Residual Chlorine, and Redox Potential) should be analyzed ASAP by the field sampler prior to delivering to the lab (within 15 minutes). However, if the analyses are to be performed in the laboratory, TestAmerica will make every effort to analyze the samples within 24 hours from receipt of the samples in the testing laboratory. Samples for “field” analyses received after 4:00 pm on Friday or on the weekend will be analyzed no later than the next business day after receipt (Monday unless a holiday). Samples will remain refrigerated and sealed until the time of analysis. The actual times of all “field” sample analyses are noted on the “Short Hold Time Detail Report” in the final report. Samples analyzed in the laboratory will be qualified on the final report with an ‘H’ to indicate holding time exceedance.

7) All samples submitted for Volatile Organic analyses must have a Trip Blank submitted at the same time. TestAmerica will supply a blank with the bottle order.

8) The project manager will be notified if any sample is received in damaged condition. TestAmerica will request that a sample be resubmitted for analysis.

9) Recommendations for packing samples for shipment.

   - Pack samples in Ice rather than “Blue” ice packs.
   - Soil samples should be placed in plastic zip-lock bags. The containers often have dirt around the top and do not seal very well and are prone to intrusion from the water from melted ice.
   - Water samples would be best if wrapped with bubble-wrap or paper (newspaper, or paper towels work) and then placed in plastic zip-lock bags.
   - Fill extra cooler space with bubble wrap.

Figure 23-3.

Example: Login Sample Receipt Check List

Login Sample Receipt Check List

Client: TestAmerica Analytical Testing Corp. Job Number: 580-8526-1

Login Number: 8526 **List Source: TestAmerica Tacoma**
Creator: Moon, Joseph
List Number: 1

Question	T / F/ NA	Comment
Radioactivity either was not measured or, if measured, is at or below background	True	
The cooler's custody seal, if present, is intact.	True	
The cooler or samples do not appear to have been compromised or tampered with.	True	
Samples were received on ice.	True	
Cooler Temperature is acceptable.	True	
Cooler Temperature is recorded.	True	
COC is present.	True	
COC is filled out in ink and legible.	True	
COC is filled out with all pertinent information.	True	
There are no discrepancies between the sample IDs on the containers and the COC.	True	
Samples are received within Holding Time.	True	
Sample containers have legible labels.	True	
Containers are not broken or leaking.	True	
Sample collection date/times are provided.	True	
Appropriate sample containers are used.	True	
Sample bottles are completely filled.	True	
There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs	True	
VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.	True	
If necessary, staff have been informed of any short hold time or quick TAT Needs	True	
Multiphasic samples are not present.	True	
Samples do not require splitting or compositing.	True	

SECTION 24

ASSURING THE QUALITY OF TEST RESULTS *(NELAC 5.5.9)*

24.1 OVERVIEW

In order to assure our clients of the validity of their data, the laboratory continuously evaluates the quality of the analytical process. The analytical process is controlled not only by instrument calibration as discussed in Section 20, but also by routine process quality control measurements (e.g. Blanks, Laboratory Control Samples (LCS), Matrix Spikes (MS), duplicates (DUP), surrogates, Internal Standards (IS)). These quality control checks are performed as required by the method or regulations to assess precision and accuracy. In addition to the routine process quality control samples, Proficiency Testing (PT) Samples (concentrations unknown to laboratory) are analyzed to help ensure laboratory performance.

24.2 CONTROLS

Sample preparation or pre-treatment is commonly required before analysis. Typical preparation steps include homogenization, solvent extraction, sonication, acid digestion, distillation, reflux, evaporation, drying and ashing. During these pre-treatment steps, samples are arranged into discreet manageable groups referred to as preparation (prep) batches. Prep batches provide a means to control variability in sample treatment. Control samples are added to each prep batch to monitor method performance and are processed through the entire analytical procedure with investigative/field samples.

24.3 NEGATIVE CONTROLS

Table 24-1. Sample Negative Controls

Control Type	Details
Method Blank (MB)	are used to assess preparation and analysis for possible contamination during the preparation and processing steps.
	The specific frequency of use for method blanks during the analytical sequence is defined in the specific standard operating procedure for each analysis. Generally it is 1 for each batch of samples; not to exceed 20 environmental samples.
	The method blank is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (e.g., Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The method blank goes through all of the steps of the process (including as necessary: filtration, clean-ups, etc.).
Calibration Blanks	are prepared and analyzed along with calibration standards where applicable. They are prepared using the same reagents that are used to prepare the standards. In some analyses the calibration blank may be included in the calibration curve.
Instrument Blanks	are blank reagents or reagent water that may be processed during an analytical sequence in order to assess contamination in the analytical system. In general, instrument blanks are used to differentiate between contamination caused by the analytical system and that caused by the sample handling or sample prep process. Instrument blanks may also be inserted throughout the analytical sequence to minimize the effect of carryover from samples with high analyte content.

Table 24-1. Sample Negative Controls

Control Type	Details
Trip Blank [1]	are required to be submitted by the client with each shipment of samples requiring aqueous and solid volatiles analyses. Additionally, trip blanks may be prepared and analyzed for volatile analysis of air samples, when required by the client. A trip blank may be purchased (certified clean) or is prepared by the laboratory by filling a clean container with pure deionized water that has been purged to remove any volatile compounds. Appropriate preservatives are also added to the container. The trip blank is sent with the bottle order and is intended to reflect the environment that the containers are subjected to throughout shipping and handling and help identify possible sources if contamination is found. The field sampler returns the trip blank in the cooler with the field samples.
Field Blanks [1]	are sometimes used for specific projects by the field samplers. A field blank prepared in the field by filling a clean container with pure reagent water and appropriate preservative, if any, for the specific sampling activity being undertaken. (EPA OSWER)
Equipment Blanks [1]	are also sometimes created in the field for specific projects. An equipment blank is a sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (NELAC)
Holding Blanks	also referred to as refrigerator or freezer blanks, are used to monitor the sample storage units for volatile organic compounds during the storage of VOA samples in the laboratory

[1] When known, these field QC samples should not be selected for matrix QC as it does not provide information on the behavior of the target compounds in the field samples. Usually, the client sample ID will provide information to identify the field blanks with labels such as "FB", "EB", or "TB."

Evaluation criteria and corrective action for these controls are defined in the specific standard operating procedure for each analysis.

24.4 POSITIVE CONTROLS

Control samples (e.g., QC indicators) are analyzed with each batch of samples to evaluate data based upon (1) Method Performance (Laboratory Control Sample (LCS) or Blank Spike (BS)), which entails both the preparation and measurement steps; and (2) Matrix Effects (Matrix Spike (MS) or Sample Duplicate (MD, DUP), which evaluates field sampling accuracy, precision, representativeness, interferences, and the effect of the matrix on the method performed. Each regulatory program and each method within those programs specify the control samples that are prepared and/or analyzed with a specific batch.

Note that frequency of control samples vary with specific regulatory, methodology and project specific criteria. Complete details on method control samples are as listed in each analytical SOP.

24.4.1 Method Performance Control - Laboratory Control Sample (LCS)

24.4.1.1 The LCS measures the accuracy of the method in a blank matrix and assesses method performance independent of potential field sample matrix affects in a laboratory batch.

24.4.1.2 The LCS is prepared from a clean matrix similar to that of the associated samples that is free from target analytes (for example: Reagent water, Ottawa sand, glass beads, etc.) and is processed along with and under the same conditions as the associated samples. The LCS is spiked with verified known amounts of analytes or is made of a material containing known and verified amounts of analytes, taken through

all preparation and analysis steps along with the field samples. Where there is no preparation taken for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), a calibration verification standard is reported as the LCS. In some instances where there is no practical clean solid matrix available, aqueous LCS's may be processed for solid matrices; final results may be calculated as mg/kg or ug/kg, assuming 100% solids and a weight equivalent to the aliquot used for the corresponding field samples, to facilitate comparison with the field samples.

24.4.1.3 Certified pre-made reference material purchased from a NIST/A2LA accredited vendor may also be used for the LCS when the material represents the sample matrix or the analyte is not easily spiked (e.g. solid matrix LCS for metals, TDS, etc.).

24.4.1.4 The specific frequency of use for LCS during the analytical sequence is defined in the specific standard operating procedure for each analysis. It is generally 1 for each batch of samples; not to exceed 20 environmental samples.

24.4.1.5 If the mandated or requested test method, or project requirements, do not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample (and Matrix Spike) where applicable (e.g. no spike of pH). However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, at a minimum, a representative number of the listed components (see below) shall be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses, permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.

24.4.1.5.1 For methods that have 1-10 target analytes, spike all components.

24.4.1.5.2 For methods that include 11-20 target analytes, spike at least 10 or 80%, whichever is greater.

24.4.1.5.3 For methods with more than 20 target analytes, spike at least 16 components.

24.4.1.5.4 Exception: Due to analyte incompatibility in pesticides, Toxaphene and Chlordane are only spiked at client request based on specific project needs.

24.4.1.5.5 Exception: Due to analyte incompatibility between the various PCB aroclors, aroclors 1016 and 1260 are used for spiking as they cover the range of all of the aroclors. Specific aroclors may be used by request on a project specific basis.

24.5 SAMPLE MATRIX CONTROLS

Table 24-2. Sample Matrix Control

Control Type	Details	
Matrix Spikes (MS)	Use	used to assess the effect sample matrix of the spiked sample has on the precision and accuracy of the results generated by the method used;
	Typical Frequency [1]	At a minimum, with each matrix-specific batch of samples processed, an MS is carried through the complete analytical procedure. Unless specified by the client, samples used for spiking are randomly selected and rotated between different client projects.If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. Refer to the method SOP for complete details
	Description	essentially a sample fortified with a known amount of the test analyte(s).
Surrogate	Use	Measures method performance to sample matrix (organics only).
	Typical Frequency [1]	Are added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available. The recovery of the surrogates is compared to the acceptance limits for the specific method. Poor surrogate recovery may indicate a problem with sample composition and shall be reported, with data qualifiers, to the client whose sample produced poor recovery.
	Description	Are similar to matrix spikes except the analytes are compounds with properties that mimic the analyte of interest and are unlikely to be found in environment samples.
Duplicates[2]	Use	For a measure of analytical precision, with each matrix-specific batch of samples processed, a matrix duplicate (MD or DUP) sample, matrix spike duplicate (MSD), or LCS duplicate (LCSD) is carried through the complete analytical procedure.
	Typical Frequency [1]	Duplicate samples are usually analyzed with methods that do not require matrix spike analysis.
	Description	Performed by analyzing two aliquots of the same field sample independently or an additional LCS.
Internal Standards	Use	Are spiked into all environmental and quality control samples (including the initial calibration standards) to monitor the qualitative aspect of organic and some inorganic analytical measurements.
	Typical Frequency [1]	All organic and ICP methods as required by the analytical method.
	Description	Used to correct for matrix effects and to help troubleshoot variability in analytical response and are assessed after data acquisition. Possible sources of poor internal standard response are sample matrix, poor analytical technique or instrument performance.

[1] See the specific analytical SOP for type and frequency of sample matrix control samples.

[2] LCSD's are normally not performed except when regulatory agencies or client specifications require them. The recoveries for the spiked duplicate samples must meet the same laboratory established recovery limits as the accuracy QC samples. If an LCSD is analyzed both the LCS and LCSD must meet the same recovery criteria and be included in the final report. The precision measurement is reported as "Relative Percent Difference" (RPD). Poor precision between duplicates (except LCS/LCSD) may indicate non-homogeneous matrix or sampling.

24.6 ACCEPTANCE CRITERIA (CONTROL LIMITS)

24.6.1 As mandated by the test method and regulation, each individual analyte in the LCS, MS, or Surrogate Spike is evaluated against the control limits published in the test method. Where there are no established acceptance criteria, the laboratory calculates in-house control limits with the use of control charts or, in some cases, utilizes client project specific control limits. When this occurs, the regulatory or project limits will supersede the laboratory's in-house limits.

Note: For methods, analytes and matrices with very limited data (e.g., unusual matrices not analyzed often), interim limits are established using available data or by analogy to similar methods or matrices.

24.6.2 Once control limits have been established, they are verified, reviewed, and updated if necessary on an annual basis unless the method requires more frequent updating. Control limits are established per method (as opposed to per instrument) regardless of the number of instruments utilized.

24.6.3 Laboratory generated % Recovery acceptance (control) limits are generally established by taking ± 3 Standard Deviations (99% confidence level) from the average recovery of a minimum of 20-30 data points (more points are preferred).

24.6.3.1 Regardless of the calculated limit, the limit should be no tighter than the Calibration Verification (ICV/CCV). (Unless the analytical method specifies a tighter limit).

24.6.3.2 In-house limits cannot be any wider than those mandated in a regulated analytical method. Client or contract required control limits are evaluated against the laboratory's statistically derived control limits to determine if the data quality objectives (DQOs) can be achieved. If laboratory control limits are not consistent with DQOs, then alternatives must be considered, such as method improvements or use of an alternate analytical method.

24.6.3.3 The lowest acceptable recovery limit will be 10% (the analyte must be detectable and identifiable). Exception: The lowest acceptable recovery limit for Benzidine will be 5% and the analyte must be detectable and identifiable.

24.6.3.4 The maximum acceptable recovery limit will be 185%.

24.6.3.5 The maximum acceptable RPD limit will be 35% for waters and 40% for soils. The minimum RPD limit is 10%.

24.6.3.6 If either the high or low end of the control limit changes by ≤ 5% from previous, the control chart is visually inspected and, using professional judgment, they may be left unchanged if there is no affect on laboratory ability to meet the existing limits.

24.6.4 The lab must be able to generate a current listing of their control limits and track when the updates are performed. In addition, the laboratory must be able to recreate historical control limits. See SOP TA-QA-0600 Quality Control Charting and Establishing Warning and Action Limits.

24.6.4.1 One example: The QA department generates a Quality Control Limit Summary that contains tables that summarize the precision and accuracy acceptability limits for analyses performed at TestAmerica Seattle. This summary includes an effective date, is updated each time new limits are generated and is located in LIMS. Unless otherwise noted, limits within these tables are laboratory generated. The analysts are instructed to use the current limits in the laboratory (dated and approved by the Technical Director and QA Manager) and entered into the Laboratory Information

Management System (LIMS). The Quality Assurance department maintains an archive of all limits used within the laboratory.

24.6.5 A LCS that is within the acceptance criteria establishes that the analytical system is in control and is used to validate the process. Samples that are analyzed with an LCS with recoveries outside of the acceptance limits may be determined as out of control and should be reanalyzed if possible. If reanalysis is not possible, then the results for all affected analytes for samples within the same batch must be qualified when reported. The internal corrective action process (see Section 12) is also initiated if an LCS exceeds the acceptance limits. Sample results may be qualified and reported without reanalysis if:

24.6.5.1 The analyte results are below the reporting limit and the LCS is above the upper control limit.

24.6.5.2 If the analytical results are above the relevant regulatory limit and the LCS is below the lower control limit.

24.6.5.3 Or, for NELAC and Departement Of Defense (DOD) work, there are an allowable number of Marginal Exceedances (ME):

- <11 analytes – 0 marginal exceedances are allowed.
- 11 – 30 Analytes – 1 marginal exceedance is allowed
- 31-50 Analytes – 2 marginal exceedances are allowed
- 51-70 Analytes – 3 marginal exceedances are allowed
- 71-90 Analytes – 4 marginal exceedances are allowed
- > 90 Analytes – 5 marginal exceedances are allowed

24.6.5.3.1 Marginal exceedances are recovery exceedances between 3 SD and 4 SD from the mean recovery limit (NELAC).

24.6.5.3.2 Marginal exceedances must be random. If the same analyte exceeds the LCS control limit repeatedly, it is an indication of a systematic problem. The source of the error must be located and corrective action taken. The laboratory has a system to monitor marginal exceedances to ensure that they are random.

24.6.5.3.3 Though marginal excedences may be allowed, the data must still be qualified to indicate it is outside of the normal limits.

24.6.6 If the MS/MSDs do not meet acceptance limits, the MS/MSD and the associated spiked sample is reported with a qualifier for those analytes that do not meet limits. If obvious preparation errors are suspected, or if requested by the client, unacceptable MS/MSDs are reprocessed and reanalyzed to prove matrix interference. A more detailed discussion of acceptance criteria and corrective action can be found in the lab's method SOPs and in Section 12.

24.6.7 If a surrogate standard falls outside the acceptance limits, if there is not obvious chromatographic matrix interference, reanalyze the sample to confirm a possible matrix effect. If the recoveries confirm or there was obvious chromatographic interference, results are reported from the original analysis and a qualifier is added. If the reanalysis meets surrogate

recovery criteria, the second run is reported (or both are reported if requested by the client). Under certain circumstances, where all of the samples are from the same location and share similar chromatography, the reanalysis may be performed on a single sample rather than all of the samples and if the surrogate meets the recovery criteria in the reanalysis, all of the affected samples would require reanalysis.

24.7 ADDITIONAL PROCEDURES TO ASSURE QUALITY CONTROL

24.7.1 The laboratory has written and approved method SOPs to assure the accuracy of the test method including calibration (see Section 20), use of certified reference materials (see Section 21) and use of PT samples (see Section 15).

24.7.2 A discussion regarding MDLs, Limit of Detection (LOD) and Limit of Quantitation (LOQ) can be found in Section 19.

24.7.3 Use of formulae to reduce data is discussed in the method SOPs and in Section 20.

24.7.4 Selection of appropriate reagents and standards is included in Section 9 and 21.

24.7.5 A discussion on selectivity of the test is included in Section 5.

24.7.6 Constant and consistent test conditions are discussed in Section 18.

24.7.7 The laboratories sample acceptance policy is included in Section 23.

SECTION 25

REPORTING RESULTS *(NELAC 5.5.10)*

25.1 OVERVIEW

The results of each test are reported accurately, clearly, unambiguously, and objectively in accordance with State and Federal regulations as well as client requirements. Analytical results are issued in a format that is intended to satisfy customer and laboratory accreditation requirements as well as provide the end user with the information needed to properly evaluate the results. Where there is conflict between client requests and laboratory ethics or regulatory requirements, the laboratory's ethical and legal requirements are paramount, and the laboratory will work with the client during project set up to develop an acceptable solution. Refer to Section 7.

A variety of report formats are available to meet specific needs.

In cases where a client asks for simplified reports, there must be a written request from the client. There still must be enough information that would show any analyses that were out of conformance (QC out of limits) and there should be a reference to a full report that is made available to the client.

Review of reported data is included in Section 19.

25.2 TEST REPORTS

Analytical results are reported in a format that is satisfactory to the client and meets all requirements of applicable accrediting authorities and agencies. A variety of report formats are available to meet specific needs. The report is printed on laboratory letterhead, reviewed, and signed by the appropriate project manager. At a minimum, the standard laboratory report shall contain the following information:

25.2.1 A report title (e.g. Analytical Report).

25.2.2 The cover page of the report is printed on company letterhead, which includes the laboratory name, address and telephone number.

25.2.3 A unique identification of the report (e.g. job number) and on each page an identification in order to ensure the page is recognized as part of the report and a clear identification of the end.

Note: Page numbers of report are represented as page # of ##. Where the first number is the page number and the second is the total number of pages.

25.2.4 A copy of the chain of custody (COC).

- Any COCs involved with Subcontracting are included.
- In most cases, the applicable COC is paginated as an integral part of the report.

- Any additional addenda to the report are also paginated as an integral part of the report (eg. Sample Receiving Checklist).

25.2.5 The name and address of client and a project name/number, if applicable.

25.2.6 Client project manager or other contact

25.2.7 Description and unambiguous identification of the tested sample(s) including the client identification code.

25.2.8 Date of receipt of sample, date and time of collection, and date(s) of test preparation and performance, and time of preparation or analysis if the required holding time for either activity is less than or equal to 72 hours.

25.2.9 Date reported or date of revision, if applicable.

25.2.10 Method of analysis including method code (EPA, Standard Methods, etc).

25.2.11 Reporting limit.

25.2.12 Method detection limits (if requested)

25.2.13 Definition of Data qualifiers and reporting acronyms (e.g. ND).

25.2.14 Sample results.

25.2.15 QC data consisting of method blank, surrogate, LCS, and MS/MSD recoveries and control limits.

25.2.16 Condition of samples at receipt including temperature. This may be accomplished in a narrative or by attaching sample login sheets (Refer to Sec. 25.2.4 – Item 3 regarding additional addenda).

25.2.17 A statement to the effect that the results relate only to the items tested and the sample as received by the laboratory.

25.2.18 A statement that the report shall not be reproduced except in full, without prior express written approval by the laboratory coordinator.

25.2.19 A signature and title of the person(s) accepting responsibility for the content of the report and date of issue. Signatories are appointed by the Lab Director.

25.2.20 When NELAC accreditation is required, the lab certifies that the test results meet all requirements of NELAC or provide reasons and/or justification if they do not using the following statement: “The results included in this report have been reviewed for compliance with the laboratory QA/QC plan and meet all requirements of NELAC. All data have been found to be compliant with laboratory protocol, with the exception of any items noted.”

25.2.21 Where applicable, a narrative to the report that explains the issue(s) and corrective action(s) taken in the event that a specific accreditation or certification requirement was not met.

25.2.22 When soil samples are analyzed, a specific identification as to whether soils are reported on a "wet weight" or "dry weight" basis.

25.2.23 Appropriate laboratory certification number for the state of origin of the sample, if applicable.

25.2.24 If only part of the report is provided to the client (client requests some results before all of it is complete), it must be clearly indicated on the report (e.g., preliminary). A complete report must be sent once all of the work has been completed.

25.2.25 Any non-TestAmerica subcontracted analysis results are provided as a separate report on the official letterhead of the subcontractor. All TestAmerica subcontracting is clearly identified on the report as to which laboratory performed a specific analysis.

Note: Refer to the Corporate SOP on Electronic Reporting and Signature Policy (No. CA-I-P-002) for details on internally applying electronic signatures of approval.

25.2.26 REPORTING LEVEL OR REPORT TYPE

TestAmerica Seattle offers four levels of quality control reporting. Each level, in addition to its own specific requirements, contains all the information provided in the preceding level. The packages provide the following information in addition to the information described above:

- Level I is a report with the features described in Section 25.2 above except Section 25.2.15.
- Level II is a Level I report plus QC data consisting of method blank, surrogate, LCS, and client specific MS/MSD recoveries and control limits, and the RPD values for all MSD and sample duplicate analyses.
- Level III contains all the information supplied in Level II with the chromatograms for all client samples.
- Level IV is the same as Level III with the addition of all raw supporting data.

In addition to the various levels of QC packaging, the laboratory also provides reports in diskette deliverable form. Initial reports may be provided to clients by facsimile. All faxed reports are followed by hardcopy. Procedures used to ensure client confidentiality are outlined in Section 25.6.

25.2.27 Electronic Data Deliverables (EDDs)

EDDs are routinely offered as part of TestAmerica's services. TestAmerica Seattle offers a variety of EDD formats including Environmental Restoration Information Management System (ERPIMS), Staged Electronic Data Deliverable (SEDD) Environmental Quality Information System (EQuIS), Electronic Deliverable Format (EDF), Excel, and custom files.

EDD specifications are submitted to the IT department by the PM for review and undergo the contract review process. Once the facility has committed to providing data in a specific

electronic format, the coding of the format may need to be performed. This coding is documented and validated. The validation of the code is retained by the IT staff coding the EDD.

EDDs shall be subject to a review to ensure their accuracy and completeness. If EDD generation is automated, review may be reduced to periodic screening if the laboratory can demonstrate that it can routinely generate that EDD without errors. Any revisions to the EDD format must be reviewed until it is demonstrated that it can routinely be generated without errors. If the EDD can be reproduced accurately and if all subsequent EDDs can be produced error-free, each EDD does not necessarily require a review.

25.3 SUPPLEMENTAL INFORMATION FOR TEST

The lab identifies any unacceptable QC analyses or any other unusual circumstances or observations such as environmental conditions and any non-standard conditions that may have affected the quality of a result. This is typically in the form of a footnote or a qualifier and/or a narrative explaining the discrepancy in the front of the report.

25.3.1 Numeric results with values outside of the calibration range, either high or low are qualified as 'estimated'.

25.3.2 Where quality system requirements are not met, a statement of compliance/non-compliance with requirements and/or specifications is required, including identification of test results derived from any sample that did not meet NELAC sample acceptance requirements such as improper container, holding time, or temperature.

25.3.3 Where applicable, a statement on the estimated uncertainty of measurements; information on uncertainty is needed when a client's instructions so require.

25.3.4 Opinions and Interpretations - The test report contains objective information, and generally does not contain subjective information such as opinions and interpretations. If such information is required by the client, the Laboratory Director will determine if a response can be prepared. If so, the Laboratory Director will designate the appropriate member of the management team to prepare a response. The response will be fully documented, and reviewed by the Laboratory Director, before release to the client. There may be additional fees charged to the client at this time, as this is a non-routine function of the laboratory.

Note: Review of data deliverable packages for submittal to regulatory authorities requires responses to non-conforming data concerning potential impact on data quality. This necessitates a limited scope of interpretation, and this work is performed by the QA Department. This is the only form of "interpretation" of data that is routinely performed by the laboratory.

When opinions or interpretations are included in the report, the laboratory provides an explanation as to the basis upon which the opinions and interpretations have been made. Opinions and interpretations are clearly noted as such and where applicable, a comment should be added suggesting that the client verify the opinion or interpretation with their regulator.

25.4 ENVIRONMENTAL TESTING OBTAINED FROM SUBCONTRACTORS

If the laboratory is not able to provide the client the requested analysis, the samples would be subcontracted following the procedures outlined in the Corporate SOP on Subcontracting (SOP # CA-L-S-002).

Data reported from analyses performed by a subcontractor laboratory are clearly identified as such on the analytical report provided to the client. Results from a subcontract laboratory outside of TestAmerica are reported to the client on the subcontract laboratory's original report stationary and the report includes any accompanying documentation.

25.5 CLIENT CONFIDENTIALITY

In situations involving the transmission of environmental test results by telephone, facsimile or other electronic means, client confidentiality must be maintained.

TestAmerica will not intentionally divulge to any person (other than the Client or any other person designated by the Client in writing) any information regarding the services provided by TestAmerica or any information disclosed to TestAmerica by the Client. Furthermore, information known to be potentially endangering to national security or an entity's proprietary rights will not be released.

Note: This shall not apply to the extent that the information is required to be disclosed by TestAmerica under the compulsion of legal process. TestAmerica will, to the extent feasible, provide reasonable notice to the client before disclosing the information.

Note: Authorized representatives of an accrediting authority are permitted to make copies of any analyses or records relevant to the accreditation process, and copies may be removed from the laboratory for purposes of assessment.

25.5.1 Report deliverable formats are discussed with each new client. If a client requests that reports be faxed or e-mailed, the reports are faxed with a cover sheet or e-mailed with the following note that includes a confidentiality statement similar to the following:

This report is issued solely for the use of the person or company to whom it is addressed. Any use, copying or disclosure other than by the intended recipient is unauthorized. If you have received this report in error, please notify the sender immediately at 253-922-2310 and destroy this report immediately.

25.6 FORMAT OF REPORTS

The format of reports is designed to accommodate each type of environmental test carried out and to minimize the possibility of misunderstanding or misuse.

25.7 AMENDMENTS TO TEST REPORTS

Corrections, additions, or deletions to reports are only made when justification arises through supplemental documentation. Justification is documented using the laboratory's corrective action system (refer to Section 12).

The revised report is retained on the Archive data server, as is the original report. The revised report is stored in the Archive data server under the sample number followed by the appropriate Revision number. The revised report will have the word “revised” or “amended” next to the date rather than the word “reported”.

When the report is re-issued, a notation of “Revision“ with the appropriate number is placed on the cover/signature page of the report or at the top of the narrative page with a brief explanation of reason for the re-issue and a reference back to the last final report generated. For Example: Report was revised on 11/3/08 to include toluene in sample NQA1504 per client’s request. This final report replaces the final report generated on 10/27/08 at 10:47am.

25.8 POLICIES ON CLIENT REQUESTS FOR AMENDMENTS

25.8.1 Policy on Data Omissions or Reporting Limit Increases

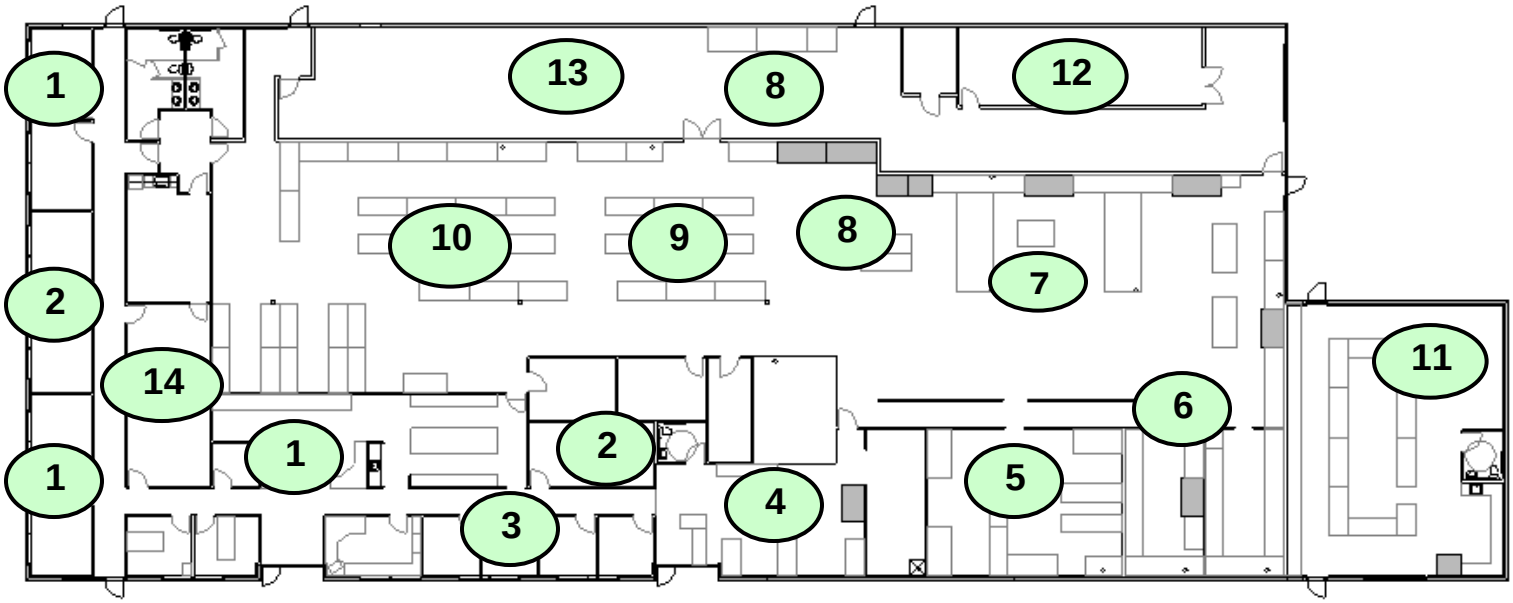
Fundamentally, our policy is simply to not omit previously reported results (including data qualifiers) or to not raise reporting limits and report sample results as ND. This policy has few exceptions. Exceptions are:

- Laboratory error.
- Sample identification is indeterminate (confusion between COC and sample labels).
- An incorrect analysis (not analyte) was requested (e.g., COC lists 8315 but client wanted 8310). A written request for the change is required.
- Incorrect limits reported based on regulatory requirements.
- The requested change has absolutely *no possible* impact on the interpretation of the analytical results and there is *no possibility* of the change being interpreted as misrepresentation by anyone inside or outside of our company.

25.8.2 Multiple Reports

TestAmerica does not issue multiple reports for the same job where there is different information on each report (this does not refer to copies of the same report) unless required to meet regulatory needs and approved by QA.

Appendix 1. Laboratory Floor Plan



Key Areas *

1. Admin/HR
2. QA Offices
3. Project Management
4. Sample Control
5. Metals & Mercury Lab
6. Wet / General Chem
7. Metals Prep
8. Organics Prep
9. GC-MS SVOA
10. GC SVOA / HPLC
11. GC & GC-MS VOA
12. Sample Disposal
13. GeoTech, Storage, Warehouse

Appendix 2. Glossary/Acronyms

Glossary:

Acceptance Criteria:
Specified limits placed on characteristics of an item, process, or service defined in requirement documents. (ASQC)

Accreditation:
The process by which an agency or organization evaluates and recognizes a laboratory as meeting certain predetermined qualifications or standards, thereby accrediting the laboratory. In the context of the National Environmental Laboratory Accreditation Program (NELAP), this process is a voluntary one. (NELAC)

Accrediting Authority:
The Territorial, State, or Federal Agency having responsibility and accountability for environmental laboratory accreditation and which grants accreditation (NELAC) [1.5.2.3]

Accuracy:
The degree of agreement between an observed value and an accepted reference value. Accuracy includes a combination of random error (precision) and systematic error (bias) components which are due to sampling and analytical operations; a data quality indicator. (QAMS)

Analyst:
The designated individual who performs the "hands-on" analytical methods and associated techniques and who is the one responsible for applying required laboratory practices and other pertinent quality controls to meet the required level of quality. (NELAC)

Assessment:
The evaluation process used to measure or establish the performance, effectiveness, and conformance of an organization and/or its systems to defined criteria (to the standards and requirements of NELAC). (NELAC)

Assessment Criteria:
The measures established by NELAC and applied in establishing the extent to which an applicant is in conformance with NELAC requirements. (NELAC)

Assessment Team:
The group of people authorized to perform the on-site inspection and proficiency testing data evaluation required to establish whether an applicant meets the criteria for NELAP accreditation. (NELAC)

Assessor:
One who performs on-site assessments of accrediting authorities and laboratories' capability and capacity for meeting NELAC requirements by examining the records and other physical evidence for each one of the tests for which accreditation has been requested. (NELAC)

Audit:
A systematic evaluation to determine the conformance to quantitative and qualitative specifications of some operational function or activity. (EPA-QAD)

Batch:
Environmental samples which are prepared and/or analyzed together with the same process and personnel, using the same lot(s) of reagents. A preparation batch is composed of one to 20 environmental samples of the same matrix, meeting the above mentioned criteria and with a maximum time between the start of processing of the first and last sample in the batch to be 24 hours. An analytical batch is composed of prepared environmental samples (extracts, digestates or concentrates) and /or those samples not requiring preparation, which are analyzed together as a group using the same calibration curve or factor. An analytical batch can include samples originating from various environmental matrices and can exceed 20 samples. (NELAC Quality Systems Committee)

Blank:
A sample that has not been exposed to the analyzed sample stream in order to monitor contamination during sampling, transport, storage or analysis. The blank is subjected to the usual analytical and measurement process to establish a zero baseline or background value and is sometimes used to adjust or correct routine analytical results. (ASQC)

Blind Sample:
A sample for analysis with a composition known to the submitter. The analyst/laboratory may know the identity of the sample but not its composition. It is used to test the analyst's or laboratory's proficiency in the execution of the measurement process.

Calibration:
To determine, by measurement or comparison with a standard, the correct value of each scale reading on a meter, instrument, or other device. The levels of the applied calibration standard should bracket the range of planned or expected sample measurements. (NELAC)

Calibration Curve:
The graphical relationship between the known values, such as concentrations, of a series of calibration standards and their instrument response. (NELAC)

Calibration Method:
A defined technical procedure for performing a calibration. (NELAC)

Calibration Standard:
A substance or reference material used to calibrate an instrument (QAMS)

Certified Reference Material (CRM):
A reference material one or more of whose property values are certified by a technically valid procedure, accompanied by or traceable to a certificate or other documentation which is issued by a certifying body. (ISO Guide 30–2.2)

Chain of Custody:
An unbroken trail of accountability that ensures the physical security of samples and includes the signatures of all who handle the samples. (NELAC) [5.12.4]

Clean Air Act:
The enabling legislation in 42 U>S>C> 7401 et seq., Public Law 91-604, 84 Stat. 1676 Pub. L. 95-95, 91 Stat., 685 and Pub. L. 95-190, 91 Stat., 1399, as amended, empowering EPA to promulgate air quality standards, monitor and enforce them. (NELAC)

Comprehensive Environmental Response, Compensation and Liability Act (CERCLA/SUPERFUND):
The enabling legislation in 42 U.S.C. 9601-9675 et seq., as amended by the Superfund Amendments and Reauthorization Act of 1986 (SARA), 42 U.S.C. 9601 et seq., to eliminate the health and environmental threats posed by hazardous waste sites. (NELAC)

Compromised Samples:
Those samples which are improperly sampled, insufficiently documented (chain of custody and other sample records and/or labels), improperly preserved, collected in improper containers, or exceeding holding times when delivered to a laboratory. Under normal conditions, compromised samples are not analyzed. If emergency situation require analysis, the results must be appropriately qualified. (NELAC)

Confidential Business Information (CBI):
Information that an organization designates as having the potential of providing a competitor with inappropriate insight into its management, operation or products. NELAC and its representatives agree to safeguarding identified CBI and to maintain all information identified as such in full confidentiality.

Confirmation:
Verification of the identity of a component through the use of an approach with a different scientific principle from the original method. These may include, but are not limited to:

Second column confirmation
Alternate wavelength
Derivatization
Mass spectral interpretation
Alternative detectors or
Additional Cleanup procedures
(NELAC)

Conformance:
An affirmative indication or judgement that a product or service has met the requirements of the relevant specifications, contract, or regulation; also the state of meeting the requirements. (ANSI/ASQC E4-1994)

Correction:
Actions necessary to correct or repair analysis specific non-conformances. The acceptance criteria for method specific QC and protocols as well as the associated corrective actions. The analyst will most frequently be the one to identify the need for this action as a result of calibration checks and QC sample analysis**.** No significant action is taken to change behavior, process or procedure.

Corrective Action:
The action taken to eliminate the causes of an existing nonconformity, defect or other undesirable situation in order to prevent recurrence. (ISO 8402)

Data Audit:
A qualitative and quantitative evaluation of the documentation and procedures associated with environmental measurements to verify that the resulting data re of acceptable quality (i.e., that they meet specified acceptance criteria). (NELAC)

Data Reduction:
The process of transforming raw data by arithmetic or statistical calculations, standard curves, concentration factors, etc., and collation into a more useable form. (EPA-QAD)

Deficiency:
An unauthorized deviation from acceptable procedures or practices, or a defect in an item. (ASQC)

Detection Limit:
The lowest concentration or amount of the target analyte that can be identified, measured, and reported with confidence that the analyte concentration is not a false positive value. See Method Detection Limit. (NELAC)

Document Control:
The act of ensuring that documents (and revisions thereto) are proposed, reviewed for accuracy, approved for release by authorized personnel, distributed properly, and controlled to ensure use of the correct version at the location where the prescribed activity if performed. (ASQC)

Duplicate Analyses:
The analyses or measurements of the variable of interest performed identically on two subsamples of the same sample. The results from duplicate analyses are used to evaluate analytical or measurement precision but not the precision of sampling, preservation or storage internal to the laboratory. (EPA-QAD)

Environmental Detection Limit (EDL):
The smallest level at which a radionuclide in an environmental medium can be unambiguously distinguished for a given confidence interval using a particular combination of sampling and measurement procedures, sample size, analytical detection limit, and processing procedure. The EDL shall be specified for the 0.95 or greater confidence interval. The EDL shall be established initially and verified annually for each test method and sample matrix. (NELAC Radioanalysis Subcommittee)

Equipment Blank:
Sample of analyte-free media which has been used to rinse common sampling equipment to check effectiveness of decontamination procedures. (NELAC)

External Standard Calibration:
Calibrations for methods that do not utilize internal standards to compensate for changes in instrument conditions.

Federal Insecticide, Fungicide and Rodenticide Act (FIFRA):
The enabling legislation under 7 U.S.C. 135 et seq., as amended, that empowers the EPA to register insecticides, fungicides, and rodenticides. (NELAC)

Federal Water Pollution Control Act (Clean Water Act, CWA):
The enabling legislation under 33 U.S.C. 1251 et seq., Public Law 92-50086 Stat 816, that empowers EPA to set discharge limitations, write discharge permits, monitor, and bring enforcement action for non-compliance. (NELAC)

Field Blank:
Blank prepared in the field by filing a clean container with pure de-ionized water and appropriate preservative, if any, for the specific sampling activity being undertaken (EPA OSWER)

Field of Testing:
NELAC's approach to accrediting laboratories by program, method and analyte. Laboratories requesting accreditation for a program-method-analyte combination or for an up-dated/improved method are required to submit to only that portion of the accreditation process not previously addressed (see NELAC, section 1.9ff). (NELAC)

Finding:
An assessment conclusion that identifies a condition having a significant effect on an item or activity. As assessment finding is normally a deficiency and is normally accompanied by specific examples of the observed condition. (NELAC)

Holding Times (Maximum Allowable Holding Times):
The maximum times that samples may be held prior to analyses and still be considered valid or not compromised. (40 CFR Part 136)

Inspection:
An activity such as measuring, examining, testing, or gauging one or more characteristics of an entity and comparing the results with specified requirements in order to establish whether conformance is achieved for each characteristic. (ANSI/ASQC E4-1994)

Internal Standard:
A known amount of standard added to a test portion of a sample and carried through the entire measurement process as a reference for evaluating and controlling the precision and bias of the applied analytical test method. (NELAC)

Internal Standard Calibration:
Calibrations for methods that utilize internal standards to compensate for changes in instrument conditions.

Instrument Blank:
A clean sample (e.g., distilled water) processed through the instrumental steps of the measurement process; used to determine instrument contamination. (EPA-QAD)

Instrument Response:
Instrument response is normally expressed as either peak area or peak height however it may also reflect a numerical representation of some type of count on a detector (e.g. Photomultiplier tube, or Diode array detector) and is used in this document to represent all types.

Laboratory:
A defined facility performing environmental analyses in a controlled and scientific manner. (NELAC)

Laboratory Control Sample (however named, such as laboratory fortified blank, spiked blank, or QC check sample):
A sample matrix, free from the analytes of interest, spiked with verified known amounts of analytes or a material containing known and verified amounts of analytes, taken through all preparation and analysis steps. Where there is no preparation taken for an analysis (such as in aqueous volatiles), or when all samples and standards undergo the same preparation and analysis process (such as Phosphorus), there is no LCS. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system.

An LCS shall be prepared at a minimum of 1 per batch of 20 or less samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The results of these samples shall be used to determine batch acceptance.

Note: NELAC standards allow a matrix spike to be used in place of this control as long as the acceptance criteria are as stringent as for the LCS. (NELAC)

Laboratory Duplicate:
Aliquots of a sample taken from the same container under laboratory conditions and processed and analyzed independently. (NELAC)

Least Squares Regression (1st Order Curve):
The least squares regression is a mathematical calculation of a straight line over two axes. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The regression calculation will generate a correlation coefficient (r) that is a measure of the "goodness of fit" of the regression line to the data. A value of 1.00 indicates a perfect fit.

In order to be used for quantitative purposes, r must be greater than or equal to 0.99 for organics and 0.995 for inorganics.

Limit of Detection (LOD):
An estimate of the minimum amount of a substance that an analytical process can reliably detect. An LOD is analyte- and matrix-specific and may be laboratory dependent. (Analytical Chemistry, 55, p.2217, December 1983, modified) See also Method Detection Limit.

Manager (however named):
The individual designed as being responsible for the overall operation, all personnel, and the physical plant of the environmental laboratory. A supervisor may report to the manager. In some cases, the supervisor and the manager may be the same individual. (NELAC)

Matrix:
The component or substrate that contains the analyte of interest. For purposes of batch and QC requirement determinations, the following matrix distinctions shall be used:

Aqueous: Any aqueous sample excluded from the definition of Drinking Water matrix or Saline/Estuarine source. Includes surface water, groundwater, effluents, and TCLP or other extracts.

Drinking Water: any aqueous sample that has been designated as a potable or potential potable water source.

Saline/Estuarine: any aqueous sample from an ocean or estuary, or other salt water source such as the Great Salt Lake.

Non-aqueous Liquid: any organic liquid with <15% settleable solids.

Biological Tissue: any sample of a biological origin such as fish tissue, shellfish, or plant material. Such samples shall be grouped according to origin.

Solids: includes soils, sediments, sludges, and other matrices with >15% settleable solids.

Chemical Waste: a product or by-product of an industrial process that results in a matrix not previously defined.

Air: whole gas or vapor samples including those contained in flexible or rigid wall containers and the extracted concentrated analytes of interest from a gas or vapor that are collected with a sorbant tube, impinger solution, filter, or other device. (NELAC)

Matrix Spike (spiked sample or fortified sample):

Prepared by adding a known mass of target analyte to a specified amount of matrix sample for which an independent estimate of target analyte concentration is available. Matrix spikes are used, for example, to determine the effect of the matrix on a method's recovery efficiency.

Matrix spikes shall be performed at a frequency of one in 20 samples per matrix type per sample extraction or preparation method except for analytes for which spiking solutions are not available such as, total suspended solids, total dissolved solids, total volatile solids, total solids, pH, color, odor, temperature, dissolved oxygen or turbidity. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in a matrix spike may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the spike. (QAMS)

Matrix Spike Duplicate (spiked sample or fortified sample duplicate):
A second replicate matrix spike is prepared in the laboratory and analyzed to obtain a measure of the precision of the recovery for each analyte.

Matrix spike duplicates or laboratory duplicates shall be analyzed at a minimum of 1 in 20 samples per matrix type per sample extraction or preparation method. The laboratory shall document their procedure to select the use of an appropriate type of duplicate. The selected sample(s) shall be rotated among client samples so that various matrix problems may be noted and/or addressed. Poor performance in the duplicates may indicate a problem with the sample composition and shall be reported to the client whose sample was used for the duplicate. (QAMS)

Method Blank:
A sample of a matrix similar to the batch of associated samples (when available) that is free from the analytes of interest and is processed simultaneously with and under the same conditions as samples through all steps of the analytical procedures, and in which no target analytes or interferences are present at concentrations that impact the analytical results for sample analyses. (NELAC)

Method Detection Limit:
The minimum concentration of a substance (an analyte) that can be measured and reported with 99% confidence that the analyte concentration is greater than zero and is determined from analysis of a sample in a given matrix containing the analyte. (40 CFR Part 136, Appendix B)

National Environmental Laboratory Accreditation Conference (NELAC):
A voluntary organization of State and Federal environmental officials and interest groups purposed primarily to establish mutually acceptable standards for accrediting environmental laboratories. A subset of NELAP. (NELAC)

National Environmental Laboratory Accreditation Program (NELAP):
The overall National Environmental Laboratory Accreditation Program of which NELAC is a part. (NELAC)

Negative Control:
Measures taken to ensure that a test, its components, or the environment do not cause undesired effects, or produce incorrect test results. (NELAC)

NELAC Standards:
The plan of procedures for consistently evaluating and documenting the ability of laboratories performing environmental measurements to meet nationally defined standards established by the National Environmental Laboratory Accreditation Conference. (NELAC)

Performance Audit:
The routine comparison of independently obtained qualitative and quantitative measurement system data with routinely obtained data in order to evaluate the proficiency of an analyst or laboratory. (NELAC)

Performance Based Measurement System (PBMS):
A set of processes wherein the data quality needs, mandates or limitations of a program or project are specified and serve as criteria for selecting appropriate test methods to meet those needs in a cost-effective manner. (NELAC)

Positive Control:
Measures taken to ensure that a test and/or its components are working properly and producing correct or expected results from positive test subjects. (NELAC)

Precision:
The degree to which a set of observations or measurements of the same property, obtained under similar conditions, conform to themselves; a data quality indicator. Precision is usually expressed as standard deviation, variance or range, in either absolute or relative terms. (NELAC)

Preservation:
Refrigeration and/or reagents added at the time of sample collection (or later) to maintain the chemical and/or biological integrity of the sample. (NELAC)

Proficiency Testing:
A means of evaluating a laboratory's performance under controlled conditions relative to a given set of criteria through analysis of unknown samples provided by an external source. (NELAC) [2.1]

Proficiency Testing Program:
The aggregate of providing rigorously controlled and standardized environmental samples to a laboratory for analysis, reporting of results, statistical evaluation of the results and the collective demographics and results summary of all participating laboratories. (NELAC)

Proficiency Test Sample (PT):
A sample, the composition of which is unknown to the analyst and is provided to test whether the analyst/laboratory can produce analytical results within specified acceptance criteria. (QAMS)

Quality Assurance:
An integrated system of activities involving planning, quality control, quality assessment, reporting and quality improvement to ensure that a product or service meets defined standards of quality with a stated level of confidence. (QAMS)

Quality Assurance [Project] Plan (QAPP):
A formal document describing the detailed quality control procedures by which the quality requirements defined for the data and decisions pertaining to a specific project are to be achieved. (EAP-QAD)

Quality Control:
The overall system of technical activities which purpose is to measure and control the quality of a product or service so that it meets the needs of users. (QAMS)

Quality Control Sample:
An uncontaminated sample matrix spiked with known amounts of analytes from a source independent from the calibration standards. It is generally used to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurement system. (EPA-QAD)

Quality Manual:
A document stating the management policies, objectives, principles, organizational structure and authority, responsibilities, accountability, and implementation of an agency, organization, or laboratory, to ensure the quality of its product and the utility of its product to its users. (NELAC)

Quality System:
A structured and documented management system describing the policies, objectives, principles, organizational authority, responsibilities, accountability, and implementation plan of an organization for ensuring quality in its work processes, products (items), and services. The quality system provides the framework for planning, implementing, and assessing work performed by the organization and for carrying out required QA and QC (ANSI/ASQC-E-41994)

Quantitation Limits:
The maximum or minimum levels, concentrations, or quantities of a target variable (e.g., target analyte) that can be quantified with the confidence level required by the data user. (NELAC)

Range:
The difference between the minimum and the maximum of a set of values. (EPA-QAD)

Reagent Blank (method reagent blank):
A sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and of the involved analytical steps. (QAMS)

Reference Material:
A material or substance one or more properties of which are sufficiently well established to be used for the calibration of an apparatus, the assessment of a measurement method, or for assigning values to materials. (ISO Guide 30-2.1)

Reference Method:
A method of known and documented accuracy and precision issued by an organization recognized as competent to do so. (NELAC)

Reference Standard:
A standard, generally of the highest metrological quality available at a given location, from which measurements made at that location are derived. (VIM-6.0-8)

Replicate Analyses:
The measurements of the variable of interest performed identically on two or more sub-samples of the same sample within a short time interval. (NELAC)

Report Limit (RL):
The laboratory nominal Quantitation Limit (QL) or the level of sensitivity required by the client but not lower than the LOD.

Requirement:
Denotes a mandatory specification; often designated by the term “shall”. (NELAC)

Resource Conservation and Recovery Act (RCRA):
The enabling legislation under 42 USC 321 et seq. (1976), that gives EPA the authority to control hazardous waste from the “cradle-to-grave”, including its generation, transportation, treatment, storage, and disposal. (NELAC)

Safe Drinking Water Act (SDWA):
The enabling legislation, 42 USC 300f et seq. (1974), (Public Law 93-523), that requires the EPA to protect the quality of drinking water in the U.S. by setting maximum allowable contaminant levels, monitoring, and enforcing violations. (NELAC)

Sample Duplicate:
Two samples taken from and representative of the same population and carried through all steps of the sampling and analytical procedures in an identical manner. Duplicate samples are used to assess variance of the total method including sampling and analysis. (EPA-QAD)

Second Order Polynomial Curve (Quadratic): The 2nd order curves are a mathematical calculation of a slightly curved line over two axis. The y axis represents the instrument response (or Response ratio) of a standard or sample and the x axis represents the concentration. The 2nd order regression will generate a

coefficient of determination (COD or r^2) that is a measure of the "goodness of fit" of the quadratic curvature the data. A value of 1.00 indicates a perfect fit. In order to be used for quantitative purposes, r^2 must be greater than or equal to 0.99.

Selectivity:
(Analytical chemistry) the capability of a test method or instrument to respond to a target substance of constituent in the presence of non-target substances. (EPA-QAD)

Sensitivity:
The capability of a method or instrument to discriminate between measurement responses representing different levels (e.g., concentrations) of a variable of interest. (NELAC)

Spike:
A known mass of target analyte added to a blank, sample or sub-sample; used to determine recovery efficiency or for other quality control purposes.

If the mandated or requested test method does not specify the spiking components, the laboratory shall spike all reportable components to be reported in the Laboratory Control Sample and Matrix Spike. However, in cases where the components interfere with accurate assessment (such as simultaneously spiking chlordane, toxaphene and PCBs in Method 608), the test method has an extremely long list of components or components are incompatible, a representative number (at a minimum 10%) of the listed components may be used to control the test method. The selected components of each spiking mix shall represent all chemistries, elution patterns and masses permit specified analytes and other client requested components. However, the laboratory shall ensure that all reported components are used in the spike mixture within a two-year time period.. (NELAC)

Standard:
The document describing the elements of laboratory accreditation that has been developed and established within the consensus principles of NELAC and meets the approval requirements of NELAC procedures and policies. (ASQC)

Standard Operating Procedures (SOPs):
A written document which details the method of an operation, analysis, or action whose techniques and procedures are thoroughly prescribed and which is accepted as the method for performing certain routine or repetitive tasks. (QAMS)

Standardized Reference Material (SRM):
A certified reference material produced by the U.S. National Institute of Standards and Technology or other equivalent organization and characterized for absolute content, independent of analytical method. (EPA-QAD)

Supervisor (however named):
The individual(s) designated as being responsible for a particular area or category of scientific analysis. This responsibility includes direct day-to-day supervision of technical employees, supply and instrument adequacy and upkeep, quality assurance/quality control duties, and ascertaining that technical employees have the required balance of education, training and experience to perform the required analyses. (NELAC)

Surrogate:
A substance with properties that mimic the analyte of interest. It is unlikely to be found in environment samples and is added to them for quality control purposes.

Surrogate compounds must be added to all samples, standards, and blanks, for all organic chromatography methods except when the matrix precludes its use or when a surrogate is not available.

Poor surrogate recovery may indicate a problem with sample composition and shall be reported to the client whose sample produced poor recovery. (QAMS)

Systems Audit (also Technical Systems Audit):
A thorough, systematic, qualitative on-site assessment of the facilities, equipment, personnel, training, procedures, record keeping, data validation, data management, and reporting aspects of a total measurement system. (EPA-QAD)

Technical Director:
Individuals(s) who has overall responsibility for the technical operation of the environmental testing laboratory. (NELAC)

Test:
A technical operation that consists of the determination of one or more characteristics or performance of a given product, material, equipment, organism, physical phenomenon, process, or service according to a specified procedure. The result of a test is normally recorded in a document sometimes called a test report or a test certificate. (ISO/IEC Guide 2-12.1, amended)

Test Method:
An adoption of a scientific technique for a specific measurement problem, as documented in a laboratory SOP. (NELAC)

Toxic Substances Control Act (TSCA):
The enabling legislation in 15 USC 2601 et seq., (1976) that provides for testing, regulating, and screening all chemicals produced or imported into the United States for possible toxic effects prior to commercial manufacture. (NELAC)

Traceability:
The property of a result of a measurement whereby it can be related to appropriate standards, generally international or national standards, through an unbroken chain of comparisons. (VIM-6.12)

Uncertainty:
A parameter associated with the result of a measurement that characterizes the dispersion of the value that could reasonably be attributed to the measured value.

United States Environmental Protection Agency (EPA):
The Federal governmental agency with responsibility for protecting public health and safeguarding and improving the natural environment (i.e., the air, water, and land) upon which human life depends. (US-EPA)

Validation:
The process of substantiating specified performance criteria. (EPA-QAD)

Verification:
Confirmation by examination and provision of evidence that specified requirements have been met. (NELAC)

NOTE: In connection with the management of measuring equipment, verification provides a means for checking that the deviations between values indicated by a measuring instrument and corresponding known values of a measured quantity are consistently smaller than the maximum allowable error defined in a standard, regulation or specification peculiar to the management of the measuring equipment.

The result of verification leads to a decision either to restore in service, to perform adjustment, to repair, to downgrade, or to declare obsolete. In all cases, it is required that a written trace of the verification performed shall be kept on the measuring instrument's individual record.

Acronyms:

BS – Blank Spike
BSD – Blank Spike Duplicate
CAR – Corrective Action Report
CCV – Continuing Calibration Verification
CF – Calibration Factor
CFR – Code of Federal Regulations
COC – Chain of Custody
CRS – Change Request Form
DOC – Demonstration of Capability
DQO – Data Quality Objectives
DU – Duplicate
DUP - Duplicate
EHS – Environment, Health and Safety
EPA – Environmental Protection Agency
GC - Gas Chromatography
GC/MS - Gas Chromatography/Mass Spectrometry
HPLC - High Performance Liquid Chromatography
ICP - Inductively Coupled Plasma Atomic Emission Spectroscopy
ICV – Initial Calibration Verification
IDL – Instrument Detection Limit
IH – Industrial Hygiene
IS – Internal Standard
LCS – Laboratory Control Sample
LCSD – Laboratory Control Sample Duplicate
LIMS – Laboratory Information Management System
MDL – Method Detection Limit
MS – Matrix Spike
MSD – Matrix Spike Duplicate
MSDS - Material Safety Data Sheet
NELAC - National Environmental Laboratory Accreditation Conference
NELAP - National Environmental Laboratory Accreditation Program
PT – Performance Testing
QAM – Quality Assurance Manual
QA/QC – Quality Assurance / Quality Control
QAPP – Quality Assurance Project Plan
RF – Response Factor
RPD – Relative Percent Difference
RSD – Relative Standard Deviation
SD – Standard Deviation
SOP: Standard Operating Procedure
TAT – Turn-Around-Time
VOA – Volatiles
VOC – Volatile Organic Compound

Appendix 3.

Laboratory Certifications, Accreditations, Validations

TestAmerica Seattle maintains certifications, accreditations, certifications, and validations with numerous state and national entities. Programs vary but may include on-site audits, reciprocal agreements with another entity, performance testing evaluations, review of the QA Manual, Standard Operating Procedures, Method Detection Limits, training records, etc. At the time of this QA Manual revision, the laboratory has accreditation/certification/licensing with the following organizations:

Organization	Certificate Number Or Laboratory ID Number
State of Alaska	UST-022
State of California	01115CA
State of Florida	E871074
State of Montana	None
State of Oregon	WA100007
State of Washington	C553
Dept of Defense	L2236
ISO 17025	L2236
USDA	P330-08-00099

The certificates and parameter lists (which may differ) for each organization may be found on the corporate web site, the laboratory's public server, the final report review table, and in the following offices: QA, marketing, and project management.

Appendix 4: Summary of Calibration and QC Procedures for GC Organics

Method	QC Check	Frequency	Acceptance Criteria[3]	Corrective Action[4]
SW8081A SW8082	Minimum five-point initial calibration for all target analytes[2]	Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	Linear regression correlation coefficient $r \geq 0.990$, $r^2 \geq 0.990$. RSD of CF ≤ 20% **For DoD:** Linear regression correlation coefficient $r \geq 0.995$, $r^2 \geq 0.990$. RSD of CF ≤ 20%	Correct problem then repeat initial calibration
	Initial calibration verification (ICV) must be from a 2nd source	Once immediately following initial calibration	All target analytes within 15% of expected value. **For DoD:** All target analytes within 20% of expected value.	Correct problem then repeat initial calibration
	Continuing calibration verification (CCV)	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	All analytes within 15% of expected value and within the RT Window. **For DoD:** All target analytes within 20% of expected value.	Correct problem then repeat initial CCV (re-calibrate if necessary) and re-analyze all samples since last successful CCV.
	Breakdown check (Endrin and DDT)[1]	Before sample analysis	Degradation ≤15% for either Endrin or DDT.	Inlet/column maintenance; repeat breakdown check and re-analyze all samples since last successful breakdown check.
	Method blank	One per analytical prep batch, not to exceed 20 samples in a batch.	No analytes detected ≥ ½ RL or MDL, whichever is greater[5]	Correct problem then re-prep[6] and analyze method blank and all samples processed with the contaminated blank
	LCS for all analytes, must be from a 2nd source.	One per prep batch, not to exceed 20 samples in a batch.	See Control Limits	Re-prep[6] and analyze the LCS and all samples in the affected analytical batch
	Surrogate(s)	Every sample, spike, standard, and method blank	See Control Limits	Check system, re-inject, re-extract[6]
	MS/MSD, must be from a 2nd source. Rotate Aroclors each quarter.	One per batch per matrix, if insufficient sample for MS/MSD, then a LCS/LCSD will be analyzed.	See Control Limits	None (LCS is used to determine if data is acceptable).
	Second-column confirmation	100% for all positive results	Same as for initial or primary column analysis	Same as for initial or primary column analysis. If the relative % difference of results between the 2 columns is greater than 40%, a comment should be placed in LIMS.
	Retention time window calculated for each analyte (see section 9 for how to calculate RTWs).	System set-up, with each new column or major instrument maintenance. Update the mid-RTW at the start of the run or daily.	Each analyte of the LCS, MS/MSD and CCV must be within the calculated RTW.	Correct the problem and re-process or re-analyze samples. If questions, see the supervisor or technical director.
	MDL verification	Minimum yearly **For DOD:** Minimum quarterly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.
	LOQ verification	**For DOD:** Minimum quarterly	Detectible	Re-evaluate LOQ standard used and LOQ; see Technical Director.

1 --8081A only
2 – Method 8082, a five-point calibration is only analyzed for Aroclors 1016 and 1260.

3 - This is a summary of the acceptance criteria, refer to the method SOP for specific or more information.
4 - All abnormalities must be noted on the data, the benchsheet, in the PIPE database, and in LIMS.
5 - Report all target compounds identified in the method blank above the MDL.
6 - If unable to re-extract the samples because of insufficient sample volume or holding time has expired, then place a comment on the benchsheet, in the PIPE database, and in LIMS.

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Appendix 4: Summary of Calibration and QC Procedures for GC Organics

Method	QC Check	Frequency	Acceptance Criteria[3]	Corrective Action[4]
EPA608	Minimum three-point (preferably five) initial calibration for all target analytes	Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	**RSD of CF ≤ 10%** Linear regression - correlation coefficient r ≥ 0.99, r ≥ 0.995.	Correct problem then repeat initial calibration
	Initial calibration verification (ICV) must be from a 2nd source.	Immediately following initial calibration	All analytes within 15% of expected value	Correct problem then repeat initial calibration
	Continuing calibration verification (CCV)	Before sample analysis, and at the end of the analysis sequence	All analytes within **15% of expected value** and within the RTW. 608 (not 608.2[5]) must be within 15% of the true value.	Correct problem then repeat initial CCV (re-calibrate if necessary) and re-analyze all samples since last successful CCV.
	Breakdown check (Endrin and DDT)[1]	Before sample analysis	Degradation ≤15% for either Endrin or DDT.	Inlet/column maintenance; repeat breakdown check and re-analyze all samples since last successful breakdown check.
	Method blank	One per analytical prep batch, **not to exceed 10 samples in a batch**.	No analytes detected ≥ ½ RL or MDL, whichever is greater[6]	Correct problem then re-prep[7] and analyze method blank and all samples processed with the contaminated blank
	LCS (QC check standard) must be from a 2nd source.	One per prep batch, **not to exceed 10 samples in a batch.**	See Control Limits	Re-prep[7] and analyze the LCS and all samples in the affected analytical batch
	Surrogate(s)	Every sample, spiked sample, standard, and method blank	See Control Limits	Check system, re-inject, re-extract[7]
	MS must be from a 2nd source.	One per batch per matrix, 10%, if insufficient sample for MS, then an additional LCS will be analyzed.	See Control Limits	All target compounds should be reported, and any compounds that are outside criteria must be within criteria in the LCS.
	Second-column confirmation	100% for all positive results	Same as for initial or primary column analysis	Same as for initial or primary column analysis. If the relative % difference of results between the 2 columns is greater than 40%, a comment should be placed in LIMS.
	Retention time window calculated for each analyte (see section 9 for how to calculate RTWs).	System set-up, with each new column or major instrument maintenance. Update the mid-RTW at the start of the run or as needed.	Each analyte of the LCS, MS/MSD and CCV must be within the calculated RTW.	Correct the problem and re-process or re-analyze samples. If questions, see the supervisor or technical director.
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

3 - This is a summary of the acceptance criteria, refer to the method SOP for specific or more information.
4 - All abnormalities must be noted on the data, the benchsheet, in the PIPE database, and in LIMS.
5 – 608.2 compounds are Methoxychlor and Permethrin.
6 - Report all target compounds identified in the method blank above the MDL.
7 - If unable to re-extract the samples because of insufficient sample volume or holding time has expired, then place a comment on the benchsheet, in the PIPE database, and in LIMS.

Appendix 4: Summary of Calibration and QC Procedures for GC/MS Organics

Method	QC Check	Frequency	Acceptance Criteria[2]	Corrective Action[3]
SW8260B SW8270C SW8141mod SW8151mod	Check of mass spectral ion intensities[1], i.e., Tune	Prior to initial calibration or Continuing calibration verification, every 12 hours	Refer to criteria listed in the method SOP for Tune criteria, including DDT, Benzidine and Pentachlorophenol requirements for 8270.	Retune the instrument and verify (instrument maintenance may be needed).
SW8260B SW8270C	Minimum five-point initial calibration for all target analytes	Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	VOCs: SPCCs average RF ≥ 0.30 or 0.1 depending on the compound and %RSD for RFs for CCCs ≤ 30% and all other target analytes %RSD for RF ≤ 15%.	Correct problem then repeat initial calibration
			SVOCs: SPCCs average RF ≥ 0.050 and %RSD for RFs for CCCs ≤ 30% and all other target analytes %RSD for RF ≤ 15%.	Correct problem then repeat initial calibration
			option (if %RSD is > 15%)–linear regression $r^2 \geq 0.99$, $r \geq 0.995$.	If the calibration is not considered linear by either %RSD or linear regression, then correct the problem and re-calibrate.
	Initial calibration verification (ICV) must be from a 2nd source.	Immediately following five-point initial calibration	All CCCs within 20% of expected value. **For DoD:** All analytes within 20% of expected value.	Correct problem then repeat initial calibration
	Relative Retention time window	Each sample	Relative retention time (RRT) of the analyte within 0.06 RRT units of the RRT of the internal standard	Correct problem then reprocess or re-analyze all samples analyzed since the last retention time check
	Continuing calibration verification (CCV)	Daily, before sample analysis and every 12 hours of analysis time	VOCs: SPCCs average RF ≥ 0.30 or 0.1 depending on the compound; and **For DoD:** SPCCs average RF ≥ 0.050; CCCs: ≤20% difference (when using RFs) or drift (when using least squares regression).	Correct problem then repeat initial calibration and re-analyze all samples since last successful CCV.
	Continuing calibration check		SVOCs: SPCCs average RF ≥ 0.050; and CCCs: ≤20% difference (when using RFs) or drift (when using least squares regression) for standard list analytes, ≤35% for non-standard analytes, and ≤55% for poor performing analytes. **For DoD:** SPCCs average RF ≥ 0.050; CCCs: ≤20% difference (when using RFs) or drift (when using least squares regression).	

Method	QC Check	Frequency	Acceptance Criteria[2]	Corrective Action[3]
	Method blank	One per analytical prep batch	No analytes detected ≥ ½ RL or MDL, whichever is greater[4]	Correct problem then re-prep[5] and analyze method blank and all samples processed with the contaminated blank
	Internal Standards	Every sample/standard and blank	Retention time ±30 seconds from retention time of the mid-point std. in the CCV/ICAL (sample/standard). EICP area within -50% to +100% of ICAL mid-point std for the CCV and –50% to +100% of the prior CCV for the samples.	Inspect mass spectrometer and GC for malfunctions; mandatory re-analysis of samples analyzed while system was malfunctioning (dilution of the sample may be required, see the supervisor or the technical director for advice).
	LCS for all analytes must be from a 2nd source.	One per prep batch, not to exceed the 20 samples in a batch.	See Control Limits Manual	Correct problem then re-prep[5] and analyze the LCS and all samples in the affected analytical batch
	MS/MSD must be from a 2nd source.	One per batch per matrix, if insufficient sample for MS/MSD, then a LCS/LCSD will be analyzed.	See Control Limits Manual	None (the LCS is used to evaluate to determine if the batch is acceptable).
	Surrogate(s)	Every sample, spike, standard, and blank	See Control Limits Manual	Check system, re-analyze, re-prep[5]
	MDL verification	Minimum yearly **For DOD:** Minimum quarterly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.
	LOQ verification	**For DOD:** Minimum quarterly	Detectible	Re-evaluate LOQ standard used and LOQ; see Technical Director.
SW8260B	pH check	All 8260 water samples.	pH ≤2.	If the pH is > 2, then comment the data, in the PIPE database, and LIMS.
	Residual chlorine check (North Carolina samples only)	Each sample.	Residual chlorine should be negative.	If the residual chlorine is positive, then comment the data, in the PIPE database, and LIMS.

1 - SW8260B requires BFB; SW8270C requires DFTPP
2 - This is a summary of the acceptance criteria, refer to the method SOP for specific or more information.
3 - All abnormalities must be noted in an NCM.
4 - Report all target compounds identified in the method blank above the MDL.
5 - If unable to re-prep samples because of insufficient sample volume or the holding time has expired, then note in an NCM.

Appendix 4: Summary of Calibration and QC Procedures for GC/MS Organics

Method	QC Check	Frequency	Acceptance Criteria[2]	Corrective Action[3]
EPA624 EPA625	Check of mass spectral ion intensities[1] (i.e. Tune)	Prior to initial calibration or Continuing calibration verification every 12 hours.	Refer to criteria listed in the method SOP for Tune requirements including DDT, Benzidine and Pentachlorophenol criteria for 625.	Retune instrument and verify instrument maintenance may be needed.
	Minimum three-point initial calibration for all target analytes.	Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	%RSD < 35%, if %RSD is > 35% then linear regression is used (for linear regression $r^2 \geq 0.99$), $r \geq 0.995$.	If the calibration is not considered linear by either %RSD or linear regression, then correct problem then repeat initial calibration
	Initial calibration verification (ICV), 20 ug/L, must be from a 2nd source. May be the same as the LCS.	Immediately following initial calibration	See Control Limits Manual.	Correct problem then repeat initial calibration
	Relative Retention time window	Each sample	Retention time (RT) of the analyte within 30 seconds of the RT (± 0.25 min. RTW is used) of the target.	Correct problem then reprocess or re-analyze all samples analyzed since the last retention time check
EPA625	Continuing calibration verification (CCV)	Daily, before sample analysis and every 12 hours of analysis time.	All calibration analytes within 20% of expected value	Correct problem then repeat initial calibration and re-analyze all samples since last successful CCV.
EPA624 EPA625	Method blank	One per prep batch (not to exceed 20 samples per batch).	No analytes detected ≥ ½ RL or MDL, whichever is greater[4]	Correct problem then re-prep[5] and analyze method blank and all samples processed with the contaminated blank
	LCS for all analytes, 20 ug/L, must be from a 2nd source. May be the same as the ICV.	One per prep batch (not to exceed 20 samples per batch) or daily.	See Control Limits Manual	Correct problem then re-prep[5] and analyze the LCS and all samples in the affected analytical batch
	MS must be from a 2nd source.	One per batch of 20 per matrix, if insufficient sample for MS, then a-duplicate LCS will be analyzed.	See Control Limits Manual	All target compounds should be reported, and any compound that is outside criteria must be within criteria in the LCS.
	Surrogate(s)	Every sample, spiked sample, standard, and method blank	See Control Limits Manual	Correct problem then re-prep[5] and analyze sample
EPA624 EPA625	Internal Standards	Every sample/standard	Retention time ±30 seconds from retention time of the mid-point std. in the CCV/ICAL (sample/standard). EICP area within -50% to +100% of ICAL mid-point std for the CCV and –50% to +100% of the prior CCV for the samples.	Inspect mass spectrometer and GC for malfunctions; mandatory re-analysis of samples analyzed while system was malfunctioning (dilution of the sample may be required, see the supervisor or the technical director for advice).
EPA624	pH check	All 624 samples after analysis	pH should be ≤ 2.	If the pH is > 2, then comment the data, in the PIPE database, and LIMS.
EPA624	Residual chlorine check (North Carolina samples only)	All samples after analysis	Residual chlorine should be negative.	If the residual chlorine is positive, then comment the data, in the PIPE database, and LIMS.

Method	QC Check	Frequency	Acceptance Criteria[2]	Corrective Action[3]
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 - 624 requires BFB; 625 requires DFTPP
2 - This is summary of the acceptance criteria, refer to the method SOP for specific or more information.
3 - All abnormalities must be noted on the data, the benchsheet, in the PIPE database, and in LIMS.
4 - Report all target compounds identified in the method blank above the MDL.
5 - If unable to re-prep samples because of insufficient sample volume or holding time has expired, then place a comment on the benchsheet, in the PIPE database, and in LIMS.

Appendix 4: Summary of Calibration and QC Procedures for GC Organics

Method	QC Check	Frequency	Acceptance Criteria[1]	Corrective Action[2]
SW8015[5] SW8021	Five-point initial calibration for all target analytes	Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	RSD of CF ≤ 20% Linear – least squares regression r^2 ≥ 0.99, r ≥ 0.995	Correct problem then repeat initial calibration
	Initial calibration verification (ICV), must be from a 2nd source.	Immediately following five-point initial calibration	All analytes within 20% of expected value	Correct problem then repeat initial calibration
	LCS for all analytes must be from a 2nd source.	One per prep batch, not to exceed 20 samples in a batch.	See Control Limits	Re-prep[4] and analyze the LCS and all samples in the affected analytical batch
	Continuing calibration verification (CCV)	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	All analytes within 15% of expected value and within the RTW. **For DoD:** All analytes within 20% of expected value and within the RTW.	Correct problem then repeat initial CCV (re-calibrate if necessary) and re-analyze all samples since last successful CCV.
	Method blank	One per analytical prep batch, not to exceed 20 samples in a batch.	No analytes detected ≥ ½ RL or MDL, whichever is greater[3]	Correct problem then re-prep[4] and analyze method blank and all samples processed with the contaminated blank
	Surrogate	Every sample, spiked sample, standard, and method blank	See Control Limits	Check system, re-analyze, re-prep[4]
	MS/MSD must be from a 2nd source.	One per batch per matrix, if insufficient sample for MS/MSD, then a LCS/LCSD will be analyzed.	See Control Limits	None (LCS is used to determine if data is acceptable).
	GC/MS confirmation.	At the clients request or analyst judgment.		
	Retention time window calculated for each analyte (see section 9 for how to calculate RTWs).	System set-up, with each new column or major instrument maintenance. Update the mid-RTW as the start of the run or daily.	Each analyte of the LCS, MS/MSD and CCV must be within the calculated RTW.	Correct the problem and re-process or re-analyze samples. For questions, see the supervisor or technical director.
	MDL verification	Minimum yearly **For DoD:** Minimum quarterly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.
	LOQ verification	**For DoD:** Minimum quarterly	Detectible	Re-evaluate LOQ standard used and LOQ; see Technical Director.
SW8021	pH Check	All water samples after analysis.	pH should be less than 2.	If pH is > 2, then place a comment on the benchsheet and in LIMS.
MT-VPH MT-EPH WA-VPH WA-EPH NWTPH-EPH NWTPH-VPH	Five-point initial calibration for all target analytes	Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	RSD of CF ≤ 20% Linear – least squares regression r^2 ≥ 0.99, r ≥ 0.995	Correct problem then repeat initial calibration
	Initial calibration verification (ICV) or Petroleum Performance Check Standard	Immediately following five-point initial calibration	Must be within 70-130% recovery.	Correct problem then repeat initial calibration
	Retention time window calculated for each analyte (see section 9 for how to calculate RTWs).	System set-up, with each new column or major instrument maintenance. Update the mid-RTW as the start of the run or daily.	Each analyte of the LCS, MS/MSD and CCV must be within the calculated RTW.	Correct the problem and re-process or re-analyze samples. For questions, see the supervisor or technical director.
	Continuing calibration verification	Before sample analysis, after every 10	All analytes within 20% of expected	Correct problem then repeat initial CCV

Method	QC Check	Frequency	Acceptance Criteria[1]	Corrective Action[2]
	(CCV)	samples, and at the end of the analysis sequence	value and within the RTW.	(re-calibrate if necessary) and re-analyze all samples since last successful CCV.
	Method blank	One per analytical prep batch, not to exceed 20 samples in a batch.	No analytes detected ≥ RL	Correct problem then re-prep[4] and analyze method blank and all samples processed with the contaminated blank
	LCS for all analytes must be from a 2nd source.	One per prep batch, not to exceed 20 samples in a batch.	Must be within 70-130% recovery.	Re-prep[4] and analyze the LCS and all samples in the affected analytical batch
	MS/MSD must be from a 2nd source.	One per batch per matrix, if insufficient sample for MS/MSD, then a LCS/LCSD will be analyzed.	Must be within 50-150% recovery. **For WA-VPH and WA-EPH:** Must be within 70-130% recovery.	None (LCS is used to determine if data is acceptable).
	Duplicate	Each batch, less than 20	±25%	None
	Surrogate	Every sample, spiked sample, standard, and method blank	Low end aliphatic compounds must be within 30-150% recovery and high end aliphatic compounds must be within 50-150% recovery. **For WA-VPH and WA-EPH:** Must be within 60-140% recovery	Check system, re-analyze, re-prep[4]
	MDL and MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.
SW8011 EPA504.1	Five-point initial calibration for all target analytes (calibration standards should be prepped as the samples). Three point minimum for 504.1.	Initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	RSD of CF of each analyte ≤ 20% **RSD of CF < 10% for Method 8011** Linear – $r^2 \geq 0.990$, $r \geq 0.995$	Correct problem then repeat initial calibration
	Initial calibration verification (ICV) must be from a 2nd source.	Immediately following initial calibration	All analytes within 20% of expected value	Correct problem then repeat initial calibration
	Continuing calibration verification (CCV)	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	All analytes within 10% of expected value and within the RTW.	Repeat once. If subsequent CCV fails, correct problem, re-calibrate and re-analyze all samples since last successful CCV.
	Continuing calibration blank (CCB)	After each CCV	No analytes ≥ ½ RL	Correct problem and re-analyze all samples since last successful CCB, unless contamination is <10X the conc present in the sample
	Method blank	One per analytical prep batch, not to exceed 10 samples in a batch.	No analytes ≥ ½ RL	Correct problem then re-prep[3] and analyze method blank and all samples processed with the contaminated blank
	LCS for all analytes must be from a 2nd source.	One per prep batch, not to exceed 10 samples in a batch.	All analytes within 20% of expected value for 8011. All analytes within 30% of expected value for 504.1.	Re-prep[3] and analyze the LCS and all samples in the affected analytical batch

Method	QC Check	Frequency	Acceptance Criteria[1]	Corrective Action[2]
	Surrogate	Every sample, spike, standard, and method blank	See Control Limits	Check system, re-inject, re-extract[3]
	MS/MSD must be from a 2nd source.	One per batch per matrix, if insufficient sample for MS/MSD, then a LCS/LCSD will be analyzed.	See Control Limits	(LCS is used to determine if data is acceptable). Add comments in LIMS.
	Second-column confirmation	100% for all positive results	Same as for initial or primary column analysis	Same as for initial or primary column analysis. If the relative % difference of results between the 2 columns is greater than 40%, a comment should be placed in LIMS.
	Retention time window calculated for each analyte (see section 20.1 for how to calculate RTW's).	System set-up, with each new column or major instrument maintenance. Update the mid-RTW as the start of the run or daily.	Each analyte of the LCS, MS/MSD and CCV must be within the calculated RTW.	Correct the problem and re-process or re-analyze samples. For questions, see the supervisor or technical director.
	MDL / MDL verification	Minimum yearly **For DOD:** Minimum quarterly	MDL<Spike<10X MDL Detected	Re-evaluate MDL standard used and MDL; see Technical Director.
	LOQ verification	**For DOD:** Minimum quarterly	Detectible	Re-evaluate LOQ standard used and LOQ; see Technical Director.

1 - This is a summary of the acceptance criteria, refer to the method SOP for specific or more information.
2 - All abnormalities must be noted on the data and in an NCM.
3 - Report all target compounds identified in the method blank above the MDL.
4 - If unable to re-prep the samples because of insufficient sample volume or holding time has expired, then note in an NCM.
5 - For GRO and DRO, see state specific SOP/Method for acceptance criteria. If there is not a specific method for that state, then follow the acceptance criteria in this table.

Appendix 4: Summary of Calibration and QC Procedures for Method SW6010

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
SW6010B	Initial calibration (minimum 1 standard and a blank)	Daily initial calibration prior to sample analysis.	N/A	N/A
	Second-source calibration verification (ICV)	Daily after initial calibration	All analytes within 10% of expected value	Correct problem then repeat initial calibration
	RL Standard (CRI)	Daily after initial calibration	All others: within 50% of expected value. **For DoD:** within 20% of expected value.	Re-analyzed RL Standard, correct problem no samples may be analyzed without a valid RL Standard.
	Calibration blank (CB)	After every continuing calibration verification	Must be <RL. **For DoD:** Must be < LOD	Correct problem then analyze calibration blank and previous 10 samples
	Continuing calibration verification (CCV)	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	All analytes within 10% of expected value and RSD of replicate integrations <5%	Repeat calibration and re-analyze all samples since last successful calibration
	Method blank	One per prep batch	No analytes detected ≥ ½ RL or MDL, whichever is greater[1] **For DoD:** Must be < ½ RL	Correct problem then re-prep and analyze method blank and all samples processed with the contaminated blank
	Interference check solution (ICS)	At the beginning of an analytical run	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity form one of the spike analytes) ICS-AB: Within 20% of expected value	Terminate analysis; correct problem; re-analyze ICS; re-analyze all affected samples
	LCS	One per prep batch	See Control Limits	Correct problem then re-prep and analyze the LCS and all samples in the affected analytical batch
	MS/MSD	One per batch per matrix	See Control Limits	None
	Dilution test	Each new sample matrix	1:5 dilution must agree within 10% of the original determination	Perform post digestion spike addition
	Post digestion spike addition	When dilution test fails	Recovery within 25% of expected results	None
	MDL verification	Minimum yearly **For DOD:** Minimum quarterly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.
	LOQ verification	**For DOD:** Minimum quarterly	Detectible	Re-evaluate LOQ standard used and LOQ; see Technical Director.

1 – Report all targets identified in the method blank above the MDL.

Appendix 4: Summary of Calibration and QC Procedures for Method SW6020

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
SW6020	Initial calibration (minimum 1 standard and a blank)	Daily initial calibration prior to sample analysis.	If more than one calibration standard used, r ≥ 0.995	Correct problem then repeat initial calibration
	Second-source calibration verification (ICV)	Daily after initial calibration	All analytes within 10% of expected value	Correct problem then repeat initial calibration
	RL Standard (CRI)	Daily after initial calibration	All others: within 50% of expected value. **For DoD:** within 20% of expected value.	Re-analyzed RL Standard, correct problem no samples may be analyzed without a valid RL Standard.
	Calibration blank (CB)	After every continuing calibration verification	Must be <RL. **For DoD:** Must be < LOD	Correct problem then analyze calibration blank and previous 10 samples
	Continuing calibration verification (CCV)	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	All analytes within 10% of expected value and RSD of replicate integrations <5%	Repeat calibration and re-analyze all samples since last successful calibration
	Linear Dynamic Range	Every 6 months	Within 10% of expected value	N/A
	Method blank	One per prep batch	No analytes detected ≥ RL or MDL, whichever is greater[1] **For DoD:** Must be < ½ RL	Correct problem then re-prep and analyze method blank and all samples processed with the contaminated blank
	Interference check solution (ICS)	At the beginning of an analytical run	ICS-A: Absolute value of concentration for all non-spiked analytes < LOD (unless they are a verified trace impurity form one of the spike analytes) ICS-SB: Within 20% of expected value	Terminate analysis; correct problem; re-analyze ICS; re-analyze all affected samples
	Internal standards (IS)	Every sample	IS intensity within 30-120% of intensity of the IS in the initial calibration	Perform corrective action as described in 6020.
	RL standard	Daily, after one point initial calibration	Within 20% of expected value	Correct problem then re-analyze samples.
	LCS	One per prep batch	See Control Limits	Correct problem then re-prep and analyze the LCS and all samples in the affected analytical batch
	MS/MSD	One per batch per matrix	See Control Limits	None
	Dilution test	Each new sample matrix	1:5 dilution must agree within 10% of the original determination	Perform post digestion spike addition
	Post digestion spike addition	When dilution test fails	Recovery within 25% of expected results	None.
	MDL verification	Minimum yearly **For DOD:** Minimum quarterly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.
	LOQ verification	**For DOD:** Minimum quarterly	Detectible	Re-evaluate LOQ standard used and LOQ; see Technical Director.

1 – Report all targets identified in the method blank above the MDL.

Appendix 4: Summary of Calibration and QC Procedures for Method SW7196

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
SW7196A	Initial calibration (minimum three standards and a blank)	Initial calibration prior to sample analysis.	$r^2 \geq 0.99$, $r \geq 0.995$ for linear regression	Correct problem then repeat initial calibration
	Second-source calibration verification (ICV)	Immediately following initial calibration	All analytes within 10% of expected value	Correct problem then repeat initial calibration
	Continuing calibration verification (CCV)	Beginning and after every 10 samples and at the end of the analysis sequence	All analytes within 20% of expected value	Correct problem then repeat initial calibration and re-analyze all samples since last successful calibration
	Verification check to ensure lack of reducing condition and/or interference	Once for every sample matrix analyzed	Spike recovery between 85-115%	If check indicates interference, dilute and re-analyze sample persistent interference indicates the need to use and alternate method
	Method blank	One per prep batch	No analytes detected ≥ ½ RL or MDL, whichever is greater[1]	Correct problem then re-prep and analyze method blank and all samples processed with the contaminated blank
	MS/MSD	One per 20 samples per matrix	See Control Limits Manual	none
	LCS	One per batch	See Control Limits Manual	Re-prep, re-analyze all affected samples.
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 - Report all targets identified in the method blank above the MDL.

Appendix 4: Summary of Calibration and QC Procedures for Method SW7470/SW7471

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
SW7470A SW7471A	Initial calibration (minimum 5 standards and a blank)	Daily initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	$r^2 \geq 0.99$, $r \geq 0.995$ for linear regression	Correct problem then repeat initial calibration. If calibration fails again, re-digest the entire digestion batch.
	Second-source calibration verification (ICV)	Immediately following initial daily calibration	Analytes within 10% of expected value	Correct problem then repeat initial calibration. If calibration fails again, re-digest the entire digestion batch.
	Calibration blank	Once per initial daily calibration	No analytes detected ≥ MDL	Correct problem then re-digest and re-analyze calibration and entire digestion batch
	Continuing calibration verification (CCV)	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	Analytes within 20% of expected value	Correct problem then repeat all QC and samples since last successful calibration. If the CCV fails again upon reanalysis, reprep the entire digestion batch.
	Method blank	One per prep batch	No analytes detected ≥ RL **For DoD:** Must be < ½ RL	Correct problem then re-prep and analyze method blank, all samples, and QC processed with the contaminated blank
	LCS	One per prep batch	See Control Limits Manual	Correct problem then re-prep and analyze the LCS, all samples, and QC in the affected analytical batch
	Dilution test; five-fold dilution test	Each preparatory batch	Five times dilution sample result must be ±10% of the undiluted sample result	Perform post digestion spike addition
	Recovery test	When dilution test fails	Recovery within 85-115% of expected results	Dilute the sample; re-analyze post digestion spike addition
	MS/MSD	One per batch per matrix	See Control Limits Manual	None
	MDL verification	Minimum yearly **For DOD:** Minimum quarterly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.
	LOQ verification	**For DOD:** Minimum quarterly	Detectible	Re-evaluate LOQ standard used and LOQ; see Technical Director.

1 - Report all targets identified in the method blank above the MDL.

Appendix 4: Summary of Calibration and QC Procedures for Method SW9010/SW9012/SW9014

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
SW9010 SW9012A SW9014	Initial calibration (six standards and a calibration blank)	Initial daily calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	$r^2 \geq 0.99$, $r \geq 0.995$ for linear regression	Correct problem then repeat initial calibration
	Distilled standards (one high and one low)	Once per calibration	Analyte within 10% of true value. **For DoD:** Analyte within 15% of true value.	Correct problem then repeat distilled standards
	Second-source calibration verification (ICV)	Immediately following initial daily calibration	Analyte within 15% of expected value.	Correct problem then repeat initial calibration
	Continuing calibration verification (CCV)	Beginning and after every 10 samples and at the end of the analysis sequence	Analyte within 15% of expected value	Correct problem then repeat initial Continuing calibration verification and re-analyze all samples since last successful Continuing calibration verification
	Method blank	One per prep batch	No analyte detected ≥ RL or MDL, whichever is greater[1] **For DoD:** Must be < ½ RL	Correct problem then re-prep and analyze method blank and all samples processed with the contaminated blank
	LCS	One per batch per matrix	See Control Limits in LIMS	Re-prep, re-run affected samples
	MS/MSD	One per batch per matrix	See Control Limits in LIMS	None
	MDL verification	Minimum quarterly **For DOD:** Minimum quarterly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.
	LOQ verification	**For DOD:** Minimum quarterly	Detectible	Re-evaluate LOQ standard used and LOQ; see Technical Director.

Appendix 4: Summary of Calibration and QC Procedures for Mercury

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA245.1	Initial calibration (minimum 5 standards and a blank)	Daily initial calibration prior to sample analysis. Perform instrument re-calibration once per year minimum.	$r^2 \geq 0.99$, $r \geq 0.995$ for linear regression	Correct problem then repeat initial calibration
	Second-source calibration verification (ICV)	Immediately following five-point initial calibration	Analyte within 5% of expected value	Correct problem then repeat initial calibration
	Calibration blank	Once per initial daily calibration	No analytes detected ≥ MDL	Correct problem then re-analyze calibration blank and all samples associated with blank
	Continuing calibration verification (CCV)	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	Analyte within 10% of true value	Correct problem then repeat calibration and re-analyze all samples and QC since last successful calibration
	LCS	One per prep batch	All analytes within 15% of expected value	Correct problem then re-prep and analyze the LCS, all samples, and QC in the affected analytical batch
	Matrix Spike/Matrix Spike Duplicate	One per batch or 10 samples	All analytes within 30% of expected value	None
	Method Blank	One per batch	No analytes > ½ RL	Reprep
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 - Report all targets identified in the method blank above the MDL.

Appendix 4: Summary of Calibration and QC Procedures for ICP Metals

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA200.7	Initial calibration (minimum 1 standard and a blank)	Daily initial calibration prior to sample analysis.	N/A	N/A
	Second-source calibration verification (ICV/QCS)	Each calibration	Value of all analytes within 5% of expected value	Correct problem then repeat initial calibration
	Linear Dynamic Range	Once annually	All analytes within 10% of expected value	Calibration range lowered to meet LDR results
	Calibration blank	After every Continuing calibration verification	No analytes detected < IDL	Correct problem then analyze calibration blank and previous 10 samples
	Continuing calibration verification (CCV/IPC)	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	All analytes within 10%	Repeat calibration and re-analyze all samples since last successful calibration
	Method blank	One per prep batch	No analytes detected < 10% of sample conc OR < 2.2 x MDL[1]	Correct problem then re-prep and analyze method blank and all samples processed with the contaminated blank
	Interference check solution (ICSA/ACSAB)	At the beginning of an analytical run, daily	Monitor for interferences.	Terminate analysis; correct problem; re-analyze ICS; re-analyze all affected samples
	LCS/LFB	One per prep batch	All analytes within 15% of expected value	Correct problem then re-prep and analyze the LCS and all samples in the affected analytical batch
	Dilution test	Each new sample matrix	1:5 dilution must agree within 10% of the original determination for concentrations > 50 X IDL	Perform post digestion spike addition
	Post digestion spike addition	When dilution test fails	Recovery within 15% of expected results	Correct problem then re-analyze post digestion spike addition
	Matrix Spike/Matrix Spike Duplicate	One per batch of 10 samples	All analytes within 30% of expected value	None
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 - Report all targets identified in the method blank above the MDL.

Appendix 4: Summary of Calibration and QC Procedures for ICP-MS Metals

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA200.8	Initial calibration (minimum 1 standard and a blank)	Daily initial calibration prior to sample analysis.	N/A	N/A
	Second-source calibration verification (ICV/QCS)	Each calibration	Value of all analytes within 10% of expected value	Correct problem then repeat initial calibration
	Calibration blank (ICB)	After every Continuing calibration verification	No analytes detected < RL	Correct problem then analyze calibration blank and previous 10 samples
	Continuing calibration verification (CCV)	Before sample analysis, after every 10 samples, and at the end of the analysis sequence	All analytes within 10%	Repeat calibration and re-analyze all samples since last successful calibration
	Method Blank/Laboratory Reagent Blank	One per prep batch	No analytes detected < 10% of sample conc. OR < 2.2xMDL[1]	Correct problem then re-prep and analyze method blank and all samples processed with the contaminated blank
	Interference check solution (ICSA/ICSAB)	At the beginning of an analytical run, daily	Monitor for possible interferences.	Terminate analysis; correct problem; re-analyze ICS; re-analyze all affected samples
	LCS/LFB	One per prep batch	All analytes within 15% of expected value	Correct problem then re-prep and analyze the LCS and all samples in the affected analytical batch
	Internal Standard	Every sample	IS intensity within 60-125% of intensity of the IS in the initial calibration	Perform corrective action as described in 200.8.
	Matrix Spike/Matrix Spike Duplicate (MS/MSD)	One per batch of 10 samples	All analytes within 30% of expected value	None
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 - Report all targets identified in the method blank above the MDL.

Appendix 4: Summary of Calibration and QC Procedures for Gravimetric Analyses

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA160.1 (TDS) SM2540 C (TDS) EPA160.2 (TSS) SM2540D (TSS) EPA160.3 (TS) SM2540B (TS) EPA160.4 (TVS)	Verification standard– single standard (if available)	Each batch	±10%	Repeat
	Method blank	Each batch	No analytes detected ≥ RL	Repeat, rerun
	Duplicate	Each batch, less than 20	±20%	None

Appendix 4: Summary of Calibration and QC Procedures for Titrimetric Analyses

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA310.1: Alkalinity. SM2320: HCO_3-, CO_3^{-2}.	Verification standard– single standard (if available)	Each batch	±10%	Repeat, check
	Method blank	Each batch	No analyte detected ≥ RL.	Repeat batch
	Duplicate	Each batch	±20%	None

Appendix 4: Summary of Calibration and QC Procedures for Electrometric Analyses

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA405.1: BOD[1], CBOD[1]. EPA120.1: Cond[1]. SM2510B: Cond[1]. EPA360.1: DO[1]. EPA150.1: pH. SW9040B, 9045C:pH. EPA180.1: Turbidity.	Calibration Curve – minimum of 5 standards	Initial Calibration. Perform re-calibration once per year minimum	±10%, $r^2 \geq 0.99$, $r \geq 0.995$.	Recalibrate
	Independent calibration verification (second source) (ICV)	Immediately after initial calibration	±10%	Recalibrate
	Continuing calibration verification (CCV)	Beginning, every 10 samples, and end of batch	±10%	Rerun
	Method blank	Each batch	No analyte detected ≥ ½ report limit or MDL, whichever is greater[2]	Reprep
	LCS	Each batch	±10%	Rerun batch
	MS/MSD	Each batch	± 20%	None
	Duplicate	When spike not available	±20%	None
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

[1]Calibration curve does not apply.
2 - Report all targets identified in the method blank above the MDL.

Appendix 4: Summary of Calibration and QC Procedures for Spectrophotometric Analyses

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA350.1: NH_3. EPA410.4: COD. EPA330.5: Cl_2 Res. EPA335.4: CN. EPA351.2 TKN. EPA353.2 NO_2/NO_3 EPA365.1 SM4500-P E T. Phos. EPA365.3 O-Phos. EPA376.2: S^{-2}. EPA415.1: TOC. SM4500-CN^-I: WAD CN EPA9060: TOC. EPA420.1: SW9065: Phenolics. SM4500-Cr D Hexchrome SM4500-N_{org} C	Calibration curve – minimum 5 point	Initial. Perform re-calibration once per year minimum.	RSD <10%, $r^2 \geq 0.99$, $r \geq 0.995$	Recalibrate
	Independent calibration verification – mid-level, second-source required (ICV)	Immediately following initial calibration.	±10%	Recalibrate
	Continuing calibration verification (CCV)	Beginning, every 10 samples, and at end of sequence	±10%	Correct, recalibrate
	Method blank	Each use	No analyte detected ≥ ½ report limit or MDL, whichever is greater[1]	Reprep, rerun
	MS/MSD	Each batch, less than 20	RSD < ±20%	None
	LCS	Each batch	± 10%	Rerun
	MDL verification	Minimum yearly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.

1 - Report all targets identified in the method blank above the MDL.

Appendix 4: Summary of Calibration and QC Procedures for Ion Chromatographic Analyses

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA300: SW9056A: Bromide Chloride Fluoride Nitrate Nitrite Sulfate.	Calibration Curve – Minimum 5-point calibration	Initial calibration. Perform instrument re-calibration once per year minimum.	RSD ± 10%, $r^2 \geq 0.99$, $r \geq 0.995$.	Recalibrate
	Calibration verification (ICV), second source	Immediately following initial calibration	±10%	Recalibrate
	Continuing calibration verification (CCV)	Each use, beginning, every 10 samples, end of batch	± 10%	Rerun affected samples
	Method blank	Each batch	No analyte detected ≥ ½ report limit or MDL, whichever is greater[3]	Rerun batch
	LCS	Each batch	±10%	Rerun batch
	MS/MSD[1]	Each batch	±20%	None, use LCS
	Duplicate[2]	Each batch	±30%	None
	MDL verification	Minimum yearly **For DOD:** Minimum quarterly	Detectible	Re-evaluate MDL standard used and MDL; see Technical Director.
	LOQ verification	**For DOD:** Minimum quarterly	Detectible	Re-evaluate LOQ standard used and LOQ; see Technical Director.

[1]Only applies to EPA300, SW9056.
[2]Oil only.
[1]Report all targets identified in the method blank above the MDL.

Appendix 4: Summary of Calibration and QC Procedures for Physical Analyses

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
SW1010: Flash Point. EPA110.2: Color (Pt/Co). SW9095: Paint Filter. EPA160.5: Settleable Solids.	Method blank	Each batch	No analyte detected ≥ ½ report limit or MDL, whichever is greater[1]	Repeat, rerun
	Two standards for Flash Point One standard for BTU 1 Known for Settleable Solids Method-specific standards for Color.	Each batch	±10%	Rerun batch
	Duplicate	Each batch	±20%	None

[1]Report all targets identified in the method blank above the MDL

Appendix 4: Summary of Calibration and QC Procedures for Oil & Grease Analyses

Method	QC Check	Frequency	Acceptance Criteria	Corrective Action
EPA1664A EPA 9071A	Verification standard	Single standard	±10% PAR standard	Rerun
	Method blank	Each batch	No analyte detected ≥ report limit	Repeat batch
	LCS	Each batch	See Control Limits	Repeat batch
	Duplicate	Each batch	See Control Limits	
	MS/MSD	Each batch	See Control Limits	None, use LCS
	LOQ verification	**For DOD:** Minimum quarterly	Detectible	Re-evaluate LOQ standard used and LOQ; see Technical Director.

END OF DOCUMENT

ELAP Certification

LABORATORY ACCREDITATION BUREAU

Certificate of Accreditation

ISO/IEC 17025:2005 ***Certificate Number L2236***

TestAmerica Laboratories, Inc

5755 8th Street East
Tacoma, WA 98424

has met the requirements set forth in L-A-B's policies and procedures, all requirements of ISO/IEC 17025:2005 "General Requirements for the competence of Testing and Calibration Laboratories" and the U.S. Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP).*

The accredited lab has demonstrated technical competence to a defined "Scope of Accreditation" and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated 8 January 2009).

Accreditation Granted through: January 19, 2013

R. Douglas Leonard, Jr., Managing Director
Laboratory Accreditation Bureau
Presented the 19th of January 2010

*See the laboratory's Scope of Accreditation for details of the DoD ELAP requirements
Laboratory Accreditation Bureau is found to be in compliance with ISO/IEC 17011:2004 and recognized by ILAC (International Laboratory Accreditation Cooperation) and NACLA (National Cooperation for Laboratory Accreditation).

LABORATORY ACCREDITATION BUREAU

Certificate # L2236

Scope of Accreditation
For
TestAmerica Laboratories, Inc.

5755 8th Street East
Tacoma, WA 98424
Dave Wunderlich
1-253-922-2310

In recognition of a successful assessment to ISO/IEC 17025:2005 and the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) as detailed in the DoD Quality Systems Manual for Environmental Laboratories (DoD QSM v4.1) based on the National Environmental Laboratory Accreditation Conference Chapter 5 Quality Systems Standard (NELAC Voted Revision June 5, 2003), accreditation is granted to TestAmerica Laboratories, Inc. to perform the following tests:

Accreditation granted through: January 19, 2013

Testing - Environmental

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-AES	6010B/200.7	Silver
ICP-AES	6010B/200.7	Aluminum
ICP-AES	6010B/200.7	Arsenic
ICP-AES	6010B/200.7	Boron
ICP-AES	6010B/200.7	Barium
ICP-AES	6010B/200.7	Beryllium
ICP-AES	6010B/200.7	Calcium
ICP-AES	6010B/200.7	Cadmium
ICP-AES	6010B/200.7	Cobalt
ICP-AES	6010B/200.7	Chromium
ICP-AES	6010B/200.7	Copper
ICP-AES	6010B/200.7	Iron
ICP-AES	6010B/200.7	Potassium
ICP-AES	6010B/200.7	Magnesium
ICP-AES	6010B/200.7	Manganese
ICP-AES	6010B/200.7	Molybdenum
ICP-AES	6010B/200.7	Sodium
ICP-AES	6010B/200.7	Nickel
ICP-AES	6010B/200.7	Lead
ICP-AES	6010B/200.7	Antimony
ICP-AES	6010B/200.7	Selenium

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP-AES	6010B/200.7	Silicon
ICP-AES	6010B/200.7	Tin
ICP-AES	6010B/200.7	Titanium
ICP-AES	6010B/200.7	Strontium
ICP-AES	6010B/200.7	Thallium
ICP-AES	6010B/200.7	Vanadium
ICP-AES	6010B/200.7	Zinc
ICP-MS	6020/200.8	Silver
ICP-MS	6020/200.8	Arsenic
ICP-MS	6020/200.8	Barium
ICP-MS	6020/200.8	Beryllium
ICP-MS	6020/200.8	Cadmium
ICP-MS	6020/200.8	Cobalt
ICP-MS	6020/200.8	Chromium
ICP-MS	6020/200.8	Copper
ICP-MS	6020/200.8	Manganese
ICP-MS	6020/200.8	Molybdenum
ICP-MS	6020/200.8	Nickel
ICP-MS	6020/200.8	Lead
ICP-MS	6020/200.8	Antimony
ICP-MS	6020/200.8	Selenium
ICP-MS	6020/200.8	Thallium
ICP-MS	6020/200.8	Uranium
ICP-MS	6020/200.8	Vanadium
ICP-MS	6020/200.8	Zinc
CVAAS	7470A/245.1	Mercury
ICP-AES	7195/6010B	Hexavalent Chromium
GC/MS	8260B/624	1,1,1,2-Tetrachloroethane
GC/MS	8260B/624	1,1,1-Trichloroethane
GC/MS	8260B/624	1,1,2,2-Tetrachloroethane
GC/MS	8260B/624	1,1,2-Trichloroethane
GC/MS	8260B/624	1,1-Dichloroethane
GC/MS	8260B/624	1,1-Dichloroethene
GC/MS	8260B/624	1,1-Dichloropropene
GC/MS	8260B/624	1,2,3-Trichlorobenzene
GC/MS	8260B/624	1,2,3-Trichloropropane
GC/MS	8260B/624	1,2,4-Trichlorobenzene
GC/MS	8260B/624	1,2,4-Trimethylbenzene
GC/MS	8260B/624	1,2-Dibromo-3-Chloropropane
GC/MS	8260B/624	1,2-Dichlorobenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8260B/624	1,2-Dichloroethane
GC/MS	8260B/624	1,2-Dichloropropane
GC/MS	8260B/624	1,3,5-Trimethylbenzene
GC/MS	8260B/624	1,3-Dichlorobenzene
GC/MS	8260B/624	1,3-Dichloropropane
GC/MS	8260B/624	1,4-Dichlorobenzene
GC/MS	8260B/624	2,2-Dichloropropane
GC/MS	8260B/624	2-Chlorotoluene
GC/MS	8260B/624	2-Hexanone
GC/MS	8260B/624	4-Chlorotoluene
GC/MS	8260B/624	4-Isopropyltoluene
GC/MS	8260B/624	Acetone
GC/MS	8260B/624	Benzene
GC/MS	8260B/624	Bromobenzene
GC/MS	8260B/624	Bromodichloromethane
GC/MS	8260B/624	Bromoform
GC/MS	8260B/624	Bromomethane
GC/MS	8260B/624	Carbon disulfide
GC/MS	8260B/624	Carbon tetrachloride
GC/MS	8260B/624	Chlorobenzene
GC/MS	8260B/624	Chlorobromomethane
GC/MS	8260B/624	Chlorodibromomethane
GC/MS	8260B/624	Chloroethane
GC/MS	8260B/624	Chloroform
GC/MS	8260B/624	Chloromethane
GC/MS	8260B/624	cis-1,2-Dichloroethene
GC/MS	8260B/624	cis-1,3-Dichloropropene
GC/MS	8260B/624	Dibromomethane
GC/MS	8260B/624	Dichlorodifluoromethane
GC/MS	8260B/624	Ethylbenzene
GC/MS	8260B/624	Ethylene Dibromide
GC/MS	8260B/624	Hexachlorobutadiene
GC/MS	8260B/624	Isopropylbenzene
GC/MS	8260B/624	Methyl Ethyl Ketone
GC/MS	8260B/624	Methyl Isobutyl Ketone
GC/MS	8260B/624	Methyl tert-butyl ether
GC/MS	8260B/624	Methylene Chloride
GC/MS	8260B/624	m-Xylene & p-Xylene
GC/MS	8260B/624	Naphthalene
GC/MS	8260B/624	n-Butylbenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8260B/624	N-Propylbenzene
GC/MS	8260B/624	o-Xylene
GC/MS	8260B/624	sec-Butylbenzene
GC/MS	8260B/624	Styrene
GC/MS	8260B/624	tert-Butylbenzene
GC/MS	8260B/624	Tetrachloroethene
GC/MS	8260B/624	Toluene
GC/MS	8260B/624	trans-1,2-Dichloroethene
GC/MS	8260B/624	trans-1,3-Dichloropropene
GC/MS	8260B/624	Trichloroethene
GC/MS	8260B/624	Trichlorofluoromethane
GC/MS	8260B/624	Vinyl chloride
GC/MS	8270C/625	1,2,4-Trichlorobenzene
GC/MS	8270C/625	1,2-Dichlorobenzene
GC/MS	8270C/625	1,3-Dichlorobenzene
GC/MS	8270C/625	1,4-Dichlorobenzene
GC/MS	8270C/625	bis(2-chloroisoprolyl)ether
GC/MS	8270C/625	2,4,5-Trichlorophenol
GC/MS	8270C/625	2,4,6-Trichlorophenol
GC/MS	8270C/625	2,4-Dichlorophenol
GC/MS	8270C/625	2,4-Dimethylphenol
GC/MS	8270C/625	2,4-Dinitrophenol
GC/MS	8270C/625	2,4-Dinitrotoluene
GC/MS	8270C/625	2,6-Dinitrotoluene
GC/MS	8270C/625	2-Chloronaphthalene
GC/MS	8270C/625	2-Chlorophenol
GC/MS	8270C/625	2-Methylnaphthalene
GC/MS	8270C/625	2-Methylphenol
GC/MS	8270C/625	2-Nitroaniline
GC/MS	8270C/625	2-Nitrophenol
GC/MS	8270C/625	3 & 4 Methylphenol
GC/MS	8270C/625	3,3'-Dichlorobenzidine
GC/MS	8270C/625	3-Nitroaniline
GC/MS	8270C/625	4,6-Dinitro-2-methylphenol
GC/MS	8270C/625	4-Bromophenyl phenyl ether
GC/MS	8270C/625	4-Chloro-3-methylphenol
GC/MS	8270C/625	4-Chloroaniline
GC/MS	8270C/625	4-Chlorophenyl phenyl ether
GC/MS	8270C/625	4-Nitroaniline
GC/MS	8270C/625	Acenaphthene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	8270C/625	Acenaphthylene
GC/MS	8270C/625	Anthracene
GC/MS	8270C/625	1,2-Diphenylhydrazine as Azobenzene
GC/MS	8270C/625	Benzo[a]anthracene
GC/MS	8270C/625	Benzo[a]pyrene
GC/MS	8270C/625	Benzo[b]fluoranthene
GC/MS	8270C/625	Benzo[g,h,i]perylene
GC/MS	8270C/625	Benzo[k]fluoranthene
GC/MS	8270C/625	Benzoic acid
GC/MS	8270C/625	Benzyl alcohol
GC/MS	8270C/625	Bis(2-chloroethoxy)methane
GC/MS	8270C/625	Bis(2-chloroethyl)ether
GC/MS	8270C/625	Bis(2-ethylhexyl) phthalate
GC/MS	8270C/625	Butyl benzyl phthalate
GC/MS	8270C/625	Carbazole
GC/MS	8270C/625	Chrysene
GC/MS	8270C/625	Dibenz(a,h)anthracene
GC/MS	8270C/625	Dibenzofuran
GC/MS	8270C/625	Diethyl phthalate
GC/MS	8270C/625	Dimethyl phthalate
GC/MS	8270C/625	Di-n-butyl phthalate
GC/MS	8270C/625	Di-n-octyl phthalate
GC/MS	8270C/625	Fluoranthene
GC/MS	8270C/625	Fluorene
GC/MS	8270C/625	Hexachlorobenzene
GC/MS	8270C/625	Hexachlorobutadiene
GC/MS	8270C/625	Hexachloroethane
GC/MS	8270C/625	Indeno[1,2,3-cd]pyrene
GC/MS	8270C/625	Isophorone
GC/MS	8270C/625	Naphthalene
GC/MS	8270C/625	Nitrobenzene
GC/MS	8270C/625	N-Nitrosodimethylamine
GC/MS	8270C/625	N-Nitrosodi-n-propylamine
GC/MS	8270C/625	N-Nitrosodiphenylamine
GC/MS	8270C/625	Pentachlorophenol
GC/MS	8270C/625	Phenanthrene
GC/MS	8270C/625	Phenol
GC/MS	8270C/625	Pyrene
GC/MS SIM	8270C SIM	2-Methylnaphthalene
GC/MS SIM	8270C SIM	Acenaphthene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS SIM	8270C SIM	Acenaphthylene
GC/MS SIM	8270C SIM	Anthracene
GC/MS SIM	8270C SIM	Benzo[a]anthracene
GC/MS SIM	8270C SIM	Benzo[a]pyrene
GC/MS SIM	8270C SIM	Benzo[b]fluoranthene
GC/MS SIM	8270C SIM	Benzo[g,h,i]perylene
GC/MS SIM	8270C SIM	Benzo[k]fluoranthene
GC/MS SIM	8270C SIM	Chrysene
GC/MS SIM	8270C SIM	Dibenz(a,h)anthracene
GC/MS SIM	8270C SIM	Fluoranthene
GC/MS SIM	8270C SIM	Fluorene
GC/MS SIM	8270C SIM	Indeno[1,2,3-cd]pyrene
GC/MS SIM	8270C SIM	Naphthalene
GC/MS SIM	8270C SIM	Phenanthrene
GC/MS SIM	8270C SIM	Pyrene
GC-ECD	8011	1,2-Dibromoethane
GC-ECD	8011	1,2-Dibromo-3-Chloropropane
GC-ECD	8081A/608	4,4'-DDD
GC-ECD	8081A/608	4,4'-DDE
GC-ECD	8081A/608	4,4'-DDT
GC-ECD	8081A/608	Aldrin
GC-ECD	8081A/608	alpha-BHC
GC-ECD	8081A/608	alpha-Chlordane
GC-ECD	8081A/608	beta-BHC
GC-ECD	8081A/608	delta-BHC
GC-ECD	8081A/608	Dieldrin
GC-ECD	8081A/608	Endosulfan I
GC-ECD	8081A/608	Endosulfan II
GC-ECD	8081A/608	Endosulfan sulfate
GC-ECD	8081A/608	Endrin
GC-ECD	8081A/608	Endrin aldehyde
GC-ECD	8081A/608	Endrin ketone
GC-ECD	8081A/608	gamma-BHC (Lindane)
GC-ECD	8081A/608	gamma-Chlordane
GC-ECD	8081A/608	Heptachlor
GC-ECD	8081A/608	Heptachlor epoxide
GC-ECD	8081A/608	Methoxychlor
GC-ECD	8081A/608	Technical Chlordane
GC-ECD	8081A/608	Toxaphene
GC-ECD	8082/608	PCB-1016

Non-Potable Water		
Technology	**Method**	**Analyte**
GC-ECD	8082/608	PCB-1221
GC-ECD	8082/608	PCB-1232
GC-ECD	8082/608	PCB-1242
GC-ECD	8082/608	PCB-1248
GC-ECD	8082/608	PCB-1254
GC-ECD	8082/608	PCB-1260
GC-IT/MS	8151A mod.	2,4,5-T
GC-IT/MS	8151A mod.	2,4-D
GC-IT/MS	8151A mod.	2,4-DB
GC-IT/MS	8151A mod.	4-Nitrophenol
GC-IT/MS	8151A mod.	Dalapon
GC-IT/MS	8151A mod.	Dicamba
GC-IT/MS	8151A mod.	Dichlorprop
GC-IT/MS	8151A mod.	Dinoseb
GC-IT/MS	8151A mod.	MCPA
GC-IT/MS	8151A mod.	Mecoprop
GC-IT/MS	8151A mod.	Pentachlorophenol
GC-IT/MS	8151A mod.	Silvex (2,4,5-TP)
GC-FID	EPA 8015B/AK101/ NWTPH-Gx/NWVPH	Gasoline and Volatile Petroleum Hydrocarbons
GC-FID	EPA 8015B/AK102/ NWTPH-Dx/NWEPH	Diesel and Extractable Petroleum Hydrocarbons
GC-FID	EPA 8015B/AK102/ NWTPH-Dx/NWEPH	Motor Oil and Extractable Petroleum Hydrocarbons
Gravimetric	1664A	Oil & Grease
Colorimetric/RFA	9012A	Total Cyanides
Ion Chromatography	300.0/9056A	Bromide
Ion Chromatography	300.0/9056A	Chloride
Ion Chromatography	300.0/9056A	Fluoride
Ion Chromatography	300.0/9056A	Sulfate
Ion Chromatography	300.0/9056A	Nitrate
Ion Chromatography	300.0/9056A	Nitrite
TOC Analyzer (IR)	415.1/9060	TOC
Probe	9040/9045/150.1	pH
Conductivity meter	9050/120.1/SM2510B	Specific Conductance
Pensky-Martens closed-cup tester/ Setaflash	1010/1020	Ignitability/Flashpoint
Preparation	**Method**	**Type**
Separatory Funnel Liquid-Liquid Extraction	3510C	Semivolatile and Nonvolatile Organics

Non-Potable Water

Preparation	Method	Type
Continuous Liquid-Liquid Extraction	3520	Semivolatile and Nonvolatile Organics
Solvent Dilution	3580	Semivolatile and Nonvolatile Organics
Waste Dilution	3585	Volatile Organic Compounds
Purge and Trap	5030	Volatile Organic Compounds
Purge and Trap	5035	Volatile Organic Compounds
Acid Digestion (Aqueous)	3005/3010	Inorganics
Acid Digestion (Sediments, Sludges, and Soils)	3050	Inorganics
TCLP Extraction	1311	Toxicity Characteristic Leaching Procedure
Florisil Cleanup	3620B	Cleanup of pesticide residues and other chlorinated hydrocarbons
Silica Gel Cleanup	3630C	Column Cleanup
Gel Permeation Cleanup	3640A	Separation of Synthetic Macromolecules
Sulfur Cleanup	3660B	Sulfur Cleanup Reagent
Sulfuric Acid Cleanup	3665A	Cleanup for Quantitation of PCBs

Solid and Chemical Materials

Technology	Method	Analyte
ICP-AES	6010B	Silver
ICP-AES	6010B	Aluminum
ICP-AES	6010B	Arsenic
ICP-AES	6010B	Boron
ICP-AES	6010B	Barium
ICP-AES	6010B	Beryllium
ICP-AES	6010B	Calcium
ICP-AES	6010B	Cadmium
ICP-AES	6010B	Cobalt
ICP-AES	6010B	Chromium
ICP-AES	6010B	Copper
ICP-AES	6010B	Iron
ICP-AES	6010B	Potassium
ICP-AES	6010B	Magnesium
ICP-AES	6010B	Manganese
ICP-AES	6010B	Molybdenum
ICP-AES	6010B	Sodium
ICP-AES	6010B	Nickel
ICP-AES	6010B	Lead
ICP-AES	6010B	Antimony
ICP-AES	6010B	Selenium

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
ICP-AES	6010B	Silicon
ICP-AES	6010B	Tin
ICP-AES	6010B	Titanium
ICP-AES	6010B	Strontium
ICP-AES	6010B	Thallium
ICP-AES	6010B	Vanadium
ICP-AES	6010B	Zinc
ICP-MS	6020	Silver
ICP-MS	6020	Arsenic
ICP-MS	6020	Barium
ICP-MS	6020	Beryllium
ICP-MS	6020	Cadmium
ICP-MS	6020	Cobalt
ICP-MS	6020	Chromium
ICP-MS	6020	Copper
ICP-MS	6020	Iron
ICP-MS	6020	Manganese
ICP-MS	6020	Molybdenum
ICP-MS	6020	Nickel
ICP-MS	6020	Lead
ICP-MS	6020	Antimony
ICP-MS	6020	Selenium
ICP-MS	6020	Thallium
ICP-MS	6020	Uranium
ICP-MS	6020	Vanadium
ICP-MS	6020	Zinc
CVAAS	7471A	Mercury
ICP-AES	7195/6010B	Hexavalent Chromium
GC/MS	8260B	1,1,1,2-Tetrachloroethane
GC/MS	8260B	1,1,1-Trichloroethane
GC/MS	8260B	1,1,2,2-Tetrachloroethane
GC/MS	8260B	1,1,2-Trichloroethane
GC/MS	8260B	1,1-Dichloroethane
GC/MS	8260B	1,1-Dichloroethene
GC/MS	8260B	1,1-Dichloropropene
GC/MS	8260B	1,2,3-Trichlorobenzene
GC/MS	8260B	1,2,3-Trichloropropane
GC/MS	8260B	1,2,4-Trichlorobenzene
GC/MS	8260B	1,2,4-Trimethylbenzene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8260B	1,2-Dibromo-3-Chloropropane
GC/MS	8260B	1,2-Dichlorobenzene
GC/MS	8260B	1,2-Dichloroethane
GC/MS	8260B	1,2-Dichloropropane
GC/MS	8260B	1,3,5-Trimethylbenzene
GC/MS	8260B	1,3-Dichlorobenzene
GC/MS	8260B	1,3-Dichloropropane
GC/MS	8260B	1,4-Dichlorobenzene
GC/MS	8260B	2,2-Dichloropropane
GC/MS	8260B	2-Chlorotoluene
GC/MS	8260B	2-Hexanone
GC/MS	8260B	4-Chlorotoluene
GC/MS	8260B	4-Isopropyltoluene
GC/MS	8260B	Acetone
GC/MS	8260B	Benzene
GC/MS	8260B	Bromobenzene
GC/MS	8260B	Bromoform
GC/MS	8260B	Bromomethane
GC/MS	8260B	Carbon disulfide
GC/MS	8260B	Carbon tetrachloride
GC/MS	8260B	Chlorobenzene
GC/MS	8260B	Chlorodibromomethane
GC/MS	8260B	Chloroethane
GC/MS	8260B	Chloroform
GC/MS	8260B	Chloromethane
GC/MS	8260B	cis-1,2-Dichloroethene
GC/MS	8260B	cis-1,3-Dichloropropene
GC/MS	8260B	Dibromomethane
GC/MS	8260B	Dichlorodifluoromethane
GC/MS	8260B	Ethylbenzene
GC/MS	8260B	Ethylene Dibromide
GC/MS	8260B	Hexachlorobutadiene
GC/MS	8260B	Isopropylbenzene
GC/MS	8260B	Methyl Ethyl Ketone
GC/MS	8260B	Methyl Isobutyl Ketone
GC/MS	8260B	Methyl tert-butyl ether
GC/MS	8260B	Methylene Chloride
GC/MS	8260B	m-Xylene & p-Xylene
GC/MS	8260B	Naphthalene
GC/MS	8260B	n-Butylbenzene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8260B	N-Propylbenzene
GC/MS	8260B	o-Xylene
GC/MS	8260B	sec-Butylbenzene
GC/MS	8260B	Styrene
GC/MS	8260B	tert-Butylbenzene
GC/MS	8260B	Tetrachloroethene
GC/MS	8260B	Toluene
GC/MS	8260B	trans-1,2-Dichloroethene
GC/MS	8260B	trans-1,3-Dichloropropene
GC/MS	8260B	Trichloroethene
GC/MS	8260B	Trichlorofluoromethane
GC/MS	8260B	Vinyl chloride
GC/MS	8270C	1,2,4-Trichlorobenzene
GC/MS	8270C	1,2-Dichlorobenzene
GC/MS	8270C	1,3-Dichlorobenzene
GC/MS	8270C	1,4-Dichlorobenzene
GC/MS	8270C	bis(2-chloroisoprolyl)ether
GC/MS	8270C	2,4,5-Trichlorophenol
GC/MS	8270C	2,4,6-Trichlorophenol
GC/MS	8270C	2,4-Dichlorophenol
GC/MS	8270C	2,4-Dimethylphenol
GC/MS	8270C	2,4-Dinitrophenol
GC/MS	8270C	2,4-Dinitrotoluene
GC/MS	8270C	2,6-Dinitrotoluene
GC/MS	8270C	2-Chloronaphthalene
GC/MS	8270C	2-Chlorophenol
GC/MS	8270C	2-Methylnaphthalene
GC/MS	8270C	2-Methylphenol
GC/MS	8270C	2-Nitroaniline
GC/MS	8270C	2-Nitrophenol
GC/MS	8270C	3 & 4 Methylphenol
GC/MS	8270C	3,3'-Dichlorobenzidine
GC/MS	8270C	3-Nitroaniline
GC/MS	8270C	4,6-Dinitro-2-methylphenol
GC/MS	8270C	4-Bromophenyl phenyl ether
GC/MS	8270C	4-Chloro-3-methylphenol
GC/MS	8270C	4-Chloroaniline
GC/MS	8270C	4-Chlorophenyl phenyl ether
GC/MS	8270C	4-Nitroaniline
GC/MS	8270C	Acenaphthene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	8270C	Acenaphthylene
GC/MS	8270C	Anthracene
GC/MS	8270C	1,2-Diphenylhydrazine as Azobenzene
GC/MS	8270C	Benzo[a]anthracene
GC/MS	8270C	Benzo[a]pyrene
GC/MS	8270C	Benzo[b]fluoranthene
GC/MS	8270C	Benzo[g,h,i]perylene
GC/MS	8270C	Benzo[k]fluoranthene
GC/MS	8270C	Benzoic acid
GC/MS	8270C	Benzyl alcohol
GC/MS	8270C	Bis(2-chloroethoxy)methane
GC/MS	8270C	Bis(2-chloroethyl)ether
GC/MS	8270C	Bis(2-ethylhexyl) phthalate
GC/MS	8270C	Butyl benzyl phthalate
GC/MS	8270C	Carbazole
GC/MS	8270C	Chrysene
GC/MS	8270C	Dibenz(a,h)anthracene
GC/MS	8270C	Dibenzofuran
GC/MS	8270C	Diethyl phthalate
GC/MS	8270C	Dimethyl phthalate
GC/MS	8270C	Di-n-butyl phthalate
GC/MS	8270C	Di-n-octyl phthalate
GC/MS	8270C	Fluoranthene
GC/MS	8270C	Fluorene
GC/MS	8270C	Hexachlorobenzene
GC/MS	8270C	Hexachlorobutadiene
GC/MS	8270C	Hexachloroethane
GC/MS	8270C	Indeno[1,2,3-cd]pyrene
GC/MS	8270C	Isophorone
GC/MS	8270C	Naphthalene
GC/MS	8270C	Nitrobenzene
GC/MS	8270C	N-Nitrosodimethylamine
GC/MS	8270C	N-Nitrosodi-n-propylamine
GC/MS	8270C	N-Nitrosodiphenylamine
GC/MS	8270C	Pentachlorophenol
GC/MS	8270C	Phenanthrene
GC/MS	8270C	Phenol
GC/MS	8270C	Pyrene
GC/MS SIM	8270C SIM	2-Methylnaphthalene
GC/MS SIM	8270C SIM	Acenaphthene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS SIM	8270C SIM	Acenaphthylene
GC/MS SIM	8270C SIM	Anthracene
GC/MS SIM	8270C SIM	Benzo[a]anthracene
GC/MS SIM	8270C SIM	Benzo[a]pyrene
GC/MS SIM	8270C SIM	Benzo[b]fluoranthene
GC/MS SIM	8270C SIM	Benzo[g,h,i]perylene
GC/MS SIM	8270C SIM	Benzo[k]fluoranthene
GC/MS SIM	8270C SIM	Chrysene
GC/MS SIM	8270C SIM	Dibenz(a,h)anthracene
GC/MS SIM	8270C SIM	Fluoranthene
GC/MS SIM	8270C SIM	Fluorene
GC/MS SIM	8270C SIM	Indeno[1,2,3-cd]pyrene
GC/MS SIM	8270C SIM	Naphthalene
GC/MS SIM	8270C SIM	Phenanthrene
GC/MS SIM	8270C SIM	Pyrene
GC-ECD	8081A	4,4'-DDD
GC-ECD	8081A	4,4'-DDE
GC-ECD	8081A	4,4'-DDT
GC-ECD	8081A	Aldrin
GC-ECD	8081A	alpha-BHC
GC-ECD	8081A	alpha-Chlordane
GC-ECD	8081A	beta-BHC
GC-ECD	8081A	delta-BHC
GC-ECD	8081A	Dieldrin
GC-ECD	8081A	Endosulfan I
GC-ECD	8081A	Endosulfan II
GC-ECD	8081A	Endosulfan sulfate
GC-ECD	8081A	Endrin
GC-ECD	8081A	Endrin aldehyde
GC-ECD	8081A	Endrin ketone
GC-ECD	8081A	gamma-BHC (Lindane)
GC-ECD	8081A	gamma-Chlordane
GC-ECD	8081A	Heptachlor
GC-ECD	8081A	Heptachlor epoxide
GC-ECD	8081A	Methoxychlor
GC-ECD	8081A	Technical Chlordane
GC-ECD	8081A	Toxaphene
GC-ECD	8082	PCB-1016
GC-ECD	8082	PCB-1221
GC-ECD	8082	PCB-1232

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC-ECD	8082	PCB-1242
GC-ECD	8082	PCB-1248
GC-ECD	8082	PCB-1254
GC-ECD	8082	PCB-1260
GC-IT/MS	8151A mod.	2,4,5-T
GC-IT/MS	8151A mod.	2,4-D
GC-IT/MS	8151A mod.	2,4-DB
GC-IT/MS	8151A mod.	4-Nitrophenol
GC-IT/MS	8151A mod.	Dalapon
GC-IT/MS	8151A mod.	Dicamba
GC-IT/MS	8151A mod.	Dichlorprop
GC-IT/MS	8151A mod.	Dinoseb
GC-IT/MS	8151A mod.	MCPA
GC-IT/MS	8151A mod.	Mecoprop MCPP
GC-IT/MS	8151A mod.	Pentachlorophenol
GC-IT/MS	8151A mod.	Silvex (2,4,5-TP)
GC-FID	8015B/AK101/ NWTPH-Gx/NWVPH	Gasoline and Volatile Petroleum Hydrocarbons
GC-FID	8015B/AK102/ NWTPH-Dx/NWEPH	Diesel and Extractable Petroleum Hydrocarbons
GC-FID	8015B/AK102/ NWTPH-Dx/NWEPH	Motor Oil and Extractable Petroleum Hydrocarbons
Colorimetric/RFA	9012A	Total Cyanides
Ion Chromatography	300.0/9056A	Fluoride
Ion Chromatography	300.0/9056A	Chloride
Ion Chromatography	300.0/9056A	Fluoride
Ion Chromatography	300.0/9056A	Sulfate
Ion Chromatography	300.0/9056A	Nitrate
Ion Chromatography	300.0/9056A	Nitrite
TOC Analyzer (IR)	9060	TOC
Probe	9040/9045	pH/Corrosivity
Conductivity meter	9050	Specific Conductance
Pensky-Martens closed-cup tester/ Setaflash	1010/1020	Ignitability/Flashpoint
Preparation	**Method**	**Type**
Separatory Funnel Liquid-Liquid Extraction	3510C	Semivolatile and Nonvolatile Organics
Continuous Liquid-Liquid Extraction	3520	Semivolatile and Nonvolatile Organics
Ultrasonic Extraction	3550C	Semivolatile and Nonvolatile Organics
Solvent Dilution	3580	Semivolatile and Nonvolatile Organics

LABORATORY ACCREDITATION BUREAU

Certificate # L2236

Solid and Chemical Materials		
Preparation	**Method**	**Type**
Waste Dilution	3585	Volatile Organic Compounds
Purge and Trap	5030	Volatile Organic Compounds
Purge and Trap	5035	Volatile Organic Compounds
Acid Digestion (Aqueous)	3005/3010	Inorganics
Acid Digestion (Sediments, Sludges, and Soils)	3050	Inorganics
TCLP Extraction	1311	Toxicity Characteristic Leaching Procedure
Florisil Cleanup	3620B	Cleanup of pesticide residues and other chlorinated hydrocarbons
Silica Gel Cleanup	3630C	Column Cleanup
Gel Permeation Cleanup	3640A	Separation of Synthetic Macromolecules
Sulfur Cleanup	3660B	Sulfur Cleanup Reagent
Sulfuric Acid Cleanup	3665A	Cleanup for Quantitation of PCBs

Notes:

1) This laboratory offers commercial testing service.

Approved By: _____ Date: January 19, 2010

R. Douglas Leonard
Chief Technical Officer

Issued: 01/19/10

THE STATE OF ALASKA

Department of Environmental Conservation
Laboratory Certification Program

Certificate of Approval for Contaminated Sites Analysis

TestAmerica-Tacoma

5755 8th Street East
Tacoma, WA 98424

UST-022

has complied with the provisions set forth in 18 AAC 78 and is hereby recognized by The Department of Environmental Conservation as **Approved** for the analytical parameter listed on the accompanying Scope of Accreditation. This certificate is effective **3/4/11**, and expires **3/4/12**.

Patryce D. McKinney
State of Alaska Certification Authority

Lance W. Morris
Laboratory Chemistry Certification Officer

THE STATE OF ALASKA
Department of Environmental Conservation
Laboratory Approval Program

Scope of Approval

Expiration: 03/04/2012

TestAmerica-Seattle, WA UST-022
5755 8th Street East
Tacoma, WA 98424

is approved by the State of Alaska Department of Environmental Conservation, pursuant to 18 AAC 78, to perform analysis for the parameters listed below using the analytical methods indicated. Approval for all parameters is final. Approval is for the latest version of a method unless specified otherwise in a note. EPA refers to the U.S. Environmental Protection Agency. AK refers to Alaska Methods 101, 102 and 103 for the determination of gasoline, diesel and residual range organics in soil and water. ASTM refers to the American Society for Testing and Materials.

Contaminated Sites

Method/Test Name	Reference	Analyte	Matrix	Status
6010B	EPA	Total Arsenic	Soil	Approved
6010B	EPA	Total Barium	Soil	Approved
6010B	EPA	Total Cadmium	Soil	Approved
6010B	EPA	Total Chromium	Soil	Approved
6010B	EPA	Total Lead	Soil	Approved
6010B	EPA	Total Nickel	Soil	Approved
6010B	EPA	Total Vanadium	Soil	Approved
6010B	EPA	Total Arsenic	Water	Approved
6010B	EPA	Total Barium	Water	Approved
6010B	EPA	Total Cadmium	Water	Approved
6010B	EPA	Total Chromium	Water	Approved
6010B	EPA	Total Lead	Water	Approved
6010B	EPA	Total Nickel	Water	Approved
6010B	EPA	Total Vanadium	Water	Approved
6020	EPA	Total Arsenic	Soil	Approved
6020	EPA	Total Barium	Soil	Approved
6020	EPA	Total Cadmium	Soil	Approved
6020	EPA	Total Chromium	Soil	Approved
6020	EPA	Total Lead	Soil	Approved

Contaminated Sites

Method/Test Name	Reference	Analyte	Matrix	Status
6020	EPA	Total Nickel	Soil	Approved
6020	EPA	Total Vanadium	Soil	Approved
6020	EPA	Total Arsenic	Water	Approved
6020	EPA	Total Barium	Water	Approved
6020	EPA	Total Cadmium	Water	Approved
6020	EPA	Total Chromium	Water	Approved
6020	EPA	Total Lead	Water	Approved
6020	EPA	Total Nickel	Water	Approved
6020	EPA	Total Vanadium	Water	Approved
8021B	EPA	BTEX	Water	Approved
8082	EPA	Polychlorinated Biphenyls-PCB	Soil	Approved
8082	EPA	Polychlorinated Biphenyls-PCB	Water	Approved
8260B	EPA	BTEX	Soil	Approved
8260B	EPA	Total Volatile Chlorinated Solvents	Soil	Approved
8260B	EPA	BTEX	Water	Approved
8260B	EPA	Total Volatile Chlorinated Solvents	Water	Approved
8270C	EPA	PAH	Soil	Approved
8270C	EPA	PAH	Water	Approved
AK101	AK	Gasoline Range Organics	Soil	Approved
AK101	AK	Gasoline Range Organics	Water	Approved
AK101/8021B	EPA	BTEX-methanol preserved	Soil	Approved
AK102	AK	Diesel Range Organics	Soil	Approved
AK102	AK	Diesel Range Organics	Water	Approved
AK102-SV	AK	Diesel Range Organics-small volume	Water	Approved
AK103	AK	Residual Range Organics	Soil	Approved

ATTACHMENT 4

TestAmerica Laboratories, Inc.
Standard Operating Procedures

TestAmerica Denver

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Title: Dissolved Gases in Water
Method No. RSK-175

Approvals (Signature/Date):

Dennis Jonsrud Technical Specialist	9-30-10 Date	Adam Alban Health & Safety Manager / Coordinator	04Oct10 Date
Karen Kuoppala Quality Assurance Manager	10-6-10 Date	Robert C. Hanisch Laboratory Director	10/7/10 Date

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1.0 Scope and Application

1.1. This document describes a procedure for the determination of methane, ethane, ethene, and acetylene dissolved in water using a static headspace autosampler connected to a gas chromatograph with dual flame ionization detectors (GC/FID). This SOP is based on the RSK-175 method described in EPA document EPA/600/J-89/186, 1994.

1.2. The most common application for this analysis is to assist in evaluating the biological activity in aquifers contaminated with petroleum hydrocarbons.

1.3. The standard reporting limit is 5 µg/L for each of the compounds.

1.4. Analytes, Matrix(s), and Reporting Limits

1.5. Refer to Table 3 for a list of analytes and standard reporting limits.

2.0 Summary of Method

2.1 A water sample, with field blank and duplicate, is collected in a VOA vial with a screw cap fitted with a Teflon septum. The vial is completely filled so that there is no headspace. When the sample is received at the laboratory, 18 mL of the sample is transferred to a 22-mL serum vial with a crimp septum cap. The sample is loaded onto the headspace autosampler and analyzed by dual column GC/FID.

2.2 The instrument is calibrated using a minimum of 5 of the 7 calibration levels shown in Table 2. Sample results are calculated using the external standardization method.

2.3 Unless extrapolating results to conditions different than those used for analysis, this procedure does not require calculation of the concentration in the headspace using Henry's Law and then using this result to calculate the concentration in the aqueous sample. Instead of calibrating with gas standards, the calibration standards are prepared in water to mimic the actual field samples. Therefore, the calibration incorporates the equilibration between the aqueous and gaseous phases in the sample vial. Continuing calibration verification standards are analyzed immediately prior to sample analysis to ensure that the same temperature and pressure exist for both standards and samples.

3.0 Definitions

3.1 Henry's Law

Henry's Law states that the equilibrium value of the mole fraction of gas dissolved in a liquid is directly proportional to the partial pressure of the gas above the liquid surface, and is expressed as follows:

$$P_g = X_g \times K_h$$

Where:

P_g = partial pressure in atmospheres

X_g = mole fraction of dissolved gas, which given a liquid volume and the gram molecular weight per mole can be converted to a concentration

K_h = Henry's law constant in atmospheres, the value of the constant is dependent on temperature

Henry's Law is applicable at low concentrations and low partial pressures of gas at or below one atmosphere of pressure.

3.2 Static Headspace Autosampler

The term "static headspace" means that the sample is not stirred, mixed, or bubbled during analysis. The autosampler described in Section 6.2 includes a heating block that holds the 22-mL vials and ensures a constant 40°C (± 1°C) temperature during analysis.

4.0 Interferences

Method interferences may be caused by contaminants in solvents, reagents, glassware, and other processing apparatus that lead to discrete artifacts. All of these materials must be routinely demonstrated to be free from interferences under conditions of the analysis by running laboratory method blanks as described in the Quality Control section. Specific selection of reagents may be required to avoid introduction of contaminants.

5.0 Safety

Employees must abide by the policies and procedures in the Environmental Health and Safety Manual, Radiation Safety Manual, and this document.

5.1 Specific Safety Concerns or Requirements

5.1.1 Eye protection that satisfies ANSI Z87.1 (as per the Environmental Health and Safety Manual), laboratory coat, and latex or nitrile gloves must be worn while handling samples, standards, solvents, and reagents. Disposable gloves that have been contaminated will be removed and discarded; other gloves will be cleaned immediately.

5.1.2 The gas chromatograph contains zones that have elevated temperatures. The analyst needs to be aware of the locations of those zones, and must cool them to room temperature prior to working on them.

5.1.3 There are areas of high voltage in the gas chromatograph. Depending on the type of work involved, either turn the power to the instrument off, or disconnect it from its source of power.

5.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating.

NOTE: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.

A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material	Hazards	Exposure Limit (1)	Signs and Symptoms of Exposure
Hydrogen Gas	Flammable High-Pressure Gas Asphyxiant	None established	Hydrogen gas can form explosive mixtures with air. May ignite if valve is opened to air. Burns with invisible flame. Inhalation effects are due to lack of oxygen. Moderate concentrations may cause headache, drowsiness, excitation, excess salivation, vomiting, and unconsciousness.
(1) Exposure limit refers to the OSHA regulatory exposure limit.			

6.0 Equipment and Supplies

6.1 Supplies

- Sample Collection Containers: 43-mL VOA vial with septum cap.
- Sample Analysis Containers: 22-mL crimp cap vials.
- Columns:
  - Restek Rt-UPLOT™, 30m, 0.32mm ID
  - Restek Rt-SPLOT™, 30m, 0.32mm ID
  - Columns giving equivalent performance can also be used.
- Syringes: 10 µL – 20.0 mL gas-tight syringes.
- Several 12" transfer cannulas, 20ga.
- Pressure relief valve (cannula or needle)
- Source of N2 gas regulated to a flow of 10-15 ml per minute.
- Balance to weigh to nearest 0.01g.
- Sonicator bath.

6.2 Instrumentation

- Instrumentation: Agilent Model 6890 GC with Dual FID detectors, or equivalent.
- Autosampler: Tekmar 7000 Headspace Autosampler
- Data System: Chemstation for acquisition and Target™ for data processing, or equivalent.

7.0 Reagents and Standards

7.1 Gas cylinders of ultrahigh purity helium, hydrogen, air, and nitrogen, > 99.999% pure.

7.2 Gas Standards: Expiration dates of gas standards will be the expiration date assigned by the vendor. If the vendor does not provide an expiration date, then the expiration date is set to the date of receipt plus two years. Standards should

be replaced sooner than the assigned date if there is evidence of degradation of the standard.

7.2.1 Calibration Standards: The primary standard is made by Scott Specialty Gases and is purchased through Supelco. The stock calibration standard mix is composed of nominally 1% (10,000 ppmv) methane, ethane, ethene, and acetylene in nitrogen.

- The initial calibration (ICAL) standards are prepared fresh each time an ICAL is performed.
- To prepare the ICAL standards, a gas-tight syringe is used to transfer the following volumes of the stock standard to 22-mL vials that contain 18 mL of deionized water and 4 mL of headspace:

ICAL Level	Volume of Stock Calibration Mix (µL)
1	2.5
2	50
3	200
4	400
5	600
6	1000
7	2000

- The resulting seven ICAL levels are shown in Table 2. An example calculation explaining the derivation of these concentrations is shown in Appendix 1.

7.2.2 Initial Calibration Verification (ICV) Standard: The calibration gases are not readily available from two, independent commercial sources. Therefore, a second lot from Scott Specialty Gases is used to prepare the ICV. The standard is prepared by adding 100 uL of the gas standard mixture to 18 mLs of water. The concentrations of the gases in the ICV are as follows:

Concentration of Gases in ICV Standard

Gas	Concentration (µg/L)
Methane	36.5
Ethane	68
Ethene	63.5
Acetylene	59

7.2.3 Continuing Calibration Verification (CCV) Standard: CCV standards are prepared from the same Scott gas stock as the ICAL standards. The concentrations of the gases in the CCV are equivalent to the Level 3 standards shown in Table 2.

7.2.4 Laboratory Control Sample: The LCS is fortified with the concentration of the level 3 calibration standard (see Table 2) using deionized water in the same fashion as the calibration standards.

7.2.5 Matrix Spikes: The matrix spike (MS) is created by fortifying a portion of an actual sample with the concentration of the level 3 calibration standard (see Table 2) in the same fashion as the calibration standards. The matrix spike duplicate (MSD) is created by fortifying a second portion of the sample used for the matrix spike with the concentration of the level 3 calibration standard (see Table 2).

8.0 Sample Collection, Preservation, Shipment and Storage

8.1 The AFCEE QAPP, both version 3.1 and 4.0, do not require preservation with HCL and allow a holding time of 14 days. For non-AFCEE work refer to the table below.

NOTE: Effervescing of carbon dioxide from alkaline waters will cause loss of the compounds of interest. Samples should be collected without acid if effervescence is observed. Exceptions such as this should be noted on the COC at the time of collection.

8.2 Care should be taken that no headspace is present in the sealed vials.

Matrix	Sample Container	Min. Sample Size	Preservation	Holding Time[1]	Reference
Waters	VOA vial	40 mLs	HCL, pH < 2; Cool 4 ± 2°C	14 Days	40 CFR Part 136.3

9.0 Quality Control

9.1 Sample QC

9.1.1 Initial Method Performance Studies

An initial demonstration of capability (IDOC), retention time study, and a method detection limit study must be performed by an analyst before that analyst can analyze samples. Current MDLs are found in the laboratory LIMS system. See Section 13 of this SOP for further details.

Any QC result that fails to meet control criteria must be documented in a Nonconformance Memo (NCM). The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The QA group also receives NCMs by e-mail for tracking and trending purposes. The NCM process is described in more detail in SOP DV-QA-0031P. This is in addition to the corrective actions described in the following sections.

9.1.2 Batch Definition

Batches are defined at the sample preparation stage. The batch is a set of up to 20 samples of the same matrix, plus required QC samples, processed using the same procedures and reagents within the same time period. Batches should be kept together through the whole analytical process as far as possible, but it is not mandatory to analyze prepared extracts on the same instrument or in the same sequence. The method blank must be run on each instrument. See QC Policy DV-QA-003P for further details.

9.1.3 Method Blank

A method blank is prepared and analyzed with each batch of samples. The method blank consists of deionized water. The method blank is subject to the entire extraction and analysis process.

Acceptance Criteria: The method blank must not contain any analyte of interest at or above ½ the reporting limit or above one-tenth of the concentration found in the associated samples.

Corrective Action: If the method blank exceeds allowable levels, the source of the contamination should be investigated and all associated samples re-extracted and reanalyzed.

9.1.4 Laboratory Control Sample (LCS)

An LCS is prepared and analyzed with each batch of samples. The LCS is prepared as described in Section 7.2.4.

Acceptance Criteria: LCS recovery limits are set at ±3 standard deviations around the mean of historical data, unless project-specific limits apply. Current control limits are maintained in the laboratory LIMS system.

Corrective Action: If recoveries are not within the applicable control limits, the system is out of control and corrective action must occur. All associated samples must be re-extracted and reanalyzed. One exception might be for an LCS compound above the upper control limit with samples that were "non-detect" for the same compound.

9.1.5 Matrix Spike Sample (MS) and Matrix Spike Duplicate (MSD)

One MS/MSD pair is required with each analytical batch. The MS and MSD samples are prepared as described in Section 7.2.5.

Acceptance Criteria: The MS/MSD recoveries and relative percent difference (RPD) between the two results must be within historical control limits, which are based on three standard deviations of past results, using a minimum of 20 points. QC limits are reviewed on an on-going basis as QC data are developed, and limits

are updated semi-annually. Current control limits are in the laboratory LIMS system.

Corrective Actions: If MS/MSD recoveries or the RPD exceed acceptance limits, the entire batch control data must be evaluated. If the MS/MSD are out of control and the LCS is in control, the data will be flagged as outside of control limits. This condition is documented in an NCM and the information will be included in the final report case narrative. Otherwise, the affected samples should be reanalyzed.

9.2 Instrument QC

The GC is set up according to the operating conditions listed in Table 1.

9.2.1 Initial Calibration (ICAL)

An initial calibration (ICAL) is performed after installing a new column and prior to analyzing samples. An ICAL is also performed whenever the initial or continuing calibration verification (ICV or CCV) analysis fails acceptance criteria, following major repair of the instrument, following maintenance that affects data quality, or when, in the judgment of the analyst, the GC performance is suspect.

The laboratory analyzes seven calibration levels (as shown in Table1) for the dissolved gases. The lowest point on the calibration curve is below the standard RL. The preparation of the calibration standards is described in Section 7.2.1.

Detailed information regarding calibration models and calculations can be found in Coporate SOP CA-Q-S-005, Calibration Curves (General).

Generally, it is NOT acceptable to remove points from a calibration for the purposes of meeting calibration criteria, unless the points are the highest or lowest on the curve AND the reporting limit and/or the linear range is adjusted accordingly. The only exception is that a level may be removed from the calibration if the reason can be clearly documented, for example a broken vial. A minimum of five levels must remain in the calibration for a linear regression. The documentation must be retained with the initial calibration. Alternatively, if the analyst believes that a point on the curve is inaccurate, the point may be reanalyzed and the reanalysis used for the calibration. All initial calibration points must be analyzed without any changes to instrument conditions, and all points must be analyzed within 24 hours.

Calibrations are modeled either as average response factors (RF) or as calibration curves, using a systematic approach to selecting the optimum calibration function in order as follows:

9.2.1.1 Average Response Factor

The following is the equation for average response factor:

$$\text{Average Response Factor} = \overline{RF} = \frac{\sum_{i=1}^{n} RF_i}{n}$$

Where:

n	=	number of calibration levels
RF_i	=	response factor for the ith calibration level

9.2.1.2 Average Response Factor Evaluation

As a guideline, the function can be graphically represented as a line through the origin with a slope equal to the average response factor.

Examine the residuals, i.e., the difference between the points and the fitted line. Particular attention should be paid to the residuals for the highest points, and if the residual values are large, a linear regression should be considered.

The method linearity requirement is that the relative standard deviation RSD) of the average response factors must be ≤30%. SW-846 Method 8000B allows evaluation of the grand average across all compounds, but some programs (e.g., AFCEE and South Carolina) require evaluation of each compound individually). Check program requirements to determine the appropriate criteria.

Corrective Action: If the RSD is > 30%, average response factor cannot be used for calibration, and least-squares linear regression should be attempted.

9.2.1.3 Linear Regression

Calibrations using least-squares linear regression produce a calibration function in the following form:

$$y = ax + b \quad \text{or} \quad x = \frac{(y-b)}{a}$$

Where:

y	=	instrument response
x	=	concentration
a	=	slope
b	=	intercept

9.2.1.4 Linear Regression Evaluation

With an unweighted linear regression, points at the lower end of the calibration curve have less weight in determining the curve than points at the high concentration end of the curve. For this reason, inverse weighting of the linear function is recommended to optimize the accuracy at low concentrations. The August 7, 1998 EPA memorandum "Clarification Regarding Use of SW-846 Methods", Attachment 2, Page 9, includes the statement "The Agency further recommends the use of this for weighted regression over the use of an unweighted regression."

To avoid bias in low level results, the absolute value of the intercept must be significantly less than the reporting limit. Also examine the residuals (as discussed in 0 above), but pay particular attention to the residuals at the low end of the curve. If the intercept or the residuals are large, a second-order regression should be considered.

The linear regression must have a correlation coefficient ≥ 0.990. Some programs (e.g., AFCEE) require a correlation coefficient of ≥ 0.995.

Corrective Action: If the correlation coefficient falls below the acceptance limit, linear regression cannot be used and a second-order regression should be attempted

9.2.1.5 Second-Order Regression

Calibrations using second-order regression produce a calibration function in the following form:

$$y = ax^2 + bx + c$$

Where:

y = instrument response for analyte (area)
x = concentration of standard (ug/L)
a = factor for second-order term (curvature)
b = factor for linear term
c = intercept

9.2.1.6 Second-Order Regression Evaluation

A minimum of six points must be used for a second-order regression fit, and the coefficient of determination must be ≥ 0.990.

NOTE: Some programs (e.g., South Carolina) do not allow the use of second-order regressions.

Corrective Action: If the coefficient of determination falls below the acceptance limit and the other

calibration models are unacceptable, the source of the problem should be investigated and the instrument recalibrated. Third-order regressions are not allowed at TestAmerica Denver.

9.2.2 Initial Calibration Verification (ICV)

Analysis of an ICV is performed after each ICAL. The preparation of the ICV standard is described in Section 7.2.2. The result for the ICV must be within ± 20% of the expected value.

Corrective Action: If the measured value of the ICV is more than 25% different from the expected value, the accuracy of the standards used for calibration should be re-verified. The instrument must be recalibrated before analyzing samples.

9.2.3 Continuing Calibration Verification (CCV)

Frequency : A CCV is analyzed after every 10 samples and at the end of the analytical sequence.

Evaluation: Any analyte that is reportable as found must be bracketed by acceptable CCVs on the column used for quantitation. A CCV result is acceptable if the absolute value of the difference between the result and the accepted value is ≤20%. Acceptance of a CCV that demonstrates a negative drift >25% when the samples are non-detect should be evaluated to ensure that the instrument response is still adequate to support the required reporting limit before data are reported.

Some programs, such as the AFCEE QAPP, require CCVs on <u>both</u> the primary and confirmation columns to be within ± 25% of the expected value. Refer to section 11.2 for which result to report.

Ideally, all analytes in the CCV standard, including those analytes that are not detected in client samples, should be within ± 25% of the expected value. However, the analysis is acceptable if the average of the % differences for all the analytes is ≤ 25% (control of each compound to ± 25% is required for some programs, e.g., AFCEE). This average is calculated by summing the %difference values for all of CCV analytes and dividing by the number of analytes. The following equation is used to calculate % difference:

$$\%\,difference = \frac{Measured\ Conc - Accepted\ Value}{Accepted\ Value} \times 100\%$$

<u>9.2.3.1</u> Corrective Actions for CCV Failures

If the acceptance limit is exceeded, corrective action must be taken. This may include clipping the column or other minor instrument adjustments, followed by reanalyzing the standard.

If the criterion is still not met, a new calibration curve must be prepared and all samples analyzed since the last successful CCV must be reanalyzed.

9.2.4 Daily Retention Time Windows

The center of the retention time windows determined in Section 12.2 are adjusted to the retention time of each analyte as determined in the CCV chromatogram. The centers of the retention time windows are adjusted at the beginning of each analytical sequence, but are not adjusted based on subsequent CCVs.

10.0 Procedure

10.1 Procedural variations are allowed only if deemed necessary in the professional judgment of the supervisor to accommodate variation in sample matrix, radioactivity, chemistry, sample size, or other parameters. Any variation in procedure shall be completely documented using a Nonconformance Memo (NCM) that is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The QA department also receives NCMs by e-mail for tracking and trending purposes. The NCM process is described in more detail in SOP DV-QA-0031. The NCM shall be filed in the project file. The nonconformance is also addressed in the case narrative.

10.2 Transfer 18 mL of the sample using a 12" cannula needle to a tare weighed 22 mL serum vial with a crimp septum cap that is marked to contain approximately 18 ml. Insert a pressure relief valve (needle or cannula) through the septum about 3 mm into the 22 ml headspace vial. Insert a transfer cannula into the 40 ml VOA sample vial about ¾ of the way down into the vial. Insert the other end of the cannula into the 22 ml headspace vial all of the way to the bottom of the vial. Pressurize the 40 ml VOA vial with a stream of N2 gas with a flow of about 10-15 ml per minute. Remove the pressure gas after about 15 ml of volume has been transferred and pull the cannula to above the liquid in the 40 ml VOA vial when the 18 ml transfer is complete (to stop the flow of liquid). Pull the cannula out of the headspace vial and allow the pressure to equilibrate through the pressure relief for a few seconds. Remove the pressure relief valve. Reweigh the headspace vial to determine the volume transferred. Shake the headspace vial for about 1 minute.

10.3 Measure the pH of the remaining sample using a pH strip and record it in the run log. Prepare an NCM for any samples with a pH > 2.

10.4 Allow all samples and standards to warm to room temperature before injection. Samples are automatically injected onto two columns. Samples, standards, and QC samples must be introduced into the GC using the same procedure.

10.5 Load each sample, as well as the various standards and QC samples, into the autosampler.

10.6 The daily run sequence is documented in a bound log book, and should be as follows:

Primer (generally the primer is run twice)

Daily opening CCVs

LCS

Method Blank

10 samples

CCVs

Followed by cycles of 10 samples and CCVs as needed

Closing CCV

11.0 Calculations / Data Reduction

11.1 Qualitative Identification

Tentative identification occurs when a peak is found on the primary column within the retention time window for an analyte, at a concentration above the reporting limit, or above the MDL if qualified data (J flags) are to be reported. Identification is confirmed if a peak is also present in the retention time window for that analyte on the confirmation column. Absolute retention times are adjusted according to the retention times of the daily opening CCV.

The experience of the analyst should weigh heavily in the interpretation of the chromatogram. For example, sample matrix or laboratory temperature fluctuation may result in variation of retention times.

11.2 Dual-Column Quantitation

A primary column is designated. The result from the primary column is normally reported. The result from the secondary (confirmation) column is reported if any of the following is true:

There is obvious chromatographic interference on the primary column.

Continuing or bracketing standard (ICV and/or CCVs) fails on the primary column but is acceptable on the secondary column. However, if the primary column result is > 40% higher than the secondary column result and the primary column calibration fails, then the sample must be evaluated for reanalysis.

11.2.1 Dual Column Results With > 40% RPD

If the relative percent difference (RPD) between the responses on the two columns is greater than 40%, the higher of the two results is reported unless there is obvious interference in the chromatogram. In this situation, the results reported to the client are qualified with a flag, footnote, and/or narrative comment in the final report.

RPD for the results from the primary and secondary columnsis calculated using the following equation:

$$RPD = \frac{R_p - R_s}{\frac{1}{2}\left(R_p + R_s\right)}$$

Where:

R_p = result from primary column
R_s = result from secondary column

11.3 Calibration Range and Sample Dilutions

If the concentration of any analyte exceeds the working range as defined by the calibration standards, then the sample must be diluted and reanalyzed. Dilutions should target the most concentrated analyte in the upper half (over 50% of the high level standard) of the calibration range. It may also be necessary to dilute samples due to matrix interferences.

11.3.1 Guidance for Dilutions Due to Matrix Interference

If the sample is initially run at a dilution and only minor matrix peaks are present, then the sample should be reanalyzed at a more concentrated dilution. Analyst judgement is required to determine the most concentrated dilution that will not result in instrument contamination. Ideally the dilution chosen will make the response of the matrix interferences equal to approximately half the response of the calibration range.

11.3.2 Reporting Dilutions

Some programs (e.g., South Carolina and AFCEE) and some projects require reporting of multiple dilutions (check special requirements in LIMS). In other cases, the most concentrated dilution with no target compounds above the calibration range will be reported.

11.4 Interferences in Observed in Samples

Dual column analysis does not entirely eliminate interfering compounds. Complex samples with high background levels of interfering organic compounds can produce false positive and/or false negative results. The analyst must use appropriate judgement to take action as the situation warrants.

11.5 Calculations

11.5.1 Spike Recovery Calculation

LCS, MS, and MSD spike recoveries are calculated using the following equation:

$$\%\,Recovery = \frac{Concentration\,(or\ amount)\ found}{Concentration\,(or\ amount)\ spiked} \times 100$$

MS/MSD RPD Calculation

$$RPD = \frac{R_1 - R_2}{\frac{1}{2}(R_1 + R_2)}$$

Where:

R_1 = result for the MS

R_2 = result for the MSD

11.5.2 Concentration of Analyte in Sample

The concentration of the analyte in the sample is calculated as follows:

$$C_S = C_C \times DF$$

Where:

C_s	=	concentration of analyte in sample (µg/L)
C_C	=	on-column concentration (ng/mL)
DF	=	Dilution Factor, post extraction dilutions

11.6 All data are subject to two levels of review, which is documented on a checklist (see SOP DV-QA-0020, "Level II Organic Data Review").

12.0 Method Performance

12.1 Method Detection Limit Study (MDL)

An initial method detection limit (MDL) study must be performed on each instrument before samples can be analyzed. MDL studies are conducted annually as follows:

- Prepare seven samples at three to five times the estimated MDL concentration.
- Analyze the MDL standards as described in Section 11.
- Calculate the mean concentration found (X) in µg/L, and the standard deviation of the mean concentration in µg/L, for each analyte. Then, calculate the MDL (single-tailed, 99% confidence level, as described in Policy QA-005) for each analyte.
- MDL studies are repeated annually, and MDL results are stored in the laboratory LIMS system. See Policy DV-QA-005P for further details concerning MDL studies.

12.2 Retention Time Windows

- Retention time windows must be determined for all analytes. Make an injection of all analytes of interest each day over a 72-hour period. Calculate the mean and standard deviation of the three retention times for each analyte. For the multi-component analytes, the mean and standard deviation must be calculated for each of the three to five major peaks used for sample calculations. Plus or minus three times the standard deviation of the retention times of each analyte defines the retention time window.

- The center of the retention time window is the retention time from the last of the three standards. The centers of the windows are updated each day of analysis at the beginning of the analytical sequence, using the retention times obtained during the analysis of the daily opening CCV. The widths of the windows will remain the same until new windows are generated following the installation of a new column.
- If the retention time window as calculated above is less than ±0.03 minutes, use ±0.03 minutes as the retention time window. This allows for slight variations in retention times caused by sample matrix.
- The laboratory must calculate new retention time windows each time a new column is installed.

12.2.1 Corrective Action for Retention Times

- The retention times of all compounds in each continuing calibration must be within the retention time windows established by the initial calibration. If this condition is not met, all samples analyzed after the last compliant standard must be reanalyzed unless the following conditions are met for any compound that elutes outside the retention time window:
- The retention time of that compound in the standard must be within a retention time range equal to twice the original window.
- No peak that would be reportable may be present on the sample chromatogram within an elution time range equal to three times the original retention time window.

12.3 Initial Demonstration of Capability (IDOC)

Each laboratory must make a one-time initial demonstration of capability for each individual method. Demonstrations of capability for both soils and water matrices are required. This requires analysis of QC check samples containing all of the standard analytes for the method. Separate mixes are analyzed for the single component pesticides, toxaphene, and technical chlordane.

- Four aliquots of the QC check sample are analyzed using the same procedures used to analyze samples, including sample preparation. The concentration of the QC check sample should be equivalent to a mid-level calibration.
- Calculate the average recovery and standard deviation of the recovery for each analyte of interest. Compare these results with the acceptance criteria in LIMS.
- If any analyte does not meet the acceptance criteria, the test must be repeated. Only those analytes that did not meet criteria in the first test need to be evaluated. Repeated failure for any analyte indicates the need for the laboratory to evaluate the analytical procedure and take corrective action

12.4 Training Requirements

The group/team leader has the responsibility to ensure that this procedure is performed by an analyst who has been properly trained in its use and has the required experience.

13.0 Pollution Prevention

Standards and reagents should be prepared in volumes consistent with laboratory use to minimize the volume of expired standards and reagents requiring disposal.

14.0 Waste Management

All waste will be disposed of in accordance with Federal, State, and local regulations. Where reasonably feasible, technological changes have been implemented to minimize the potential for pollution of the environment. Employees will abide by this procedure, the policies in section 13, "Waste Management and Pollution Prevention", of the Environmenatl Health and Safety Manual, and DV-HS-001P, "Waste Management Program."

14.1 The following waste streams are produce when this method is carried out:

- Methanol Vial Waste – Waste Stream A
- Liquid Methanol Waste – Waste Stream C
- Acidified Water – Waste Stream W
- Expired Chemicals/Reagents/Standards – Contact Waste Coordinator

NOTE: Radioactive waste, mixed waste, and potentially radioactive waste must be segregated from non-radioactive waste as appropriate. Contact the Radioactive Waste Coordinator for proper management of radioactive or potentially radioactive waste generated by this procedure.

15.0 References / Cross-References

15.1 RSK SOP-175 Revision 0, R.S. Kerr Environmental Research Laboratory; August 11, 1994.

15.2 Method 8000B, "Test Method for Evaluating Solid Waste", EPA SW-846, Update III; December, 1996.

15.3 AFCEE Quality Assurance Project Plan, Version 3.1; August 2001.

15.4 AFCEE Quality Assurance Project Plan, Version 4.0, February 2005

16.0 Deviations From the Source Method

The method measures the concentration of the gases in the headspace and then calculates the concentration of the gas dissolved in the original water sample based on its

partitioning properties, as indicated by its Henry's Law constant. This has been modified for this SOP by calibrating against the concentration of dissolved gases in water standards instead of the concentration of gases in the sample headspace.

17.0 Attachments

- Appendix 1 – Example Calculation of ICAL Concentrations
- Table 1 – GC Operating Conditions
- Table 2 – Initial Calibration Levels
- Table 3 – Routine Reporting Limits

18.0 Revision History

- Revision 2.3, dated 8 October 2010
  - Added items to supplies in section 6.1
  - Section 10.2 modified to utilize sample transfering process that eliminates exposure of the sample to the air during transfer to the headspace vials that are used by the instrumentation.
- Revision 2.2, dated 11 June 2010
  - Annual Technical review
  - Made grammatical and formatting corrections
  - Deleted the 4th dot in Section 5.1 (Purge & Trap not used)
  - Fixed Section 9.2.1.2 to be 30% RSD.
- Previous Changes made.
  - Major changes and updates were made, which resulted in significant changes in numbering compared to revision 0.
  - In section 2.2, deleted statement that calibration is performed daily. The frequency of the initial calibration is clarified in section 10.2.1.
  - Revised section 2.3 for clarity.
  - Rewrote section 5, Safety, to comply with current TestAmerica requirements.
  - Incorporated Interim Change A into section 7.2.
  - In section 7.2.1.2, added 2 more levels to the calibration.
  - In section 7.2.1.3, added table with concentration values.
  - In section 7.2.3, corrected the text to state that the matrix spike is made using a portion of an actual sample, instead of reagent water.
  - Added section 10.2.1 to explain when initial calibrations are performed.
  - Added section 10.2.9 to provide calculation for second order regression.
  - Revised section 10.4.2 for clarity.
  - Added section 11.2 to provide step for measuring and recording pH of samples.

- Added section 11.3 to provide step for transferring 18 mL of sample to the serum vial.
- Added section 11.5 to provide step for loading autosampler.
- In section 12.2.3, added explanation of variables.
- In section 12.5.2, added explanation of variables.
- In section 12.5.3, clarified variables used.
- Added section 17, which was missing from revision 0.
- In Appendix 1, corrected calculations.
- Added Table 1 to provide GC operating conditions.
    - Modifications made for this "dot" revision:
    - Corrected vial specification in Section 8.1 from "43-mL vials" to "three 40-mL vials."
    - Revision 2 – February 1008
    - Changed to TestAmerica new format and changed name to TestAmerica Denver

APPENDIX 1 – Example Calculation of ICAL Concentrations

This example is for methane at the 6th calibration level, where 1,000 µL of the stock standard (10,000 ppmV) is used..

The calculation is based on the Ideal Gas Law: PV = nRT

Where:

P	=	pressure in atmospheres (760 mm Hg = 1 atmosphere)
V	=	volume of gas in liters
n	=	number of moles of gas
R	=	gas constant, i.e., 08206 atm L / mol K
T	=	temperature in degrees Kelvin (T = °C +273.15)

Calculations for the standards are based on 22°C at 754 mm Hg, therefore

P	=	754/760 = 0.99211 atm
V	=	1 L of stock standard gas
R	=	0.08206
T	=	22 + 273.15 = 295.15 °K

Solving for n,

$$n = \frac{PV}{RT} = \frac{0.99211 atm \times 1L}{0.08206 atm \bullet L / mole \bullet K \times 296.15K} = 0.04082 \text{ moles of methane in 1 L standard}$$

NOTE: Daily variations in laboratory temperature and pressure create less than 1% variation.

The following equation is used to calculate the concentration of methane in the Level 6 ICAL standard:

$$\frac{0.001 L\, N_2}{0.018 L\, H_2O} \times \frac{0.01 L\, CH_4}{1.0 L\, N_2} \times \frac{0.04082\, mole\, CH_4}{1.0 L\, CH_4} \times \frac{16.04\, g\, CH_4}{1.0\, mole\, CH_4} = 0.00036375\, g\, CH_4 / L\, H_2O =$$

363.8 $\mu g/L$ methane concentration in Level 6 ICAL standard

Where:

0.001 L N_2	=	Volume of gas (in L) used to prepare the aqueous standard.
0.018 L H_2O	=	Volume of water in which the standards are prepared.
0.01 L CH_4	=	Volume of methane in 1.0 L of the gas standard, which is a 1% methane mixture in N_2
0.04082 mole CH_4	=	Number of moles of methane in 1.0 L of methane as determined above
16.04 g CH_4	=	Molecular weight of methane

TABLE 1 – GC Operating Conditions

Parameter	Recommended Conditions
Injection Port Temperature	200° C
Detector Temperature	250° C
Oven Temperature	50°C
Column 1	RT-U-Plot 30 m x 0.32 mm
Column 2	RT-S-Plot 30 m x 0.32 mm
Injection Volume	1 mL
Carrier Gas and Flow Rate	Helium 40 psi, 14 mL/minute
Detector Gases and Flow Rates	Hydrogen/Air 40 mL/min, makeup nitrogen at 25 mL/min
Y Splitter	Yes

TABLE 2 – Initial Calibration Levels

Compound	Concentration in Aqueous Phase (µg/L)						
	Level 7	Level 6	Level 5	Level 4	Level 3	Level 2	Level 1
Methane	728	364	218	146	72.8	18.2	.909
Ethane	1360	682	409	273	136	34.1	1.70
Ethene	1270	636	382	254	127	31.8	1.59
Acetylene	1180	590	354	236	118	29.5	1.48

TABLE 3 – Routine Reporting Limits

Compound	(ug/L)
Methane	5.0
Ethane	5.0
Ethene	5.0
Acetylene	5.0

Title: Work Sharing Process

Approvals (Signature/Date):

11/19/09
Dr. Keith Wheatstone
Chief Operating Officer (COO)

11/19/09
Dr. Charles W. Carter
Vice President of Quality & Technical Services

11/19/09
Tim O'Shields
Director of Client Advocacy

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1.0 PURPOSE

Identify and define Work Sharing Procedures to be followed by TestAmerica laboratories.

2.0 SCOPE AND APPLICATION

The laboratory with the primary or direct relationship with the client (the Export Lab), may require analytical services support from one or several additional TestAmerica facilities (the Import Lab). This procedure applies to all 'shared work' including testing for specialty and conventional parameters, ongoing or discrete projects, and routine and complex programs

3.0 DEFINITIONS

3.1 **Export Lab** - The laboratory that transfers the samples in the work sharing process. Generally it is the Export Lab that has the primary or direct relationship with the client.

3.2 **Import Lab** - The laboratory that receives the samples in the work sharing process.

3.3 **Chain of Custody (COC)** - Record that documents the possession of the samples from the time of collection to receipt in the laboratory. This record generally includes: the number and types of containers; the mode of collection; collector; time of collection; preservation; and requested analysis. COC must be maintained during inter-laboratory transfers. (NELAC)

3.4 **WorkShare Agreement** – Record that documents the internal review requirements for acceptance of work from another TestAmerica Facility. Client requirements including turn around time, due dates, analyte lists and report limits, QA/QC limits and requirements, and deliverable requirements must be completed in the WorkShare agreement.

4.0 SAFETY

4.1 There are no specific safety hazards associated with this SOP.

4.2 During the course of performing this procedure it may be necessary to go into laboratory areas to consult with appropriate staff members, therefore employees performing this procedure must be familiar with the Laboratory Health & Safety Plan, and take appropriate precautions and wear appropriate attire and safety glasses.

5.0 PROCEDURE

5.1 Identification

5.1.1 If the Export Project Manger (PM) **has** prior knowledge of a compatible Import Lab, they should:

- Contact the laboratory directly (telephone or E-mail) to assess capacity.
- Request pricing.

- Initiate documentation of client requirements.

5.1.2 If the Export PM **has no** prior knowledge or historical preference, they should consult the currently available tools designed to facilitate placement of work within TestAmerica.

- For non-conventional parameters, consult the Specialty Capabilities Matrix.
- For unique or new parameters, the Export PM should post basic requirements via the Opportunities Inquiry Process and contact the Sales Representative, Business Development Director (BDD), or Laboratory Director (LD) to facilitate identification of a prospective laboratory.

5.2 Communication

With as much lead time as possible, the Export Lab must contact the Import Lab and ensure there is an agreement on the following:

- Capacity/Capability.
- Due Date (Due to the lab or the client) or overall Turn Around Time (TAT) required.
- Data Submittal Contact (send to the PM or designated Data Contact).
- Job Identifier – where or how to identify the job number so the Export Lab can identify a report versus its own numbering sequence. **NOTE:** It is strongly urged that Import Labs find a way to display the Export Lab's original job number for ease of cross reference.
- Verify the number of samples and matrix involved – determine if the event is a one time or repeats at some frequency.
- Use this opportunity to review the Work Share Agreement, if used, and clarify any issues pending.
- The above communication is required/expected to take place prior to the first time an event occurs.

5.3 Qualification

Once a prospective Import Lab is identified, the Work Sharing Agreement (refer to Attachment 1) or LIMS Quote/Project is generated to document and communicate client requirements.

5.3.1 As outlined in the Usage Instructions (refer to Attachment 2), completion of all fields and information indicated in the Work Share Agreement, if used, is mandatory.

5.3.2 Use of the Work Share Agreement is mandatory unless all of the following conditions are met:

- A documented agreement exists between the Import Lab and Export Lab to proceed without the formal Work Share Agreement;
- Laboratories are using the same LIMS platform;
- Written notification including sample volume, TAT requirements, analyses requested, and deliverables required is provided to the Import Lab for review;
- Export Lab agrees in writing to the project requirements; or
- A complete subcontract COC is provided with the samples at the time of delivery to the Import Lab.

5.3.3 The Hardcopy Deliverables Standard Formats contained in Attachment 3 should be used to define final deliverables.

5.3.4 Once generated, the initial Work Sharing Agreement or LIMS Quote/Project may be utilized for multiple discrete SDGs, lots, Work Orders, jobs or projects as long as all of the specified information is applicable and accurate.

5.4 Selection and Agreement

5.4.1 The Export PM should select an Import Lab that provides the necessary combination of price, capability and capacity for each shared project.

5.4.2 The Export Lab should attempt to place all shared or subcontracted work with a TestAmerica lab. It may be necessary to negotiate project requirements (such as TAT) with the TestAmerica Import Lab(s) and/or the client. This negotiation is the responsibility of the Export Lab and needs to be completed and communicated before samples are transferred. It is not acceptable to send work outside TestAmerica without attempting to negotiate alternative requirements with your client and/or the TestAmerica Import Lab, including the Import LD if necessary.

5.4.3 The default for shipping costs is that the Importing Lab pays for shipping. Exceptions to this rule will be made in a limited number of situations where the Import Lab is unduly burdened by low prices in a certain region or quick turn around expectations due to problems at the Exporting Laboratory. In such cases, the Exporting Lab will pay the shipping charges. All exceptions should be managed with LD oversight and approval. Ultimately, the responsibility for this cost must be agreed upon as a condition to setting up an agreement. In some cases, the labs may need to execute a Pricing Agreement for Inter-Company work to properly delineate the shipping cost responsibilities.

5.4.4 If a mutually agreeable arrangement cannot be made that will benefit the client and the TestAmerica Import Lab, or if a TestAmerica Lab does not offer the required analytical needs, it may become necessary to place work outside of TestAmerica. This decision should only be reached as a last resort and with the Export Lab LD approval.

5.4.5 Once a final selection is made by the Export PM, a final copy of the Work Sharing Agreement or LIMS Quote/Project will be forwarded by e-mail to the Import PM.

5.4.6 The Import PM will acknowledge and accept the incoming project by replying affirmatively via e-mail to the Export PM.

5.4.7 Any changes in scope, schedule, requirements, or capacity must be communicated immediately and may require an updated Work Sharing Agreement or LIMS Quote/Project.

5.5 Transfer of Samples and Confirmation of Due Date

5.5.1 Samples are shipped from the Export Lab per their SOP.

5.5.1.1 The Export lab **must** include a COC (a copy of the original suffices). Other internal transfer documents are welcomed but often do not provide sufficient detail for login. Both labs must agree on the documentation necessary.

- The COC must clearly document the samples (including IDs and collection times) being transferred, the state the samples originated in and the tests being requested in the specific sample delivery group. A requested 'Due Date' may also be specified.
- A signed COC must be returned to the Export Lab with the final results so that it may be included with the final report.

5.5.1.2 The Work Sharing Agreement, the LIMS Quote/Project Number, Subcontract Order and/or Promium Autolog file **must** be submitted along with the COC.

5.5.1.3 The Export Lab must instruct the Import Lab how to identify sample IDs – either by the lab sample number or Client ID.

5.5.2 The Import Lab receives the transferred samples per their sample receiving procedures. The COC must be signed by the receiving lab.

Any anomalies associated with the condition of the samples upon receipt will be immediately communicated to the Export Lab.

5.5.3 The Import Lab PM establishes a due date based on the requested TAT and communicates the due date to the Export Lab PM.

If the Import Lab is no longer able to meet the requested TAT or achieve any other client requirement, the Import Lab PM must notify the Export Lab PM immediately.

NOTE: Extended periods of time may elapse between the initial Work Sharing Agreement and actual transfer of samples. Poor communication between labs regarding changes in scope or capacity during the intervening period is the primary cause of failure to meet internal and external expectations. Communication between labs is of the outmost importance.

5.6 Project Progress and Completion

5.6.1 Once analyses are in progress at the Import Lab, any deviations from the Work Sharing Agreement will be immediately communicated to the Export Lab PM.

5.6.2 All method modifications or out-of-control events will be immediately communicated to the Export Lab PM.

5.6.3 Upon completion, the Import Lab PM will notify the Export Lab PM that results are available and provide an update on final generation of deliverables and invoice.

5.6.4 The agreement and other project documents should be archived for future reference and possible re-use.

5.7 Tools

5.7.1 Adobe Acrobat Writer or similar to generate a PDF file of the report. The agreed upon version of the software at this time is for production of files legible by Adobe Acrobat Reader 7.0 or greater. Labs that have a need to further paginate or manipulate the PDF file may require updates of their writer software.

5.7.2 Adobe Reader is free software readily available. To determine the most recent version of Adobe Reader available, please visit www.adobe.com.

5.7.3 The normal mode of transmission for pdf report files and EDDs of relative small size (< 3 MB) will be via e-mail. TestAmerica report transfer files sent to other TestAmerica labs that do not transfer between labs on an automated base must also be sent via e-mail.

5.8 Contingencies

If for any reason a part of this SOP cannot be followed, seek the guidance of the Vice President of Quality & Technical Services.

6.0 RESPONSIBILITIES

6.1 Project Managers (PMs), Customer Service Managers (CSM), or Sales Representatives from the Export Lab are responsible for obtaining client approval prior to transfer of any samples. Document approval following the Export Lab's procedures.

6.2 Export Lab Client Services Personnel (usually a PM) are responsible for selecting and qualifying the Import Laboratory. This includes generation and maintenance of the Work Share Agreement or LIMS Quote/Project.

It is strongly encouraged that the lab designates an alternate contact to receive information about the progress of the work, anomalies or notification that data are complete and posted. A best practice in place to address this need is simply to designate a fixed internal data management contact to receive such notifications.

6.3 Import Lab Client Services Personnel (usually a PM) are responsible for communicating client requirements internally so as to ensure timely and error-free execution.

Best Practice: Dedicating a PM to handle all Work Share provides many benefits to the process. Labs are urged to implement a dedicated Internal Work Share PM if at all possible.

6.4 Use of the Work Share Agreement and compliance with the procedures outlined herein are mandatory for all shared projects. Facilities that are on like LIMS systems and are sharing work with each other may forego use of the Work Share Agreement form.

7.0 REFERENCES

None.

8.0 ATTACHMENTS

Attachment 1: Work Sharing Agreement
Attachment 2: Usage Instructions
Attachment 3: Hardcopy Deliverables Standard Formats
Attachment 4: Inter-Laboratory Subcontracting of Extracts

9.0 REVISION HISTORY

- Revision 1, dated 9 March 2007
  - Integration for TestAmerica and STL operations.
- Revision 2, dated 19 November 2009.
  - General procedural update.

Attachment 1.

Work Sharing Agreement

TestAmerica	Work Sharing Agreement		Exporting Lab	
			Project Name	
Import Lab Information			**Export Lab Information**	
Lab Name			PM Contact Name	
PM Contact Name			Backup Contact Name	
Backup Contact Name			Agreement Date	
Pricing Information			**Project Information**	
QA/QC (i.e. MS/MSD) Billable?			Client Company Name	
Raw Data Surcharge		%	Date First Samples to Arrive	
EDD Surcharge		%	Est. Duration of Sampling Event	
TAT Surcharges		%		
Penalty Terms	None			
Other Charges Not in Unit Price? (i.e. canisters, regulators, shipping, bottles)	None		Quote or Contract Reference ID	
Project Details				
Non-Standard Work Product	No			
Quality Assurance Plan	No			
Certifications				
Analyte/Cmpd. List with RLs Attached	Yes-See Attached			
Results Dry-Weight Corrected				
Special Method Holding Times	None			
Internal Chain of Custody Required	No			
Known Hazards/High Analyte Level	No			
Saturday/Special Delivery Options	None			
Special Instructions	None			
Reporting Limit Convention	Report to RL with no "J" Values			

Deliverable Requirements		Transmittal medium	Format Column	TAT
Preliminary Report:	No			
Final Report:	No			
EDD:	No		See Attached	
myTestAmerica:	No	NA	NA	
Custom Forms:	No	NA	See Attached	

Import and Export Lab Agreement

Import lab must acknowledge receipt of Agreement and samples *via E-Mail*

Analysis	Method	Matrix	# of Samples	Import Lab's Unit Price	Unit Price w/Surcharges	Extended Price
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					$ -	$ -
					Approximate Total Project Value	$ -

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Attachment 2.
Usage Instructions (Page 1 of 2)

Field Name	Instructions
Exporting Lab	Enter the name of the exporting laboratory in Cell C5. Place a TA prefix in front of lab name.
Project Name	Enter the name by which the project will be identified. Unless otherwise indicated in "Special Instructions", the project name entered in this field must be used on the Report Cover Page.
Import Lab Information	
Lab Name	Enter the name of the importing laboratory in Cell G2. Place a TA prefix in front of lab name.
PM Contact Name	Enter the name of the importing laboratory's Project Manager
Backup Contact Name	Enter the name of the importing laboratory's Project Manager Backup, in the event that the Project Manager is unavailable
Export Lab Information	
PM Contact Name	Enter the name of the exporting laboratory's Project Manager
Backup Contact Name	Enter the name of the exporting laboratory's Project Manager Backup, in the event that the Project Manager is unavailable
Agreement Date	Enter the date on which this form is transmitted to the import lab. The date must be amended to the current date with every revision to the agreement that is transmitted. This date will be used to identify the most recent version.
Pricing Information	
QA/QC (MS/MSD) Billable?	Select Yes or No from the drop-down menu to indicate if QC samples, such as MS/MSD are billable. If Yes, number of billable QC Samples must be added to the "# of Samples Column for each analysis
Raw Data Surcharge	Enter in Cell C10 a percentage, as a whole number, to be applied to the unit price of every analysis, **or** a fixed dollar amount to be added to the Approximate Total Project Value (Cell H47) - Select units from the drop-down menu in Cell D10. This applies a Surcharge for the inclusion of raw data with the final report.
EDD Surcharge	This applies a Surcharge for the inclusion of an Electronic Data Deliverable in the final report. A percentage, or dollar amount, entered here, is only applied to the Approximate Total Project Value
TAT Surcharge	This applies a Surcharge for Expedited Turnaround Time Services, and is completed as described for Raw Data Surcharge
Penalty Terms	Briefly describe the terms of any applicable financial penalty clauses
Other Charges Not in Unit Price?	Enter in Cell C14 a brief description of any additional charges. In Cell D14 enter a total fixed dollar amount to be added to the Approximate Total Project Value
Project Information	
Client Company Name	Enter the name of the exporting laboratory's client (data end-user)
Date First Samples to Arrive	Enter the date when samples are first scheduled to arrive at the importing laboratory
Est. Duration of Sampling Event	Enter the estimated duration of the sampling event/project
Quote or Contract Reference ID	Enter the Quote, MSA or Contract Reference ID - If available. If "QUANTIMS" or Promium Element quote is available, and laboratories sharing work also share QUANTIMS or Promium Element, quote should be referenced here, and Compound/RL List may be obtained from QUANTIMS or Promium Element quote. Non-QUANTIMS or Promium Element labs can attach necessary information.
Project Details	
Non-Standard Work Product	Select Yes or No from the drop-down menu to indicate whether or not the required analyses represent a standard work product, with no special requirements, for the importing lab
Quality Assurance Plan	Select Yes or No from the drop-down menu to indicate whether or not a specific Quality Assurance Plan applies to, and accompanies the project
If "Yes" is answered to either of the two questions above, the following fields appear on the worksheet, and must be completed:	
Method Detection Limits	**Attach any non-standard, required Method Detection Limits**
Special QA/QC Requirements	**Attach any non-standard, required QA/QC Requirements**
Control Limits	**Attach any non-standard, required Control Limit Criteria**
Client Requested Storage Requirements	**Select any special sample storage requirements from the drop-down menu**
Records Retention	**Enter, in years, the length of time data records must be stored before disposal**

Attachment 2.
Usage Instructions (Page 2 of 2)

Certifications	Enter any Federal or State Certification Requirements
Analyte/Cmpd. List with RL's Attached	Select "YES" and attach Special Analyte/Compound List, with Reporting Limits. If "NO" is selected, other mechanisms must be utilized to ensure that client requirements are met.
Results Dry-Weight Corrected	Select Yes or No from the drop-down menu to indicate whether or not analytical results are to be calculated on a dry-weight basis (corrected for moisture content)
Special Method Holding Times	Select, from the drop-down menu, any applicable, special holding time definition
Internal Chain of Custody Required	Select Yes or No from the drop-down menu to indicate if a client specified internal chain of custody, that tracks the custody of samples throughout the laboratory, is required.
Known Hazards/High Analyte Level	Indicate, via the drop-down menu, if samples contain known hazards or high analyte levels. If "YES", details must be attached
Saturday/Special Delivery Options	Indicate, via the drop-down menu, if samples will be delivered during non-regular business hours. If "YES", details must be attached
Special Instructions	Indicate, via the drop-down menu, if other special instructions are attached
Reporting Limit Convention	Select the required reporting limit convention from the drop-down menu

Deliverable Requirements	
Preliminary Report	Indicate, using drop-down menus, whether or not a Preliminary report is required. If "YES", select, using drop-down menus, the Transmittal Medium, and Format. Enter the required Turnaround Time in the TAT column as Calendar Days or a specific Due Date
Final Report	Complete as described for Preliminary Report. Components of each deliverables definition may be added or subtracted (modified) to accommodate a required deliverables format not specified in the standard definitions.
EDD	Indicate, using the drop-down menu, whether or not an Electronic Data Deliverable is required. If "YES", select, using the drop-down menu, a Transmittal Medium, attach a separate sheet describing the format, and enter the required Turnaround Time in the
MyTestAmerica	Indicate, using the drop-down menu, whether or not results must be posted to MyTestAmerica. If "YES", enter the required Turnaround Time in the TAT column as Calendar Days or a specific Due Date
Custom Forms	Indicate, using the drop-down menu, whether or not Custom Reporting Forms are required. If "YES", attach a spearate sheet describing the format, and enter the required Turnaround Time in the TAT column as Calendar Days of a specific Due Date

Analysis, Method, Matrix, # of Samples and Pricing Information	
Analysis	Describe the Analysis as typically stated in the Analytical Method being used
Method	Enter the Method Number to be utilized for analysis
Matrix	Select, from the drop-down menu, the sample matrix. If "OTHER/SPECIFY", indicate, in the "Method" field, the applicable matrix
# of Samples	Enter the Number of Samples to be analyzed for this method. Include in your sample count the number of billable QC samples, if QA/QC samples were selected above as billable
Import Lab's Unit Price *	Enter the unit price to be paid to the Import Lab for succesfully completing the Analysis
Unit Price w/Surcharges	This is a calculated field, and no data entry is required. If "%" was chosen as the unit of measure in the Pricing Information Section, Surcharges will be added to the Unit Price of each Analysis and automatically entered in this column. IF "$" was chos
Extended Price	This is a calculated field, and no data entry is required. Unit Price is multiplied by the # of Samples to derive an Extended Price for the Analysis of all samples of a particular Analysis
Approximate Total Project Value	This is a calculated field, and no data entry is required. This is a sum of all extended prices. **Note: This is an approximate project value, and is not to be used for Invoice generation.**

Fields with yellow background	Indicate these contain drop down menus

*Import lab's Unit Price	The default approach for shipping costs is that the export lab pays for shipping. Exceptions to this rule are in cases where the export lab is simply acting as a "Pass Through"or where the exported tests comprise 75% or more of the entire project

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Attachment 3.

Hardcopy Deliverables Standard Formats

TestAmerica Work Sharing Agreement - Hardcopy Deliverables Standard Formats	Level A	Level B	Level C	Level D	Level E	Level F
REPORT	Results only	Results only	Results + QC	Results + data	Forms (2)	Forms + data (2)
Cover / Signature Page	x	x	x	x	x	x
Table of Contents					x	x
Report Narrative	x*	x*	x	x	x	x
Executive Summary					x	x
Method Summary						
Method /Analyst Summary			x	x		
Sample Summary	x	x	x	x		
Shipping and Receiving Documents						
Client Chain of Custody			x	x		
Sample Receipt Checklist			x	x		
Interlab CoC (where applicable)			x	x		
Internal CoC (if required)			x	x		
Glossary of Abbreviations	x	x	x	x	x	x
SAMPLE RESULTS						
Sample DataSheets	x	x	x	x		
(sort by Method, sample; Level A - by sample, no page separation)						
QC RESULTS (sort by section, method)						
QC Association Summary			x	x		
Laboratory Chronicle			x	x		
Surrogate Recovery Report			x	x		
Blank reports			x	x		
LCS Reports			x	x		
MS/MSD and DU reports			x	x		

(Extended Data Deliverables / Forms)
(CLP-Like Forms, QC and Data - group by Method)

CLP-Like Organics						
SUMMARY FORMS					x	x
Summary Forms (Org I-X, (3))					x	x
QC SUMMARY						x
QC Forms (Org I-IV,VIII, (3))						x
SAMPLE DATA						x
Quant Rpt + Chro + spectra (3)				x		x
STANDARDS DATA						
Calibration Forms (VI-VII; for GC- VIII-X (3))						x
(Quant + chro follows each form set)				x		x
QC DATA						x
Tune (3)						
Blank Form I						x
Blank Quant Rpt + Chro + spectra (3)				x		x
LCS/LCSD Form I						x
LCS/LCSD Quant Rpt + Chro + spectra (3)				x		x
MS/MSD Form I						x
MS/MSD Quant Rpt + Chro + spectra (3)				x		x
GPC Data (3)				x		x
Florisil Data (3)				x		x
MISCELLANEOUS DATA						
Logs - Instrument, Prep, Standard				x		x
CLP-Like Inorganics						
Cover Page					x	x
Sample Forms (I) (CLP-like)					x	x
Calibration + QC Forms (ex:II-XIV)					x	x
Instrument Data				x		x
Preparation Data				x		x
SHIPPING / RECEIVING DOCUMENTS						
Internal CoC (if required)					x	x
Interlab CoC (where applicable)					x	x
Client Chain of Custody					x	x
Sample Receipt Checklist					x	x
Invoice	x	x	x	x	x	x

(1) Reports should be saved as PDF normal files; and delivered on CD where possible
Paper copies provided on request
(2) Well defined programs (ex: CLP) have a strict order for their deliverable and form sets
This document defines form deliverable for other programs;
For example SW846 methods with CLP forms (CLP-like)
(3) As required or needed for method

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Attachment 4.

Inter-Laboratory Subcontracting of Extracts

As a rule, the subcontracting of extracts or digests to a different laboratory to perform the analyses should be avoided in all but extreme circumstances. Numerous pitfalls arise in situations where one laboratory performs the sample preparation step and another laboratory performs the analysis. That being said, under 'catastrophic' circumstances (e.g. Equipment goes down, power outages or other such instances) it may be necessary. **Please note: Overbooking a laboratory should not be considered a catastrophic circumstance and in these cases samples must subcontracted prior to the preparation.**

IF prepped samples must be sent out for analysis, there are several items that must be verified and documented.

1) **First and foremost, written client approval must be given <u>prior</u> to the subcontracting** (an email is sufficient).

2) Both laboratories must be accredited for all methods, matrices, and analytes.

3) All preparation documentation must accompany the samples (preparation logs).

4) All Standards information must be submitted with the samples (e.g. vendor, lot number, concentration, preparer, expiration date, etc). A copy of the Standards log must accompany the samples.

5) Control Limits for QC samples (MS, LCS) must be provided by the "Preparation" Laboratory. The preparation step is the most critical portion of the control limit determinations so in most cases, the preparation lab limits should be used. Regardless of whose limits are used, it must be clearly stated in the report narrative.

    a. If there is a QA Plan, the control limits in the QA plan shall be used.

6) The report must clearly identify the preparation lab as well as the analysis lab along with any relevant certification numbers.

7) Reporting limits must be achievable by both laboratories based on current MDL studies at the respective laboratories.

8) Reporting Limits must be clearly identified and agreed upon prior to the subcontracting of the extracts/digests.

9) If an analyte is outside of the control limits it must be flagged as such and narrated in the report.

If by some circumstance subcontracting is to be done on a non-catastrophic basis, the affected laboratories must perform joint MDL studies (one lab prepares the MDL samples and other analyzes them and calculates MDLs) and inter-laboratory control limits must be created. Extracts must be shipped following all applicable DOT requirements.

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TestAmerica

THE LEADER IN ENVIRONMENTAL TESTING
Seattle Division

Record of Management Decision

SOP: TA-GS-0351-R17

Title: PCBs by EPA 8082

ROMD ID: 00001

Effective Date: 04/29/2010 Expiration Date: When indicated SOP is revised

Laboratory Approvals:

04/29/10		4/29/10	
Technical Director Approval	Date	H & S Approval	Date
4/29/10		4/29/10	
Quality Assurance Approval	Date	Laboratory Director Approval	Date

1. **Description Of and Reason For Decision:**
Acceptance criteria for CCVs wasn't consistently stated in the following section (corrected text included):

10.18.4.2 Analytes Not Detected (< RL)

For any analyte not detected (ND) in client samples, the %D for that analyte in the bracketing CCVs should also be within ± 20%.

However, if the CCV %D exceeds ~~+15~~ 20% and the sample results are ND, it still may be possible to report sample results. In this case, the client should be consulted and an NCM written.

If the CCV % D falls below - ~~15~~ *20%* and sample results are ND, but the target analytes are detected in the RL Standard, it may still be possible to report sample results, since the detection of the analyte(s) in the RL Standard indicate that there was sufficient sensitivity to detect the analyte(s) in the samples

2. **References:** None

3. **Others Notified:** S. Chambers, C. McKean, M. Muir

SM 4/29/10
CM 04/29/10
04/29/10

Title: PCBs
[Method 8082]

Approvals

Signatures on File

Sonya Palmer Date Semivolatile Organic Department Manager	Stan Palmquist Date Health & Safety Manager / Coordinator
Dave Wunderlich Date Quality Assurance Manager	Kathy Kreps Date Laboratory Director

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Document Uncontrolled When Printed

1.0 Scope and Application

1.1 This SOP describes the procedure for the determination of concentrations of polychlorinated biphenyls (PCB) as Aroclors using the methodology prescribed in EPA SW-846 Method 8082. Table 1 lists the specific Aroclors that are determined using this procedure and their associated reporting limits (RLs).

1.2 This procedure is applicable to the analysis of extracts of aqueous, solid, and oil samples. When utilized for the analysis of oils, additional cleanup procedures may be required.

1.3 This SOP does not include the procedures for extracting environmental samples. Refer to TestAmerica Seattle SOPs TA-OP-0301, TA-OP-0323 and TA-OP-0302 for sample preparation procedures.

1.4 This SOP does not include the determination of the concentration of PCB congeners.

1.5 On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in Section 13.3.1 in the Quality Assurance Manual.

2.0 Summary of Method

2.1 Preparation

2.1.1 Aqueous Samples

PCBs are extracted from a one-liter aqueous sample with methylene chloride using a separatory funnel (SW-846 Method 3510) or continuous liquid-liquid (Method 3520C). The extract is evaporated to near dryness and exchanged to hexane. The final extract volume is 10 mL for medium level and 1 mL for low level. The extraction procedure is detailed in SOP TA-OP-0301 or TA –OP-0323.

2.1.2 Solid Samples

PCBs are extracted from solid materials using methylene chloride and ultrasonic agitation (Method 3550). The extract is evaporated to near dryness and exchanged to hexane. The final extract volume is 10 mL. The extraction procedure is detailed in SOP TA-OP-0302.

2.1.3 Oil Samples

Oil samples are typically prepared by diluting 0.2 gram of sample to a final volume of 10 mL with hexane. The extraction procedure is detailed in SOP TA-OP-314.

2.1.4 Solid Sample Cleanup Procedures

Cleanup options are discussed in Section 4 below. Instructions for performing various cleanup procedures are detailed in SOPs TA-OP-0364, TA-OP-0353, and TA-OP-0383.

2.2 Analysis

Samples are analyzed using a gas chromatograph with dual electron capture detectors (ECDs). Specific Aroclor mixtures are identified by the pattern of peaks compared to chromatograms of reference standards. The concentrations of Aroclors in the sample extract are determined using an external standard calibration.

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3.0 Definitions

3.1 Polychlorinated biphenyls (PCBs): PCBs are a class of organic compounds with 1 to 10 chlorine atoms attached to biphenyl, with a general chemical formula of $C_{12}H_{10-x}Cl_x$. There are 209 possible congeners.

3.2 Aroclor: PCBs were produced as technical mixtures by the chlorination of biphenyl. Production processes were designed to produce mixtures with characteristic chlorine contents. In the United States, most of the PCBs in the environment are in the form of Aroclors, which were produced by Monsanto from the 1930s through 1977. Each Aroclor mixture is identified by a four-digit number, the first two digits of which indicate the number of carbons in the biphenyl ring, i.e., 12, and the second two of which indicate the weight percent of chlorine. For example, Aroclor 1254 has 12 carbons and 54% by weight chlorine. The exception is Aroclor 1016, which has 12 carbons and 42% by weight chlorine.

NOTE: Each specific Aroclor produces a characteristic gas chromatographic pattern that represents the relative amounts of PCB congeners in the formulation. The formulation of the mixtures from batch to batch was fairly consistent, but never exactly the same. In almost all cases, the gas chromatogram can be used as a fingerprint to identify the specific Aroclor. Exceptions occurred for Aroclors 1254 and 1221. In each case, at least one batch was produced under different conditions, which resulted in an Aroclor mixture with the same approximate chlorine content , but with a significantly different distribution of congeners. These odd batches of 1254 and 1221 produce chromatographic patterns that are very different from the typical formulations. Standards for these odd batch Aroclors can be used to aid in the qualitative identification of Aroclors in environmental samples.

3.3 AR1660: Laboratory designation for the mixture of Aroclors 1016 and 1260.

3.4 AR2154: Laboratory designation for the mixture of Aroclors 1221 and 1254.

3.5 AR3262: Laboratory designation for the mixture of Aroclors 1232 and 1262.

3.6 AR4868: Laboratory designation for the mixture of Aroclors 1248 and 1268.

3.7 AR1242: Laboratory designation for Aroclor 1242.

4.0 Interferences

4.1 Hydrocarbons can co-elute and thereby mask the Aroclor pattern. The laboratory uses acid cleanup with concentrated sulfuric acid to remove hydrocarbons from solid and oil sample extracts, and for water samples when extracts have noticeable color or whenever there is clear evidence of interferences in the initial sample chromatograms. Acid cleanup removes low-to-medium molecular weight polar organic interferences from sample extracts. Detailed instructions for performing acid cleanup are provided in SOP TA-OP-0383.

4.2 Sulfur will interfere and can be removed using procedures described in SOP TA-OP-0353. See Figure 2 for an example chromatogram showing sulfur interference.

4.3 Contamination by carryover can occur when a low concentration sample is analyzed after a high concentration sample. Any affected samples are re-analyzed.

4.4 Interferences in the GC analysis arise from many compounds amenable to gas chromatography that give a measurable response on the electron capture detector. Phthalate esters, which are common plasticizers, can pose a major problem in the

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determinations. Interferences from phthalates are minimized by avoiding contact with any plastic materials.

4.5 Samples that may have interference, colored extract after acid clean-up or a history of interference problems may require an additional silica gel clean-up. Refer to SOP TA-OP-0364.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Safety Manual, Radiation Safety Manual and this document.

This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1 Specific Safety Concerns or Requirements

5.1.1 Eye protection that satisfies ANSI Z87.1, laboratory coat, and nitrile gloves must be worn while handling samples, standards, solvents, and reagents. Disposable gloves that have been contaminated must be removed and discarded; non-disposable gloves must be cleaned immediately.

5.1.2 The gas chromatograph contains zones that have elevated temperatures. The analyst needs to be aware of the locations of those zones, and must cool them to room temperature prior to working on them.

5.1.3 There are areas of high voltage in the gas chromatograph. Depending on the type of work involved, either turn the power to the instrument off, or disconnect it from its source of power.

5.1.4 All ^{63}Ni sources shall be leak tested every six months, or in accordance with the manufacturer's general radioactive material license. All ^{63}Ni sources shall be inventoried every six months. If a detector is missing, the EH&S Coordinator shall be immediately notified.

5.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material	Hazards	Exposure Limit (1)	Signs and symptoms of exposure
Acetone	Flammable	1000 ppm (TWA)	Inhalation of vapors irritates the respiratory tract. May cause coughing, dizziness, dullness, and headache.
Hexane	Flammable Irritant	500 ppm (TWA)	Inhalation of vapors irritates the respiratory tract. Overexposure may cause lightheadedness, nausea, headache, and blurred vision. Vapors may cause irritation to the skin and eyes.
Methylene Chloride	Carcinogen Irritant	25 ppm (TWA) 125 ppm (STEL)	Causes irritation to respiratory tract. Has a strong narcotic effect with symptoms of mental confusion, light-headedness, fatigue, nausea, vomiting, and headache. Causes irritation, redness and pain to the skin and eyes. Prolonged contact can cause burns. Liquid degreases the skin. May be absorbed through skin.
Hydrogen gas	Explosive	None	The main hazard is flammability. Exposure to moderate concentrations may cause dizziness, headache, nausea, and unconsciousness. Exposures to atmospheres less than 8 to 10% oxygen will bring about sudden unconsciousness, leaving individuals unable to protect themselves. Lack of sufficient oxygen may cause serious injury or death.
Sulfuric Acid	Corrosive Oxidizer Dehydrator Poison Carcinogen	1 Mg/M3-TWA	Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. Symptoms may include irritation of the nose and throat, and labored breathing. Symptoms of redness, pain, and severe burn can occur. Contact can cause blurred vision, redness, pain and severe tissue burns. Can cause blindness.
1 – Exposure limit refers to the OSHA regulatory exposure limit.			

6.0 Equipment and Supplies

6.1 Instrumentation

- A gas chromatographic system with dual columns and dual ECD (^{63}Ni) detectors, and a data system capable of measuring peak area and/or height
- Primary Column: CLPI, 30 m x 0.32 mm id, 0.5 µm coating or MR-1, 30 m x 0.25 mm ID x 0.25 µm coating
- Secondary Column: CLPII, 30 m x 0.32 mm id, 0.25 µm coating or MR-2, 30 m x 0.25 mm ID x 0.20 µm coating
- Guard column: 5 m x 0.25 mm ID
- Additional columns that can be used for confirmation include 30m x 0.32mm id HP5 or HP-1701

6.2 Supplies

- Autosampler vials, crimp caps with PTFE-faced septa
- Microsyringes, various sizes, for standards preparation, sample injection, and extract dilution

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7.0 Reagents and Standards

7.1 *Document reagent/standards and reagent/standard preparation in TALS using the reagent module as described in SOP TA-QA-0619.*

7.2 Standards

7.2.1 Stock Standards

7.2.1.1 All standards are subject to verification using a second-source standard before they are used for sample analysis. This process is described in SOP TA-QA-0619.

7.2.1.2 All standards must be stored at manufactures specifications. All stock standards must be protected from light. Stock standard solutions should be brought to room temperature before using.

7.2.1.3 Stock standards are monitored for signs of degradation or evaporation. The standards must be replaced annually from the date of receipt or earlier if the vendor indicates an earlier date.

7.2.1.4 Dilutions from stock standards cannot have a later expiration date than the date assigned to the parent stock solutions. The standards must be replaced at least every six months or sooner if comparison with check standards indicates a problem.

7.2.2 PCB and Surrogate Stock Calibration Standards

7.2.2.1 Stock A

For each of the Aroclors listed in Table 1, a commercially prepared stock standard solution is obtained. Each stock standard contains the specific Aroclor in pesticide-grade hexane (or in some cases, isooctane) at a concentration of 1,000 µg/mL.

7.2.2.2 Surrogate Stock B

A commercially prepared stock standard solution is obtained that contains the surrogate compounds tetrachloro-m-xylene (TCMX) and decachlorobiphenyl (DCB) in acetone, each at a concentration of 200 µg/mL.

7.2.3 Intermediate and Working Level Calibration Standard Solutions

7.2.3.1 Stock C Standard Solutions

A Stock C standard solution is prepared for the various Aroclors or combination of Aroclors as summarized in the following table.

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Stock C	Recipe	Conc (µg/mL)	Final Vol (mL)	Final Concentrations (µg/mL)	
AR1660	100 µL of Aroclor 1016 Stock A	1000	10	Aroclor 1016	10
	100 µL of Aroclor 1260 Stock A	1000		Aroclor 1260	10
	50 µL of surrogate Stock B	200		TCMX	1.0
				DCB	1.0
AR2154	100 µL of Aroclor 1221 Stock A	1000	10	Aroclor 1221	10
	100 µL of Aroclor 1254 Stock A	1000		Aroclor 1254	10
AR1242	100 µL of Aroclor 1242 Stock A	1000	10	Aroclor 1242	10
AR3262	100 µL of Aroclor 1232 Stock A	1000	10	Aroclor 1232	10
	100 µL of Aroclor 1262 Stock A	1000		Aroclor 1262	10
AR4868	100 µL of Aroclor 1248 Stock A	1000	10	Aroclor 1248	10
	100 µL of Aroclor 1268 Stock A	1000		Aroclor 1268	10

7.2.3.2 AR1660 Calibration Levels

A total of 6 calibration standards are prepared for AR1660 as summarized in the following table. As needed, the following table can be used to prepare calibration standards for any of the Aroclors, but only the AR1660 calibration standards include the surrogates. In all cases, measured volumes of the Stock C standard are diluted using pesticide-grade hexane to the final volume indicated in the following table.

Level	Vol of Stock C Used (µL)	Final Volume (mL)	Final PCB Conc (µg/L)	Final Surrogate Conc (µg/L)*
1	10	10	10	1.0
2	20	10	20	2.0
3	50	10	50	5.0
4 (CCV)	100	10	100	10.0
5	500	10	500	50
6	1000	10	1000	100

* *Surrogates are in the AR1660 calibration solutions only. None of the other Aroclor calibration solutions contain the surrogate compounds.*

7.2.3.3 Working Single-Point PCB Calibration Standards

The Level 4 standard in the table above is used for single-point calibrations of the individual Aroclors. These standards are also used as pattern recognition standards.

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7.2.4 Second-Source Standards for Initial Calibration Verification (ICV)

These standards are purchased from a vendor different from the one that supplied the stock calibration standards.

7.2.5 Second-Source Stock A' Aroclor Standard Solutions

Commercially prepared solutions in pesticide-grade hexane (or isooctane) are routinely obtained for Aroclors 1016 and 1260. The Aroclor concentration in each solution is 1000 µg/mL. A second source may be obtained for the other Aroclors, if necessary.

7.2.6 Second-Source Surrogate Stock B' Standard Solution

A commercially prepared solution is obtained containing TCMX and DCB, **each at a concentration of 200 µg/mL.**

7.2.7 Second-Source Working Level Standards

The working level second-source ICV standard is prepared by combining 1.0 mL of Aroclor 1016/ 1260 Stock A' and 0.50 mL of surrogate Stock B', and diluting to a final volume of 100 mL with pesticide-grade hexane. This results in a concentration of 10.0 µg/mL for each of the Aroclors and 1.0 µg/mL for each of the surrogates. If a second source verification standard is prepared for any of the Aroclors other than the AR1660 mixture, the surrogates are not added.

7.2.8 Continuing Calibration Verification Standard (CCV), 0.1 µg/mL

The working CCV solution is the same as the Level 4 initial calibration standard, as shown in the table in Section 7.2.3.2.

7.2.9 RL Standard

The lowest concentration calibration standard (i.e., Level 1) is used as the RL Standard.

7.2.10 Laboratory Control Standard (LCS) Spiking Solution (AR1660)

NOTE: The LCS/MS spiking solution is prepared and used as part of the scope of the organic preparation SOPs TA-OP-0301 and TAN-OP-0302. The following information is provided for reference only.

The soil working LCS spike solution is prepared in a 10 mL volumetric flask by combining 1 mL of the Aroclor 1016/ 1260 Stock A' standard, and diluting to volume with acetone.

The water working LCS spike solution is prepared in a 10 mL volumetric flask by combining 100 µL of the Aroclor 1016 Stock A standard and 100 µL of the Aroclor 1260 Stock A standard, and diluting to volume with acetone.

The LCS for a batch of aqueous samples is prepared by adding 100 µL of the water working LCS spiking solution to one liter of water. The LCS for a batch of soil samples is prepared by adding 100 µL of the soil working LCS spiking solution to 10 grams of Ottawa sand.

7.2.11 Matrix Spike (MS) Spiking Solution:

The working matrix spike solution is the same as the LCS spike solution. Matrix spike samples are prepared by adding 1.0 mL of the working solution to a second one-liter aliquot of the selected aqueous sample, or to a 10-gram subsample of the

selected soil sample. The MS duplicate (MSD) is prepared in the same way using a third aliquot of the selected sample.

7.2.12 Surrogate Spike Solution

7.2.12.1 Stock Surrogate Spike Solution:

A commercially prepared solution containing 200 µg/mL each of decachlorobiphenyl (DCB) and tetrachloro-m-xylene (TCMX) in acetone is purchased.

7.2.12.2 Working Surrogate Spike Solution

NOTE: Samples are spiked with the surrogate compounds during sample preparation, which is described in the organic preparation SOPs TA-OP-0301 and TA-OP-0302. The following information is provided for reference only.

The soil and water working surrogate spike solution is prepared in a 50 mL volumetric flask by adding 500 uL of the stock surrogate spike solution and diluting to 50 mL volume with acetone. The surrogate compounds are added to all field and QC samples as follows:

Sample	Sample Volume (L) or Mass (grams)	Vol. of Surrogate Spike Solution Added (µL)
LCS (aqueous)	1 L reagent water	100
LCS (solid)	10 g reagent free sand	100
MS/MSD (aqueous)	1 L sample aliquot	100
MS/MSD (solid)	10 g reagent free sand	100
Aqueous Sample	1 L sample aliquot	100
Solid Sample	10 g reagent free sand	100

7.2.13 Primer Mix

The primer mix typically consists of a mixture of CCV standards and/or old calibration standards. The concentrations of the components of the primer mix are not critical. The primer mix is injected one or more times prior to analyzing standards and samples to ensure that the chromatographic system is stable, i.e., that retention times are reproducible.

7.3 Reagents

7.3.1 Acetone, 99.4% for organic residue analysis. Each lot is tested for purity prior to use per SOP S-T-001.

7.3.2 Hexane, pesticide grade. Each lot is tested for purity prior to use per SOP S-T-001.

7.3.3 Carrier Gas: ≥ 99.99999% pure hydrogen

7.3.4 Make-up Gas: ≥ 99.99980% pure nitrogen

7.4 *Managers/supervisors or a designee are expected to check their areas on a monthly basis for expired standards and dispose of them according to SOP TA-EHS-0036.*

8.0 Sample Collection, Preservation, Shipment and Storage

8.1 Water samples are collected in pre-cleaned amber glass bottles fitted with a Teflon-lined caps. To achieve routine reporting limits, a full one liter of sample is required. Additional one-liter portions are needed to satisfy the requirements for matrix spikes and duplicate matrix spikes.

8.2 Soil samples are collected in 8-ounce, wide-mouth jars with a Teflon-lined lid.

8.3 Samples are stored at 0-6°C.

8.4 Water samples must be extracted within 7 days of collection, and soil samples must be extracted within 14 days of collection.

8.5 Sample extracts are refrigerated at 0-6°C and analyzed within 40 days from extraction.

Listed below are the holding times and the references that include preservation requirements.

Matrix	Sample Container	Min. Sample Size	Preservation	Extraction Holding Time	Analysis Holding Time	Reference
Waters	Amber glass	1 Liter	Cool 0-6°C	7 Days	40 Days from extraction	40 CFR Part 136.3
Soils	Glass	30 grams	Cool 0-6°C	14 Days	40 Days from extraction	N/A

9.0 Quality Control

9.1 The minimum quality controls (QC), acceptance criteria, and corrective actions are described in this section. When processing samples in the laboratory, use the LIMS QC program code and special instructions to determine specific QC requirements that apply.

9.1.1 The laboratory's standard QC requirements, the process of establishing control limits, and the use of control charts are described more completely in TestAmerica Seattle SOP TA-QA-0620, *Quality Control Program.*

9.1.2 Project-specific requirements can override the requirements presented in this section when there is a written agreement between the laboratory and the client, and the source of those requirements should be described in the project documents. Project-specific requirements are communicated to the analyst via special instructions in the LIMS.

9.1.3 Any QC result that fails to meet control criteria must be documented in a Nonconformance Memo (NCM). The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The QA group also receives NCMs by e-mail for tracking and trending purposes. The NCM process is described in more detail in SOP TA-QA-0610. This is in addition to the corrective actions described in the following sections.

9.2 Batch Definition

Batches are defined at the sample preparation stage. The batch is a set of up to 20 samples of the same matrix, plus required QC samples, processed using the same procedures and reagents within the same time period. Batches should be kept together through the whole analytical process as far as possible, but it is not mandatory to analyze

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prepared extracts on the same instrument or in the same sequence. The method blank must be run on each instrument. See SOP TA-QA-0620 for further details.

PIBLK Instrument blank with surrogate added. Needs to be run after a CCV unless a Mb is run first. If the PIBLK is run it needs to be evaluated with results less than the RL for the target list and passing surrogate criteria and uploaded to TALS.

9.3 Method blank

A method blank is prepared and analyzed with each batch of samples. The method blank consists of reagent water (for aqueous sample batches) or reagent free sand (for solid sample batches) to which the surrogate compounds are added. The method blank is subject to the entire extraction and analysis process.

Acceptance Criteria: The method blank must not contain any analyte of interest at or above the reporting limit (RL) or above one-tenth of the concentration found in the associated samples. Note that some programs (e.g. *BP LaMP*, AFCEE, Navy, and USACE) require that the maximum blank concentration must be one-half of the RL or less.

Corrective Action: If the method blank exceeds allowable levels, the source of the contamination should be investigated and all associated samples re-extracted and reanalyzed.

9.4 Laboratory Control Sample (LCS)

One LCS is prepared and analyzed with each batch of samples. The LCS is prepared as described in Section 7.2.9. The LCS is subject to the entire extraction and analysis process.

Acceptance Criteria: The LCS recovery must be within the established control limits. The laboratory's standard control limits are set at ± 3 standard deviations around the historical mean, unless project requirements dictate otherwise. Current control limits are maintained in the LIMS.

Corrective Action: If recoveries are not within the established limits, the analytical system is out of control and corrective action must occur. All associated samples must be re-extracted and reanalyzed. *Samples which are associated with a high LCS recovery but are non-detect may be reported. This occurrence must be documented in a non-conformance memorandum and the data flagged.*

9.5 Matrix Spike (MS) and Matrix Spike Duplicate Samples (MSD)

One MS/MSD pair is required with each analytical batch. Note that some programs (e.g., North Carolina and South Carolina) require preparation and analysis of an MS/MSD pair at a 10% frequency. Preparation of the MS is described in Section 7.2.11. The MSD is another aliquot of the sample selected for the MS that is spiked in the same manner as the MS.

Acceptance Criteria: The MS and MSD recoveries must fall within the established control limits, which are set at ± 3 standard deviations around the historical mean, unless project requirements dictate otherwise. The relative percent difference (RPD) between the MS and MSD must be less than the established limit, which is based on statistical analysis of past results, unless otherwise dictated by project requirements.

Current control limits are maintained in the LIMS.

Corrective Actions: If analyte recovery or RPD falls outside the acceptance range, but the associated LCS recovery is in control, and all other QC criteria (e.g., continuing calibration verification) are met, then there is no evidence of analytical problems, and qualified results may be reported. The situation must be described in an NCM and in the final report case narrative. In other circumstances, the batch must be re-prepared and reanalyzed.

If the recovery for any component is outside control limits for both the MS and the LCS, the laboratory is out of control and corrective action must be taken. Corrective action will normally include re-preparation and reanalysis of the batch.

The MS must be analyzed at the same dilution level as the unspiked sample, unless the matrix spike components would then be above the calibration range.

9.6 Surrogates

Each field sample, QC sample, and each calibration standard that is used for the AR1660 initial calibration, is spiked with surrogate compounds decachlorobiphenyl (DCB) and trichloro-m-xylene (TCMX). The surrogate spike solution is prepared as described in Section 7.2.12.

Acceptance Criteria: The surrogate recoveries must be within the established control limits, which are set at ± 3 standard deviations around the historical mean, unless project requirements dictate otherwise.

Corrective Action: If recoveries of the surrogates in blanks are outside of the control limits, check for calculation or instrument problems. High recoveries might be acceptable if the surrogate recoveries for the samples and other QC in the batch are acceptable. Low surrogate recoveries in the blank require re-preparation and reanalysis of the associated samples.

For field samples, surrogate recovery is calculated and reported for DCB only. TCMX may also be added. However, if both surrogate compounds are added, and recoveries calculated, and either surrogate fails to fall within the control limits, corrective actions are required (this also applies to programs that require the use of only one surrogate).

If matrix interference is not obvious from the initial analysis, it is only necessary to re-prepare and reanalyze a sample once to demonstrate that poor surrogate recovery is due to matrix effects, as long as the extraction/instrument system is proven to be working properly.

Note: *For BP samples, if the surrogate percent recovery fails, the recovery must be confirmed by re-extraction and reanalysis with the following exceptions:*

- *The lab has unequivocally demonstrated a sample matrix effect and informed the BP representative.*
- *The recovery exceeds control limits and all target analytes in the sample are non-detect.*

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9.7 *Any extra QC that is analyzed in a batch or sequence must be evaluated using the same criteria as the corresponding QC above.*

10.0 **Procedure**

10.1 One-time procedural variations are allowed only if deemed necessary in the professional judgment of supervision to accommodate variation in sample matrix, radioactivity, chemistry, sample size, or other parameters. Any variation in procedure shall be completely documented using an NCM. The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The QA group also receives NCMs by e-mail for tracking and trending purposes. The NCM process is described in more detail in SOP TA-QA-00610. The NCM shall be filed in the project file and addressed in the case narrative.

10.2 Any deviations from this procedure identified after the work has been completed must be documented in an NCM, with a cause and corrective action described.

10.3 **Sample Preparation**

10.4 Samples are extracted and prepared for analysis as described in SOPsTA-OP-0301 or TA-0P-0323 (aqueous samples) and TA-OP-0302 (solid samples).

10.5 Acid cleanups are routinely performed on sample extracts. Sulfur cleanups are performed as needed. Extraction and cleanup procedures are described in SOPs TA-OP-0353, TAN-OP-0364, and TA-OP-0383. *Lot# of reagent(s) used for cleanup must be noted were applicable in the TALS batch.*

10.6 **Calibration**

10.7 TestAmerica Seattle gas chromatograph instrument systems are computer controlled to automatically inject samples and process the resulting data.

10.7.1 Use the ChemStation chromatography data system to set up GC conditions for calibration. See Table 2 for typical operating conditions.

10.7.2 Transfer calibration standard solutions into autosampler vials and load into the GC autosampler. Use the ChemStation software to set up the analytical sequence.

10.7.3 After processing the calibration data, the associated initial calibration verification is linked in TALS to the first set of samples analyzed after the calibration and submitted to a qualified peer or the group leader for final review.

10.8 A new calibration curve must be generated initially, after major changes to the system, or when continuing calibration criteria cannot be met. Major changes include installation of new columns.

10.9 Initial Calibration (ICAL)

10.9.1 An external standard calibration using six concentration levels of the AR1660 mixture is routinely performed. (At least five calibration levels are required.) This provides concentration levels for Aroclor 1016, Aroclor 1260, and the surrogate compounds DCB and TCMX.

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10.9.2 All initial calibration points must be analyzed without any changes to instrument conditions, and all points must be analyzed within 24 hours.

10.9.3 The calibration curves for Aroclors 1016 and 1260 and the surrogate compounds are modeled either as average calibration factors (CF) or as calibration curves using a systematic approach to selecting the optimum calibration function.

10.9.4 The calibration for each of the other Aroclors (see Table 1) is initially determined using one point calibrations. As needed, the laboratory may generate a multi-point calibration for other commonly detected Aroclors, such as 1221, 1254, and 1248. When additional multi-point calibrations are developed for the other Aroclors, a second-source ICV standard is also analyzed.

NOTE: Samples from sites known to be contaminated with specific Aroclors should be analyzed using a multi-point calibration curve for the identified Aroclors. This information is provided to the analyst through special instructions in the LIMS.

NOTE: Generally, it is NOT acceptable to remove points from a calibration for the purposes of meeting calibration criteria, unless the points are the highest or lowest on the curve AND the reporting limit and/or the linear range is adjusted accordingly. The only exception is that a level may be removed from the calibration if the reason can be clearly documented, for example a broken vial. A minimum of five levels must remain in the calibration for a linear regression. The documentation must be retained with the initial calibration. Alternatively, if the analyst believes that a point on the curve is inaccurate, the point may be reanalyzed and the reanalysis used for the calibration.

10.9.5 The high and low standard for the initial calibration of the AR1660 mixture defines the acceptable quantitation range for all of the Aroclors. If a sample extract contains any Aroclor at a concentration that exceeds the upper range of the calibration, then the extract must be diluted and reanalyzed.

10.9.6 Select 5 major peaks in the analyte pattern (only 3 peaks are usable for Aroclor 1221). Calculate the response of each of the major peaks for each Aroclor, and use these responses independently, averaging the resultant concentrations found in samples for a final concentration result. When using this option, it is appropriate to remove peaks that appear to be co-eluting with contaminant peaks from the quantitation (i.e. peaks that are significantly larger than would be expected from the rest of the pattern).

NOTE: A minimum of three accurate peaks must be used to quantify an Aroclor.

10.10 External Standard Calibration

External standard calibration involves the comparison of instrument responses from the samples to the responses from the target compounds in the calibration standards. The area (or height) of a peak in a sample chromatogram is compared to the area (or height) of the peak in the standard chromatograms that appears at the same retention time. The ratio of the detector response to the concentration of the target analyte in the calibration standard is defined as the calibration factor (CF) and is calculated as follows:

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$$CF = \frac{A_s}{C_s}$$

Where:

A_s = Peak area (or height) of the target analyte in the calibration standard.

C_s = Concentration of the target analyte in the calibration standard (µg/mL).

10.11 Establishing the Calibration Function

Calibrations are modeled either as average calibration factors (CF) or as linear regression curves, using a systematic approach to select the optimum calibration function. Start with the simplest model, i.e., a straight line through the origin and progress through the other options until calibration acceptance criteria are met.

10.12 Linear Calibration Using Average Calibration Factor (CF)

The calibration factor is a measure of the slope of the calibration line, assuming that the line passes through the origin. Under ideal conditions, the factors calculated for each calibration level will not vary with the concentration of the standard. In practice, some variation can be expected. When the variation, measured as the relative standard deviation, is relatively small (e.g., ≤ 20%), the use of the straight line through the origin model is generally appropriate.

The average calibration factor is calculated as follows:

$$\text{Average CF} = \overline{CF} = \frac{\sum_{i=1}^{n} CF_i}{n}$$

Where:

CF_i = The calibration factor for the ith calibration level.

n = The number of calibration levels.

The relative standard deviation (RSD) is calculated as follows:

$$RSD = \frac{SD}{\overline{CF}} \times 100\%$$

Where SD is the standard deviation of the average RF, which is calculated as follows:

$$SD = \sqrt{\frac{\sum_{i=1}^{n} \left(CF_i - \overline{CF}\right)^2}{n-1}}$$

10.13 Evaluation of the Average Calibration Factor

Plot the calibration curve using the average CF as the slope of a line that passes through the origin. Examine the residuals, i.e., the difference between the actual calibration points and the plotted line. Particular attention should be paid to the residuals for the highest points, and if the residual values are relatively large, a linear regression should be considered.

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Acceptance Criteria: The RSD must be ≤ 20%. SW-846 Method 8000B allows evaluation of the grand average across all compounds, but some programs (e.g., AFCEE and South Carolina require evaluation of each compound individually). Check project requirements.

Corrective Action: If the RSD exceeds the limit, linearity through the origin cannot be assumed, and a least-squares linear regression should be attempted.

10.14 Linear Calibration Using Least-Squares Regression

Calibration using least-squares linear regression produces a straight line that does not pass through the origin. The calibration relationship is constructed by performing a linear regression of the instrument response (peak area or peak height) versus the concentration of the standards. The instrument response is treated is the dependent variable (y) and the concentration as the independent variable (x). A weighted least squares regression may be used if at least three multi-point calibrations have been performed. The weighting used is the reciprocal of the square of the standard deviation. The regression produces the slope and intercept terms for a linear equation in the following form:

$$y = ax + b$$

Where:

y = Instrument response (peak area or height).
x = Concentration of the target analyte in the calibration standard.
a = Slope of the line.
b = The y-intercept of the line.

For an external standard calibration, the above equation takes the following form:

$$A_s = aC_s + b$$

Where:

A_s = Peak area (or height) of the target analyte in the calibration standard.
C_s = Concentration of the target analyte in the calibration standard (µg/mL).

To calculate the concentration in an unknown sample extract, the regression equation 6 is solved for concentration, resulting in the following equation, where C_s is now C_e, the concentration of the target analyte in the unknown sample extract, and A_s is now A_e, the peak area (or height) of the target analyte in the sample extract.

$$C_e = \frac{A_e - b}{a}$$

10.15 Evaluation of the Linear Least-Squares Regression Calibration Function

With an unweighted linear regression, points at the lower end of the calibration curve have less weight in determining the curve than points at the high concentration end of the curve. For this reason, inverse weighting of the linear function is recommended to

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optimize the accuracy at low concentrations. Note that the August 7, 1998 EPA memorandum "Clarification Regarding Use of SW-846 Methods", Attachment 2, Page 9, includes the statement "The Agency further recommends the use of this for weighted regression over the use of an unweighted regression."

Acceptance Criteria: To avoid bias in low level results, the absolute value of the y-intercept must be significantly less than reporting limit (RL), and preferably less than the MDL.

Also examine the residuals, but with particular attention to the residuals at the bottom of the curve. If the intercept or the residuals are large, the calibration should be repeated since a higher order regression is not allowed for this method.

The linear regression must have a correlation coefficient (r) ≥ 0.99. Some programs (e.g., USACE and AFCEE) require a correlation coefficient ≥ 0.995.

Corrective Action: If the correlation coefficient falls below the acceptance limit, the linear regression is unacceptable and the calibration should be repeated since a higher order regression is not allowed for this method.

10.16 Second-order regressions and polynomial regression fits of third order or higher are not allowed for this method.

10.17 Second-Source Initial Calibration Verification (ICV)

The second-source ICV standard usually consists of Aroclors 1016 and 1260 only. The stock standards are obtained from a source different than that of the standards used for the calibration. The preparation of the ICV standard is described in Section 7.2.4. The concentration of each Aroclor in the ICV is 0.10 µg/mL; the concentration of each surrogate is 0.01 µg/mL. The ICV standard is analyzed immediately following the initial calibration.

If it is necessary to generate a multi-point calibration for any of the other Aroclors, then an ICV standard containing the specific Aroclor(s) is analyzed immediately following the calibration.

Acceptance Criteria: The result for the target analyte(s) in the ICV standard must be within ± 20 of the expected value.

Corrective Action: If this is not achieved, the ICV standard, calibration standards, and instrument operating conditions should be checked. Correct any problems and rerun the ICV standard. If the ICV still fails to meet acceptance criteria, then repeat the ICAL.

10.18 Continuing Calibration Verification (CCV), 0.10 µg/L and/or 0.01 µg/L

10.18.1 12-Hour Calibration Verification

The 12-hour calibration verification sequence consists of, at a minimum, an instrument blank and the mid-level calibration standard. The 12-hour calibration verification sequence must be analyzed within 12 hours of the start of the initial calibration and at least once every 12 hours thereafter when samples are being analyzed. If more than 12 hours have elapsed since the injection of the last sample in the analytical sequence, a new analytical sequence must be started with a 12-hour calibration sequence.

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NOTE: It is not necessary to run a CCV standard at the beginning of the sequence if samples are analyzed immediately after the completion of the initial calibration.

10.18.2 Continuing Calibration Verification (CCV), 0.10 µg/L and/or 0.010 µg/L

It may be appropriate to analyze a mid-level standard more frequently than every 12 hours (DoD QSM and LAMP). The mid-level calibration standard is analyzed as the continuing calibration verification (CCV) standard. At a minimum, this is analyzed after every 10 injections, including matrix spikes, LCSs, and method blanks. If 12 hours elapse, analyze the 12-hour standard sequence instead.

10.18.3 RL Standard

It may also be appropriate to analyze a standard prepared at or below the reporting limit (RL) for the method at the end of the analytical sequence, as a minimum (see Section 7.2.9). This standard can be used to rule out false negatives in client samples in cases where the %D for one or more of the analytes in a bracketing CCV falls below the lower acceptance limit. The results for the RL standard are not evaluated **unless** the previous CCV fails acceptance criteria.

10.18.4 Acceptance Criteria for Continuing Calibration Verification (CCV)

10.18.4.1 Detected Analytes (≥ RL)

For any analyte detected at or above the reporting limit (RL) in client samples, the percent difference (%D) for that analyte in the preceding and following CCVs (i.e., bracketing CCVs) or 12-hour calibration, on the column used for quantitation, must be within ± 20%.

In some cases, the nature of the samples being analyzed may be the cause of a failing %D. When the %D for an analyte falls outside of criteria in the CCV, and that analyte is detected in any or all of the associated samples, then those samples must be reanalyzed to prove a matrix effect. If the drift is repeated in the reanalysis, the analyst must generate an NCM for this occurrence to explain that the drift was most likely attributable to the sample matrix and that the samples may be diluted and reanalyzed to minimize the effect if so desired by the client.

If a failing CCV is followed by a second verifying CCV and the subsequent calibration verification injection also fails, a new initial calibration curve must be processed. (i.e., no more than two consecutive injections of the calibration verification may be processed.

Refer to Section 12 for which result to report.

The %D is calculated as follows:

$$\%D = \frac{\text{Measured Conc} - \text{Theoretical Conc}}{\text{Theoretical Conc}} \times 100$$

10.18.4.2 Analytes Not Detected (< RL)

For any analyte not detected (ND) in client samples, the %D for that analyte in the bracketing CCVs should also be within ± 20%.

However, if the CCV %D exceeds +15% and the sample results are ND, it still may be possible to report sample results. In this case, the client should be consulted and an NCM written.

If the CCV % D falls below -15% and sample results are ND, but the target analytes are detected in the RL Standard, it may still be possible to report sample results, since the detection of the analyte(s) in the RL Standard indicate that there was sufficient sensitivity to detect the analyte(s) in the samples. In this case, the client should be consulted and an NCM written.

10.19 Retention Time (RT) Windows

10.19.1 Determine the retention time (RT) windows for the 5 major peaks selected for each Aroclor (3 peaks for Aroclor 1221). The AR1016 windows will be used to establish retention time windows for PCBs AR1221, AR1016, AR1232, AR1242, and AR1248. The AR1260 windows will be used to establish retention time windows for PCBs AR1254, AR1260, AR1262, and AR1268.

10.19.2 Determine new RT windows each time a new column is installed.

10.19.3 Inject a standard containing all analytes at least once each day over a 72-hour period.

10.19.4 Calculate the mean and standard deviation of the three RTs for each analyte as follows:

$$\text{Mean RT} = \overline{RT} = \frac{\sum_{i=1}^{n} RT_i}{n} \qquad SD = \sqrt{\frac{\sum_{i=1}^{n}\left(RT_i - \overline{RT}\right)^2}{n-1}}$$

Where:

RT_i = Retention time for the ith injection.

n = Number of injections (typically 3).

SD = Standard deviation.

10.19.5 RT window for each analyte is set at ± 3 times the standard deviation of the RTs determined for each analyte over the 72-hour period. For multi-response analytes, use the RT of major peaks.

10.19.6 The center of the RT window for each analyte is the RT from the last of the three analyses of the standard.

10.19.7 The center of the window for each analyte is updated with the RT from the level 4 standard of the ICAL, the CCV at the beginning of the analytical sequence, and with each subsequent 12-hour calibration verification. The width of each window remains the same until new windows are generated following the installation of a new column, or in response to an RT failure.

10.19.8 If the width of the RT window, as calculated above, is less than ±0.03 minute, use ± 0.03 minute as the RT window width. This allows for slight variations in RTs caused by sample matrix.

10.19.9 Acceptance Criteria for Retention Times

The RT for each compound in each CCV analysis must be within the RT windows

established by the daily initial CCV.

10.19.10 Corrective Action for Retention Times

If a target analyte falls outside the established RT window in a CCV standard, either adjust the center of the window based on the CCV, or investigate the problem and calculate new RT windows. All samples analyzed after the last acceptable CCV must be reanalyzed.

10.19.11 Sample Retention Time Criteria

The surrogate must fall within the established RT window. Target analyte peaks must be within the established RT window to be reported as such. If the surrogate RT indicates an RT shift, it may be possible to accept a target analyte peak if it has not shifted relative to the surrogate peak.

10.19.12 Daily Retention Time Windows

The centers of the retention time windows are adjusted to the retention time of each analyte as determined by the daily initial CCV. The centers of the retention time windows are adjusted at the beginning of each analytical sequence based on the daily initial CCV.

10.20 <u>Sample Analysis</u>

10.21 Gas Chromatography

10.21.1 Chromatographic conditions for this method are presented in Table 2.

10.21.2 Use the Chemstation interface to establish instrument operating conditions for the GC.

10.21.3 Raw data obtained are processed using Chrom. The data analysis method, including peak processing and integration parameters, calibration, RT windows, and compound identification parameters, is set up in the software.

10.21.4 The instrument is set up and calibrated as described in Section 10 above.

10.22 Sample Introduction

10.22.1 An autosampler is used to introduce samples into the chromatographic system by direct injection of 1 or 2 µL of the sample extract. For dual-column instruments, 2 µL of sample extract are automatically injected onto two columns. For single-column instruments, 1 µL of sample extract is automatically injected onto one column.

10.22.2 Samples, standards, and QC samples must be introduced using the same procedure.

10.22.3 All extracts and standards are allowed to warm to room temperature before injection.

10.22.4 Use Chemstation interface to set up and run the analytical sequence. Sample injection and analysis are automated and may proceed unattended.

10.23 Analytical Sequence

An analytical sequence starts with a minimum five-level initial calibration (ICAL) or a daily calibration verification. The daily run sequence is documented in a bound log book.

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10.23.1 The daily calibration verification includes analysis of the 12-hour calibration sequence and updating the retention time windows.

10.23.2 If there is a break in the analytical sequence of greater than 12 hours, a new analytical sequence must be started with a daily calibration verification.

10.23.3 Following is the typical analytical sequences:

Primer	(Injection of any standard that contains analytes to establish the stability of the chromatographic system.)
Rinse blank	
Daily initial CCVs	(Unless an ICAL is performed, which is immediately followed by the second-source initial calibration verification. CCVs include injections for AR1660. AR3262, AR1242, AR2154, and AR4868 can also be injected at this time, in which case a closing CCV for these analytes is not required)(DoD QSM projects require all target Aroclor compounds to be injected at this time).
10 sample injections	(The first set of samples analyzed usually includes the method blank and the LCS, and may include matrix spikes.)
CCV (AR1660)	
Followed by cycles of 10 sample injections and a CCV, as needed	
Closing CCV (AR1660) and rinse blank(s) as needed	

10.23.4 Following is the typical DoD or LaMP analytical sequence:

Primer
Hexane blank (with surrogates)
Daily initial CCVs (as above)
Method or Instrument Blank (PIBLK) with surrogate
10 injections including samples and QC
CCVs (as above)
Method or Instrument Blank (PIBLK) with surrogate
Followed by cycles of 10 injections (including samples and QC) and CCVs & Blanks as needed totaling less than 12 hours of analysis time from injection of daily initial CCV Std.
Closing CCV (as above)
Method or Instrument Blank (PIBLK) with surrogate

10.24 Retention Times

The centers of the retention time windows are updated with the mid point of the initial calibration and each 12 hour calibration. The widths of the windows will remain the same until new windows are generated following the installation of a new column or after one-year which ever is more frequent.

10.25 When a sample result exceeds the upper calibration range, then that sample extract is diluted to obtain a result in the upper half of the calibration range and reanalyzed. Any samples that were analyzed immediately following the high sample are evaluated for carryover. If the samples had target analyte detections at or above the RL, the samples must be reanalyzed to rule out carryover.

10.26 Upon completion of the analytical sequence review chromatograms online and determine whether manual data manipulations are necessary. All manual integrations must be justified and documented. See Corporate SOP CA-Q-S-002 for requirements for manual integration. Manual integrations may be processed using an automated macro, which prints the before and after chromatograms and the reason for the change, and attaches the analyst's electronic signature. Alternatively, the manual integration may be processed manually. In the latter case, print both the both the before and after chromatograms and record the reason for the change and initial and date the after chromatogram. Before and after chromatograms must be of sufficient scale to allow an independent reviewer to evaluate the manual integration.

10.27 Compile the raw data for all the samples and QC samples in a batch. The analytical batch is defined as containing no more than 20 samples, which include field samples and the MS and MSD. Confirm that run logs have printed on them the instrument ID, the analyst and the method used. If this is not printed on the run logs, this must be entered by hand prior to completing the package. Perform a level 1 data review and document the review on the data review checklist (GC Data Review Checklist). Submit the data package and review checklist to a Data Reviewer for the level 2 review. The data review process is explained in SOP TA-QA-0635.

10.28 Instrument Maintenance

Refer to section 11.10 of TA-GS-0308 for maintenance procedures and spare parts lists.

All maintenance and repairs need to be documented in the instrument's maintenance logbook. The logbook must include the instrument name, serial number for each major component (e.g., GC, autosampler) and the date of start-up. When an instrument is not capable of analyzing samples, it needs to be tagged "Out of Service". Logbook entries must include a description of the problem and what actions were taken to address the problem. After an instrument has undergone maintenance or repairs, the system is evaluated using a tune, CCV or ICAL. If the evaluation is successful, the analyst documents in the logbook that the "System returned to control as indicated by a passing CCV" (or ICAL or MB, etc as may be the case).

11.0 <u>Calculations / Data Reduction</u>

11.1 Qualitative Identification of Aroclors

Retention time windows are used for identification of Aroclors, but the "fingerprint" produced by major peaks of those analytes in the standard is used in tandem with the retention times for identification. The ratios of the areas of the major peaks are also taken into consideration. Identification may be made even if the retention times of the peaks in the sample fall outside of the retention time windows of the standard, if in the analyst's judgment the fingerprint (retention time and peak ratios) resembles the standard chromatogram.

11.2 Quantitation of Aroclors

Quantitation of Aroclors is accomplished using 5 major peaks (3 peaks for Aroclor 1221). The peaks must be within the established retention time windows. If there is an

interference that affects the accuracy of results, the analyst may use as few as 3 major peaks (2 peaks for Aroclor 1221). The same peaks that are used for sample quantitation must be used for standards and QC quantitation.

11.3 Second column confirmation of Aroclors is performed only when requested by the client, because the appearance of the multiple peaks in the sample usually serves as a confirmation of analyte presence.

NOTE: USACE projects require the use of second-column confirmation of Aroclors unless the project work plans (SOW, SAP, QAPP, etc.) specify single-column analysis.

11.4 Dual Column Quantitation and Reporting

NOTE: Dual column quantitation is not routinely performed for PCB analysis. This section is included for those clients/projects that require dual column confirmation.

11.4.1 The result from a designated primary column is normally reported. The result from the secondary column is reported if any of the following is true:

11.4.1.1 There is obvious chromatographic interference on the primary column.

11.4.1.2 The difference between the result on the primary column and the result on the secondary column is > 40% and chromatographic interference is evident.

11.4.1.3 A continuing or bracketing standard fails on the primary column, but is acceptable on the secondary column. However, if the difference between the primary column and secondary column results is > 40% and the primary column calibration verification fails, then the sample must be evaluated for reanalysis.

If the relative percent difference (RPD) between the results on the two columns is greater than 40%, or if the opinion of an experienced analyst is that the complexity of the matrix is resulting in false positives, the confirmation is suspect and the results are qualified. The RPD is calculated as follows:

$$\%RPD = \frac{|R_1 - R_2|}{1/2(R_1 + R_2)} \times 100\%$$

Where R_1 is the result for the primary column, and R_2 is the result for the secondary column.

11.5 Surrogate Recovery

11.5.1 Surrogate recovery results are calculated and reported for decachlorobiphenyl (DCB).

11.5.2 In cases where the addition of the surrogate tetrachloro-m-xylene (TCMX) is required, its recovery is calculated and reported. In cases where both surrogates are added, the recovery of each surrogate is evaluated and corrective action must be taken if either surrogate recovers outside of the established control limits and matrix interference is not evident. Depending on project requirements, corrective action may be necessary only if DCB and TCMX are both outside of acceptance limits. *(LaMP: if surrogates fail acceptance criteria they must be re-extracted*

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unless the samples are high ND or demonstrate matrix interference and client is notified. See Section 9.7)

11.6 Calibration Range and Sample Dilutions

If the concentration of any analyte exceeds the working range as defined by the calibration standards, then the sample must be diluted and reanalyzed. Dilutions should target the most concentrated analyte in the upper half (over 50% of the high level standard) of the calibration range. Samples that were analyzed immediately following the high sample must be evaluated for carryover. If the samples have results at or above the RL for any analyte, they must be reanalyzed to rule out carryover. It may also be necessary to dilute samples because of matrix interferences.

11.6.1 If the initial diluted run has no hits or hits below 20% of the calibration range, and the matrix allows for analysis at a lesser dilution, then the sample must be reanalyzed at a dilution targeted to bring the largest hit above 50% of the calibration range.

11.6.2 Guidance for Dilutions Due to Matrix Interference

If the sample is initially run at a dilution and only minor matrix peaks are present, then the sample should be reanalyzed at a more concentrated dilution. Analyst judgment is required to determine the most concentrated dilution that will not result in instrument contamination. Ideally, the dilution chosen will make the response of the matrix interferences equal to approximately half the response of the mid-level calibration standard.

11.6.3 Reporting Dilutions

Some programs (e.g., South Carolina and AFCEE) and some projects require reporting of multiple dilutions (check special requirements in LIMS). In other cases, the most concentrated dilution with no target compounds above the calibration range will be reported.

11.7 Interferences in Observed in Samples

11.7.1 Dual column analysis does not entirely eliminate interfering compounds. Complex samples with high background levels of interfering organic compounds can produce false positive and/or false negative results. The analyst must use appropriate judgment to take action as the situation warrants.

11.7.2 GC/MS Confirmation of Samples for EPA Region 10

If the samples being analyzed are for EPA Region 10 and the laboratory has agreed to perform this option, then all analyte identifications of positive concentrations that are of sufficient concentration for that purpose must be confirmed by GC/MS analysis. For multi-component analytes, the confirmation is for the presence of chlorinated biphenyls in PCB and the presence of chlorinated camphenes in Toxaphene. See Appendix 1 for detailed instructions for performing GC/MS confirmation for EPA Region 10 work.

11.7.3 Suspected Negative Interferences

If peak detection is prevented by interferences, further cleanup should be attempted. Elevation of reporting levels and/or lack of positive identification must be addressed in the case narrative. If numerous PCB peaks are present but there are no good matches to any individual Aroclor fingerprint, the Aroclor or Aroclors that most closely match the sample are choosen to quanify the peaks as those

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Aroclors. At a minimum, the Data Review Template prepared by the analyst should include the following comment for inclusion in the case narrative:

> *"Sample XXXX appears to contain PCBs based on the presence of numerous PCB peaks. However, due to weathering or other environmental processes, the PCBs in the sample do not closely match any of the Aroclor standards we use to calibrate our instruments. We quantified and reported the sample as Aroclor ZZZZ (or as a mixture of Aroclors ZZZZ and YYYY). Due to the poor match with the Aroclor standard(s), there is increased qualitative and quantitative uncertainty associated with this result. This approach is consistent with the guidance in section 7.9.3 of SW-846 method 8082A. If these results do not meet the needs of your project then we would suggest a further analysis of the sample. Depending on the objectives, this may include congener-specific analysis by 8082A; or analysis a more specific method, (e.g., method 1668 or an adaptation of method 8270) for PCB congeners or PCB homolog totals."*

11.7.4 Suspected Positive Interferences

If no further cleanup is reasonable and interferences are evident that are suspected of causing false positive results, consult with the laboratory Project Manager to determine if analysis using additional confirmation techniques is appropriate for the project. Use of additional confirmation columns is another possible option. At a minimum, the Data Review Template prepared by the analyst should include the following comment for inclusion in the case narrative:

> *" Based on review of the chromatograms for samples _____, it is my opinion that the evident interferences may be causing false results.*
>
> *Date _____ Analyst _____"*

11.8 Calculations

11.8.1 Concentration of Analyte in Sample Extract

Depending on the calibration function used, the concentration of the analyte in the sample extract is calculated as follows (see Section 10.11 for details on establishing the calibration function):

Average Calibration Factor: $$C_e = \frac{A_e}{\overline{CF}}$$

Linear Regression: $$C_e = \frac{[A_e - b]}{a}$$

Where:

C_e	=	Concentration of the analyte in the sample extract (ng/mL).
A_e	=	Peak area for the analyte in the sample extract injection.
b	=	y-intercept of the calibration fit.
a	=	Slope of the calibration fit.

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11.8.2 Concentration of Analyte in Original Sample

The concentration of the analyte in the original sample is calculated as follows:

$$C_{sample} = \frac{C_e}{1000\frac{ng}{\mu g}} \times \frac{V_e}{V_s} \times DF$$

Where:

C_{sample}	=	Concentration of analyte in original sample (µg/L or µg/kg).
C_e	=	Concentration of analyte in sample extract injected in GC (ng/mL).
$1000\frac{ng}{\mu g}$	=	Factor to convert ng/mL to µg/mL.
V_e	=	Volume of sample extract (mL).
V_s	=	Volume (or weight) of original sample (L or kg).
DF	=	Dilution Factor (post extraction dilutions)

11.8.3 Spike Recovery Calculation

LCS, MS, and surrogate spike recoveries are calculated using the following equation:

$$\%\text{Recovery} = \frac{\text{Measured Concentration}}{\text{Spiked Concentration}} \times 100\%$$

11.8.4 MS/MSD RPD Calculation

The percent difference between the analyte concentration in the MS and the MSD is calculated as follows:

$$RPD = \frac{|MS - MSD|}{1/2(MS + MSD)} \times 100\%$$

11.9 All data are subject to two levels of review, which is documented on a checklist, as described in SOP TA-QA-0635.

12.0 <u>Method Performance</u>

12.1 Method Detection Limit Study (MDL)

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure (see SOP TA-QA-0602). MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method requirements require a greater frequency.

Instrumentation software must have each target limit set to the lowest MDL. CHROM (LOD).

12.2 Demonstration of Capabilities

Analyst initial and continuing Demonstrations of Capability (DOC) are performed before any client samples are analyzed and are updated annually. See SOP TA-QA-0617 for details.

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12.3 Training Requirements

See SOP TC-QA-0608 for detailed training requirements.

13.0 Pollution Control

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability).

14.0 Waste Management

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to Waste Disposal SOP TA-EHS-0036.

14.1 Waste Streams Produced by the Method

14.1.1 Waste hexane solvent: Flammable Solvent – Waste Stream C

14.1.2 Vials containing extracts in hexane: Expired Extract Vials – Waste Stream A

14.1.3 Concentrated sulfuric acid and hexane from sample cleanup: Concentrated Acids with Organics - Waste Stream V

14.1.4 Expired reagents and standards – Contact Waste Coordinator

14.2 Samples containing polychlorinated biphenyls (PCB's) at concentrations ≥50 ppm are regulated under the Toxic Substance Control Act (TSCA) and must be segregated from all other waste streams. Analysts are responsible for contacting the Group Leader, Sample Control, and the Waste Coordinator immediately if a sample falls into the TSCA category.

15.0 References / Cross-References

15.1 SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition and all promulgated updates, EPA Office of Solid Waste, January 2005.

15.1.1 Method 8082, Polychlorinated Biphenyls (PCBs) by Gas Chromatography, Revision 0, December, 1996.

15.1.2 Method 8000B, *Determinative Chromatographic Separations*, Revision 2, December 1996.

15.2 EPA Handbook of Analytical Quality Control in Water and Wastewater Laboratories, Test Method EPA-600/4-81-045, September 1982.

16.0 Method Modifications:

Item	Method	Modification
1	8082	Method 8082 includes an internal standardization option. Because of the high probability of interferences affecting internal standards, this is strictly an external standard SOP.
2	8082	Method 8082 references 8000B, which allows the use of third-order calibration curves. This SOP does not allow third-order calibration curves.

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17.0 Tables and Figures

Table 1: Analyte List and Standard Reporting Limits
Table 2: Typical Instrument Conditions
Table 3: Calibration Levels (µg/mL)
Table 4: Standard LCS/MS Spike and Surrogate Spike Levels (µg/L)
Table 5: Low Level LCS/MS Spike and Surrogate Spike Levels (µg/L)
Table 6: DoD QC Tables
Table 7: Summary of QC Requirements

Figure 1: Example Chromatogram with Sulfur Interference
Figure 2: Example Chromatogram of Extract with Methylene Chloride Contamination

Appendix 1: GCMS Confirmation of Pesticides and PCBs for EPA Region 10

18.0 Revision History

- Revision 17, dated 31 October 2009
  - Added documentation of reagent/standards and reagent/standard preparation Section 7.1.
  - Added removal of expired standards Section 7.4.
  - Added Method PCB Instrument Blank criteria for BP LaMP Section 9.3
  - Added Method Blank criteria for BP LaMP Section 9.4
  - Added LCS Criteria for BP LaMP Section 9.5
  - Added BP LaMP Surrogate criteria, Section 9.7
  - Addressed corrective action after a second CCV failure, Section 10.18.4
  - Added recording of reagents used in clean-up Section10.5
  - Added maintenance documentation and return to service requirements, section 10.28
  - Added requirement for instrument software MDLs Section12.1

- Revision 16, dated 10 March 2009
  - Added additional column options in section 6.1.
  - Updated CCV concentrations in Section 10.18.
  - Corrected minor typographical errors.
  - DoD QSM Tables in Table 7 updated to the new QSM v.4.

- Revision 15, dated 21 March 2008
  - SOP updated to include example chromatograms for special instrument situations.
  - Example Typical Instrument Sequence updated

- Revision 14, dated 12 March 2008
  - Integration for TestAmerica and STL operations.
  - This revision is a complete rewrite and an expansion of scope.

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Table 1. Analyte List and Standard Reporting Limits

Compound	Water Reporting Limit (µg/L)	Soil Reporting Limit (µg/kg)
Aroclor 1016	0.5	10
Aroclor 1221	0.5	10
Aroclor 1232	0.5	10
Aroclor 1242	0.5	10
Aroclor 1248	0.5	10
Aroclor 1254	0.5	10
Aroclor 1260	0.5	10
Aroclor 1262	0.5	10
Aroclor 1268	0.5	10

Table 2. Typical Instrument Conditions

Parameter	Recommended Conditions
Injection Port Temperature:	280 °C
Detector Temperature:	320 °C
Temperature Program:	110 °C for 0.10 minute 30 °C/min to 220 °C for 0.50 minute 25 °C/min to 290 °C, 30 °C/min to 320 °C for 3.00 minutes
Guard Column:	Phenomenex Zebron Guard Column (5m x 0.25 mm ID)
Column 1:	Phenomenex Zebron MultiResidue-1 (30 m X 0.25 mm ID X 0.25 um) (primary)
Column 2:	Phenomenex Zebron MultiResidue-2 (30 m X 0.25 mm ID X 0.20 um) (confirmation)
Injection:	1 µL
Carrier Gas:	Hydrogen
Make-up Gas:	Nitrogen
Y-splitter:	Phenomenex Zebron Glass Press-Tight Y Splitter or equivalent

Table 3. Calibration Levels (µg/L)

Aroclors	Level 1	Level 2	Level 3	Level 4	Level 6	Level 7
Aroclor 1016	10	20	50	100	500	1000
Aroclor 1221	10	20	50	100	500	1000
Aroclor 1232	10	20	50	100	500	1000
Aroclor 1242	10	20	50	100	500	1000
Aroclor 1248	10	20	50	100	500	1000
Aroclor 1254	10	20	50	100	500	1000
Aroclor 1260	10	20	50	100	500	1000
Aroclor 1262	10	20	50	100	500	1000
Aroclor 1268	10	20	50	100	500	1000
TCMX*	1.0	2.0	5.0	10.0	50.0	100.0
DCB*	1.0	2.0	5.0	10.0	50.0	100.0

* Surrogates are included in the AR1660 calibration mix only.

Table 4. Standard LCS/MS Spike and Surrogate Spike Levels (µg/L)

Compound(s)	Concentration (µg/L)
Aroclor 1016/Aroclor 1260 mix	100
Surrogates	
Decachlorobiphenyl (DCB)	20
Tetrachlor-m-xylene (TCMX)	20

Table 5. Low Level LCS/MS Spike and Surrogate Spike Levels (µg/L)

Compound(s)	Concentration (µg/L)
Aroclor 1016/Aroclor 1260 mix	10
Surrogates	
Decachlorobiphenyl (DCB)	2
Tetrachlor-m-xylene (TCMX)	2

Table 6. DoD QC Tables

Table G-16. LCS Control Limits for Polychlorinated Biphenyls SW-846 Method 8082 Water Matrix[18]

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
Aroclor 1016	85	20	25	145
Aroclor 1260	87	19	30	145

Table G-17. LCS Control Limits for Polychlorinated Biphenyls SW-846 Method 8082 Solid Matrix[18]

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
Aroclor 1016	90	16	40	140
Aroclor 1260	96	12	60	130

[18]LCS control limits are not available for Aroclors 1221, 1232, 1242, 1248, 1262, and 1268. Sufficient data to perform statistically significant analyses were not received for those analytes during the LCS study. Additional limits for surrogate compounds can be found in section G.6.

Table G-3. Surrogates

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
8082 Water:				
Decachlorobiphenyl	88	15	40	135
8082 Solid:				
Decachlorobiphenyl	91	11	60	125

Table 7. Summary of Quality Control Requirements

QC Parameter	Frequency	Acceptance Criteria	Corrective Action
Minimum 5-point Initial Calibration	Initial calibration prior to sample analysis	One of the options below: For avg. calibration factor: RSD ≤ 10%. Linear least squares regression: r ≥ 0.990 **Linear least squares regression for DoD: r ≥ 0.995** For quadratic regression: r^2 ≥ 0.990.	Terminate analysis; correct the problem; recalibrate. Problem must be corrected. No samples may be run until ICAL has passed.
ICV	Following initial calibration.	80 - 120% recovery. .	Terminate analysis; correct the problem; recalibrate.
CCV	Beginning and minimum every 12 hours and at the end of the run or every 10 injections for DoD QSM and LAMP.	80 – 120% recovery.	Correct problem, then rerun CCV. If that fails, then repeat ICAL. Reanalyze all sample since the last successful CCV.
Retention time (RT) window width determination	At method set-up and after major maintenance (e.g. column change)	NA	See Section 10.19 for additional requirements.
Method Blank	One per lot of 20 field samples or fewer.	The result must be < RL or < 1/10 the amount measured in any sample or 1/10 the regulatory limit. **For DoD and LAMP:** No analytes detected > ½ RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit.	Re-extract and reanalyze samples. Note exceptions under criteria section. See Section 9.3 for additional requirements.
LCS	One per batch of 20 field samples or fewer.	Must be within laboratory control limits. **For DoD:** Must be within QSM control limits.	See Section 9.4 for additional requirements.
PIBLK (Instrument blank with surrogates)	***For DoD and BP LaMP:*** *analyzed after each CCV (unless the CCV is followed by a Method Blank)*	***For DoD and BP LaMP:*** *No analytes detected > ½ RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit.*	

Surrogate	All field and QC samples.	Must be within laboratory control limits. **For DoD:** must be within QSM control limits.	See Section 9.6 for additional requirements.
Matrix Spike and Matrix Spike Duplicate	One pair per lot of 20 field samples or fewer.	Must be within laboratory control limits. **For DoD:** Must be within QSM control limits.	See Section 9.5 for additional requirements.
Confirmation of Positive Results	Required for select projects (i.e. DoD QSM).	Results between primary and confirmation column RPD ≤ 40%.	Apply f if RPD ≥ 40% RPD if sample is not confirmed.

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Figure 1. Example Chromatogram of Sulfur Interference

```
File        : Z:\DATA\071130_A\PCB13324.D
Operator    : SLC
Acquired    : 12-1-2007 04:38:10 AM using AcqMethod PCBSLOW.M
Instrument :   sea034
Sample Name: 580-8259-A-3-B 1:5
Misc Info   : BT=SEA03426184
Vial Number: 38
```

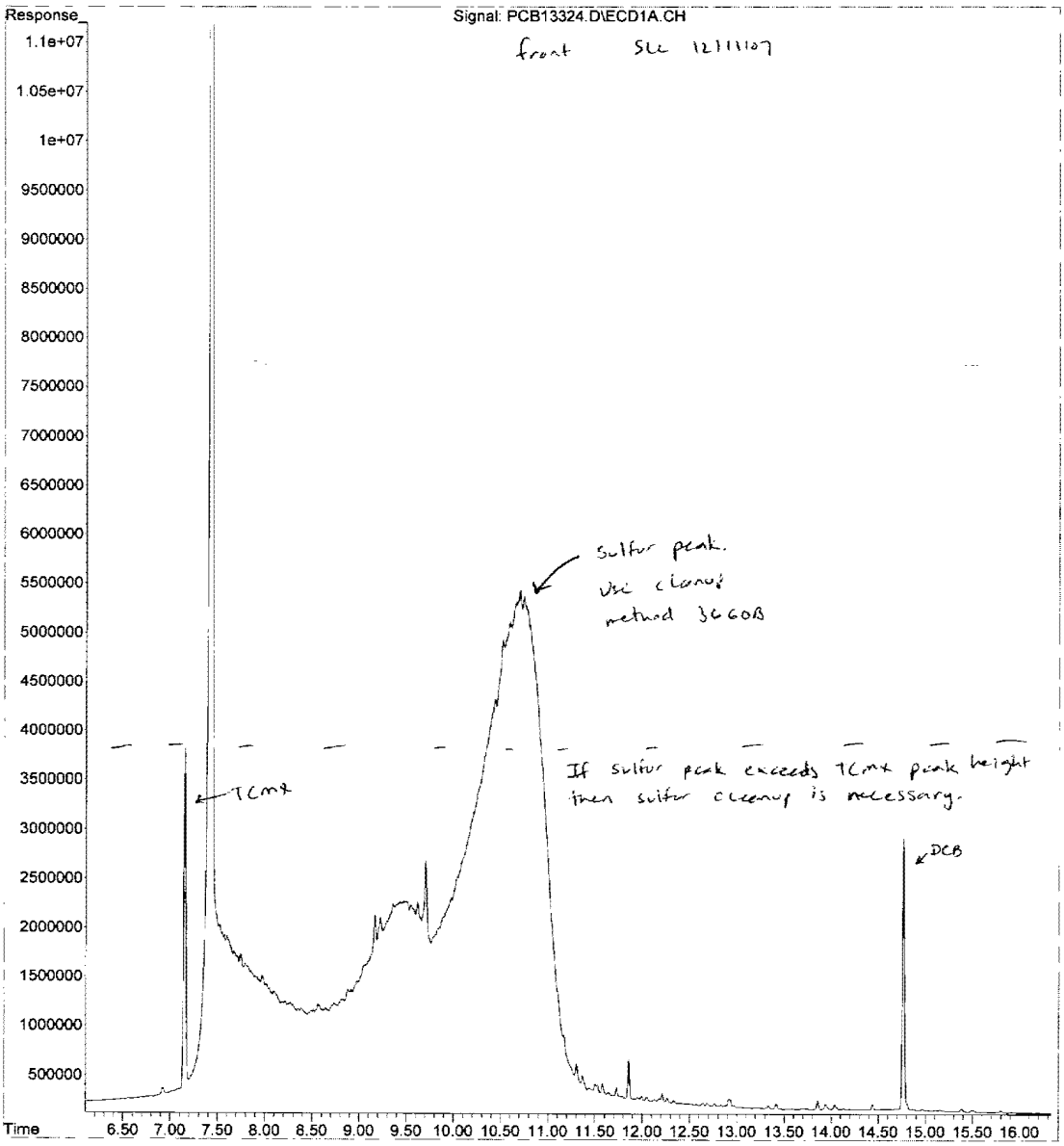

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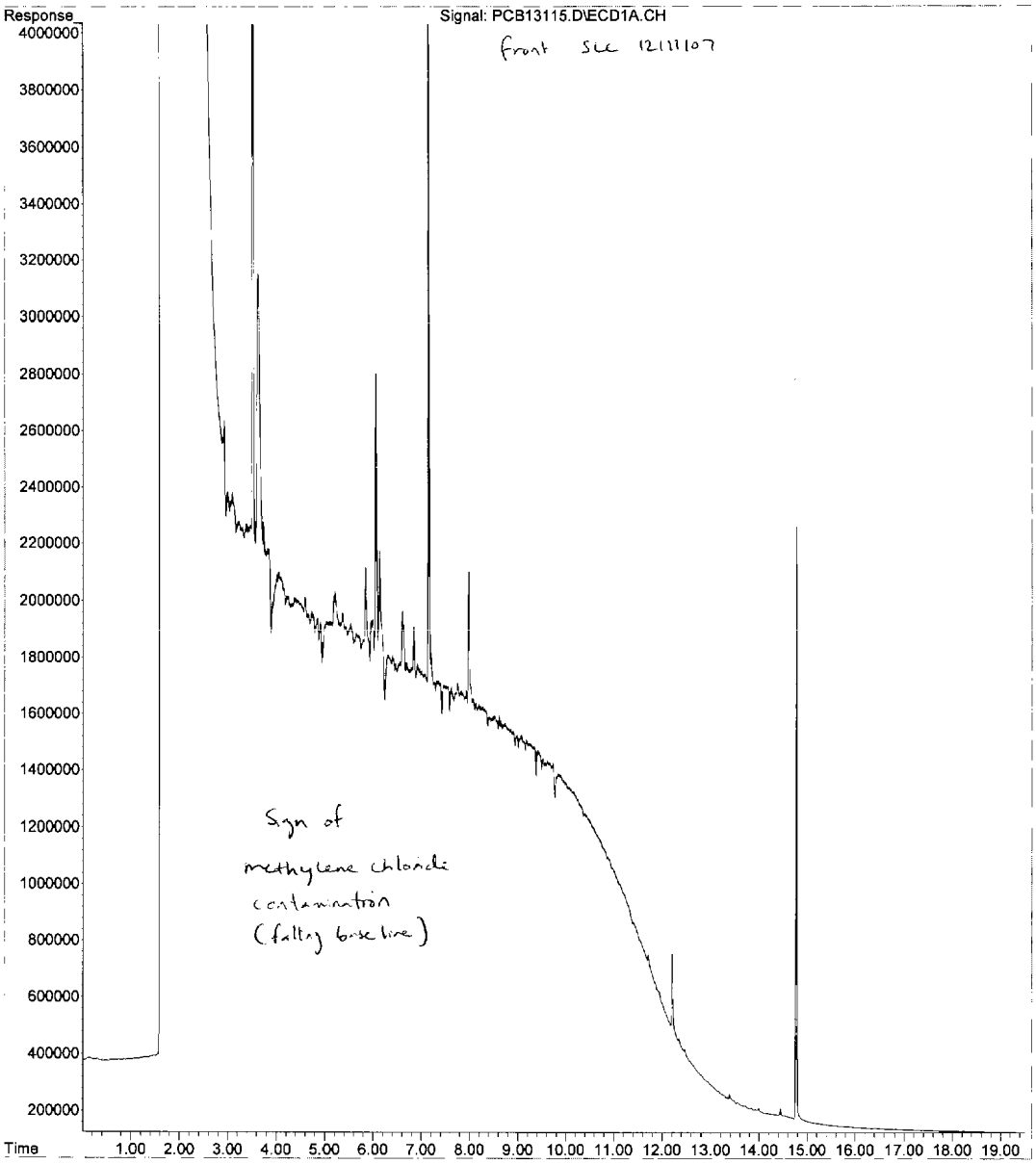
Figure 2. Example Chromatogram of Methylene Chloride Contamination

```
File        : Z:\DATA\071123_A\PCB13115.D
Operator    : SLC
Acquired    : 11-26-2007 03:46:03 PM using AcqMethod PCBSLOW.M
Instrument :   sea034
Sample Name: MB 580-26066/1-A
Misc Info   : BT=SEA03426066
Vial Number: 36
```



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Appendix 1. GC/MS Confirmation of Pesticides and PCBs for EPA Region 10

The Requirement

The purpose of the GC/MS analysis for the single component pesticides is for confirmation of the identification. The purpose of the GC/MS analysis for the multi-component analytes is to confirm the presence of chlorinated biphenyls in PCB and the presence of chlorinated camphenes in Toxaphene. The GC/MS analytical results for the pesticides/PCBs shall not be used for quantitation. If the identification of the analyte cannot be confirmed by any of the recommended GC/MS procedures and the concentration calculated from the GC/ECD analysis is greater than or equal to the concentration of the reference standard analyzed by GC/MS, then report the analyte as undetected, adjust the sample quantitation limit to a sample concentration equivalent to the concentration of the GC/MS reference standard, qualify the results, and note the data qualification in the Laboratory Case Narrative.

Any pesticide or PCB analyte for which a concentration is reported from a GC/ECD analysis must have the identification confirmed by GC/MS if the concentration is sufficient for that purpose. If the laboratory fails to perform GC/MS confirmation as appropriate, the EPA Region 10 will require re-analysis of any effected samples at no additional cost to EPA Region 10.

The Guidance in Performing GC/MS Confirmation

A. The GC/MS confirmation may be accomplished by one of three general means:
   - If there was an SVOC full scan GC/MS analysis (such as SW-846 Method 8270) performed on the sample in question, then examination of the tentatively identified compound library search results can be used or,
   - An analysis of the pesticide/PCB extract, following any necessary solvent exchange and concentration steps (preferred) or
   - Analysis of another aliquot of the SVOC sample extract after further concentration

B. Full-scan GC/MS will normally require a concentration of approximately 10-ng/uL in the final extract for each single component compound, 50-ng/uL for PCBs, and 125-ng/uL for multi-component pesticide (Toxaphene).

C. In order to confirm the identification of the target pesticide or PCB, the laboratory must also analyze a reference standard for the analyte. In order to demonstrate the ability of the GC/MS system to identify the analyte in question, the concentration of the standard should be less than or equal to 10-ng/uL for single component pesticides, 50-ng/uL for PCBs, and 125-ng/uL for multi-component pesticides.

D. The laboratory mass spectral interpretation specialist is advised to compare the CAS Registry numbers for the pesticides or PCBs to those from the library search routine.

E. Regardless of which of the three approaches above is used for GC/MS confirmation, the appropriate blank must also be analyzed by GC/MS to demonstrate that the presence of the analyte was not the result of laboratory contamination. If the confirmation is based on the analysis of the SVOC extract, then the SVOC method blank extracted with the sample must also be analyzed. If the confirmation is based on the analysis of the pesticide or PCB extract prepared for the GC/EC analysis, the pesticide or PCB method blank extracted with the sample must be analyzed.

F. For GC/MS confirmation of single component analytes, the required deliverables are copies of the library search results (best tentatively identified compound matches) or analyte spectrum and the spectrum of the reference standard. For multi-component analytes, spectra of three characteristic peaks are required for both the sample component and the reference standard.

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Title: Diesel and/or Residual Range Organics [Methods AK102 & AK103]

Approvals

Signatures on File

Sonya Palmer Date Semivolatile Organic Department Manager	Stan Palmquist Date Health & Safety Manager / Coordinator
Dave Wunderlich Date Quality Assurance Manager	Kathy Kreps Date Laboratory Director

This SOP was previously identified as SOPs No. 0363.11 and 366.10.

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1.0 Scope and Application

1.1 Analytes, Matrix(s), and Reporting Limits

1.1.1 This SOP delineates the specific requirements for analyzing diesel range and/or residual range petroleum hydrocarbons using the State of Alaska methodology. The method is applicable to soil and water matrices.

1.1.2 Reporting limits are approximately:

Analyte	RL Soil (mg/kg)	RL Water (mg/L)
Diesel Range Organics	20.0	0.1
Residual Range Organics	50.0	0.1

Actual sample RLs are corrected for sample volume or weight, sample percent moisture, and any dilution of the extract.

1.1.3 On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in Section 13.3.1 in the Quality Assurance Manual.

2.0 Summary of Method

This method is used to identify and quantitate petroleum hydrocarbons containing components in the diesel range (nC_{10} through < nC_{25} and/or nC_{25} through nC_{36}). Samples are weighed, dried, and surrogate is added. Samples are extracted with methylene chloride and the extract concentrated to 10.0 mL. An aliquot of the extract is analyzed by GC/FID. The hydrocarbons are quantitated by the method against the diesel standard used for calibration, and identified by pattern matching to the calibration standard or appropriate library spectra (other diesels, kerosene, jet fuel, etc.).

3.0 Definitions

3.1 Diesel Range Organics (DRO): The sum of compounds producing chromatographic peaks, both resolved and unresolved, eluting between n-decane (C_{10}) and n-pentacosane (C_{25}).

3.2 Residual Range Organics (RRO): All compounds producing chromatographic peaks, both resolved and unresolved, eluting between the peak start of n-pentacosane (C_{25}) and the peak end of n-hexatriacontane (C_{36}).

3.3 Initial Calibration Verification (ICV)/Calibration Verification Standard (ICV/CVS): A multi-element standard of known concentrations prepared to verify instrument calibration. This solution must be an independent standard prepared near the mid-point of the calibration curve, and at a concentration other than that used for instrument calibration

3.4 Continuing Calibration Verification (CCV)/Continuing Calibration Standard (CCS): A multi-element standard of known concentrations prepared to monitor and verify the instrument daily continuing performance.

4.0 Interferences

4.1 Non-petroleum hydrocarbons (polar and non-polar) will also be extracted using this procedure. Interferences include animal and vegetable oil and grease, chlorinated

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hydrocarbons, phenols, and phthalate esters are measurable under the conditions of this method. Hydrocarbons eluting in the ranges described above for fuel hydrocarbons will be detected and reported as false positives. All diesel range results must be reported; non-diesel results should be flagged appropriately.

4.2 Method interferences are reduced by thoroughly washing all glassware (SOP TA-QA-0010).

4.3 High purity reagents must be used to minimize interferences from residual solvent contaminants.

4.4 Interference from sample carryover can occur whenever high-level and low-level samples are sequentially analyzed. High level samples should be followed by an analysis of a solvent blank.

4.5 Sodium sulfate may have elevated levels of phthalate esters which may cause false positives. Sodium sulfate must be muffled at 400 °C for 4 hours prior to use

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001) and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1 Specific Safety Concerns or Requirements

5.1.1 The gas chromatograph contains zones that have elevated temperatures. The analyst needs to be aware of the locations of those zones, and must cool them to room temperature prior to working on them.

5.1.2 There are areas of high voltage in both the gas chromatograph. Depending on the type of work involved, either turn the power to the instrument off, or disconnect it from its source of power.

5.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material	Hazards	Exposure Limit (1)	Signs and symptoms of exposure
Methylene Chloride	Carcinogen Irritant	25 ppm-TWA 125 ppm-STEL	Causes irritation to respiratory tract. Has a strong narcotic effect with symptoms of mental confusion, light-headedness, fatigue, nausea, vomiting and headache. Causes irritation, redness and pain to the skin and eyes. Prolonged contact can cause burns. Liquid degreases the skin. May be absorbed through skin.

Methanol (MeOH)	Flammable Poison Irritant	200 ppm-TWA	A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Symptoms of overexposure may include headache, drowsiness and dizziness. Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure. Irritant to the eyes.
Acetone	Flammable	1000 ppm-TWA	Inhalation of vapors irritates the respiratory tract. May cause coughing, dizziness, dullness, and headache.
1 – Exposure limit refers to the OSHA regulatory exposure limit.			

6.0 Equipment and Supplies

6.1 Instrumentation

- Gas chromatograph and detector: HP 5890 II or 6890 Plus GC equipped with an FID, or equivalent
- Chromatographic column *types*:
  - i.) *Phenomenex* ZB-1 ms 20 meters x 0.18 mm ID x 0.18 um film thickness.
  - *ii.) Phenomenex ZB-5: 30 meters x 0.25 mm ID x 0.25 um film thickness, cut in half to give two (2) 15 meter columns for dual column applicable instruments.*
  - *iii.) Restek Rtx-5MS: 30 meters x 0.25 mm ID x 0.5 um film thickness, cut in half to give two (2) 15 meter columns for dual column applicable instruments*
  - *iv.) Restek Rtx-5MS: 15 meters x 0.25 mm ID x 0.5 um film thickness*
- Data acquisition system: Hewlett Packard ChemStation or equivalent
- Analytical balance, 0.0001 g accuracy
- Horn sonicator
- Ultrasonic bath type sonicator (Peak output = 1230 watts, frequency = 42kHz, capable of temperature control to ± 5°C
- Water bath

6.2 Supplies

- KD Apparatus: 250 mL Kuderna-Danish flask, 10 mL concentrator, 3-ball Snyder column
- Gastight syringes, 10 uL, 25 uL, 50 uL, 100uL, and 1000 uL
- Scintillation vials
- Volumetric flasks, 250 mL, 10 mL
- Teflon separatory funnel, 2L
- Drying oven
- Filter funnel
- Glass wool
- Glass standard vials with screw caps and Teflon-coated septum
- Autosampler vials, 1.5 mL, Teflon lined crimp top

7.0 Reagents and Standards

7.1 *Document reagent/standards and reagent/standard preparation in TALS using the reagent module as described in SOP TA-QA-0619.*

7.2 Methylene Chloride (CH_2Cl_2), analytical reagent grade or equivalent.

7.3 Sodium Sulfate, anhydrous powder, reagent grade or equivalent.

Note: Sodium sulfate must be muffled at 400 °C for 4 hours prior to use to avoid phthalate contamination.

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7.4 *Check the Balance logbook to determine if the daily calibration check has been completed. If it has not, the analyst must perform this check according to SOP TA-QA-0014*

7.5 Surrogate standard. Approximately 0.2 g (weighed to the nearest 0.0001 g) of o-terphenyl (99%, Aldrich) and n-Triacontane-d62 (99%, Aldrich) are diluted to a volume of 100 mL with acetone, providing a solution concentration of approximately 2,000 mg/L of each surrogate.

Note: Due to the poor solubility of n-triacontane-d62 a small % of the DCM and hexane may need to be added to the surrogate solution. The surrogate solution is to be stored at room temperature.

7.6 Diesel stock standard. Prepared from a composite of three local #2 diesel fuel service stations, (Texaco, Chevron, BP) or from a commercial vendor such as Ultra at a concentration of 50,000 mg/L.

7.6.1 Diesel working standards. Prepare calibration standards from the stock diesel standard at concentrations of 20-ug/mL, 50-ug/mL, 100-ug/mL, 500-ug/mL, 1000-ug/mL, and 5000-ug/mL of diesel. A continuing calibration standard is prepared at a concentration of 500 mg/mL (vary the concentration every 6 months). Surrogate calibration standards are prepared at concentrations of 4.0-ug/mL, 8.0-ug/mL, 40-ug/mL, 100-ug/mL and 200-ug/mL by adding the appropriate volumes of stock surrogate solution to the ICAL stock. The calculation for the volumes of diesel stock and surrogate stock standards used for preparation of a standard is as follows:

$$\text{Volume stock std, uL} = \frac{\text{(Std conc.)(10-mL)}}{\text{Stock std conc., ug/mL}} \times \frac{\text{1000-uL}}{\text{mL}}$$

Std = standard
Conc. = Concentration

7.7 Motor Oil stock standard. Prepared from 30 and 40 weight motor oils (such as Penzoil) or purchased from a commercial vendor such as Restek. Weigh a 1:1 ratio of 30 and 40 weight motor oils together to yield composite motor oil. Approximately 5.0 grams (weighed to the nearest 0.0001 grams) of the composite motor oil is diluted in a 100-mL volumetric flask with methylene chloride, providing a solution concentration of approximately 50,000 mg/L. The motor oil is combined along with the diesel to make a combined ICAL standard. The motor oil standard concentration is calculated as follows:

$$\text{Concentration mg/L} = \frac{\text{(Composite wt., g)}}{\text{(0.250 L)}} \times \frac{\text{1000 mg}}{\text{1 g}}$$

7.7.1 Motor Oil working standards. A minimum of five calibration standards are prepared from the stock standard using a 10-mL volumetric flask and diluting with methylene chloride. The typical concentrations used are 50-mg/L, 100-mg/L, 500-mg/L, 1,000-mg/L, and 5,000-mg/L. A continuing calibration standard is prepared at a concentration of 500-mg/L.

~~7.8~~ Retention time standard. *The retention time standard is prepared by diluting the EPH aliphatic stock standard (EPH AL calstk_0000X), and TPH surrogates (AK1023_SR_0000X) to a final concentration of 20 ug/mL each, with a final volume of 25 mL. The standard contains nC8-nC40 sans nC39, plus surrogates.*

7.9 Second source calibration verification standard. A composite mix obtained from Restek (product #31259) or equivalent vendor containing #2 Diesel at 50,000-mg/L. A spike solution may also be used as long as it is second source. This solution is then diluted 1:100 to make the ICV standard. A second source diesel and motor oil standard, which is usually a dilution of the spiking solution along with surrogate. The typical concentration is 500 mg/L for motor oil and 20 mg/L for n-triacontane-d62.

7.10 *Managers/supervisors or a designee are expected to check their areas on a monthly basis for expired standards/reagents and dispose of them according to SOP TA-EHS-0036.*

8.0 Sample Collection, Preservation, Shipment and Storage

Sample container, preservation techniques and holding times may vary and are dependent on sample matrix, method of choice, regulatory compliance, and/or specific contract or client requests. Listed below are the holding times and the references that include preservation requirements.

Matrix	Sample Container	Min. Sample Size	Preservation	Extraction Holding Time	Analysis Holding Time	Reference
Waters	Amber glass	1 Liter	HCl, pH < 2; Cool 0-6°C	14 Days	40 Days from extraction	40 CFR Part 136.3
Soils	Glass	30 grams	Cool 0-6°C	14 Days	40 Days from extraction	N/A

9.0 Quality Control

9.1 The minimum quality controls (QC), acceptance criteria, and corrective actions are described in this section. When processing samples in the laboratory, use the LIMS QC program code and special instructions to determine specific QC requirements that apply.

9.2 The laboratory's standard QC requirements, the process of establishing control limits, and the use of control charts are described more completely in SOP TA-QA-0620, Quality Control Program.

9.3 Project-specific requirements can override the requirements presented in this section when there is a written agreement between the laboratory and the client, and the source of those requirements should be described in the project documents. Project-specific requirements are communicated to the analyst via special instructions in the LIMS.

9.4 Any QC result that fails to meet control criteria must be documented in a Nonconformance Memo (NCM). The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The QA group also receives NCMs by e-mail for tracking and trending purposes. The NCM process is described in more detail in SOP TA-QA-0610. This is in addition to the corrective actions described in the following sections.

9.5 Quality Control Batch

The batch is a set of up to 20 samples of the same matrix processed together using the same reagents and standards. Each quality control batch must contain a method blank (MB), a laboratory control sample (LCS), and matrix spike - matrix spike duplicate (MS/MSD) pair. For more details see SOP TA-QA-0620.

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PIBLK Instrument blank with surrogate added. Needs to be run after a CCV unless a MB is run first. If the PIBLK is run it needs to be evaluated with results less than the RL for the target list and passing surrogate criteria.

9.6 Method Blank (MB)

One method blank is analyzed with every preparation batch or every 20 samples, whichever is more frequent. The method blank consists of either 1 liter of organic-free water (for batches of aqueous samples) or 10 grams of Ottawa sand (for batches of soil samples). The method blank is processed exactly as samples in the batch, and is used to assess whether the laboratory processes have contaminated the samples in the batch.

Acceptance Criteria: Results for the method blank must be less than or equal to the reporting limit concentration or less than 5% of the lowest concentration found in the associated samples. BP LaMP requires ≤ ½ RL.

Corrective Action: If the method blank acceptance criteria are not met, identify and correct the source of contamination, and re-prepare and reanalyze the associated samples.

9.7 Laboratory Control Sample (LCS)

One LCS is analyzed with every preparation batch or every 20 samples, whichever is more frequent. The LCS (and LCSD as appropriate) consists of either 1 liter of organic-free water (for batches of aqueous samples) or 10 grams of Ottawa sand (for batches of soil samples), to which 100-µL of spike solution is added. See Table III for spike levels. The LCS is processed exactly as samples in the batch and is used to assess the accuracy of the analytical system.

Acceptance Criteria: The percent recovery of the analytes of interest must fall within control limits of 75-125% recovery for DRO and 60-120% for RRO.

The relative percent difference (RPD) between the LCS and LCSD must be ≤ 20%.

Corrective Action: If LCS acceptance limits are not met, the LCS should be reanalyzed once to confirm that the original analysis is reliable. If the results are still outside control limits, the associated samples must be re-extracted and reanalyzed. If the LCS recovery is <u>above</u> the upper control limit, and the associated samples are all <u>below</u> reportable concentrations, the deviation may be described in an NCM, if this is acceptable to the client or allowed by the specific program or project.

9.8 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

One matrix spike (MS) and one matrix spike duplicate (MSD) are prepared for each preparation batch by spiking replicate portions of the selected field sample with the same spiking standard that is used for the LCS. Field blanks and equipment rinses may not be used to prepare the MS and MSD. The MS and MSD are processed exactly as samples in the batch, and are used to assess the effects of sample matrix on the accuracy and precision of the analytical system.

Acceptance Criteria: The percent recovery of the analytes of interest must fall within control limits of 75-125% recovery for water samples and 60-120% recovery for soil samples.

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The relative percent difference (RPD) between the MS and MSD must be ≤30% for water samples and ≤ 50% for soil samples.

Corrective Action: If the analyte recovery in the MS and/or the RPD between the MS and MSD fails acceptance criteria, but all other QC criteria are met, the MS/MSD failure may be attributed to matrix effects and the associated sample results may be reported as qualified. However, some programs (e.g., USACE) require reanalysis to confirm that presumed matrix effects are reproducible.

9.9 Surrogate Spikes

The ortho-terphenyl and n-triacontane-d62 surrogates have chemistry similar to the analytes of interest, but are not expected to be found in environmental samples. One mL of the surrogate spike solution is added to each field and QC sample in the batch prior to sample extraction *and all instrument blanks*. See Table III for spike levels. Surrogate results are used to assess the performance of the analytical system for each field and QC sample *and instrument blank*.

Acceptance Criteria: The percent recovery of the surrogates must fall within control limits of 60-120% for the MB, CVS, and CCS and within 50-150% for all other samples.

Corrective Action: If surrogate recoveries are outside the established limits, verify calculations, dilutions, and standard solutions. Also verify that the instrument performance is acceptable. High recoveries may be due to a co-eluting matrix interference and the chromatogram should be examined for evidence of this. Low recoveries may be due to adsorption by the sample matrix (e.g., clay particles, peat, or organic material in the sample). Recalculate the results and/or reanalyze the extract if the checks reveal a problem.

If the surrogate recovery is outside the established limits due to well-documented matrix effects, the results must be flagged and an explanation included in the report narrative. As with matrix spike failures, some programs (e.g., USACE) may require additional analyses to confirm suspected matrix interferences. The decision to reanalyze or flag the data should be made in consultation with the client. It is only necessary to reprepare / reanalyze a sample once to demonstrate that a matrix effect is reproducible.

NOTE: *For BP samples, if the surrogate percent recovery fails, the recovery must be confirmed by re-extraction and reanalysis with the following exceptions:*

- *The lab has unequivocally demonstrated a sample matrix effect and informed the BP representative.*
- *The recovery exceeds control limits and all target analytes in the sample are non-detect.*

9.10 RT Reference Standard

C_{10} to C_{25} and C_{32} to C_{36}n-alkane mixtures at concentrations of approximately 25 ug/mL for each component are analyzed to establish the retention time (RT) window for each initial calibration. The upper and lower limits are established by subtracting 5σ from the

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absolute retention time of appropriate compound. Alternatively a default standard deviation of 0.01 may be used for a retention time window of 0.05 minutes (section 9.4.2.2 of method AK102). A retention time standard is analyzed every 24 hours of instrument operation.

Acceptance Criteria: This analysis should demonstrate that the methylene chloride solvent front can be resolved from C_{10}; that diesel components can be resolved from the ortho-terphenyl surrogate; and that the diesel calibration standard produces peaks within the expected carbon range.

Corrective Action: If the acceptance criteria are not met, check instrument conditions and calibration materials, correct as necessary and repeat analysis of the reference standard before proceeding with the analysis of samples.

9.11 **Instrument QC**

9.12 PIBLK Instrument blank with surrogate added. Needs to be run after a CCV unless a MB is run first. If the PIBLK is run it needs to be evaluated with results less than the RL for the target list and passing surrogate criteria

9.13 Initial Calibration (ICAL)

9.13.1 A new calibration curve must be generated initially, after major changes to the system, or when continuing calibration criteria cannot be met. Major changes include installation of new columns and changing FID jets.

9.13.2 The ICAL is performed using the concentration levels described in section 7.5. Calibration levels are also presented in Table II. A total of four separate initial calibration curves (ICALs) is required to calibrate for all the mixtures. An ICAL must always be analyzed for the diesel fuel as these standards contain the surrogate compounds. ICALs for the other mixtures are analyzed as needed, depending upon the requested parameters. Samples may be calculated as one or more mixtures, dependent upon the project requirements. The lowest calibration concentration is equal to the laboratory reporting limit (RL) concentration. The highest standard defines the highest sample extract concentration that may be reported without dilution. It is not acceptable to remove points from a calibration curve for the purpose of meeting criteria.

9.13.3 The external standardization method is used. Tabulate the area response for each calibration level against the concentration injected. The ratio of the response to the concentration injected, defined as the calibration factor (CF), is calculated for the standard at each concentration as follows:

$$CF_i = \frac{A_{fuel}}{C_{fuel}}$$

Where:

CF_i = Calibration factor for the ith calibration level.
A_{fuel} = Total area of the fuel calibration standard peak.
C_{fuel} = Concentration of fuel calibration standard, mg/mL

9.13.4 If the percent relative standard deviation (%RSD) for the average (mean) of the calculated calibration factors is <u>less</u> than 25%, the average calibration factor can be used for sample quantitation.

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$$\text{Average Response Factor} = \overline{CF} = \frac{\sum_{i=1}^{n} CF_i}{n}$$

Where:

CF_i = Calibration factor for the ith calibration level.
n = The number of calibration levels.

9.13.5 If %RSD for the mean calibration factor is greater than 25%, a linear least-squares regression may be used to fit the calibration data. The linear fit calculates the slope and intercept of a straight line that relates the concentration of each calibration standard to a chromatographic peak area, as follows:

$$A_s = mC_s + b$$

Where:

A_s = Area of the chromatographic peak for the target fuel.
m = Slope of the line as determined by the least-squares regression.
C_s = Concentration of the target fuel in the calibration standard, mg/mL.
b = Intercept of the line as determined by the least-squares regression.

9.13.6 The correlation of determination for the fitted line must be ≥ 0.995. Note that some programs (e.g., USACE) require that the correlation coefficient is ≥ 0.995, unless approval is given in the project QAPP to use 0.990.

9.13.7 If the ICAL %RSD or correlation coefficient linearity criteria are not met, sample analysis cannot be performed using the calibration. Confirm that the instrument is performing properly, adjust as needed, and confirm that the standards are made correctly. After correcting the problem(s), prepare and reanalyze a new set of calibration standards.

9.14 Second-Source Initial Calibration Verification (ICV)

A second-source initial calibration verification (ICV) standard is prepared as described in section 7.7 and analyzed immediately after each ICAL. This standard can also be used as the continuing calibration verification (CCV) standard. The response for this standard must be within ± 25% of the response predicted from the ICAL. The percent difference between the measured ICV calibration factor (or the measured concentration of the ICV standard) and the ICAL calibration factor (or the known concentration of the ICV standard) is calculated as follows:

$$\text{Percent Difference} = \frac{\text{R1} - \text{R2}}{\text{R1}} \times 100\%$$

Where:

R1 = Average calibration factor from the calibration curve or the ICV known value.
R2 = Calculated calibration factor for the ICV analysis or the measured ICV value.

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If the percent difference for the second-source verification falls outside of ± 25%, then sample analysis cannot be performed. Reanalyze the second-source verification standard to confirm the original result. If the second result fails, then re-prepare the verification standard, and/or re-prepare and rerun the ICAL.

NOTE: *For BP samples, the percent difference of the second-source verification must fall within* ± 15%.

9.15 Continuing Calibration Verification (CCV)

A CCV standard (see Section 7.5 for CCV standard concentration) is analyzed at the beginning of the analytical sequence, every 12 hours of operation, or every 20 samples (whichever is more frequent), and at the end of the analytical sequence. The response for this standard must be within ± 25% of the response predicted from the ICAL (see previous equation).

NOTE: *For all DoD and BP projects a CCV is analyzed at the beginning of a batch, every 10 injections and the end of each analytical batch.*

If the percent difference between the measured CCV value and the expected CCV value falls outside of ± 25% (see the calculation in Section 10.13 above), first check the accuracy of the CCV standard. If the standard is accurate and the results fail acceptance criteria, the instrument must be recalibrated and all samples analyzed since the last successful CCV must be reanalyzed.

NOTE: *For BP samples, the percent difference of the CCV must fall within* ± 15%.

9.15 *Any extra QC that is analyzed in a batch or sequence must be evaluated using the same criteria as the corresponding QC above.*

10.0 Procedure

One-time procedural variations are allowed only if deemed necessary in the professional judgment of supervision to accommodate variation in sample matrix, radioactivity, chemistry, sample size, or other parameters. Any variation in procedure shall be completely documented using an NCM. The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The QA group also receives NCMs by e-mail for tracking and trending purposes. The NCM process is described in more detail in SOP TA-QA-0610. The NCM shall be filed in the project file and addressed in the case narrative.

10.1 Sample Preparation

10.2 Water Extraction by 3510

Note: Samples may be extracted for AK102 and AK103 analysis simultaneously.

10.2.1 Homogenize each sample by shaking the bottle. Check the pH of each sample to ensure proper preservation (pH < 2). If the pH of any sample is not < 2, acidify the sample to a pH < 2 and homogenize. Determine the sample volume. Decant each sample (approximately 1 liter) into a separatory funnel. If requested, MS and MSD aliquots should be extracted as well. An LCS/LCSD must be extracted with each back and 10ul spike shall be added. Add 10 uL of surrogate standard to each separatory funnel, and then add 60 mL of methylene chloride to each separatory funnel.

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10.2.2 Stopper each separatory funnel and shake vigorously, venting frequently, for two minutes. After the two phases have separated, drain the solvent layer into a KD flask. If necessary (sample emulsion) the sample extract can be dried by taking the solvent layer through filter paper and pre-rinsed sodium sulfate.

10.2.3 Repeat the extraction twice more using 60 mL of methylene chloride each time and add these extracts to the appropriate KD.

10.2.4 Assemble the KD apparatus and concentrate the extract to 1.0 mL following the procedure outlined in SOP TA-OP-0301.

10.2.5 Transfer 1.0 mL of the extract to an autosampler vial. Cap and store the extract in the refrigerator until ready for analysis.

10.3 Water Extraction by 3520

Note: Samples may be extracted for AK102 and AK103 analysis simultaneously.

10.3.1 Homogenize each sample by shaking the bottle. Check the pH of each sample to ensure proper preservation (pH < 2). If the pH of any sample is not < 2, acidify the sample to a pH < 2 and homogenize. Determine the sample volume. Decant each sample (approximately 1 liter) into a 1L extraction body containing approximately 200mls of Methylene Chloride. If requested, MS and MSD aliquots should be extracted as well. An LCS/LCSD must be extracted with each batch and 10ul spike shall be added. Add 10 uL of surrogate standard to each extraction body, and then allow the samples to flux for 18-24 hours.

10.3.2 Assemble the KD apparatus and concentrate the extract to 1.0 ml following the procedure outlined in SOP TA-OP-0323.

10.3.3 Transfer the 1.0 ml of extract to an autosampler vial. Cap and store the extract in the refrigerator until ready for analysis.

10.4 Soil Extraction

Note: Samples may be extracted for AK102 and AK103 analysis simultaneously.

10.4.1 *Check the Balance logbook to determine if the daily calibration check has been completed. If it has not, the analyst must perform this check according to SOP TA-QA-0014.*

10.4.2 Weigh approximately 10 grams of sample into a disposable sample jar. Mix an adequate amount of sodium sulfate with the sample to obtain a free-flowing, sandy texture.

10.4.3 Add 100 uL of the surrogate standard solution and 40 mL of methylene chloride; extract samples following procedures described in SOP TA-OP-0334 for horn sonication.

10.4.4 Concentrate the sample in KD by hot water bath and vial at a 10ml final volume using volumetric flasks. If the extract is highly colored or forms a precipitate, a dilution may be performed.

10.4.5 Store the extract in the refrigerator until ready for analysis.

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10.5 Dry Weight

10.5.1 The percent solid (dry weight) of an approximately 10 gram portion of the sample is determined for use in determination of the concentration of analyte in the sample, following procedures described in SOP TA-WC-0160.

10.6 Calibration

10.6.1 The gas chromatograph is set up to initial conditions as follows:

Injector: 280°C

Detector: 300°C

10.6.1.1 *Oven ramping profile for 6890 GC systems with 15 meter column(s): Initial column temperature is set to 45-60°C, and held for 0.5 minutes, ramped to 340°C at 30°C/min and held for 2-3 minutes. Flow is set to constant flow at 1.5-3.5 mL/min. A post run is initialized at 340°C at a flow rate of 5.0 mL/min, and held for 2-4 minutes to clean out the system of contaminants.*

Oven ramping profile for 5890 GC systems with 15 meter column(s): The oven temperature program parameters for these systems are similar to that of the 6890 systems, however, the final holding time is increased to 4-6 minutes due to the instrument software not having a post run capability.

Note: the oven ramping profile will vary from instrument to instrument, as each does not perform exactly like one another. In addition, actual column lengths and types vary as well.

10.6.2 The FID detector is stabilized at manufacturer recommended makeup and carrier gas flows prior to analysis.

10.6.3 Standard and surrogate solutions are allowed to come to room temperature prior to use.

10.6.4 The working calibration range is typically 20 mg/L to 5000 mg/L (solution concentration); this range may be extended if curve linearity is acceptable.

10.6.5 Retention time windows are established for the surrogate and for the range envelope (nC10 to nC25) using the n-alkane retention time standard, following EPA SW-846 Method 8000B procedures. Default retention time windows for the system described above are ± 0.05 min.

10.6.6 The calibration curve must have a minimum of five points.

10.6.7 Curve fit must have an r^2 value of 0.995 or better for linear or quadratic regression or (% RSD) of less than 25% over the working range.

10.6.8 The curve must be confirmed using the CVS (ICV) solution.

10.7 Sample Analysis

Note: Samples may be analyzed for AK102 and AK103 simultaneously.

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10.7.1 Extracts are analyzed by injection of 1.0 uL onto the GC by the autosampler.

10.7.2 Sample chromatograms are compared to the appropriate standard for identification and quantitation. Diesel and related products are indicated if compounds are detected eluting after decane (nC_{10}) to the beginning of pentacosane (nC_{25}). Motor oil and related products are indicated if compounds are detected eluting from the beginning of pentacosane (nC_{25}) through hextriacontane (nC_{36}).

10.7.3 Samples which are expected to contain elevated levels of contamination may be followed by a solvent rinse blank to avoid possibility of carryover.

10.7.4 For DRO, the calibration standard area of the components from decane to pentacosane is integrated to the baseline as a group. Integration is initiated on the leading edge of nC_{10} to the beginning of pentacosane (nC_{25}). Position of integration area is demonstrated on the n-alkane standard provided with this SOP. The samples are integrated in the same manner and the areas compared. Raw area counts in the diesel range are corrected for surrogate area.

10.7.5 For RRO, the calibration standard area of the components from the beginning of pentacosane (nC_{25}) through hexatriacontane (nC_{36}) is integrated to the baseline as a group. Integration is initiated at the leading edge of nC_{25} and continued through the training edge of nC_{36}. The samples and quality control are integrated in the same manner and the areas are compared to the external standard calibration curve. Raw area counts of the residual range are corrected for surrogate area.

10.7.6 Typical analysis sequence:

solvent rinse *(PIBLK)*

RT *reference* standard (at least once per 24 hours) [note: *RT reference* standard is not required at the end of the sequence]

CCS (continuing calibration Standard)

CCB (continuing calibration blank), solvent rinse (PIBLK) or method blank (MB)

10 injections, including batch and matrix QC

Continuing calibration standard (CCS)

CCB, PIBLK or MB

Additional samples - *maximum of 10* (if necessary)

CCS (end of run)

CCB, PIBLK or MB (end of run)

10.8 <u>Instrument Maintenance</u>

10.8.1 Refer to Section 10.20 of SOP TA-GS-0339.

All maintenance and repairs need to be documented in the instrument's maintenance logbook. The logbook must include the instrument name, serial number for each major component (e.g., GC, autosampler) and the date of start-up. When an instrument is not capable of analyzing samples, it needs to be tagged "Out of Service". Logbook entries must include a description of the problem and what actions were taken to address the problem. After an instrument has undergone maintenance or repairs, the system is evaluated using a CCV or

ICAL. If the evaluation is successful, the analyst documents in the logbook that the "System returned to control as indicated by a passing CCV" (or ICAL, MB, etc as may be the case).

10.9 Calculations / Data Reduction

10.10 Accuracy

ICV / CCV, LCS % Recovery = $\frac{\text{observed concentration}}{\text{known concentration}} \times 100$

MS % Recovery = $\frac{\text{(spiked sample) - (unspiked sample)}}{\text{spiked concentration}} \times 100$

10.11 Precision (RPD)

Matrix Duplicate (MD) = $\frac{|\text{orig. sample value - dup. sample value}|}{[(\text{orig. sample value + dup. sample value})/2]} \times 100$

10.12 Concentration

sample conc., mg/L = $\frac{\text{(area count* x response factor**) x extract volume}}{\text{(Volume injected, uL)(Sample volume, mL)}}$

sample conc., mg/kg = $\frac{\text{(area count* x response factor**) x extract volume}}{\text{(Volume injected, uL)(Sample weight, g)(\%solids)}}$

*corrected for surrogate area
** ng injected/area count

NOTE: All dry weight corrections are made in LIMS at the time the final report is prepared.

11.0 Method Performance

11.1 Method Detection Limit Study (MDL)

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure (see SOP TA-QA-0602). MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method requirements require a greater frequency.

Instrumentation software must have each target limit set to the lowest MDL. CHROM (LOD)

11.2 Demonstration of Capabilities

Analyst initial and continuing Demonstrations of Capability (DOC) are performed before any client samples are analyzed and are updated annually. See SOP TA-QA-0617 for details.

11.3 Training Requirements

See SOP TA-QA-0608 for detailed training requirements.

12.0 Pollution Control

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide

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by the policies in Section 13 of the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention".

13.0 Waste Management

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to SOP TA-EHS-0036.

13.1 Waste Streams Produced by the Method

13.1.1 Acidic extracted sample and QC wastewater. After the extraction has been completed the spent water is neutralized and then collected into the organics extraction water conical reservoir. The collected wastewater is then purged with air to remove any remaining methylene chloride. The air-purged wastewater is then tested for methylene chloride. When the concentration levels are at or below local discharge limits, the wastewater can be discarded down the drain.

13.1.2 Methylene chloride waste. Any waste methylene chloride, i.e. KD rinses, syringe rinses, etc., from the extraction procedure is collected in beakers and then poured into a 4-liter amber bottle (appropriately labeled) located in the hood. After the extraction has been completed the $MeCl_2$ collected in the 4 L bottles is emptied into the $MeCl_2$ waste barrel located in the waste disposal room.

13.1.3 Vialed extract waste. Sample extracts that have been placed in vials for analysis are discarded into plastic waste buckets located underneath the bench top. Once the buckets are full the GC vials are discarded into the non-PCB GC vial waste barrel located in the waste room.

13.1.4 Extract waste. Unused sample extracts are held for at least 40 days, in case further testing is deemed necessary. After at least 40 days has passed these extracts are transported to the waste room in racks of 100 were they are disposed of by the sample waste technician.

14.0 References / Cross-References

14.1 State of Alaska Department of Environmental Conservation, Method AK102 for Determination of Diesel Range Organics, Version 4-8-02.

14.2 State of Alaska Department of Environmental Conservation, Method AK103 for Determination of Residual Range Organics, Version 4-8-02.

14.3 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition, Methods 3510C, 3550B, 3540C, 5030B, 8000B, 8021B, and 8015B.

15.0 Method Modifications:

Item	Method	Modification
1	AK102	TZ requirement for nC_{24} and nC_{25} to be greater than 15 is not used in simultaneous analysis.
2	AK102	DB-1ms 0.25 ID 0.1um film is used instead of DB-5ms 0.32 ID 0.25um film.
3	AK102	Sonic bath *may be* used instead of a horn sonicator.
4	AK103	The published method provides a procedure for extraction and analysis of soil samples only. This SOP extends the scope of the method to allow for extraction and analysis of water samples also.

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16.0 Tables and Attachments

Table I: Aliphatic Hydrocarbon Standard
Table II: Calibration Levels
Table III: Spike Levels for Quality Control
Table IV: Recommended GC Conditions
Table V. Acceptance Criteria for Quality Control

Attachment 1. Example Instrument Sequence
Attachment 2. n-Alkane Retention Time Standard Chromatogram

17.0 Revision History

- Revision 13, dated 26 March 2010
    - Added documentation of standards/reagents and standard/reagent preparation Section 7.1
    - Added removal of expired standards Section 7.9.
    - Added criteria for additional QC, Section 9.1.
    - Added BP surrogate requirements, Section 9.9.
    - Added CCBs to example sequence in section 10.7.6
    - Added daily balance check to Section 10.3.1
    - Added maintenance documentation requirements to section 10.8

- Revision 12, dated 13 May 2008
    - Integration for TestAmerica and STL operations.

Table I: Aliphatic Hydrocarbon Standard

Compound Boiling Points		
n-Alkane	**Name**	**B.P.$_{760}$ (°C)**
C_{10}	Decane	174
C_{36}	Hexatriacontane	498

This Table can be used to get the estimated boiling point ranges of the hydrocarbons reported in a given sample.

Table II: Calibration Levels (µg/mL)

Standard	Level 1	Level 2	Level 3	Level 4	Level 5	Level 6
DRO	20	50	100	500*	1000	5000
Motor Oil / RRO	50	100	500*	1000	5000	---
o-Terphenyl and n-Triacontane-d62 (surrogates)	2.0	4.0	20	40	200	---

***** Level used for CCV.

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Table III: Spike Levels for Quality Control

Laboratory Control Samples (LCS) and Matrix Spike/ Spike Duplicate		
Analyte	**Spike Concentration**	
	Water (mg/L)	**Soil (mg/kg)**
Diesel Range Organics	0.5	500
Residual Range Organics (or Motor Oil)	0.5	500

Surrogate Control Samples		
Analyte	**Spike Concentration**	
	Water (mg/L)	**Soil (mg/kg)**
o-Terphenyl	0.02	20
n-Triacontane-d62	0.02	20

Table IV: Recommended GC Conditions

Helium Column Pressure	42 psi
Initial Column Temperature	45 ºC for 0.5 minutes
Temperature Ramp	30 ºC / minute to 330°C, hold 3 minutes Alternately: hold 8 minutes
Final Column Temperature	330 ºC for 3 minutes
Injector Temperature	280 ºC
FID Temperature	300 ºC

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Table V. Acceptance Criteria for Quality Control

Method AK102 (DRO) Acceptance Criteria				
QC Parameter	**Water (mg/L)[1]**	**Soils (mg/kg)[1]**	**% Recovery**	**RPD (%)**
Lab Fortified Blanks (LCS)	0.5 – 2.0	---	75 - 125	20
Continuing Calibration (Includes surrogate compounds)[2]	---	---	75 - 125	---
Calibration Verification	---	---	75 - 125	---
Surrogate Recovery for "Laboratory Control Sample"[2]	0.02	0.8	60 - 120	---
Surrogate Recovery for Field Samples	0.02	0.8	50 - 150	---
Method AK103 (RRO) Acceptance Criteria				
QC Parameter	**Water (mg/L)[1]**	**Soils (mg/kg)[1]**	**% Recovery**	**RPD (%)**
Lab Fortified Blanks (LCS)	---	500	60 - 120	20
Continuing Calibration	2000	---	75 - 125	---
Calibration Verification	2000	---	75 - 125	---
Surrogate (n-triacontane-d_{62}) Recovery for Control Samples[2]	---	50	60 - 120	---
Surrogate (n-triacontane-d_{62}) Recovery for Field Samples	---	50	50 - 150	---

NOTE: The information in this table is taken verbatim from the referenced Alaska methods. This SOP provides for spiking both DRO and RRO in water and soils. The acceptance limits in this table are used when client or project requirements specify compliance with the Alaska methods.

---

[1] Suggested concentrations. May vary with matrix.

[2] According to the Alaska methods, this is any laboratory prepared sample used for quality control, except calibration standards. At TestAmerica Seattle, this includes the Method Blank, LCS, MS, and MSD. The continuing calibration for surrogates is verified at the instrument by including them in the continuing calibration sample.

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Attachment 1. Example Instrument Sequence

Page 1

Sequence Log

Directory : f:\DATA\052008_a

#	Filename	Sample Name	Date/Time
1	pl19001.d	RINSE	05/20/08 09:16
2	pl19002.d	1166-95-4 n-alkane RT STD	05/20/08 09:35
3	pl19003.d	ccv 253853 500 AK102103	05/20/08 09:55
4	pl19004.d	MB 580-31322/1-A	05/20/08 10:51
5	pl19005.d	LCS 580-31322/2-A	05/20/08 11:16
6	pl19006.d	580-9918-B-1-A	05/20/08 11:41
7	pl19007.d	580-9918-B-1-B MS	05/20/08 12:01
8	pl19008.d	580-9918-B-1-C MSD	05/20/08 12:27
9	pl19009.d	580-9918-B-2-A	05/20/08 12:52
10	pl19010.d	580-9918-B-3-A	05/20/08 13:12
11	pl19011.d	580-9918-B-4-A	05/20/08 13:32
12	pl19012.d	580-9918-B-5-A	05/20/08 13:52
13	pl19013.d	580-9918-B-6-A	05/20/08 14:12
14	pl19014.d	580-9918-B-7-A 1:5	05/20/08 14:32
15	pl19015.d	580-9918-B-8-A	05/20/08 14:52
16	pl19016.d	ccv 253853 500 AK102103	05/20/08 15:13

INST: SEA 05
METHOD: AK102/103 (TPH) 5-2008

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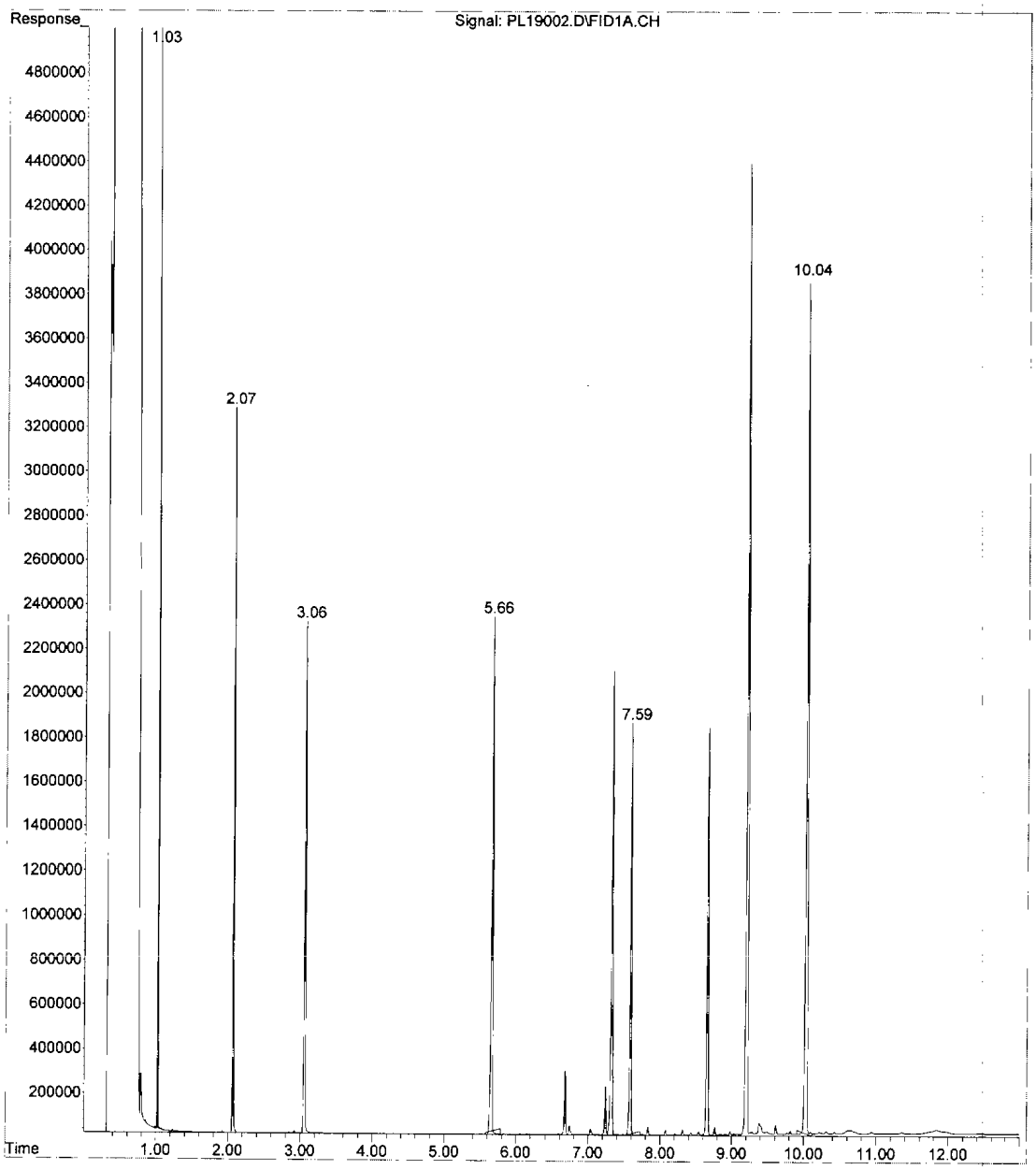
Attachment 2. n-Alkane Retention Time Standard Chromatogram

```
File        : F:\DATA\052008_A\PL19002.D
Operator    : TMR
Acquired    : 05-20-2008 09:35:44 AM using AcqMethod FACQ.M
Instrument  :   SEA015
Sample Name: 1166-95-4 n-alkane RT STD
Misc Info   : BT=S15051308
Vial Number: 2
```



Title: Semivolatile Organic Compound (Base/Neutrals and Acids) Analysis by GC/MS [Methods 8270C and 625]

Approvals

Signatures on File

Sonya Palmer Date Semivolatile Organic Department Manager	Stan Palmquist Date Health & Safety Manager / Coordinator
Dave Wunderlich Date Quality Assurance Manager	Kathy Kreps Date Laboratory Director

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1.0 Scope and Application

1.1 This method is based upon standard method SW846 8270C, and is applicable to the determination of the concentration of semivolatile organic compounds in extracts prepared from solid and aqueous matrices.

1.1.1 The modifications presented in Appendix A may be followed for analysis of wastewater following method 625.

1.1.2 Direct injection of a sample may be used in limited applications.

1.1.3 Refer to Table 1 for the list of compounds applicable for this method. This method may be amenable to additional compounds. If non-standard analytes are required, they must be validated by the procedures described in section 13 before sample analysis.

1.2 The following compounds may require special treatment when being determined by this method:

- Benzidine can be subject to oxidative losses during solvent concentration and exhibits poor chromatography. Neutral extraction should be performed if this compound is expected.
- Hexachlorocyclopentadiene is subject to thermal decomposition in the inlet of the gas chromatograph, chemical reaction in acetone solution, and photochemical decomposition.
- N-Nitrosodiphenylamine decomposes in the gas chromatographic inlet and cannot be distinguished from diphenylamine.
- Pentachlorophenol, 2,4-dinitrophenol, 4-nitrophenol, 4,6-dinitro-2-methylphenol, 4-chloro-3-methylphenol, benzoic acid, 2-nitroaniline, 3-nitroaniline, 4-chloroaniline, and benzyl alcohol are subject to erratic chromatographic behavior, especially if the GC system is contaminated with high boiling material.
- 3-Methylphenol cannot be separated from 4-methylphenol by the conditions specified in this method. They are reported as 3- and 4-methylphenol.
- Hexachlorophene and famphur analysis are not quantitatively reliable by this method.

1.3 The reporting limit (RL) of this method for determining an individual compound is approximately 20 ug/kg to 5,000 ug/kg (or 10X lower for low level) for soil/sediment samples, 1 - 200 mg/kg for wastes (dependent on matrix and method of preparation), and 0.2-10 µg/L (or 10X lower for low level) for groundwater samples. Some compounds have higher reporting limits. Refer to Table 1 for specific RLs. Reporting limits will be proportionately higher for sample extracts that require dilution.

1.4 On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in Section 13.3.1 in the Quality Assurance Manual.

2.0 Summary of Method

2.1 Aqueous samples are extracted with methylene chloride using a continuous extractor or a separatory funnel.

2.2 Solid samples are extracted with methylene chloride / acetone using sonication extraction. The extract is dried, concentrated to a volume of 1 mL, and analyzed by GC/MS.

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2.3 Waste dilution is used for samples that are miscible with the solvent.

2.4 Extraction procedures are detailed in the following SOPs:

TA-OP-0301 LIQUID-LIQUID EXTRACTION BY SEPARATORY FUNNEL, SW846 3510C AND EPA 600 SERIES

TA-OP-0302 SONICATION EXTRACTION PROCEDURE, SW846 3550B

TA-OP-0323 CONTINUOUS LIQUID-LIQUID EXTRACTION, SW846 3520C

2.5 Qualitative identification of the analytes in the extract is performed using the retention time and the relative abundance of characteristic ions. Quantitative analysis is performed using the internal standard technique with a single characteristic ion.

3.0 Definitions

3.1 CCC (Calibration Check Compounds) - A subset of target compounds used to evaluate the calibration stability of the GC/MS system. A maximum percent deviation of the CCCs is specified for calibration acceptance.

3.2 SPCC (System Performance Check Compounds) - Target compounds designated to monitor chromatographic performance, sensitivity, and compound instability or degradation on active sites. Minimum response factors are specified for acceptable performance.

3.3 Batch - The batch is a set of up to 20 samples of the same matrix processed using the same procedures and reagents within the same time period. The Quality Control batch must contain a matrix spike / matrix spike duplicate (MS/MSD), a Laboratory Control Sample (LCS), and a method blank (MB). In some cases, at client request, the MS/MSD may be replaced with a matrix spike and sample duplicate. Batches are defined at the sample preparation stage. Batches should be kept together through the whole analytical process to the extent possible, but it is not mandatory to analyze prepared extracts on the same instrument or in the same sequence. Refer to the TestAmerica Seattle SOP TA-QA-0620 Quality Control Program for further details of the batch definition.

3.4 Method Blank (MB) - An analytical control consisting of all reagents, internal standards and surrogate standards that is carried through the entire analytical procedure. The method blank is used to define the level of laboratory background and reagent contamination.

3.5 Laboratory Control Sample (LCS) - A blank matrix (reagent water or Ottawa Sand) spiked with the analytes of interest that is carried through the entire analytical procedure. Analysis of this sample with acceptable recoveries of the spiked analytes demonstrates that the laboratory techniques for this method are acceptable.

3.6 Matrix Spike (MS) – An aliquot of a matrix (water or soil) fortified (spiked) with known amounts of specific analytes and subjected to the entire analytical procedure in order to indicate the appropriateness of the method for the matrix by measuring recovery.

3.7 Matrix Spike Duplicate (MSD) - A second aliquot of the same sample as the matrix spike (above) that is spiked in order to determine the precision of the method by measuring the relative percent difference (RPD) between the MS and MSD results.

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3.8 Surrogates - Organic compounds which are similar to the target analyte(s) in chemical composition and behavior in the analytical process, but which are not normally found in environmental samples. Each sample, blank, LCS, MS, and MSD is spiked with surrogate standards. Surrogate spike recoveries must be evaluated by determining whether the concentration (measured as percent recovery) falls within the required recovery limits.

3.9 PIBLK Instrument blank with surrogate added. Needs to be run after a CCV unless a Mb is run first. If the PIBLK is run it needs to be evaluated with results less than the RL for the target list and passing surrogate criteria.

4.0 Interferences

4.1 Matrix interferences may be caused by contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source, depending upon the nature of the sample. Cleanup procedures may help to eliminate select interferences, as follows:

- Method 3640A, Gel-Permeation Chromatography - Removes higher molecular weight hydrocarbons by size exclusion chromatography, which is most frequently used for biological samples.
- Other, more aggressive cleanup procedures listed in SW-846 may be used for select compounds listed in this procedure, but may cause degradation of some of the more reactive compounds. Consult with a technical expert in the laboratory for more difficult interference problems.

4.2 Contaminants in solvents, reagents, glassware, and other processing apparatus that lead to discrete artifacts may cause method interferences. All of these materials must be routinely demonstrated to be free from interferences under conditions of the analysis by running laboratory method blanks as described in the Quality Control section (Section 9.0). Raw GC/MS data from all blanks, samples, and spikes must be evaluated for interferences. If interference is detected, it is necessary to determine if the source of interference is in the preparation and/or cleanup of the samples; then take corrective action to eliminate the problem.

4.3 The use of high purity reagents, solvents, and gases helps to minimize interference problems.

4.4 Contamination by carryover can occur whenever high-level and low-level samples are sequentially analyzed. To reduce carryover, the sample syringe must be rinsed with solvent between samples. Whenever an unusually concentrated sample is encountered, it should be followed by the analysis of solvent to check for cross contamination.

4.5 Phthalate contamination is commonly observed in this analysis and its occurrence should be carefully evaluated as an indicator of a contamination problem in the sample preparation step of the analysis.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001) and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples

and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum

5.1 Specific Safety Concerns

5.1.1 Eye protection that satisfies ANSI Z87.1, laboratory coat, and nitrile gloves must be worn while handling samples, standards, solvents, and reagents. Disposable gloves that have been contaminated must be removed and discarded; non-disposable gloves must be cleaned immediately.

NOTE: LATEX AND VINYL GLOVES PROVIDE NO PROTECTION AGAINST THE ORGANIC SOLVENTS USED IN THIS METHOD. NITRILE OR SIMILAR GLOVES MUST BE USED.

5.1.2 The gas chromatograph and mass spectrometer contain zones that have elevated temperatures. The analyst needs to be aware of the locations of those zones, and must cool them to room temperature prior to working on them.

5.1.3 The mass spectrometer is under deep vacuum. The mass spectrometer must be brought to atmospheric pressure prior to working on the source.

5.1.4 There are areas of high voltage in both the gas chromatograph and the mass spectrometer. Depending on the type of work involved, either turn the power to the instrument off, or disconnect it from its source of power before performing any maintenance.

5.1.5 The use of separatory funnels to extract aqueous samples with methylene chloride creates excessive pressure very rapidly. Initial venting should be done immediately after the sample container has been sealed and inverted. Vent the funnel into the hood away from people and other samples. This is considered a high-risk activity, and must be done either in a hood with the sash down to chest level or while wearing a face shield over safety glasses.

5.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Materials with Significant or Serious Hazard Rating

Material (1)	Hazards	Exposure Limit (2)	Signs and Symptoms of Exposure
Methanol	Flammable Poison Irritant	200 ppm-TWA	A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Symptoms of overexposure may include headache, drowsiness and dizziness. Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure. Irritant to the eyes.
Methylene Chloride	Carcinogen Irritant	25 ppm-TWA 125 ppm-STEL	Causes irritation to respiratory tract. Has a strong narcotic effect with symptoms of mental confusion, light-headedness, fatigue, nausea, vomiting and headache. Causes irritation, redness and pain to the skin and eyes. Prolonged contact can cause burns. Liquid degreases the skin. May be absorbed through skin.
Sodium Hydroxide	Corrosive	2 mg/m^3-Ceiling	Severe irritant. Effects from inhalation of dust or mist vary from mild irritation to serious damage of the upper respiratory tract, depending on severity of exposure. Symptoms may include sneezing, sore throat or runny nose. Contact with skin can cause irritation or severe burns and scarring with greater exposures. Causes irritation of eyes, and with greater exposures it can cause burns that may result in permanent impairment of vision, even blindness.
Sulfuric Acid	Corrosive Oxidizer Dehydrator Poison Carcinogen	1 mg/m^3-TWA	Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. Symptoms may include irritation of the nose and throat, and labored breathing. Symptoms of redness, pain, and severe burn can occur. Contact can cause blurred vision, redness, pain and severe tissue burns. Can cause blindness.

(1) Always add acid to water to prevent violent reactions.
(2) Exposure limit refers to the OSHA regulatory exposure limit.

6.0 Equipment and Supplies

6.1 Instrumentation

- Gas chromatograph/mass spectrometer system: an analytical system complete with a temperature-programmable gas chromatograph suitable for split/splitless injection and all required accessories, including syringes, analytical columns, and gases. The capillary column should be directly coupled to the source
- Mass Spectrometer: Capable of scanning from 35 to 500 u (previously “amu”) every one second or less, using 70 volts (nominal) electron energy in the electron impact ionization mode. The mass spectrometer must be capable of producing a mass spectrum for

decafluorotriphenylphosphine (DFTPP) that meets all of the criteria in Table 4 when 25 ng of the GC/MS tuning standard is injected through the GC

- Autosampler: LEAP Technologies CTC A200S, HP7683 Autosampler or equivalent
- GC/MS Interface: Any GC-to-MS interface that gives acceptable calibration points and achieves acceptable tuning performance criteria may be used
- Data System: A computer system must be interfaced to the mass spectrometer. The system must allow the continuous acquisition and storage on machine-readable media of all mass spectra obtained throughout the duration of the chromatographic program. The computer must have software that can search any GC/MS data file for ions of a specific mass and that can plot such ion abundances versus time or scan number. This type of plot is defined as the Extracted Ion Current Profile (EICP). Software must also be available that allows integrating the abundances in any EICP between specified time or scan-number limits. The most recent version of the NIST Mass Spectral Library is recommended

6.2 **Supplies**

- Column: 30 m x 0.25 mm I.D., 0.25-µm film thickness fused-silica capillary column coated with 5% diphenyl/95% dimethyl polysiloxane (Phenomenex Zebren-ZB-5MS or equivalent). Alternate columns are acceptable if they provide acceptable performance
- Gas-tight syringes (Hamilton 1700 Series, or 1000 Series or equivalent).
- 10 ml scintillation vials with polypropylene closures or 10, 20, 40 or 60 ml VOA vials with Teflon-lined silicone septa enclosures (or equivalent).
- Analytical balance, capable of reading to 0.0001g. *Analysts must verify calibration has been preformed on the balance before using it. The calibration must bracket the weights to be determined.*
- Class A volumetric flasks; 10 mL, 25 mL, 50 mL, 100 mL, 250 mL.
- Carrier gas: Ultra high-purity helium or hydrogen

7.0 **Reagents and Standards**

7.1 *Document reagent/standards and reagent/standard preparation in TALS using the reagent module as described in SOP TA-QA-0619.*

7.2 A minimum five-point calibration curve is prepared when average response factors or linear regression curve fitting is used. Six calibration points are required for second-order curve fits. The low point should be at or below the reporting limit. Refer to tables 11 and 12 for typical calibration levels for all analytes. Other calibration levels may be used, depending on instrument capability, but the low standard must support the reporting limit and the high standard defines the range of the calibration.

7.2.1 Initial calibration stock standards 8270

7.2.1.1 1000 ug/ml 8270 ICAL STD STOCK Restek #31850 (8270 Megamix) (or equivalent).

7.2.1.2 A custom mix is purchased from Restek (#5609464 or equivalent). This is the Purchased Primary Standard. It contains the following compounds at the following concentrations.

Acetophenone	1000 µg/mL
Atrazine	1000 µg/mL
Benzoic Acid	5000 µg/mL
Biphenyl	1000 µg/mL

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Decane	1000 µg/mL
N-Nitrosodimethylamine	4000 µg/mL
Octadecane	1000 µg/mL
Pyridine	4000 µg/mL
2,3-Dichloroaniline	1000 µg/mL
2,4-Dinitrophenol	4000 µg/mL
4-Nitrophenol	4000 µg/mL
4,6-Dinitro-2-methylphenol	4000 µg/mL

7.2.1.3 2000-ug/mL Benzidines Standard from Restek (#31030 or equivalent). It contains the following compounds at the following concentrations.

Benzidine	2000 µg/mL
3,3'-Dichlorobenzidine	2000 µg/mL

7.2.2 4000 µg/mL 8270 Surrogate Standard Supelco #47960-U (or equivalent).

7.2.3 Intermediate calibration standard 8270

7.2.3.1 Dilute 1.0-mL of Benzidine mix, 1.0-mL of custom mix, 1.0-mL of Megamix and 0.250-mL of surrogate mix to a final volume of 10-mL to make a 100-500 µg/mL intermediate stock solution.

7.2.4 Working calibration standards 8270

7.2.4.1 Dilute the intermediate calibration stock solution (section 7.1.5.1) as follows to make working calibration standards:

Calibration Level	Volume of Intermediate Stock (µL)	Final Volume	Concentration (µg/L)
1	10	50	20
2	25	50	50
3	50	50	100
4	100	50	200
5	250	50	500
6	500	50	1000
7	1000	50	2000
8	2500	50	5000

7.2.5 ICV Standard 8270

7.2.5.1 1000 µg/mL Element 8270 Megamix #110E381-01 or equivalent. This is the primary Secondary Source Standard for Base/Neutral and Acid Extractables.

7.2.5.2 2000 µg/mL Element Benzidines Mixture #110E029-05 or equivalent. This is the Secondary Source for Benzidines and contains the following compounds:

Benzidine	2000 µg/mL
3,3'-Dichlorobenzidine	2000 µg/mL

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7.2.5.3 Element prepares a Custom ICV Mixture #110E641-03-5 or equivalent. This is the Secondary Source Custom mix. It contains the following compounds:

Acetophenone	1000 µg/mL
Atrazine	1000 µg/mL
Benzoic Acid	5000 µg/mL
Biphenyl	1000 µg/mL
Decane	1000 µg/mL
N-Nitrosodimethylamine	4000 µg/mL
Octadecane	1000 µg/mL
Pyridine	4000 µg/mL
2,3-Dichloroaniline	1000 µg/mL
2,4-Dinitrophenol	4000 µg/mL
4-Nitrophenol	4000 µg/mL
4,6-Dinitro-2-methylphenol	4000 µg/mL

7.2.5.4 1.0 ug/mL ICV Working Solution is prepared by diluting 100 µL of each of Megamix (7.1.5.1), and Secondary Source for Benzidines (7.1.5.2), and Secondary Source Custom Mix (7.1.5.3) to a final volume of 100-mL with methylene chloride.

7.3 Matrix Spike Short List 8270

7.3.1 Supelco 4-7421 8270 Base Neutrals Matrix Spike 500 µg/mL in methanol Supelco 4-7423 8270 Acid Matrix Spike 1000 µg/mL Dilute 2-mL of the base Neutrals and 1-mL of the Acid Matrix spike stock to 10-mL in Acetone to make 100 µg/mL matrix spike solution.

7.4 Matrix Spike Full List 8270

7.4.1 1000 µg/mL Restek Megamix, 1000- 5000 µg/L custom Mix and the 2000 µg/mL Benzidine Mix. Dilute 1-mL of each to 10-mL in Acetone to make 100 µg/mL- 500 µg/mL Full List matrix spike.

7.4.2 This spike mix is also used for PAH and TCLP.

7.5 4000 ug/mL 8270 Surrogate Standard Supelco #47960-U (or equivalent); 100 ug/mL 8270 Surrogate Standard is prepared by diluting 1.0-mL of the 4000 µg/mL Purchased Surrogate Standard to 40-mL with acetone. Surrogate compounds and levels are listed in Table 7.

7.6 An internal standard (IS) solution is prepared. Compounds in the IS Mix are acenaphthene-d10, chrysene-d12, 1,4-dichlorobenzene-d4, naphthalene-d8, perylene-d12, and phenanthrene-d10.

7.6.1 4000 ug/ml 8270 Internal Standard Supelco #46886-U; 100 ug/ml 8270 Internal Standard is prepared by diluting 5.0 ml of the 2000 ug/ml Restek Standard to 100 ml with methylene chloride.

7.6.2 Internal standards are added to all standards and extracts to result in a final concentration of 1000 µg/L for full scan and 100 µg/L for SIM. For example, if the volume of an extract aliquot used was 1 mL, 10 µL of a 100 µg/mL internal standard solution would be added to the aliquot.

7.7 GC/MS Tuning Standard: A methylene chloride solution containing 25 µg/mL of decafluorotriphenylphosphine (DFTPP) is prepared. Pentachlorophenol, benzidine, and

DDT should also be included in the Tuning Standard at 25 µg/mL. 2uL of this solution should be injected for an on column concentration of 50ng.

7.8 Laboratory Control Spiking Solution: Prepare as indicated in the extraction SOPs (refer to Section 2.4 for extraction SOPs numbers). LCS compounds and levels are listed in Tables 4 and 5.

7.9 Matrix Spike Solution: Prepare as indicated in the extraction SOPs (refer to Section 2.4 for extraction SOPs numbers). The matrix spike compounds and levels are the same as the LCS compounds.

7.10 The standards listed in sections 7.1 to 7.9 must be refrigerated at 0-6°C. Stock standards expire 1 year after preparation.

7.11 *Managers/supervisors or a designee are expected to check their areas on a monthly basis for expired standards and dispose of them according to SOP TA-EHS-0036.*

8.0 Sample Collection, Preservation, Shipment and Storage

8.1 Water samples are collected in pre-cleaned, amber glass bottles fitted with a Teflon-lined cap. To achieve routine reporting limits, a full one-liter of sample is required. Additional one-liter portions are needed to satisfy the requirements for matrix spikes and duplicate matrix spikes.

8.2 Soil samples are collected in 8-ounce, pre-cleaned, wide-mouth jars with a Teflon-lined lid.

8.3 Samples are stored at 0-6°C.

8.4 Extracts are refrigerated at 0-6°C.

Matrix	Sample Container	Min. Sample Size	Preservation	Extraction Holding Time	Analysis Holding Time	Reference
Waters	Amber glass	1 Liter	Cool 0-6°C	7 Days	40 Days from extraction	40 CFR Part 136.3
Soils	Glass	30 grams	Cool 0-6°C	14 Days	40 Days from extraction	N/A

9.0 Quality Control

9.1 The minimum quality controls (QC), acceptance criteria, and corrective actions are described in this section and in Table 9. The process of establishing control limits, and the use of control charts are described more completely in TA-QA-0620, Quality Control Program. When processing samples in the laboratory, use the LIMS QC program code and special instructions to determine specific QC requirements that apply.

9.1.1 The laboratory's standard QC requirements, the process of establishing control limits, and the use of control charts are described more completely in SOP TA-QA-0620, *Quality Control Program.*

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9.1.2 Project-specific requirements can override the requirements presented in this section when there is a written agreement between the laboratory and the client, and the source of those requirements should be described in the project documents. Project-specific requirements are communicated to the analyst via instructions in the LIMS.

9.1.3 Any QC result that fails to meet control criteria must be documented in a Nonconformance Memo (NCM). The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The QA group also receives NCMs by e-mail for tracking and trending purposes. The NCM process is described in more detail in SOP TA-QA-0610. This is in addition to the corrective actions described in the following sections.

9.2 Quality Control Batch

The batch is a set of up to 20 samples of the same matrix processed together using the same reagents and standards. Each quality control batch must contain a method blank (MB), a laboratory control sample (LCS), matrix spike (MS), and/or matrix spike duplicate (MSD) or duplicate (DUP) pair. For more details see SOP TA-QA-0620.

9.3 Method Blank (MB)

For aqueous sample batches, the method blank is reagent water; for solid sample batches, the method blank is clean sand. In either case, the method blank is free of the analytes of interest and is spiked with the surrogates. At least one method blank must be processed with each preparation batch.

Acceptance Criteria: The result for the method blank must be less than the reporting limit or less than 10% of the analyte concentration found in the associated samples, whichever is higher.

NOTE: Some programs (e.g., DOD and BP) require that the maximum blank concentration must be less than one-half of the reporting limit or less than 10% of the lowest sample concentration.

Corrective Action: Re-preparation and reanalysis of all samples associated with an unacceptable method blank. If the analyte was not detected in the samples, the data may be reported with qualifiers (check project requirements to be sure this is allowed) and it must be addressed in the project narrative.

9.4 Laboratory Control Sample (LCS)

The LCS is prepared using reagent water for aqueous methods and Ottawa sand for solid sample methods. A laboratory control sample (LCS) is prepared and analyzed with every batch of samples. Ongoing monitoring of the LCS provides evidence that the laboratory is performing the method within accepted QC guidelines for accuracy and precision.

Acceptance Criteria: All analytes must be within established control limits. See QC SOP TA-QA-0620 for details on establishing control limits.

Corrective Action: If any analyte in the LCS is outside the laboratory-established historical control limits or project-specific control limits, as

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applicable, corrective action must occur. Corrective action may include re-extraction and reanalysis of the batch.

- For BP LaMP, where the LCS recovery is high and there are non-detect samples. An NCM is initiated. The non-detect samples are flagged and reported.
- If the batch is not re-extracted and reanalyzed, the reasons for accepting the batch must be clearly presented in the project records and the report. An example of acceptable reasons for not reanalyzing might be that the matrix spike and matrix spike duplicate are acceptable, and sample surrogate recoveries are good, demonstrating that the problem was confined to the LCS. This type of justification should be reviewed and documented with the client before reporting.
- If re-extraction and reanalysis of the batch are not possible due to limited sample volume or other constraints, the LCS is reported, all associated samples are flagged, and appropriate comments are made in a narrative to provide further documentation.

9.5 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

The matrix spike is a second aliquot of one of the samples in the batch. The matrix spike duplicate is a third aliquot of the same sample. The MS and MSD are spiked with the same analytes as the LCS. An MS/MSD pair is prepared and analyzed with every batch of samples when sufficient sample volume is available.

Acceptance Criteria: The percent recovery (%R) must fall within either historical limits or project-specific limits, as applicable. The relative percent difference (RPD) between the MS and MSD results must be less than or equal to the established historical or project-specific limit. See QC SPP TA-QA-0620 for details on establishing control limits

Corrective Action: If any individual recovery or RPD fails the acceptance criteria, then corrective action must occur. Initially check the recovery of the analyte in question in the LCS. Generally, if the recovery of the analyte in the LCS is within limits, then the laboratory operation is considered to be in control and analysis may proceed. The reasons for accepting the batch must be documented.

- If the recovery for any analyte fails acceptance criteria for the MS, MSD, and the LCS, the laboratory operation is considered to be out of out of control and corrective action must be taken. Corrective action will normally include re-preparation and reanalysis of the batch.
- If it is not possible to prepare both an MS and MSD due to limitations of sample amount, then a duplicate LCS should be prepared and analyzed. The RPD between the LCS and LCSD must be less than or equal to the RPD limit established for the MS/MSD.

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- The MS/MSD pair must be analyzed at the same dilution as the unspiked sample, even if the matrix spike compounds will be diluted to concentrations below the calibration range.

9.6 Surrogates

9.6.1 Each sample, blank, and QC sample is spiked with the surrogate standards. Surrogate compounds are spiked at 100 µg/mL. The compounds routinely included in the surrogate spiking solution, along with recommended standard concentrations, are listed in Table 7.

Acceptance Criteria: Surrogate spike recoveries must be evaluated by determining whether the concentration (measured as percent recovery) falls within the required recovery limits.

Corrective Action: For particular sublists, such as an acid only extraction (e.g. PAHs), base/neutral surrogates may fail with no corrective action required, however, the failure must be documented in an NCM if the surrogates are reported. Otherwise, if any surrogates are outside of the limits, then the following corrective actions must take place (except for dilutions):

- Check all calculations for error.
- Ensure that instrument performance is acceptable.
- Recalculate the data and/or reanalyze the extract if either of the above checks reveals a problem.
- Re-extract and reanalyze the sample or flag the data as “Estimated Concentration” if neither of the above resolves the problem.

Note: *For BP LaMP samples, if the surrogate %R fails, the recovery must be confirmed by re-extraction and reanalysis with the following exceptions:*

- *The lab has unequivocally demonstrated a sample matrix effect and informed the BP representative.*
- *The recovery exceeds control limits and all target analytes in the sample are non-detect.*

NOTE: The decision to reanalyze or flag the data should be made in consultation with the client. It is only necessary to reprepare / reanalyze a sample once to demonstrate that poor surrogate recovery is due to matrix effect, unless the analyst believes that the repeated out-of-control results are not due to matrix effect.

9.6.2 If the sample with failed surrogate recoveries was a sample used for an MS/MSD pair and the surrogate recoveries in the MS/MSD are also outside of the control limits, then the sample and the MS and the MSD do not require reanalysis. This phenomenon indicates a possible matrix problem.

9.6.3 If the sample is reanalyzed and the surrogate recoveries in the reanalysis are acceptable, then the problem was within the analyst's control and only the reanalyzed data should be reported. (Unless the reanalysis was outside holding times, in which case reporting both sets of results may be appropriate).

9.6.4 If the reanalysis does confirm the original results, the original analysis is reported and the data flagged as estimated due to matrix effects.

9.7 Instrument QC

Detailed instrument calibration controls are given in Section 10.2 Calibration.

PIBLK Instrument blank with surrogate added. Needs to be run after a CCV unless a MB is run first. If the PIBLK is run it needs to be evaluated with results less than the RL (<1/2 RL for DOD and BP) for the target list and passing surrogate criteria.

9.8 *Any extra QC that is analyzed in a batch or sequence must be evaluated using the same criteria as the corresponding QC above.*

10.0 Procedure

Procedural variations are allowed only if deemed necessary in the professional judgment of the supervisor to accommodate variation in sample matrix, radioactivity, chemistry, sample size, or other parameters. Any variation in procedure shall be completely documented using a Nonconformance Memo (NCM). The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The QA department also receives NCMs by e-mail for tracking and trending purposes. The nonconformance shall be addressed in the case narrative, and the NCM shall be filed in the project file. The NCM process is described in more detail in SOP TA-QA-0610.

10.1 Sample Preparation

Samples are prepared according to the following organic preparation SOPs, as applicable:

TA-OP-0301	LIQUID-LIQUID EXTRACTION BY SEPARATORY FUNNEL, SW846 3510C AND EPA 600 SERIES
TA-OP-0302	SONICATION EXTRACTION PROCEDURE, SW846 3550B
TA-OP-0323	CONTINUOUS LIQUID-LIQUID EXTRACTION, SW846 3520C

10.2 Calibration

10.3 Summary

The instrument is tuned for DFTPP, calibrated initially with a minimum of a five levels, and verified each 12-hour shift with one or more continuing calibration standard(s). Recommended instrument conditions are listed in Table 3.

10.4 All standards and extracts are allowed to warm to room temperature before injecting.

10.5 Instrument Tuning

10.5.1 A MS tuning compound (DFTPP) is analyzed every twelve hours during instrument operation, prior to analysis of standards, samples, or QC samples. Method tuning criteria must be met before sample analysis can proceed.

10.5.2 Tuning Procedure (Ion Trap): 2.0 ul of a 2.5 ng/uL solution of decafluorotriphenylphosphine (DFTPP) must be analyzed in a scanning mode of 40 - 450 m/z. The tuning solution must also contain 4,4'-DDT, Pentachlorophenol, and Benzidine at the same concentration.

10.5.3 Tuning Procedure (Quadrupole): 2.0 ul of a 25 ng/uL solution of decafluorotriphenylphosphine (DFTPP) must be analyzed in a scanning mode of 40 - 450 m/z. The tuning solution must also contain 4,4'-DDT, Pentachlorophenol,

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and Benzidine at the same concentration.

10.5.4 Inject the GC/MS tuning standard (Section 7.7) into the GC/MS system. Obtain a background-corrected mass spectra of DFTPP and confirm that all the key m/z criteria are achieved. If all the criteria are not achieved, the analyst must retune the mass spectrometer and repeat the test until all criteria are achieved. The performance criteria must be achieved before any samples, blanks, or standards are analyzed. DFTPP Tuning Criteria (per EPA method 525.1):

Mass	Ion Abundance Criteria
51	10 - 80% of base peak
68	< 2% of mass 69
69	present
70	< 2% of mass 69
127	10 - 80% of base peak
197	< 2% of mass 198
198	Base peak or > 50% of 442
199	5 - 9% of mass 198
275	10 - 60% of base peak
365	> 1% of base peak
441	Present, but less than mass 443
442	Base peak or > 50% of mass 198
443	15 - 24% of mass 442

10.5.5 The GC/MS tuning standard should also be used to evaluate the inertness of the chromatographic system. Column performance and Injector Inertness Acceptance Criteria:

- *Benzidine tailing factor of ≤ 3.0 (≤ 2 for DoD).*
- *Pentachlorophenol tailing factor of < 5.0 (≤ 2 for DoD).*
- Degradation of 4,4'-DDT to 4,4'-DDE and 4,4'-DDD < 20%.

10.6 8270 SIM PAH

10.6.1 Instead of running full scan, SIM (selective ion monitoring) selects specific target ions for analysis. SIM can be up to ten times more sensitive. In order to achieve maximum sensitivity the selected ions should be broken up in to several groups. Since SIM can be less selective than the full scan run. 1 to 2 qualifier ions should be used where it's practical. The following is a suggested SIM grouping. Other parameters can be used as long as sufficient sensitivity is achieved.

10.6.1.1 Many PAH compounds do not have more than 1 qualifier ion that respond well enough to use.

- Group 1

  Mass, Dwell

  54,100; 82,100; 128,50; 152,50;

  Group 1 includes the following PAH's along with surrogates and internal standards:

  1,4 dichlorobenze-d4, Nitrobenze-d5,

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- Group 2

  Mass, Dwell
  102, 50; 108, 50; 127, 50; 128, 50; 136, 50;
  Naphthalene; Naphthalene-d8
- Group 3

  115,50; 141, 50; 142, 50 172, 50; 171, 50
  1-methylnaphthalene; 2-methylnaphthalene, 2-fluorobiphenyl
- Group 4

  151,50; 152,50; 153, 50; 154, 50; 162, 50 164,50
  Acenaphthylene, Acenaphthene, Acenaphthene-d10
- Group 5

  165, 100 166, 100
  Fluorene
- Group 6

  152, 50; 160,50; 176,50; 178,50 179, 50; 188, 50
  Phenanthrene Anthracene, Phenathrene-d10
- Group 7

  101, 50; 200, 50; 202, 50; 203, 50; 244,50
  Fluoranthene, Pyrene, p-terphenyl-d14
- Group 8

  113,50; 226, 50; 228, 50; 229,50; 236,50 240, 50 248, 50 263, 50
  Benzo(A)anthracene, Chrysene, Chrysene-d12
- Group 9

  113, 50; 126, 50; 252; 50; 264, 50
  Benzo(b)fluoranthene, Benzo(k)fluoranthene, Benzo(a)pyrene, perylene-d12
- Group 10

  113, 50; 138, 50 139; 50 276, 50; 278, 50
  Indeno(1,2,3-cd)pyrene; Dibenzo(a,h)anthracene, Benzo(g,h,i)perylene

10.6.1.2 SIM can also be extended to other 8270 target analytes such as pentachlorophenol or phthalates.

10.7 Initial Calibration

10.7.1 Internal Standard (IS) Calibration Procedure: Internal standards are listed in Section 7.2. Use the base peak m/z as the primary m/z for quantitation of the standards. If interferences are noted, use one of the next two most intense masses for quantitation. 10 uL of internal standard solution is added to all calibration standards, QC samples, and samples prior to analysis. The autosampler up to 5 uL of standard and extract volumes into the instrument for analysis.

10.7.2 Compounds are assigned to the IS with the closest retention time.

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10.7.3 Prepare calibration standards at a minimum of five concentration levels for each parameter of interest when average response factors or linear regression curve fits are used. Six standards must be used for a quadratic least-squares calibration. It may also be useful to analyze six calibration levels and use the lower five for most analytes and the upper five for analytes that have poor response.

10.7.4 Rejection of Calibration Points

10.7.4.1 Generally, it is NOT acceptable to remove points from a calibration. If calibration acceptance criteria are not met, the normal corrective action is to examine conditions such as instrument maintenance and accuracy of calibration standards. Any problems must be fixed and documented in the run log or maintenance log. Then the calibration standard(s) must be reanalyzed.

10.7.4.2 If no problems are found or there is documented evidence of a problem with a calibration point (e.g., obvious misinjection explained in the run log), then one point might be rejected, but only if all of the following conditions are met:

- The rejected point is the highest or lowest on the curve, i.e., the remaining points used for calibration must be contiguous; and
- The lowest remaining calibration point is still at or below the project reporting limit; and
- The highest remaining calibration point defines the upper concentration of the working range, and all samples producing results above this concentration are diluted and reanalyzed; and
- The calibration must still have the minimum number of calibration levels required by the method, i.e. five levels for calibrations modeled with average response factors or linear regressions, or six levels for second-order curve fits.

10.7.5 Add the internal standard mixture to result in a 1,000-µg/L final concentration. (For example, if the volume of the calibration standard used is 0.5 mL, add 5 µL of the 100 µg/L internal standard). The concentrations of all analytes are listed in Tables 11 and 12.

10.7.6 Analyze each calibration standard and tabulate the area of the primary characteristic m/z against the concentration for each compound and internal standard. Calculate the response factors (RF), average response factors, and the percent RSD of the response factors for each compound using the equations in section 12. Verify that the CCC and SPCC criteria, which are specified in Sections 10.7.7 and 10.7.8 are met. No sample analysis may be performed unless these criteria are met.

10.7.7 System Performance Check Compounds (SPCCs)

The minimum average RF for semivolatile SPCCs is 0.050. If the minimum response factors are not met, the system must be evaluated and corrective action must be taken before sample analysis begins. Some possible problems are standard mixture degradation, injection port inlet contamination, contamination at the front end of the analytical column, and active sites in the column or chromatographic system. This check must be met before analysis begins.

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10.7.7.1 SPCC Compounds

N-nitroso-di-n-propylamine
Hexachlorocyclopentadiene
2,4-Dinitrophenol
4-Nitrophenol

10.7.8 Calibration Check Compounds (CCCs)

The %RSD of the response factors for each CCC in the initial calibration must be less than 30% for the initial calibration to be considered valid. This criterion must be met before sample analysis begins. Problems similar to those listed under SPCCs could affect this check.

10.7.8.1 If none of the CCCs are required analytes, then project-specific calibration specifications (which may include the use of the CCCs listed in Section 10.7.8.2) must be implemented with concurrence from the client.

10.7.8.2 CCC Compounds:

Phenol
Acenaphthene
1,4-Dichlorobenzene
N-Nitrosodiphenylamine
2-Nitrophenol
Pentachlorophenol
2,4-Dichlorophenol
Fluoranthene
Hexachlorobutadiene
Di-n-octylphthalate
4-Chloro-3-methylphenol
Benzo(a)pyrene
2,4,6-Trichlorophenol

Resolution check.

Isomer pairs need have greater than >25% resolution. Benzo(b)flouranthene and benzo(k)floranthene are usually the most likely failure. This isomer pair must have >25% resolution. This needs to be checked on the mid point ICAL and the CCV. If the combined peak "benzoflouranthenes " is being requested the 25% resolution check is not applicable, but all other isomers that are in the list must also be >25% resolution.

10.7.9 If the software in use is capable of routinely reporting curve coefficients for data validation purposes, and the necessary calibration reports can be generated, then the analyst should evaluate analytes with RSD > 15% for calibration on a curve. If it appears that substantially better accuracy would be obtained using quantitation from a curve fit, then the appropriate curve should be used for quantitation.

10.7.10 If the RSD for a compound in the initial calibration is > 15%, then calibration using a curve fit, must be used. Linear or quadratic curve fits may be used. Use of 1/Concentration^2 weighting is recommended to improve the accuracy of quantitation at the low end of the curve. The analyst should consider instrument maintenance to improve the linearity of response.

10.7.11 If a linear regression equation is used, the correlation coefficient (r) must be greater than 0.990 for commercial projects and greater than 0.995 for DoD projects, and r squared (r^2) greater than 0.990.

10.7.12 Use of second-order equations (quadratic) may be used on rare occasions and must consist of a minimum of six data points. In these cases, the intercept and degree of curvature should be examined to be sure that results will be reliable throughout the working range, and the coefficient of determination (r^2) must be greater than 0.990.

10.7.13 An initial calibration verification containing all components from a second source (an alternate vendor or a unique lot from the same vendor or the same source but prepared by an alternate analyst) must be analyzed after the initial calibration. Acceptance criteria for ICV percent recovery (%R) are 80-120% of all target analytes for DoD projects (e.g., Navy and USACE); 80-120% recovery of all CCC analytes under method 625, 65-135% for non-DoD projects (e.g., 8270C HSL components); and 45-155% for poor performers (see Table 8). *(ICV Acceptance criteria LaMP (75%-125%)*

10.7.14 If the percent difference for the second-source verification falls outside acceptance criteria, then sample analysis cannot be performed. Reanalyze the second-source verification standard to confirm the original result. If the second result fails, then re-prepare the verification standard, and/or re-prepare and rerun the ICAL.

10.7.15 Weighting of Calibration Data Points

In a linear or quadratic calibration fit, the points at the lower end of the calibration curve have less weight in determining the curve generated than points at the high concentration end of the curve. However, in environmental analysis, accuracy at the low end of the curve is very important. For this reason, it is preferable to increase the weighting of the lower concentration points. $1/\text{Concentration}^2$ weighting (often called $1/X^2$ weighting) will improve accuracy at the low end of the curve and should be used if the data system has this capability.

10.7.16 If time remains in the 12-hour period initiated by the DFTPP injection before the initial calibration, samples may be analyzed. Otherwise, proceed to continuing calibration, Section 10.8.

NOTE: Quantitation is performed using the calibration curve or average response factor from the initial curve, not the continuing calibration.

10.8 Continuing Calibration Verification (CCV)

10.8.1 At the start of each 12-hour period, the GC/MS tuning standard must be analyzed. A 25-ng injection of DFTPP must result in a mass spectrum for DFTPP, which meets the criteria given in Table 4.

10.8.2 Following a successful DFTPP analysis, the continuing calibration verification (CCV) standard(s) are analyzed. The standard(s) must contain all semivolatile analytes, including all required surrogates. A mid level calibration standard is used for the CCV.

10.8.3 The following criteria must be met for the CCV to be acceptable:

- The SPCC compounds must have a response factor $\geq$ 0.050.

- For DOD samples, the percent difference or drift (%D) must be within ± 20% for all analytes listed in Table 1. The drift (%D) for the analytes in Table 2 must be within ± 35%D except those listed as poorly performing compounds in Table 8 which must be within ± 55%D. (See Section 12 for calculations.) If the %D of the non-CCC compounds exceeds these limits, the system must be evaluated. Corrective action may need to be taken before sample analysis begins. Any samples associated with a continuing calibration verification standard where the response for an analyte in the verification standard is above the acceptance limit and the analyte is not detected in any of the samples analyzed in the 12-hour window, do not need to be reanalyzed, as the verification standard has demonstrated that the analyte would have been detected if it were present. If a compound in the CCV fails low, the analyst may elect to analyze a RL standard immediately after the CCV. If the compounds of concern are detected in the RL standard, it demonstrates that they would be detected in the samples, if present. For situations where the failed compound is present in a sample, the results must be qualified or the problem must be fixed and the CCV and affected samples must be re-analyzed. Possible problems include standard mixture degradation, column contamination and active sites.

  If the subsequent calibration verification injection fails, a new initial calibration curve must be processed. (i.e., no more than two consecutive injections of the calibration verification may be processed.

- For SIM PAH analysis of samples run under the BP Lamp program, all target analytes must meet ± 20% D. See above for corrective actions

- For non DOD/BP SIM samples, the percent drift must be ± 20% for the CCC compounds. If CCC compounds are not included in the analyte list, then all target compounds must pass ± 20%

NOTE: Some analytes are included in both Tables 1 and 8. Those analytes that are in Table 1 will be controlled to ± 20% for projects reported under the DoD QSM and will be controlled to ± 55%D for commercial projects.

- The internal standard response of the CCV must be within 50 - 200% of the response in the same level of the corresponding calibration.

- If any internal standard retention time in the CCV changes by more than 30 seconds from that of the same level of the corresponding initial calibration, the chromatographic system must be inspected for malfunctions and corrections made, as required.

10.8.4 If the %D of any one CCC is greater than 20%, the system must be evaluated and corrective action must be taken before sample analysis begins. Possible problems include standard mixture degradation, injection port inlet contamination, column contamination and active sites. Recalibrate if necessary. The check must be met before sample analysis begins. If the subsequent calibration verification injection fails, a new initial calibration curve must be processed. (i.e., no more than two consecutive injections of the calibration verification may be processed.)

10.8.5 Once the above criteria have been met, sample analysis may begin. Initial calibration average RFs (or the calibration curve) will be used for sample quantitation, not the continuing calibration RFs. Analysis may proceed until 12

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hours from the injection of the DFTPP have passed. (A sample injected less than or equal to 12 hours after the DFTPP is acceptable.)

10.9 Sample Analysis

10.9.1 Calibrate the instrument as described in Section 10.2. Depending on the target compounds required by the client, it may be necessary to use more than one set of calibration standards.

10.9.2 All samples must be analyzed using the same instrument conditions as the preceding continuing calibration verification (CCV) standard.

10.9.3 Add internal standard to an aliquot of the extract to result in a 1000-µg/L concentration (for example, 10 µL of internal standard solution at 100 µg/mL in 1000 µL of extract). Mix thoroughly before injection into the instrument.

10.9.4 Inject the aliquot into the GC/MS system using the same injection technique as used for the standards.

10.9.5 The data system will determine the concentration of each analyte in the extract using calculations equivalent to those in Section 12. Quantitation is based on the initial calibration, not the continuing calibration verification.

10.9.6 Identified compounds are reviewed for proper integration. Manual integrations are performed if necessary and are documented by the analyst (see Corporate SOP CA-Q-S-002) or automatically by the data system. The minimum documentation required includes a hard copy of original data system peak integration and a similarly scaled hard copy showing the manual integration with analyst initials and date.

10.9.7 Target compounds identified by the data system are evaluated using the criteria listed in Section 11.1.

10.9.8 Library searches of peaks present in the chromatogram that are not target compounds, i.e., Tentatively Identified Compounds (TIC), may be performed if required by the client. They are evaluated using the criteria in Section 11.2.

10.10 Dilutions

If the response for any compound exceeds the working range of the GC/MS system, a dilution of the extract is prepared and analyzed. An appropriate dilution should be in the midrange of the calibration range. Samples may be screened to determine the appropriate dilution for the initial run. If the initial diluted run has no hits and the matrix allows for analysis at a lesser dilution, the sample may be reanalyzed at a lesser dilution.

10.10.1 Guidance for Dilutions Due to Matrix

If the sample is initially run at a dilution and the baseline rise is less than the height of the internal standards, or if individual non-target peaks are significantly less than two times the height of the internal standards, the sample may be reanalyzed at a more concentrated dilution. ***This requirement is approximate and subject to analyst judgment.*** For example, samples containing organic acids may need to be analyzed at a higher dilution to avoid destroying the column.

10.10.2 Reporting Dilutions

The most concentrated dilution with no target compounds above the calibration range will be reported. Other dilutions will be reported only at client request.

10.11 Perform all qualitative and quantitative measurements. When the extracts are not being used for analyses, refrigerate them at 0-6°C, protected from light in screw cap vials equipped with unpierced Teflon lined septa.

10.12 Retention Time Criteria for Samples

If the retention time for any internal standard changes by more than 0.5 minutes from the last continuing calibration standard, the chromatographic system must be inspected for malfunctions and corrected. Reanalysis of samples analyzed while the system was malfunctioning is required.

10.13 Percent Moisture

Analytical results may be reported as dry or wet weight, as required by the client. Percent moisture must be determined if results will be reported as dry weight. Refer to SOP TA-WC-0125 for determination of percent moisture.

10.14 Procedural Variations

One-time procedural variations are allowed only if deemed necessary in the professional judgment of supervision to accommodate variation in sample matrix, radioactivity, chemistry, sample size, or other parameters. Any variation in procedure shall be completely documented using an NCM. The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The QA department also receives NCMs by e-mail for tracking and trending purposes. The NCM process is described in more detail in SOP TA-QA-0610. The NCM shall be filed in the project file and addressed in the case narrative. Any unauthorized deviations from this procedure must also be documented as a nonconformance, with a cause and corrective action described.

10.15 Maintenance Guide for GC/MS systems

10.15.1 Routine Instrument Maintenance

In addition to the schedules listed in Appendix B, the following activities constitute routine maintenance procedures and are performed as necessary.

- Clip Column;
- Install new injection port liner;
- Install new septum;
- Install new gold seal and washer, or equivalent;

10.15.2 Injector port maintenance is performed whenever the following conditions exist:

- High column bleed
- Peak broadening and/or tailing for polar analytes such as phenols
- Loss of sensitivity
- Calibration failures due to a loss of response
- Retention time drift
- Long or training solvent tail
- Overall loss of instrument response

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10.15.2.1 Turn the GC oven off and let the system cool to room temperature. Remove the column nut and column from the injector body. Remove the injector nut, removing the septum and liner from the injector body. (See Illustration 6-10 in the instrument manual).

10.15.2.2 Clean the inside of the injector body with a cotton swab dipped in methanol. Follow with a wash of methanol, collecting the washings below at the column inlet port. Allow to air dry, and then replace the liner with a new or reconditioned liner that has been boiled in mineral acid, solvent rinsed, and muffled at 400°C. Replace the septum and tighten the nut just past finger tight.

10.15.2.3 Using a ceramic column cutter, remove at least 1 loop of the column end, depending on the severity of the system contamination. Place a column nut and new ferrule over the end of the column and re-cut one inch from the column end to ensure that no ferrule fragments remain in the column. Feed the column into the tapered liner until seated, then hold pressure on the column while the nut is tightened to one turn past finger tight. At this point, the GC oven is turned on and brought up to operating temperature. The system should then be leak checked.

10.15.3 Column installation is performed when the following conditions are encountered;

- Heavy column bleed that cannot be eliminated by thermal conditioning.
- Loss of early eluting peaks due to column cutting.
- Inability to chromatographically resolve method performance compound peaks (i.e. chrysene from benzo(a)anthracene).
- Distortion of peak shapes i.e.; broadening, ghost peaks, split peaks that can't be resolved by injection port maintenance or flow control.

10.15.3.1 Turn the GC oven off and let the system cool to room temperature. Remove the column nut, liner, septum, and presstight inlet connector. Dispose of old column appropriately.

10.15.3.2 Cut approximately six inches off of the end of new columns (DB5-MS 30m, 0.1u film thickness). Attach the column to the presstight inlet connector on the injector end and proceed as in 5.3.1.4 to connect to the injector.

10.15.3.3 Turn the GC on and set the injector temperature to 280°C, oven to 300°C and condition for five minutes.

10.15.3.4 Perform a leak check on the system following the instructions contained in the operator's manual chapter on **Miscellaneous Procedures of Operation**. When the air water spectrum shows acceptable levels, proceed with the mass calibration procedure. For additional information of column replacement see the operator's manual chapter on **Selected Routine GC Maintenance** (pages 6-33 to 6-41).

10.15.4 Major Maintenance

A new initial calibration is necessary following certain maintenance procedures. These maintenance procedures include changing the column, cleaning the ion volume or repeller, cleaning the source, replacing the multiplier, and replacing the "top board" or RF-related electronics. Refer to the manufacturer's manual for specific guidance.

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10.15.5 *Autotune the MS*

After major maintenance an autotune of the MS must be performed. Using an Agilent 5973 or 5975 MS, Select Autotune and run atune to tune the MS. When complete change the entrance lens to zero.

All maintenance and repairs need to be documented in the instrument's maintenance logbook. The logbook must include the instrument name, serial number for each major component (e.g., GC, autosampler) and the date of start-up. When an instrument is not capable of analyzing samples, it needs to be tagged "Out of Service". Logbook entries must include a description of the problem and what actions were taken to address the problem. After an instrument has undergone maintenance or repairs, the system is evaluated using a tune, CCV or ICAL. If the evaluation is successful, the analyst documents in the logbook that the "System returned to control as indicated by a passing CCV" (or ICAL, MB, tune, etc as may be the case).

10.16 Examples Analysis Sequence

Example 1	*Example 2*
PIBLK	*DFTPP*
DFTPP	CCV
STD IC 20 8270	*Method Blank or PIBLK*
STD IC 50 8270	Other QC & Samples (up to a 12 hr time limit)
STD IC 100 8270	
STD IC 200 8270	
STD IC 500 8270	
STD IC 1000 8270	
STD IC 2000 8270	
STD IC 5000 8270	
ICV	
QC and Samples (up to a 12 hour time limit)	

Instrumentation Corrective Actions

1. *If a DFTPP tune fails spectra replace vial with fresh tuning solution and reanalyze the tune sample*
    a. *If it fails a second time evaluate MS conditions*
    b. *Continued fails may result in re-auto tuning the instrument (10.15.5)*
2. *If tailing fails for either benzidine or PCP, minimum routine maintenance is required (see section 10.15.)*
    a. *Continued failure. Check column positioning into the source*
    b. *Replace column if all other options are exhausted*
3. *If DDT breakdown fails minimum routine maintenance is required*
    a. *Continued failure. Check column positioning into the source*
    b. *Replace column if all other options are exhausted*
4. *IF CCV fails for TC target analytes re-analyze a fresh CCV, if it fails a second time minimum routine maintence is required. If the 2nd CCV is acceptable the samples may be analyzed*
    a. *A second CCV failure requires additional instrument maintenance and generating a new ICAL*

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11.0 Calculations / Data Reduction

11.1 Qualitative Identification

An analyte is identified by retention time and by comparison of the sample mass spectrum with the mass spectrum of a standard of the suspected compound (standard reference spectrum). Mass spectra for standard reference may be obtained on the user's GC/MS by analysis of the calibration standards or from the NIST library. Two criteria must be satisfied to verify identification: (1) elution of sample component at the same GC retention time as the standard component; and (2) correspondence of the sample component and the standard component characteristic ions.

NOTE: Care must be taken to ensure that spectral distortion due to co-elution is evaluated.

11.1.1 The sample component retention time must compare to within ± 0.06 min. of the retention time of the standard component. For reference, the standard must be run within the same twelve hours as the sample.

11.1.2 All ions present in the standard mass spectra at a relative intensity greater than 10% (most abundant ion in the spectrum equals 100%) should be present in the sample spectrum.

11.1.3 The characteristic ions of a compound must maximize in the same scan or within one scan of each other.

11.1.4 The relative intensities of ions should agree to within ±30% between the standard and sample spectra. (Example: For an ion with an abundance of 50% in the standard spectra, the corresponding sample abundance must be between 20% and 80%).

11.1.5 If a compound cannot be verified by all the above criteria, but in the technical judgment of the analyst the identification is correct, the analyst shall report that identification and proceed with quantitation.

11.2 For samples containing components not associated with the calibration standards, a library search may be made for the purpose of tentative identification. The necessity to perform this type of identification will be determined by the type of analyses being conducted. Computer generated library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other. Only after visual comparison of sample spectra with the nearest library searches shall the mass spectral interpretation specialist assign a tentative identification. Following are guidelines for making tentative identification:

11.2.1 Relative intensities of major ions in the reference spectrum (ions >10% of the most abundant ion) should be present in the sample spectrum.

11.2.2 The relative intensities of the major ions should agree to within ±20%. (Example: For an ion with an abundance of 50% in the standard spectrum, the corresponding sample ion abundance should be between 30%and 70%.)

11.2.3 Molecular ions present in the reference spectrum should be present in the sample spectrum.

11.2.4 Ions present in the sample spectrum, but not in the reference spectrum, should be reviewed for possible background contamination or the presence of co-eluting compounds.

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11.2.5 Ions present in the reference spectrum, but not in the sample spectrum, should be reviewed for possible subtraction from the sample spectrum because of background contamination or co-eluting peaks. Data system library reduction programs can sometimes create these discrepancies.

11.2.6 Automatic background subtraction can severely distort spectra from samples with unresolved hydrocarbons.

11.3 Isomers with identical mass spectra and close elution times pose problems for definitive identification. The following compounds fall into this category:

Aniline and bis(2-chloroethyl) ether
Dichlorobenzenes
Methylnaphthalenes
Methylphenols
Trichlorophenols
Tetrachlorophenols
Phenanthrene, anthracene
Fluoranthene, pyrene
Benzo(b), (k), and (j)fluoranthene
Chrysene, benzo(a)anthracene

Identification of these compounds requires both experience and extra precautions on the part of the analyst. Specifically, the analyst must more closely scrutinize the comparison of retention times between the unknown and the calibration standard. The analyst must also check that all isomers have distinct retention times.

11.4 A second category of problem compounds consist of the poor responders or compounds that chromatograph poorly. The integrations for these types of compounds should be checked manually. The following compounds are included in this category:

Benzoic acid
Chloroanilines
Nitroanilines
2,4-Dinitrophenol
4-Nitrophenol
Pentachlorophenol
3,3'-Dichlorobenzidine
Benzyl alcohol
4,6-Dinitro-2-methylphenol
Benzidine

11.5 Calculating the Percent Relative Standard Deviation for Initial Calibration

$$\%RSD = \frac{SD}{RF} \times 100\%$$

Where:

RF = Mean of RFs from the initial calibration for a compound

SD = Standard deviation for the mean RF from the initial calibration for a compound

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$$SD = \sqrt{\frac{\sum_{i=1}^{n}\left(RF_i - \overline{RF}\right)^2}{n-1}}$$

RF_i = RF for each of the calibration levels
n = Number of RF values

11.6 Calculating the Continuing Calibration Percent Drift

$$\%Drift = \frac{C_{actual} - C_{found}}{C_{actual}} \times 100\%$$

Where:

C_{actual} = Known concentration in standard
C_{found} = Measured concentration using selected quantitation method

11.7 Calculating the Concentration in the Extract

The concentration of each identified analyte and surrogate in the extract is calculated from the linear or quadratic curve fitted to the initial calibration points, or from the average RF of the initial calibration.

11.7.1 Average Response Factor Calibration

If the average of all the RSDs of the response factors in the initial calibration is ≤15%, the average response factor from the initial calibration may be used for quantitation.

$$C_{ex} = \frac{R_x C_{is}}{R_{is}\overline{RF}}$$

Where:

C_{ex} = Concentration in the extract, µg/mL
R_x = Response for the analyte
R_{is} = Response for the internal standard
C_{is} = Concentration of the internal standard
$\overline{RF}$ = Average response factor

11.7.2 Linear Fit Calibration

$$C_{ex} = A + B\frac{\left(R_x C_{is}\right)}{R_{is}}$$

Where:

C_{ex} = Concentration in the extract, µg/mL
R_x = Response for the analyte
R_{is} = Response for the internal standard
C_{is} = Concentration of the internal standard
A = Intercept of linear calibration line
B = Slope of linear calibration line

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11.7.3 Quadratic Fit Calibration

$$C_{ex} = A + B\left(\frac{R_x C_{is}}{R_{is}}\right) + C\left(\frac{R_x C_{is}}{R_{is}}\right)$$

Where:

C_{ex}	=	Concentration in the extract, µg/mL
R_x	=	Response for the analyte
R_{is}	=	Response for the internal standard
C_{is}	=	Concentration of the internal standard
A	=	Intercept
B	=	Factor for the linear term of the quadratic calibration function
C	=	Factor for the curvature term of the quadratic calibration function

11.8 Calculating the Concentration in the Sample

11.8.1 Calculation for Aqueous Samples

$$\text{Concentration, } \mu\text{g / L} = \frac{C_{ex} V_t}{V_o}$$

Where:

C_{ex}	=	Concentration in the extract
V_t	=	Volume of total extract in µL, taking into account dilutions (i.e., a 1-to-10 dilution of a 1-mL extract will mean that V_t = 10,000 µL. If half of the base/neutral extract and half of the acid extract are combined, then V_t = 2,000.)
V_o	=	Volume of the sample that was extracted (mL)

11.8.2 Calculation for Sediment, Soil, Sludge, and Waste Samples

Results for sediments, sludges, and soils are usually calculated on a dry-weight basis, and for waste, on a wet-weight basis.

$$\text{Concentration, } \mu\text{g / kg} = \frac{C_{ex} V_t}{W_s D}$$

Where:

C_{ex}	=	Concentration in the extract
V_t	=	Volume of total extract in µL, taking into account dilutions (i.e., a 1-to-10 dilution of a 1-mL extract will mean that V_t = 10,000 µL. If half of the base/neutral extract and half of the acid extract are combined, then V_t = 2,000.)
W_s	=	Weight of sample extracted or diluted in grams
D	=	(100 - % moisture in sample)/100, for a dry-weight basis or 1 for a wet-weight basis

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11.9 MS/MSD Percent Recovery Calculation

$$\text{Matrix Spike Recovery} = \frac{S_{SR} - S_R}{S_A} \times 100\%$$

Where:

S_{SR}	=	Spike sample result
S_R	=	Sample result
S_A	=	Spike added

11.10 Calculating the Relative Percent Difference (RPD) MS/MSD Pair

$$RPD = \frac{MS_R - MSD_R}{1/2(MS_R + MSD_R)} \times 100$$

Where:

RPD	=	Relative percent difference
MS_R	=	Matrix spike result
MSD_R	=	Matrix spike duplicate result

11.11 Relative Response Factor Calculation

$$RF = \frac{A_x C_{is}}{A_{is} C_x}$$

Where:

A_x	=	Area of the characteristic ion for the compound being measured
A_{is}	=	Area of the characteristic ion for the specific internal standard
C_x	=	Concentration of the compound being measured (µg/L)
C_{is}	=	Concentration of the specific internal standard (µg/L)

11.12 Calculation of TICs

The calculation of TICs (tentatively identified compounds) is identical to the above calculation (11.11) with the following exceptions:

A_x	=	Area of the total ion chromatogram for the compound being measured
A_{is}	=	Area of the total ion chromatogram for the nearest internal standard without interference
RF	=	1

11.13 Calculating Percent DDT Breakdown

$$\%\ \text{DDT breakdown} = \frac{\text{DDEarea} + \text{DDDarea}}{\text{DDTarea} + \text{DDEarea} + \text{DDDarea}}$$

The areas for the 235 ion are used for this calculation.

11.14 Calculating the Peak Tailing Factor

$$TailingFactor = \frac{BC}{AB}$$

Where:

Peak width (AC) is measured at 10% peak height, and divided into two line segments at the peak centroid, so that .

AC = AB + BC, with

AB = left-hand segment

BC = right-hand segment

11.15 Upon completion of the analytical sequence:

11.15.1 Review chromatograms online and determine whether manual data manipulations are necessary.

11.15.2 All manual integrations must be justified and documented. See Corporate SOP CA-Q-S-002 for requirements for manual integration.

11.15.3 Manual integrations may be processed using an automated macro, which prints the before and after chromatograms and the reason for the change, and attaches the analyst's electronic signature.

11.15.4 Alternatively, the manual integration may be processed manually. In the latter case, print both the both the before and after chromatograms and record the reason for the change and initial and date the after chromatogram. Before and after chromatograms must be of sufficient scale to allow an independent reviewer to evaluate the manual integration.

11.15.5 Confirm that run logs have printed on them the instrument ID, the analyst and the method used. If this is not printed on the run logs, this must be entered by hand prior to completing the package.

11.16 Compile the raw data for all the samples and QC samples in a batch. The analytical batch is defined as containing no more than 20 samples, which include field samples and the MS and MSD.

11.16.1 Perform a level 1 data review and document the review on the data review checklist (GCMS Data Review Checklist).

11.16.2 Submit the data package and review checklist to the peer reviewer for the level 2 review. The data review process is explained in SOP TA-QA-0635.

12.0 Method Performance

12.1 Method Detection Limit Study (MDL)

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure (see SOP TA-QA-0602). MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method requirements require a greater frequency.

12.1.1 Instrumentation software must have each target limit set to the lowest MDL. CHROM (LOD)

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12.2 Demonstration of Capabilities

Analyst initial and continuing Demonstrations of Capability (DOC) are performed before any client samples are analyzed and are updated annually. See SOP TA-QA-0617 for details.

12.3 Training Requirements

See SOP TA-QA-0608 for detailed training requirements.

12.4 Non-standard Analytes

For non-standard analytes, an MDL study must be performed and calibration curve generated before analyzing any samples, unless lesser requirements are previously agreed to with the client. In any event, the minimum initial demonstration should include the analysis of an extracted standard at the reporting limit and a single point calibration.

13.0 Pollution Control

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention".

14.0 Waste Management

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to SOP TA-EHS-0036.

14.1 Waste Streams Produced by the Method

14.1.1 Acidic extracted sample and QC wastewater. After the extraction has been completed the spent water is neutralized and then collected into the organics extraction water conical reservoir. The collected wastewater is then purged with air to remove any remaining methylene chloride. The air-purged wastewater is then tested for methylene chloride. When the concentration levels are at or below local discharge limits, the wastewater can be discarded down the drain.

14.1.2 Methylene chloride waste. Any waste methylene chloride, i.e. KD rinses, syringe rinses, etc., from the extraction procedure is collected in beakers and then poured into a 4-liter amber bottle (appropriately labeled) located in the hood. After the extraction has been completed the $MeCl_2$ collected in the 4 L bottles is emptied into the $MeCl_2$ waste barrel located in the waste disposal room.

14.1.3 Vialed extract waste. Sample extracts that have been placed in vials for analysis are discarded into plastic waste buckets located underneath the bench top. Once the buckets are full the GC vials are discarded into the non-PCB GC vial waste barrel located in the waste room.

14.1.4 Extract waste. Unused sample extracts are held for at least 40 days, in case further testing is deemed necessary. After at least 40 days has passed these extracts are transported to the waste room in racks of 100 were they are disposed of by the sample waste technician.

15.0 References / Cross-References

15.1 SW846, Test Methods for Evaluating Solid Waste, Third Edition, Update III, December 1996, Semivolatile Organic Compounds by Gas Chromatography/Mass Spectrometry (GC/MS): Capillary Column Technique, Method 8270C.

15.2 Department of Defense Quality Systems Manual for Environmental Laboratories, prepared by DoD Environmental Quality Workgroup, Final Version 4.1, April 2009

15.3 40CFR, part 136, Appendix A, "Base/Neutrals and Acids", Method 625.

16.0 Method Modifications:

Item	Method	Modification
1	Include method references	A retention time window of 0.2 minutes is used for all components, since some data systems do not have the capability of using the relative retention time units specified in the reference method
2	8270C	The quantitation and qualifier ions for some compounds have been changed from those recommended in SW-846 in order to improve the reliability of qualitative identification
3	8000B/8270C	This procedure includes the option for weighted linear regression curves using 1/concentration^2 weighting factors. Section 7.5.2 of Method 8000B discusses the use of weighted least square regression based on 1/standard deviation^2 weighting factors, which would require multiple analyses of each standard to determine the standard deviation. IAETL has presented information to the EPA Office of Solid Waste demonstrating that the variance (standard deviation^2) is proportional to the standard concentration. EPA accepted this argument and issued a letter in July 1998, which authorizes the use of 1/concentration^2 weighting factors

17.0 Tables, Attachments, and Appendices

Table 1: Reporting Limits for Standard Analytes
Table 2: Reporting Limits for Non-Standard Analytes
Table 3: Suggested Instrument Conditions
Table 4: DFTPP Key Ions and Ion Abundance Criteria
Table 5: 8270C LCS Compounds
Table 6: TCLP LCS Spike Solution
Table 7: 8270C Surrogate Compounds
Table 8: Table of Poorly Performing Compounds
Table 9: Summary of QC Requirements

Attachment 1: Example Internal Standard Evaluation Custom Report
Attachment 2: Example Breakdown Evaluation Custom Report
Attachment 3: Example Tailing Evaluation Custom Report

APPENDIX A: Modifications Required for Analysis of Wastewater Following Method 625

Table A-1: Method 625 Standard Reporting List and Reporting Limits
Table A-2: Method 625 LCS and MS Compounds and Spike Concentrations

APPENDIX B: Instrument Maintenance Schedules - Mass Spectrometer & Gas Chromatograph

APPENDIX C DoD QC Limits

Table G-2: DoD Poor Performing Analytes
Table G-6: DoD LCS Control Limits for 8270 SVOC in Water
Table G-7: DoD LCS Control Limits for 8270 SVOC in Soil

18.0 Revision History

- Revision 16, dated 26 March 2010
  - Added documentation of standards/reagents and standard/reagent preparation, Section 7.1.
  - Added removal of expired standards, Section 7.11.
  - Updated tailing factor criteria, section 10.5.5
  - Addressed corrective action after a second CCV failure, Section 10.8.3
  - Added maintenance documentation and return to service requirements, end of section 10.15

- Revision 15, dated 22 July 2009
  - Updated Tables 1 and 2 to divide analytes into separate lists specifying standard analytes and nonstandard analytes.
  - Section 10.8.3 has been updated to define separate acceptance limits for the analytes listed in Tables 1 and 2.
  - Added surrogate corrective action requirements as per the BP LaMP in section 9.6.1.
  - Corrected minor typographical errors.

- Revision 14, dated 15 April 2009
  - Updated reporting limit range in Section 1.3
  - Removed the description of virgin for the polypropylene closures for scintillation vials in section 6.2.
  - Updated calibration solutions in section 7.1.
  - Updated spiking levels for the LCS in Tables 4, 5, and 6.
  - Updated example internal standard, breakdown, and tailing reports in Attachments 1 through 3.
  - Added Table 8: Summary of QC Requirements
  - Updated spiking concentrations for several analytes in Table A-2.
  - Corrected minor typographical errors.

- Revision 13, dated 29 March 2008
  - Integration for TestAmerica and STL operations.
  - This revision is a complete rewrite and an expansion of scope.
  - This SOP is the combination of SOPs 0313.12, 0340.5, and 0325.5.

Table 1. Reporting Limits for Standard Analytes

Compound	CAS Number	Reg. Soil RL (ug/kg)	LL Soil RL (ug/kg)	Reg. Water RL (ug/L)	LL Water RL (ug/L
1,2,4-Trichlorobenzene	120-82-1	50	5.0	2	0.2
1,2-Dichlorobenzene	95-50-1	50	5.0	2	0.2
1,2-Diphenylhydrazine as Azobenzene	103-33-3	100	10	5	0.5
1,3-Dichlorobenzene	541-73-1	50	5.0	2	0.2
1,4-Dichlorobenzene	106-46-7	50	5.0	2	0.2
2,4,5-Trichlorophenol	95-95-4	100	10	2	0.2
2,4,6-Trichlorophenol	88-06-2	150	15	3	0.3
2,4-Dichlorophenol	120-83-2	100	10	2	0.2
2,4-Dimethylphenol	105-67-9	100	10	10	1.0
2,4-Dinitrophenol	51-28-5	1000	100	25	2.5
2,4-Dinitrotoluene	121-14-2	100	10	2	0.2
2,6-Dinitrotoluene	606-20-2	100	10	2	0.2
2-Chloronaphthalene	91-58-7	20	2.0	0.3	0.03
2-Chlorophenol	95-57-8	100	10	2	0.2
2-Methylnaphthalene	91-57-6	20	2.0	1	0.1
2-Methylphenol	95-48-7	100	10	2	0.2
2-Nitroaniline	88-74-4	100	10	2	0.2
2-Nitrophenol	88-75-5	100	10	2	0.2
3- & 4-Methylphenol	15831-10-4	200	20	4	0.4
3,3'-Dichlorobenzidine	91-94-1	200	20	10	1.0
3-Nitroaniline	99-09-2	100	10	2	0.2
4,6-Dinitro-2-methylphenol	534-52-1	1000	100	20	2.0
4-Bromophenylphenylether	101-55-3	100	10	2	0.2
4-Chloro-3-methylphenol	59-50-7	100	10	2	0.2
4-Chloroaniline	106-47-8	100	10	2	0.2
4-Chlorophenylphenylether	7005-72-3	100	10	2	0.2
4-Nitroaniline	100-01-6	100	10	3	0.3
4-Nitrophenol	100-02-7	1000	100	10	1.0
Acenaphthene	83-32-9	20	2.0	0.5	0.05
Acenaphthylene	208-96-8	20	2.0	0.4	0.04
Anthracene	120-12-7	20	2.0	0.2	0.02
Benzo(a)anthracene	56-55-3	25	2.5	0.3	0.03
Benzo(a)pyrene	50-32-8	30	3.0	0.2	0.02
Benzo(b)fluoranthene	205-99-2	20	2.0	0.4	0.04

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Compound	CAS Number	Reg. Soil RL (ug/kg)	LL Soil RL (ug/kg)	Reg. Water RL (ug/L)	LL Water RL (ug/L
Benzo(k)fluoranthene	207-08-9	25	2.5	0.3	0.03
Benzo(g,h,i)perylene	191-24-2	25	2.5	0.3	0.03
Benzoic Acid	65-85-0	2500	250	10	1.0
Benzyl Alcohol	100-51-6	100	10	2	0.2
bis(2-Chloroethoxy)methane	111-91-1	100	10	2	0.2
bis(2-Chloroethyl)ether	111-44-4	100	10	2	0.2
bis(2-Chloroisopropyl)ether (2,2'-oxybis(1-chloropropane)	108-60-1	150	15	2	0.2
bis(2-Ethylhexyl)phthalate	117-81-7	1500	150	15	1.5
Butylbenzylphthalate	85-68-7	100	10	3	0.3
Carbazole	86-74-8	150	15	2	0.2
Chrysene	218-01-9	25	2.5	0.2	0.02
Dibenz(a,h)anthracene	53-70-3	40	4.0	0.3	0.03
Dibenzofuran	132-64-9	100	10	2	0.2
Diethylphthalate	84-66-2	100	10	2	0.2
Dimethylphthalate	131-11-3	100	10	2	0.2
Di-n-butylphthalate	84-74-2	200	20	2	0.2
Di-n-octylphthalate	117-84-0	200	20	2	0.2
Fluoranthene	206-44-0	20	2.0	0.25	0.025
Fluorene	86-73-7	20	2.0	0.3	0.03
Hexachlorobenzene	118-74-1	50	5.0	2	0.2
Hexachlorobutadiene	87-68-3	50	5.0	3	0.3
Hexachloroethane	67-72-1	100	10	3	0.3
Indeno(1,2,3-cd)pyrene	193-39-5	40	4.0	0.3	0.03
Isophorone	78-59-1	100	10	2	0.2
Naphthalene	91-20-3	20	2.0	2	0.2
Nitrobenzene	98-95-3	100	10	2	0.2
N-nitrosodimethylamine	62-75-9	1500	150	10	1.0
N-nitroso-di-n-propylamine	621-64-7	100	10	2	0.2
N-Nitrosodiphenylamine	86-30-6	50	5.0	2	0.2
Pentachlorophenol	87-86-5	100	10	3.5	0.35
Phenanthrene	85-01-8	20	2.0	0.4	0.04
Pyrene	129-00-0	20	2.0	0.3	0.03

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Table 2. Reporting Limits for Non-Standard Analytes

Compound	CAS Number	Reg. Soil RL (ug/kg)	LL Soil RL (ug/kg)	Reg. Water RL (ug/L)	LL Water RL (ug/L
1-Methylnaphthalene	90-12-0	30	3.0	0.3	0.03
2,3,4,6-Tetrachlorophenol	58-90-2	100	10	3.5	0.35
2,3,5,6-Tetrachlorophenol	935-95-5	100	10	2	0.2
2,3-Dichloroaniline	608-27-5	300	30	10	1.0
Aniline	62-53-3	100	10	3	0.3
Benzidine	92-87-5	1000	100	15	1.5
Benzofluoranthenes	56832-73-6	40	4.0	0.4	0.04
Decane	124-18-5	400	40	3	0.3
Hexachlorocyclopentadiene	77-47-4	100	10	10	1.0
Octadecane	593-45-3	450	45	2	0.2
Phenol	108-95-2	100	10	3	0.3
Pyridine	110-86-1	1000	100	10	1.0

Table 3. Suggested Instrument Conditions

Mass Range:	35 - 500 amu
Scan Time:	≤ 1 second/scan
Initial Column Temperature/Hold Time:	55 °C for 1 minute
Column Temperature Program:	30 °C /min to 300 °C hold for 1.00 min 30 °C /min to 320 °C hold for 4.00 min
Final Column Temperature/Hold Time:	325 °C (until at least one minute after benzo(g,h,i)perylene has eluted)
Injector Temperature:	280 °C
Transfer Line Temperature:	280 °C
Source Temperature:	According to manufacturer's specifications
Injector:	Pulsed splitless
Sample Volume:	1.0 µl
Carrier Gas:	Helium or hydrogen at 1.4 mL/min.

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Table 4. DFTPP Key Ions and Ion Abundance Criteria

Mass	Ion Abundance Criteria
51	10 - 80% of base peak
68	<2% of mass 69
69	Present
70	<2% of mass 69
127	10 - 80% of base peak
197	<2% of mass 198
198	Base peak or >50% of mass 442
199	5 - 9% of mass 198
275	10 - 60% of base Peak
365	>1% of base Peak
441	Present and < mass 443
442	Base peak or >50% of mass 198
443	15 - 24% of mass 442

Table 5. 8270C LCS Compounds

LCS Compounds	Spiking Level, µg/mL in standard
1,2,4-Trichlorobenzene	100
Acenaphthene	100
2,4-Dinitrotoluene	100
Pyrene	100
N-Nitroso-di-n-propylamine	100
1,4-Dichlorobenzene	100
Pentachlorophenol	100
Phenol	100
2-Chlorophenol	100
4-Chloro-3-methylphenol	100
4-Nitrophenol	100

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Table 6. TCLP LCS Spike Solution

LCS Compounds	Spiking Level, µg/mL in standard
1,4-Dichlorobenzene	100
2,4-Dinitrotoluene	100
Hexachlorobenzene	100
Hexachlorobutadiene	100
Hexachloroethane	100
2-Methylphenol	100
3/4-Methylphenol	100
Nitrobenzene	100
Pentachlorophenol	100
Pyridine	500
2,4,5-Trichlorophenol	100
2,4,6-Trichlorophenol	100

Recovery limits for the LCS and for matrix spikes are generated from historical data and are maintained in the LIMS.

Table 7. 8270C Surrogate Compounds

Surrogate Compounds	Spiking Level, µg/mL in standard
Nitrobenzene-d5	100
2-Fluorobiphenyl	100
Terphenyl-d14	100
Phenol-d5	100
2-Fluorophenol	100
2,4,6-Tribromophenol	100

1. Included in standard mix, but not routinely evaluated for method 8270C
Recovery limits for surrogates are generated from historical data and are maintained in the LIMS.

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Table 8. Table of Poor Performing Compounds*

2,3,4,6-Tetrachlorophenol	4-Nitrophenol
2,3,5,6-Tetrachlorophenol	Aniline
2,4-Dinitrophenol	Benzidine
3-Nitroaniline	**Benzoic Acid**
3,3' Dichlorobenzidine	**Carbazole**
4-Chloroaniline	**N-Nitrosodimethylamine**
4-Nitroaniline	

* - This is not a comprehensive list and is subject to change. Each project's target list should be evaluated for poor performers.

Analytes that are in bold are also represented in Table 1 Reporting Limits for Standard Analytes.

Table 9. Summary of QC Requirements

QC Parameter	Frequency	Acceptance Criteria	Corrective Action
DFTPP Tune	Prior to ICAL and at the beginning of each 12-hour period.	See Section 10.5	Retune instrument and verify. Rerun affected samples.
Breakdown Check	At the beginning of each 12-hour period and prior to analyzing samples.	Degradation ≤ 20% for DDT. Benzidine tailing < 3.0 and PCP tailing < 5.0. **For DoD:** Benzidine and PCP should be present at their normal responses, and should not exceed a tailing factor of 2.	Correct problem then repeat breakdown check. No samples can be run until degradation is acceptable.
Minimum 5-point Initial Calibration	Initial calibration prior to sample analysis	1. Average Response Factor for SPCCs: ≥ 0.050 2. RSD for RFs for CCCs: ≤ 30% and one option below: Option 1: RSD for each analyte ≤ 15% Option 2: Linear regression r ≥ 0.990 **Option 2 for DOD:** Linear regression r ≥ 0.995. Option 3: Non linear regression r^2 ≥ 0.990 and 6 points must be used.	Terminate analysis; correct the problem; recalibrate. Problem must be corrected. No samples may be run until ICAL has passed.
ICV	Following initial calibration.	80-120% recovery of all CCC analytes under method 625; 65-135% for non-DoD projects (e.g., 8270C HSL components); and 45-155% for poor performers **For DoD:** 80 - 120% recovery	Terminate analysis; correct the problem; recalibrate.
Relative Retention Times (RRT)	With each sample	RRT of each target analyte within ± 0.06 RRT units.	Correct problem, then rerun ICAL. Laboratory may update

QC Parameter	Frequency	Acceptance Criteria	Corrective Action
			RTs based on the CCV to account for minor performance fluctuations or after routine system maintenance (e.g. column clipping).
CCV	Daily before sample analysis and every 12 hours of analysis time.	1. Avg RF for SPCCs: ≥ 0.050; 2. %D/Drift for CCCs ≤ 20%D and one option below: Option 1: 80-120% recovery of all CCC analytes under method 625; Option 2: 65-135% for non-DoD projects (e.g., 8270C HSL components); Option 3: 45-155% for poor performers **For DoD:** 1. Avg RF for SPCCs: ≥ 0.050; 2. %D/Drift for all target compounds and surrogates ≤ 20%D.	Correct problem, then rerun CCV. If that fails, then repeat ICAL. Reanalyze all sample since the last successful CCV.
Internal Standards (IS) verification	Every field sample, standard, and QC sample	Retention time ± 30 seconds from RT of the midpoint standard in ICAL; EICP area within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples while system was malfunctioning is mandatory.
Method Blank	One per batch of 20 field samples or fewer.	The result must be < RL or < 1/10 the amount measured in any sample or 1/10 the regulatory limit. **For DoD:** No analytes detected > ½ RL and > 1/10 the amount measured in any sample or 1/10 the regulatory limit. For common laboratory contaminants no	Re-extract and reanalyze samples. Note exceptions under criteria section. See Section 9.3 for additional requirements.

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QC Parameter	Frequency	Acceptance Criteria	Corrective Action
		analytes detected > RL.	
LCS	One per batch of 20 field samples or fewer.	Must be within laboratory control limits. **For DoD:** Must contain all analytes to be reported. Must be within acceptance criteria specified by DOD, if available. Otherwise, use in-house control limits.	See Section 9.4 for additional requirements.
Surrogate	All field and QC samples.	Must be within laboratory control limits, however, 1 acid or 1 base/neutral surrogate may fail before requiring corrective action. **For DoD:** Must be within acceptance criteria specified by DOD, if available. Otherwise, use in-house control limits.	See Section 9.6 for additional requirements.
Matrix Spike/Laboratory Fortified Matrix	One per lot of 20 field samples or fewer.	Must be within laboratory control limits. **For DoD:** Must contain all analytes to be reported. Must be within acceptance criteria specified by DOD, if available. Otherwise, use in-house control limits.	See Section 9.5 for additional requirements.

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Attachment 1. Example Internal Standard Evaluation Custom Report

FORM VIII
GC/MS SEMI VOA INTERNAL STANDARD AREA AND RETENTION TIME SUMMARY

Lab Name: TestAmerica Tacoma Job No.: 580-12197-1

SDG No.:

Sample No.: CCVIS 580-39026/2 Date Analyzed: 12/10/2008 13:19

Instrument ID: TAC040 GC Column: ZB-5MS ID: 0.25(mm)

Lab File ID (Standard): ak018739.D Heated Purge: (Y/N) N

		DCB		NPT		ACN	
		AREA #	RT #	AREA #	RT #	AREA #	RT #
12 HOUR STD		11172	3.20	17716	4.18	11176	5.59
UPPER LIMIT							
LOWER LIMIT							
LAB SAMPLE ID	CLIENT SAMPLE ID						
MB 580-38946/1-A		7654	3.20	18328	4.18	11486	5.59
LCS 580-38946/2-A		8484	3.20	19108	4.18	11938	5.59
580-12197-3	08FTW336B-32	7980	3.20	19016	4.18	11411	5.59
580-12197-3 MS	08FTW336B-32 MS	7765	3.20	17983	4.18	11310	5.59
580-12197-3 MSD	08FTW336B-32 MSD	7232	3.20	18301	4.18	11655	5.59

DCB = 1,4-Dichlorobenzene-d4
NPT = Naphthalene-d8
ACN = Acenaphthene-d10

Area Upper Limit = 200% of Internal Standard Area
Area Lower Limit = 50% of Internal Standard Area

Column used to flag values outside QC limits

FORM VIII 8270C

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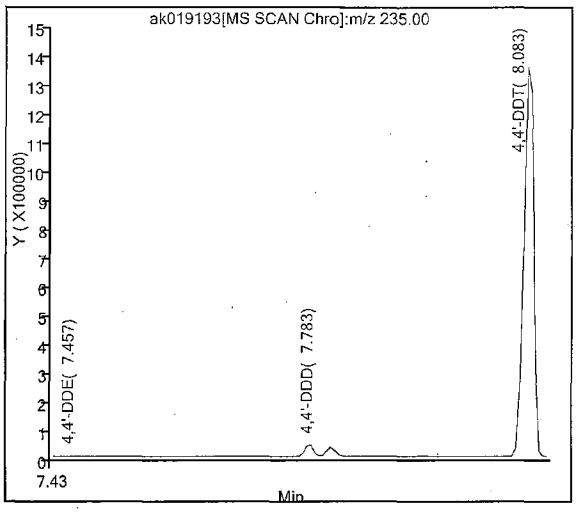
Attachment 2. Example Breakdown Evaluation Custom Reports

Report Date: 01-Apr-2009 15:08:23 Chrom Revision: 1.0.2009.312

Preliminary Report
Breakdown Report

Data File:	\\TACSVR5\Chromdata\TAC040\20090401-1.b\ak019193.D		
Inj Date:	01-Apr-2009 07:56:30	Limit Group:	8270C Standard
Lims Batch ID:	42046	Lims Sample ID:	1
Client ID:		Instrument:	TAC040
Sample Info:	dftpp		
Sample Amount:	1.00 uL	Operator:	RBF

93 4,4'-DDT, Detector: MS SCAN



SW-846 Method

%Breakdown =
(Area Breakdown Cpnds/
Total Area Breakdown Cpnds) * 100

93 4,4'-DDT Area = 1276732
89 4,4'-DDE Area = 2208
91 4,4'-DDD Area = 33705

%Breakdown: 2.74%, Max Limit: 20.00%
Passed

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Attachment 3. Example Tailing Evaluation Custom Reports

Report Date: 01-Apr-2009 15:09:32 Chrom Revision: 1.0.2009.312

Preliminary Report
Peak Tailing Report

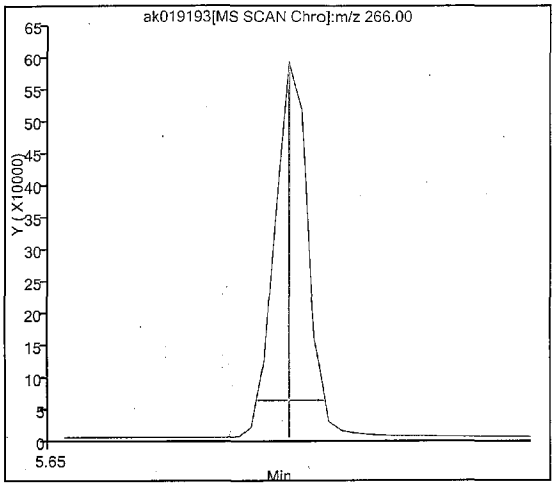
Data File:	\\TACSVR5\Chromdata\TAC040\20090401-1.b\ak019193.D		
Inj Date:	01-Apr-2009 07:56:30	Limit Group:	8270C Standard
Lims Batch ID:	42046	Lims Sample ID:	1
Client ID:		Instrument:	TAC040
Sample Info:	dftpp		
Sample Amount:	1.00 uL	Operator:	RBF

60 Pentachlorophenol_T, Detector: MS SCAN

Peak Tailing Factor =
BackWidth/FrontWidth @ 10% Peak Height

Back Width = 0.015 (min.)
Front Width = 0.014 (min.)

Tailing Factor = 1.1, Max. Tailing < 5.00
Passed

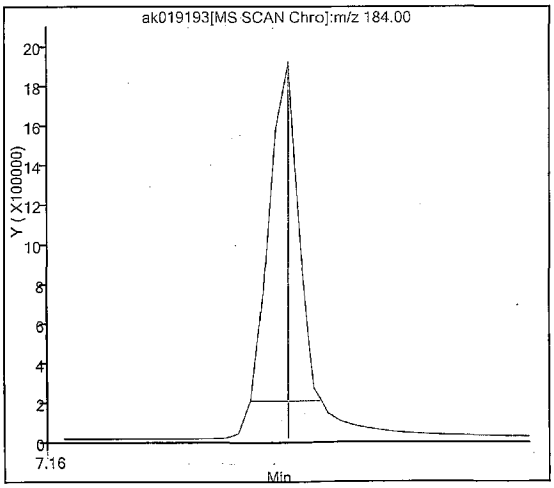


85 Benzidine_T, Detector: MS SCAN

Peak Tailing Factor =
BackWidth/FrontWidth @ 10% Peak Height

Back Width = 0.013 (min.)
Front Width = 0.016 (min.)

Tailing Factor = 0.8, Max. Tailing < 3.00
Passed



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APPENDIX A

Modifications Required for Analysis of Wastewater Following Method 625

REQUIREMENTS FOR METHOD 625

- *Method 625 is required for demonstration of compliance with NPDES wastewater discharge permits or other CWA compliance situations. The standard analyte list and reporting limits are listed in Table A-1.*
- *This method can be applied to only aqueous matrices.*
- *The tune period for this method is defined as 12 hours.*
- *<u>Initial calibration</u> curve requirements are as follows:*
  - The initial calibration curve for this method requires at least three points.
  - Target compounds must have RSD ≤ 35%.
  - If this requirement cannot be met, a regression curve must be constructed for the non-compliant compounds.
- *<u>Continuing calibration verification</u> requirements are as follows:*
  - All target compounds must have %D ≤ 20%.
- *Matrix Spike and LCS requirements are as follows:*
- A full analyte spike is required for method 625. The spiking levels are given in Table A-2.

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Table A-1. Method 625 Standard Reporting List and Reporting Limits

Analytes	CAS Number	Aqueous, µg/L
Phenol	108-95-2	3
Bis(2-chloroethyl)ether	111-44-4	2
2-Chlorophenol	95-57-8	2
1,3-Dichlorobenzene	541-73-1	2
1,4-Dichlorobenzene	106-46-7	2
1,2-Dichlorobenzene	95-50-1	2
2,2'-oxybis(1-chloropropane)	108-60-1	2
N-Nitroso-di-n-propylamine	621-64-7	2
Hexachloroethane	67-72-1	3
Nitrobenzene	98-95-3	2
Isophorone	78-59-1	2
2-Nitrophenol	88-75-5	2
2,4-Dimethylphenol	105-67-9	10
Bis(2-chloroethoxy)methane	111-91-1	2
2,4-Dichlorophenol	120-83-2	2
1,2,4-Trichlorobenzene	120-82-1	2
Naphthalene	91-20-3	2
Hexachlorobutadiene	87-68-3	3
4-Chloro-3-methylphenol	59-50-7	2
Hexachlorocyclopentadiene	77-47-4	10
2,4,6-Trichlorophenol	88-06-2	3
2-Chloronaphthalene	91-58-7	0.3
Dimethyl phthalate	131-11-3	2
Acenaphthylene	208-96-8	0.4
Acenaphthene	83-32-9	0.5
2,4-Dinitrophenol	51-28-5	25
4-Nitrophenol	100-02-7	10
2,4-Dinitrotoluene	121-14-2	2
2,6-Dinitrotoluene	606-20-2	2
Diethylphthalate	84-66-2	2
4-Chlorophenyl phenyl ether	7005-72-3	2
Fluorene	86-73-7	0.3
4,6-Dinitro-2-methylphenol	534-52-1	20
N-Nitrosodiphenylamine	86-30-6	2
4-Bromophenyl phenyl ether	101-55-3	2
Hexachlorobenzene	118-74-1	2
Pentachlorophenol	87-86-5	3.5

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Table A-1. Method 625 Standard Reporting List and Reporting Limits (continued)

Analytes	CAS Number	Aqueous, µg/L
Phenanthrene	85-01-8	0.4
Anthracene	120-12-7	0.2
Di-n-butyl phthalate	84-74-2	2
Fluoranthene	206-44-0	0.25
Benzidine	92-87-5	15
Pyrene	129-00-0	0.3
Butyl benzyl phthalate	85-68-7	3
3,3'-Dichlorobenzidine	91-94-1	10
Benzo(a)anthracene	56-55-3	0.3
Bis(2-ethylhexyl)phthalate	117-81-7	15
Chrysene	218-01-9	0.2
Di-n-octylphthalate	117-84-0	2
2,4,5 Trichlorophenol	95-95-4	2
2-Methylphenol	95-48-7	2
Benzo(a)pyrene	50-32-8	0.2
Benzofluoranthene	56832-73-6	0.4
Indeno(1,2,3-cd)pyrene	193-39-5	0.3
Dibenz(a,h)anthracene	53-70-3	0.3
Benzo(g,h,i)perylene	191-24-2	0.3
N-Nitrosodimethylamine	62-75-9	10
Carbazole	86-74-8	2
n-Decane	124-18-5	3
Dibenzofuran	132-64-9	2
Octadecane	593-45-3	2

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Table A-2. Method 625 LCS and MS Compounds and Spike Concentrations

LCS Compounds	Spiking Level, ng/µL in extract[1]
Phenol	100
Bis(2-chloroethyl)ether	100
2-Chlorophenol	100
1,3-Dichlorobenzene	100
1,4-Dichlorobenzene	100
1,2-Dichlorobenzene	100
2,2'-oxybis(1-chloropropane)	100
N-Nitroso-di-n-propylamine	100
Hexachloroethane	100
Nitrobenzene	100
Isophorone	100
2-Nitrophenol	100
2,4-Dimethylphenol	100
Bis(2-chloroethoxy)methane	100
2,4-Dichlorophenol	100
1,2,4-Trichlorobenzene	100
Naphthalene	100
Hexachlorobutadiene	100
4-Chloro-3-methylphenol	100
Hexachlorocyclopentadiene	100
2,4,6-Trichlorophenol	100
2-Chloronaphthalene	100
Dimethyl phthalate	100
Acenaphthylene	100
Acenaphthene	100
2,4-Dinitrophenol	500
4-Nitrophenol	500
2,4-Dinitrotoluene	100
2,6-Dinitrotoluene	100
Diethylphthalate	100
4-Chlorophenyl phenyl ether	100
Fluorene	100
4,6-Dinitro-2-methylphenol	500
N-Nitrosodiphenylamine	100
4-Bromophenyl phenyl ether	100
Hexachlorobenzene	100
Pentachlorophenol	100

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Table A-2. Method 625 LCS and MS Compounds and Spike Concentrations **(continued)**

LCS Compounds	Spiking Level, ng/µL in extract[1]
Phenanthrene	100
Anthracene	100
Di-n-butyl phthalate	100
Fluoranthene	100
Benzidine	200
Pyrene	100
Butyl benzyl phthalate	100
3,3'-Dichlorobenzidine	200
Benzo(a)anthracene	100
Bis(2-ethylhexyl)phthalate	100
Chrysene	100
Di-n-octylphthalate	100
Benzo(b)fluoranthene	100
Benzo(k)fluoranthene	100
Benzo(a)pyrene	100
Indeno(1,2,3-cd)pyrene	100
Dibenz(a,h)anthracene	100
Benzo(g,h,i)perylene	100
N-Nitrosodimethylamine	500

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APPENDIX B

Instrument Maintenance Schedules - Mass Spectrometer & Gas Chromatograph

MASS SPECTROMETER Instrument Maintenance Schedule				
Daily	*Weekly*	*As Needed*	*Quarterly*	*Annually*
Check for sufficient gas supply. Check for correct column flow and/or inlet pressure	***Check mass calibration (PFTBA or FC-43).***	***Check level of oil in mechanical pumps and diffusion pump if vacuum is insufficient. Add oil if needed between service contract maintenance.***	***Check vacuum, relays, gas pressures, and flows.***	***Replace the exhaust filters on the mechanical rough pump every 1 to 2 years.***
Check temperatures of injector, detector. Verify temperature programs.		***Replace electron multiplier when the tuning voltage approaches the maximum and/or when sensitivity falls below required levels.***		***Change the oil in the mechanical rough pump.***
Check inlets, septa.		***Clean source, including all ceramics and lenses. Source cleaning is indicated by a variety of symptoms, including inability of the analyst to tune the instrument to specifications, poor response, and high background contamination.***		***Relubricate the turbomolecular pump-bearing wick.***
Check baseline level.		***Repair/replace jet separator.***		
Check values of lens voltages, electron multiplier, and relative abundance and mass assignments of the calibration compounds.		***Replace filaments when both filaments burn out or performance indicates the need for replacement.***		

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APPENDIX B (continued)

Instrument Maintenance Schedules - Mass Spectrometer & Gas Chromatograph

*GAS CHROMATOGRAPH Instrument Maintenance Schedule (*For GC/MS only.*)*	
Daily	*As Needed*
Check for sufficient supply of carrier and detector gases. Check for correct column flow and/or inlet pressures.	***Replace front portion of column packing or guard column or break off front portion of capillary columns. Replace column if this fails to restore column performance or when column performance indicates it is required (e.g., peak tailing, poor resolution, high backgrounds, etc.).***
Check temperatures of injectors and detectors. Verify temperature programs.	***Change glass wool plug in injection port and/or replace injection port liner when front portion of column packing is changed or front portion of capillary column is removed.***
Check inlets, septa. ***Clean injector port.***	***Replace septa.***
Check baseline level.	***Perform gas purity check (if high baseline indicates that impure carrier gas may be in use).***
Inspect chromatogram to verify symmetrical peak shape and adequate resolution between closely eluting peaks.	***Repair or replace flow controller if constant gas flow cannot be maintained.***
	Reactivate flow controller filter dryers when the presence of moisture is suspected.
	Autosampler: Replace syringe, fill wash bottle, dispose of waste bottle contents.

APPENDIX C

Table G-2. DOD Poor Performing Analytes

Analyte	Mean/ Median	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
8270 Water						
4-Nitrophenol	54	23	0	125	0	145
Benzoic acid	54	24	0	125	0	150
Phenol	55	19	0	115	0	135
Phenol-d5/d6 (surrogate)	62	18	10	115	0	135
8270 Solid						
3,3'-Dichlorobenzidine	68	19	10	130	0	145
4-Chloroaniline	51	14	10	100	0	110
Benzoic acid	55	18	0	110	0	130

Table G-6. LCS Control Limits for Semivolatile Organic Compounds SW-846 Method 8270 Water Matrix[5]

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Polynuclear Aromatics						
2-Methylnaphthalene	75.0	9.5	45	105	35	115
Acenaphthene	77.6	10.1	45	110	35	120
Acenaphthylene	78.5	9.4	50	105	40	115
Anthracene	83.0	9.7	55	110	45	120
Benzo(a)anthracene	82.7	8.9	55	110	45	120
Benzo(a)pyrene	81.3	9.5	55	110	45	120
Benzo(b)fluoranthene	81.8	12.1	45	120	35	130
Benzo(k)fluoranthene	84.6	13.2	45	125	30	135
Benzo(g,h,i)perylene	80.5	14.1	40	125	25	135
Chrysene	82.1	8.9	55	110	45	120
Dibenz(a,h)anthracene	84.7	14.1	40	125	30	140
Fluoranthene	85.2	10.4	55	115	45	125
Fluorene	80.6	10.3	50	110	40	120
Indeno(1,2,3-cd)pyrene	84.3	13.6	45	125	30	140
Naphthalene	70.8	10.5	40	100	30	115

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Phenanthrene	84.0	11.0	50	115	40	130
Pyrene	88.6	13.2	50	130	35	140
Phenolic/Acidic						
2,4,5-Trichlorophenol	79.7	10.3	50	110	40	120
2,4,6-Trichlorophenol	80.7	10.7	50	115	40	125
2,4-Dichlorophenol	76.3	9.6	50	105	40	115
2,4-Dimethylphenol	68.8	13.5	30	110	15	125
2,4-Dinitrophenol	75.8	20.6	15	140	10	160
2-Chlorophenol	71.3	11.4	35	105	25	115
2-Methylphenol	73.3	11.7	40	110	25	120
2-Nitrophenol	75.8	12.4	40	115	25	125
3-Methylphenol/4-Methylphenol	71.3	13.0	30	110	20	125
4,6-Dinitro-2-methylphenol	84.9	15.0	40	130	25	145
4-Chloro-3-methylphenol	78.6	10.7	45	110	35	120
Pentachlorophenol	77.6	13.3	40	115	25	130
Basic						
3,3'-Dichlorobenzidine	65.2	15.3	20	110	10	125
4-Chloroaniline	62.2	15.6	15	110	10	125
Phthalate Esters						
Bis(2-ethylhexyl)phthalate	84.2	14.0	40	125	30	140
Butyl benzyl phthalate	81.1	11.7	45	115	35	130
Di-n-butyl phthalate	84.8	10.3	55	115	45	125
Di-n-octyl phthalate	87.4	16.6	35	135	20	155
Diethyl phthalate	79.2	12.9	40	120	30	130
Dimethyl phthalate	75.9	16.9	25	125	10	145
Nitrosamines						
n-Nitrosodi-n-propylamine	80.9	15.7	35	130	20	145
n-Nitrosodimethylamine	67.9	14.1	25	110	10	125
n-Nitrosodiphenylamine	79.6	10.6	50	110	35	120
Chlorinated Aliphatics						
Bis(2-chloroethoxy)methane	76.2	10.2	45	105	35	115
Bis(2-chloroethyl)ether	73.3	12.3	35	110	25	120
Bis(2-chlroisopropyl)ether	78.2	17.5	25	130	10	150

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Hexachlorobutadiene	65.2	12.6	25	105	15	115
Hexachloroethane	60.9	11.1	30	100	15	105
Halogenated Aromatics						
1,2,4-Trichlorobenzene	71.7	11.6	35	105	25	120
1,2-Dichlorobenzene	67.3	11.4	35	100	20	115
1,3-Dichlorobenzene	64.8	10.9	30	100	20	110
1,4-Dichlorobenzene	64.8	10.9	30	100	20	110
2-Chloronaphthalene	76.5	9.3	50	105	40	115
4-Bromophenyl phenyl ether	82.9	10.2	50	115	40	125
4-Chlorophenyl phenyl ether	80.6	10.3	50	110	40	120
Hexachlorobenzene	82.3	10.0	50	110	40	120
Nitroaromatics						
2,4-Dinitrotoluene	84.3	11.2	50	120	40	130
2,6-Dinitrotoluene	82.7	11.3	50	115	35	130
2-Nitroaniline	81.8	11.2	50	115	35	125
3-Nitroaniline	72.6	17.7	20	125	10	145
4-Nitroaniline	77.2	13.7	35	120	20	130
Nitrobenzene	76.8	10.8	45	110	35	120
Neutral Aromatics						
Carbazole	82.5	11.4	50	115	35	130
Dibenzofuran	80.3	8.8	55	105	45	115
Others						
1,2-Diphylhydrazine	84.8	9.4	55	115	45	120
Benzyl alcohol	71.0	13.8	30	110	15	125
Isophorone	81.0	10.5	50	110	40	125

[5]A number of sporadic marginal exceedances of the control limits is allowed depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits. LCS control limits are not available for Benzidine, 2,6-Dichlorophenol, and N-nitrosopyrrolidine. Sufficient data to perform statistically significant analyses were not received for those analytes during the LCS study. Additional limits for poor performing compounds can be found in section G.5.

Table G-7. LCS Control Limits for Semivolatile Organic Compounds SW-846 Method 8270 Solid Matrix[6]

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Polynuclear Aromatics						
2-Methylnaphthalene	77.3	10.0	45	105	35	115
Acenaphthene	77.3	10.3	45	110	35	120
Acenaphthylene	75.7	10.4	45	105	35	115
Anthracene	79.9	9.0	55	105	45	115
Benzo(a)anthracene	81.6	9.8	50	110	40	120
Benzo(a)pyrene	80.7	10.3	50	110	40	120
Benzo(b)fluoranthene	79.7	11.4	45	115	35	125
Benzo(k)fluoranthene	83.8	12.9	45	125	30	135
Benzo(g,h,i)perylene	81.8	14.7	40	125	25	140
Chrysene	82.6	9.9	55	110	45	120
Dibenz(a,h)anthracene	82.9	13.9	40	125	25	140
Fluoranthene	83.9	10.1	55	115	45	125
Fluorene	78.3	9.8	50	110	40	115
Indeno(1,2,3-cd)pyrene	79.7	13.8	40	120	25	135
Naphthalene	73.4	11.1	40	105	30	120
Phenanthrene	80.1	10.0	50	110	40	120
Pyrene	84.4	12.8	45	125	35	135
Phenolic/Acidic						
2,4,5-Trichlorophenol	80.1	10.4	50	110	40	120
2,4,6-Trichlorophenol	76.3	11.0	45	110	30	120
2,4-Dichlorophenol	77.2	10.9	45	110	35	120
2,4-Dimethylphenol	67.3	11.9	30	105	20	115
2,4-Dinitrophenol	72.6	20.0	15	130	10	150
2-Chlorophenol	74.7	10.3	45	105	35	115
2-Methylphenol	71.7	10.6	40	105	30	115
2-Nitrophenol	76.2	11.5	40	110	30	120
3-Methylphenol/4-Methylphenol	73.9	10.9	40	105	30	120
4,6-Dinitro-2-methylphenol	83.1	18.0	30	135	10	155
4-Chloro-3-methylphenol	79.5	11.1	45	115	35	125
4-Nitrophenol	77.0	20.2	15	140	10	160
Pentachlorophenol	71.9	15.6	25	120	10	135

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Phenol	69.7	10.2	40	100	30	110
Phthalate Esters						
Bis(2-ethylhexyl)phthalate	87.4	13.3	45	125	35	140
Butyl benzyl phthalate	86.4	12.3	50	125	35	135
Di-n-butyl phthalate	83.2	9.1	55	110	45	120
Di-n-octyl phthalate	86.4	15.2	40	130	25	145
Diethyl phthalate	82.2	10.6	50	115	40	125
Dimethyl phthalate	79.6	10.2	50	110	40	120
Nitrosamines						
n-Nitrosodi-n-propylamine	76.8	12.3	40	115	30	125
n-Nitrosodimethylamine	66.1	15.9	20	115	10	130
n-Nitrosodiphenylamine	82.4	11.1	50	115	40	125
Chlorinated Aliphatics						
Bis(2-chloroethoxy)methane	75.5	10.9	45	110	30	120
Bis(2-chloroethyl)ether	71.1	11.2	40	105	25	115
Bis(2-chloroisopropyl)ether	68.4	15.7	20	115	10	130
Hexachlorobutadiene	78.2	12.9	40	115	25	130
Hexachloroethane	71.9	12.6	35	110	20	120
Halogenated Aromatics						
1,2,4-Trichlorobenzene	77.4	11.2	45	110	30	120
1,2-Dichlorobenzene	70.9	8.7	45	100	35	105
1,3-Dichlorobenzene	69.7	10.3	40	100	30	110
1,4-Dichlorobenzene	69.0	11.4	35	105	25	115
2-Chloronaphthalene	75.2	9.9	45	105	35	115
4-Bromophenyl phenyl ether	81.7	11.8	45	115	35	130
4-Chlorophenyl phenyl ether	79.6	10.7	45	110	35	120
Hexachlorobenzene	82.5	11.7	45	120	35	130
Nitroaromatics						
2,4-Dinitrotoluene	82.0	11.4	50	115	35	130
2,6-Dinitrotoluene	80.2	10.7	50	110	35	125
2-Nitroaniline	81.0	12.2	45	120	30	130
3-Nitroaniline	68.8	13.8	25	110	15	125
4-Nitroaniline	73.6	13.1	35	115	20	125

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Nitrobenzene	77.2	11.9	40	115	30	125
Neutral Aromatics						
Carbazole	80.4	12.3	45	115	30	130
Dibenzofuran	77.1	8.8	50	105	40	110
Others						
Benzyl alcohol	70.9	17.4	20	125	10	140
Isophorone	77.0	11.4	45	110	30	125

[6]A number of sporadic marginal exceedances (ME) of the control limits is allowed, depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits. LCS control limits are not available for Benzidine, 2,6-Dichlorophenol, 1,2-Diphenylhydrazine, and N-nitrosopyrrolidine. Sufficient data to perform statistically significant analyses were not received for those analytes during the LCS study. Additional limits for poor performing compounds can be found in section G.5.

Table G-6. Surrogates

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
8270 Water:				
2-Fluorobiphenyl	79	10	50	110
Terphenyl-d14	92	14	50	135
2,4,6-Tribromophenol	82	13	40	125
2-Fluorophenol	63	14	20	110
Nitrobenzene-d5	76	11	40	110
8270 Solid:				
2-Fluorobiphenyl	72	10	45	105
Terphenyl-d14	78	15	30	125
2,4,6-Tribromophenol	80	15	35	125
2-Fluorophenol	70	11	35	105
Phenol-d5/d6	71	10	40	100
Nitrobenzene-d5	69	10	35	100

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Seattle Division

Record of Management Decision

SOP: TA-MT-0202-R18

Title: Mercury Analysis by CVAA [Methods 245.1, 7470A, 7471A]

ROMD ID: 00005

Effective Date: 06/04/2010 Expiration Date: When indicated SOP is revised

Laboratory Approvals:

6/3/10		6/3/10	
Technical Director Approval	Date	H & S Approval	Date
6/4/10		6/4/10	
Quality Assurance Approval	Date	Laboratory Director Approval	Date

1. **Description Of and Reason For Decision:** Currently the mercury prep takes one 0.5-gram aliquot from the sample jar for mercury analysis as described in section 10.1.2.3 of the SOP. To be compliant with the method, three 0.2-grams sample of soil need to be subsampled from the sample jar. The *new* procedure is described below:

   10.1.2.3 *Using an inert utensil, weigh triplicate 0.2 grams portions of sample into a digestion tube.*

2. **References:** **SW846 7471A**

   7.1 Sample preparation: Weigh triplicate 0.2-g portions of untreated sample and place in the bottom of a BOD bottle. Add 5 mL of reagent water and 5 mL of aqua regia. Heat 2 min in a water bath at 95oC. Cool; then add 50 mL reagent water and 15 mL potassium permanganate solution to each sample bottle. Mix thoroughly and place in the water bath for 30 min at 95oC. Cool and add 6 mL of sodium chloride-hydroxylamine sulfate to reduce the excess permanganate.

3. **Others Notified:** Peter Boardway, Fred Woo, Ben Boritz (initial and date below your name)

   6/3/10 BB 6/3/10

   RB 6-3-10

Title: Mercury Analysis by CVAA [Methods 245.1, 7470A, 7471A]

Approvals:

Signatures on File

Fred Woo Chemist Date	Stan Palmquist Metals Department Manager Health & Safety Manager / Coordinator Date
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1.0 Scope and Application

1.1 Analytes, Matrix(s), and Reporting Limits

This procedure describes the preparation and analysis of mercury (Hg, CAS # 7439-97-6) by Cold Vapor Atomic Absorption Spectroscopy (CVAA) using SW-846 Method 7470A and MCAWW Method 245.1. Method 7470A is applicable to the preparation and analysis of mercury in ground water, aqueous samples, wastes, wipes, TCLP, EP and other leachates/extracts. Method 245.1 is applicable to the determination of mercury in drinking, surface and saline waters, and domestic and industrial wastes.

Standard Aqueous RL	0.2 µg/L
Brine RL	60 µg/L
TCLP RL	2.0 µg/L
Soil RL	100 µg/kg

On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in Section 13.3.1 in the Quality Assurance Manual.

2.0 Summary of Method

This method describes the determination of mercury in solution by CVAA. Prepared samples are treated so that mercury is reduced to the elemental state and aerated from solution in a closed system. The mercury vapor passes through a cell positioned in the light path of an atomic absorption spectrophotometer at 253.7 nm. Intensity of absorption (attenuation of light signal) is directly related to the concentration of mercury by comparison with standards.

3.0 Definitions

3.1 Dissolved metals = those metals that will pass through a 0.45 um membrane filter.

3.2 Suspended metals = those elements which are retained by a 0.45 um membrane filter.

3.3 Total metals = the concentration determined of an unfiltered sample after digestion or; the sum of the dissolved plus suspended concentrations.

3.4 Total recoverable metals = the concentration determined of an unfiltered sample after treatment with hot, dilute mineral acid.

4.0 Interferences

4.1 Potassium permanganate, which is used to breakdown organic mercury compounds, is added as a reagent to eliminate interference from sulfide.

4.2 Copper also has been reported to interfere; however, copper concentrations as high as 10 mg/L had no effect on the recovery of mercury from spiked samples.

4.3 High chloride concentration requires additional permanganate (free chlorine must be absent during oxidation steps). Excess of hydroxylamine sulfate reagent eliminates chlorine interference.

4.4 Interference from certain volatile organic materials that absorb at the wavelength used for the method may also occur. If suspected, a preliminary run without stannous chloride can determine if this type of interference is present. While the possibility of absorption from

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certain organic substances present in the sample does exist, this problem is not routinely encountered. This is mentioned only to caution the analyst of the possibility. If this condition is found to exist, the mercury concentration in the sample can be determined by subtracting the result of the sample run without the reducing reagent (stannous chloride) from that obtained with the reducing reagent.

4.5 Samples containing high concentrations of oxidizable organic materials, as evidenced by high COD levels, may not be completely oxidized by this procedure. When this occurs, the recovery of mercury will be low. The problem can be eliminated by reducing the volume of original sample used.

4.6 The most common interference is laboratory contamination, which may arise from impure reagents, dirty glassware, improper sample transfers, dirty work areas, etc. Be aware of potential sources of contamination and take appropriate measures to minimize or avoid them.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001), Radiation Safety Manual and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1 Specific Safety Concerns or Requirements

5.1.1 Samples that contain high concentrations of carbonates or organic material or samples that are at elevated pH can react violently when acids are added.

5.1.2 Eye protection that satisfies ANSI Z87.1, laboratory coat, and nitrile or latex gloves must be worn while handling samples, standards, solvents, and reagents.

5.1.3 Potassium permanganate is a strong oxidizing agent. It is incompatible and must be stored separately from hydroxylamine hydrochloride and stannous chloride, the reducing agents used in this procedure, and from acids.

5.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating.

Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.

A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

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Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Mercury (100 ug/ml in Reagent)	Oxidizer Corrosive Poison	0.1 Mg/M3 Ceiling (Mercury Compounds)	Extremely toxic. Causes irritation to the respiratory tract. Causes irritation. Symptoms include redness and pain. May cause burns. May cause sensitization. Can be absorbed through the skin with symptoms to parallel ingestion. May affect the central nervous system. Causes irritation and burns to eyes. Symptoms include redness, pain, and blurred vision; may cause serious and permanent eye damage.
Sulfuric Acid	Corrosive Oxidizer Dehydrator Poison	1 Mg/M3-TWA	Inhalation produces damaging effects on the mucous membranes and upper respiratory tract. Symptoms may include irritation of the nose and throat, and labored breathing. Symptoms of redness, pain, and severe burn can occur. Contact can cause blurred vision, redness, pain and severe tissue burns. Can cause blindness.
Nitric Acid	Corrosive Oxidizer Poison	2 ppm-TWA 4 ppm-STEL	Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison. Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract. Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Hydrochloric Acid	Corrosive Poison	5 PPM-Ceiling	Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death. Can cause redness, pain, and severe skin burns. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Potassium Permanganate	Oxidizer	5 Mg/M3 for Mn Compounds	Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath. Dry crystals and concentrated solutions are caustic causing redness, pain, severe burns, brown stains in the contact area and possible hardening of outer skin layer. Diluted solutions are only mildly irritating to the skin. Eye contact with crystals (dusts) and concentrated solutions causes severe irritation, redness, and blurred vision and can cause severe damage, possibly permanent.
Potassium Persulfate	Oxidizer	None	Causes irritation to the respiratory tract. Symptoms may include coughing, shortness of breath. Causes irritation to skin and eyes. Symptoms include redness, itching, and pain. May cause dermatitis, burns, and moderate skin necrosis.
1 – Always add acid to water to prevent violent reactions.			
2 – Exposure limit refers to the OSHA regulatory exposure limit.			

6.0 Equipment and Supplies

6.1 Digestion Tubes (CPI) , certified for cleanliness and volume

If the digestion tubes come with certifications of cleanliness and certifications of volume, the following procedures do not have to be done for each lot of tubes received:

6.1.1 *Ten* tubes are used to process *ten* Method Blanks and the digestates are analyzed by ICP-MS. The lot number of the digestion tubes is recorded on the batch sheet and the results of the analyses are place in a three ring binder with the batch sheets. The lot of digestion tubes is considered acceptable if all analytes are less than ½ the ICP-MS RLs.

6.1.2 *Volumetric verification is performed on same ten digestion tubes. Each digestion tube is tared on a balance and DI water is filled to the 50 ml mark. The weight of the water is recorded and should equal 50 grams ±0.5 grams to be considered acceptable. This procedure is repeated for 10 replicates on each tube. Verification is documented in the same digestion batch as the Method Blanks in Section 6.*

6.2 Instrumentation

- Leeman Labs Hydra AA Automated Mercury Analyzer
- Computer controlled data system for Hydra AA
- Analytical balance, 0.1 mg accuracy
- Hot Bloc digestion block, capable of maintaining constant temperature at 90 - 95°C

6.3 Supplies

- Graduated cylinder, 100 mls.
- Volumetric flasks, 100 mls and 1000 mls.
- Disposable polyethylene tubes, 16 x 125 mm.
- Poly dispensing bottles
- *Inert utensils*

7.0 Reagents and Standards

7.1 *Document reagents/standards and reagent/standard preparation in TALS using the reagent module as described in SOP TA-QA-0619.*

7.2 ASTM Type II reagent water.

7.3 Argon gas, high purity grade

7.4 Sulfuric acid, concentrated, trace reagent grade.

7.5 Nitric acid, concentrated, trace reagent grade of low mercury content.

7.6 Nitric acid, 50%

7.6.1 Preparation: Dilute concentrated nitric by adding to equal volume of Type II water.

7.7 Hydrochloric acid, concentrated, trace reagent grade.

7.8 Stannous chloride, Certified ACS.

7.9 Sodium chloride, Certified ACS.

7.10 Hydroxylamine hydrochloride, Certified ACS.

7.11 Potassium permanganate, Certified ACS.

7.12 Potassium persulfate, Certified ACS.

7.13 Aqua Regia

7.13.1 Preparation: 0.6mls of Nitric acid, 1.8mls of hydrochloric acid, and 2.5mls of deionized water are added directly to each standard and sample before digestion (solid samples only).

7.14 2:1 Sulfuric:Nitric (mixed acid).

7.14.1 Preparation: 700mls trace grade nitric acid mixed into 1400mls trace grade sulfuric acid.

7.15 Stannous chloride reagent.

7.15.1 Preparation: Add 14mls of trace grade sulfuric acid, 100g stannous chloride to 1000mls of warm Type II water.

7.16 Sodium chloride-hydroxylamine hydrochloride solution.

7.16.1 Preparation: Dissolve 432 g of sodium chloride and 432 g of hydroxylamine hydrochloride type II water and dilute to 3600mls.

7.17 Potassium permanganate, mercury-free, 5% solution (w/v).

7.17.1 Preparation: Dissolve 180 g of potassium permanganate type II water and dilute to 3600mls.

7.18 Potassium persulfate, 5% solution (w/v).

7.18.1 Preparation: Dissolve 180 g of potassium persulfate type II water and dilute to 3600mls.

7.19 Calibration and laboratory control sample/matrix spiking mercury stock standard, 100 ug/mL (AccuStandard or equivalent).

7.20 Working standard preparation: 50mls Type II water mixed with 0.15mls nitric acid, 0.1mls mercury stock standard; dilute to 100mls.

7.20.1 Preparation of calibration standards (0.2, 0.5, 2.0, 5.0, and 10.0ug/l) - *All mercury calibration standards are prepped each day and included in the first LIMS prep (digestion) batch of the day.*

7.20.1.1 Liquid matrix calibration standards for methods 245.1 and 7470A:

7.20.1.1.1 Perform dilutions of mercury working standard with Type II water into the digestion vessels. The final concentration for each calibration level is listed in the following table:

Calibration Level	Volume of Calibration Working Solution (100 µg/L)	Final Volume (mls)	Final Hg Concentration (µg/L)
Blank	**0.0**	**50.0**	**0.0**
1	**0.1**	**50.0**	**0.2**
2	**0.25**	**50.0**	**0.5**
3	**1.0**	**50.0**	**2.0**
4	**2.5**	**50.0**	**5.0**
5	**5.0**	**50.0**	**10.0**

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7.20.1.1.2 Add 2.5mls of Sulfuric Acid and 1.25mls of Nitric acid to each digestion vessel.

7.20.1.1.3 Add 7.5mls of potassium permanganate solution to each digestion vessel, and allow to stand for at least 15 minutes.

7.20.1.1.4 Add 4mls of potassium persulfate to each digestion vessel and heat for 2 hours in the Digestion Bloc maintained at 90 - 95°C.

7.20.1.1.5 Cool and add 3mls of sodium chloride-hydroxylamine Hydrochloride to reduce the excess permanganate.

7.20.1.1.6 Bring the cooled solution to a final volume of 50mls with DI water.

7.20.1.2 Solid matrix calibration standards for method 7471A:

7.20.2 Perform dilutions of mercury working standard with Type II water into the digestion vessels. The final concentration for each calibration level is listed in the following table: *All mercury calibration standards are prepped each day and included in the first LIMS prep (digestion) batch of the day.*

Calibration Level	Volume of Calibration Working Solution (100 µg/L)	Final Volume (mls)	Final Hg Concentration (µg/L)
Blank	**0.0**	**50.0**	**0.0**
1	**0.1**	**50.0**	**0.2**
2	**0.25**	**50.0**	**0.5**
3	**1.0**	**50.0**	**2.0**
4	**2.5**	**50.0**	**5.0**
5	**5.0**	**50.0**	**10.0**

7.20.2.1.1 Add enough Type II water to each vessel to make a total volume of 10mls. Add 0.6 mls of nitric acid, and 1.8 mls of hydrochloric acid to each standard. Heat for 2 minutes in the Digestion Bloc maintained at 90 - 95°C.

7.20.2.1.2 Cool and add 25mls of Type II water and 7.5mls of potassium permanganate solution to each bottle.

7.20.2.1.3 Mix thoroughly and place in the Digestion Bloc maintained at 90 - 95°C for 30 minutes.

7.20.2.1.4 Cool and add 3mls of sodium chloride-hydroxylamine hydrochloride to reduce the excess permanganate.

7.20.2.1.5 *Bring the cooled solution to a final volume of 50ml with DI water.*

7.21 Second Source Check Standard (stock), 100 ug/mL(ELEMENTS or equivalent).

7.22 Second Source Check Standard (working) 50mls Type II water mixed with 0.15mls nitric acid, 0.1mls mercury stock standard; dilute to 100mls.

7.23 ICV Solution

7.23.1 Preparation:

- ICV (4 ug/L): 2.0mls of 100 ug/L Second Source Check standard diluted to 50mls with Type II water.

7.24 LCS and MS/MSD Solution / CCV Solution

7.24.1 Preparation:

- LCS and MS/MSD (2 ug/L): 1.0mls of 100 ug/L Calibration Solution diluted to 50mls with Type II water.
- CCV (5 ug/L): 2.5mls of 100 ug/L Calibration Solution diluted to 50mls with Type II water.

7.25 *Managers/supervisors or a designee are expected to check their areas on a monthly basis for expired standards/reagents and dispose of them according to SOP TA-EHS-0036*.

8.0 Sample Collection, Preservation, Shipment and Storage

8.1 Sample holding time for mercury is 28 days from time of collection to the time of analysis.

8.2 Aqueous samples are preserved with nitric acid to a pH of <2 and may be stored in either plastic or glass. Refrigeration is not required. Preservation must be verified prior to analysis.

8.3 Soil samples do not require preservation, but are to be stored at 4 ± 2°C until the time of analysis.

Matrix	Sample Container	Min. Sample Size	Preservation	Holding Time [1]	Reference
Waters	HDPE	50mls	HNO_3, pH < 2;	28 Days	40 CFR Part 136.3
Soils	Glass	3 grams	Cool 4 ± 2°C	28 Days	N/A

[1] Inclusive of digestion and analysis.

9.0 Quality Control

This section describes routine quality control practices, which are also summarized in Attachment 1. Preparation of QC materials is described in Section 7. Initial calibrations and calibration verifications are discussed in Section 10. Initial performance studies are described in Section 13. Current control limits are stored in the laboratory LIMS system.

9.1 The process of establishing control limits, and the use of control charts are described more completely in TA-QA-0620, *Quality Control Program*.

9.2 Any QC result that fails to meet control criteria must be documented in a Nonconformance Memo (NCM). The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The QA department also receives NCMs by e-mail for tracking and trending purposes. The NCM process is described in more detail in SOP # TA-QA-0610. This is in addition to the corrective actions described in the following sections.

9.3 Project-specific requirements can override the requirements presented in this section when there is a written agreement between the laboratory and the client, and the source of those requirements should be described in the project documents.

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9.4 Preparation Batch

A group of up to 20 samples that are of the same matrix and are processed together using the same procedures and reagents. The preparation batch must contain a method blank, an LCS, and a matrix spike/matrix spike duplicate pair (MS/MSD). As discussed in the following sections, special program or project requirements can include additional requirements. Always refer to special project instructions for details before proceeding with the analysis.

9.5 Method Blank (MB)

The MB consists of an empty vessel or <1-mm glass beads (for DoD projects) containing all reagents specific to the method that is carried through the entire analytical procedure, including preparation and analysis. At least one method blank (MB) must be processed with each preparation batch.

Acceptance Criteria: The result for the method blank must be less than the reporting limit or less than 10% of the mercury concentration found in the associated samples, whichever is higher. Some programs (e.g., Department of Defense (DoD) and *BP LaMP*) require that the maximum blank concentration must be less than one-half of the reporting limit.

Corrective Action: All samples associated with an unacceptable method blank must be re-prepared and reanalyzed. If mercury was not detected in the samples, the data may be reported with qualifiers (check project requirements to be sure this is allowed) and it must be addressed in the project narrative.

9.6 Laboratory Control Sample (LCS)

The preparation of the LCS is described in Section 7.21. At least one aqueous LCS must be processed with each preparation batch. The LCS must be carried through the entire analytical procedure.

Acceptance Criteria: *For Methods 7470/7471*, the maximum control limits for LCS recoveries are 80-120%. In-house control limits based on three standard deviations of the mean of historical results are used as long as they are at least as tight as 80-120% (see SOP TA-QA-0620 for further details on establishing control limits).

For Method 245.1, the maximum control limits for LCS recoveries are 85-115%.

Corrective Action: If LCS recoveries are outside established control limits, the system is out of control and corrective action must occur. If recoveries are <u>above</u> control limits and mercury is not detected in samples, the data may be reported with qualifiers (check project requirements to be sure this is allowed - BP LaMP makes no allowance for out high/ND scenarios) and it must be addressed in the project narrative. In other circumstances, the entire batch must be re-prepared and reanalyzed.

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9.7 Matrix Spike/Matrix Spike Duplicate (MS/MSD)

One MS/MSD pair must be processed for each preparation batch. Some programs may require the use of sample duplicates in place of or in addition to MS/MSDs. In addition, some programs will allow spikes to be reported only for project-related samples. Samples identified as field blanks cannot be used for MS/MSD analysis.

Acceptance Criteria: Control limits are statistically determined based on three standard deviations of the mean of the laboratory's historical data. The MS/MSD recoveries must fall within 75-125% (80-120% for DoD); the relative percent difference (RPD) between the MS and MSD cannot exceed 20%.

Corrective Action: If analyte recovery or RPD fails acceptance criteria, the LCS recovery must be in control for the data to be reported. If there is no evidence of analytical problems and all other QC criteria are met, then qualified results may be reported and the situation must be described in the final report case narrative. In other circumstances, the batch must be re-prepared and reanalyzed.

If the native analyte concentration in the MS/MSD exceeds 4 times the spike level for that analyte, the recovery data are reported as NC (i.e., not calculated). If the reporting software does not have the ability to report NC, then the actual recovery must be reported and narrated as follows: "Results outside of limits do not necessarily reflect poor method performance in the matrix due to high analyte concentrations in the sample relative to the spike level."

9.8 **Instrument QC**

9.8.1 Initial Calibration (ICAL)

9.8.1.1 Calibration must be performed daily (every 24 hours) and each time the instrument is set up. The instrument calibration date and time must be included in the raw data.

9.8.1.2 Calibrate using five standards and a blank (see Section *7.20*.)

NOTE: It is generally not acceptable to reject calibration points for this method.

9.8.1.3 The calibration curve must have a correlation coefficient of ≥ 0.995 or the instrument shall be stopped and recalibrated prior to running samples. Sample results cannot be reported from a curve with an unacceptable correlation coefficient.

9.8.2 Initial and Continuing Calibration Blanks

9.8.2.1 An initial calibration blank (ICB) is tested immediately after the daily ICAL standards.

Acceptance Criteria: The absolute value of the blank result must be less than the reporting limit (< Limit of Detection (LOD) for DoD). As noted with the method blank, some programs require that results for blanks must be less than two times the method detection limit (refer

to special project requirements). Samples analysed for BP LaMP must be less than ½ the RL.

Corrective Action: If the blank acceptance limit is exceeded, the analysis should be terminated, the source of contamination identified, and the instrument recalibrated.

9.8.2.2 Continuing calibration blanks (CCBs) are run after every 10 samples and at the end of the run.

Acceptance Criteria: The absolute value of the blank result must be less than the reporting limit (< LOD for DoD). As just noted, some programs require that results for blanks must be less than two times the method detection limit (refer to special project requirements). Samples analysed for BP LaMP must be less than ½ the RL.

Corrective Action: If the blank acceptance limit is exceeded, the analysis should be terminated, the source of contamination identified, and the instrument recalibrated.

9.8.3 *RL Calibration Check Standard (for BP and BNSF)*

Calibration accuracy at the RL is verified by analyzing a standard prepared within two times the laboratory's standard reporting limit. The preparation of this standard is described in Section 7. For analytical sequences that include BNSF and/or BP LAMP samples, the Calibration Check Standard must be analyzed at the beginning of the analytical sequence, every 8 hours and/or at the end of the analytical sequence.

Acceptance Criteria: The acceptance limits are ± 50% of the expected value.

Corrective Action: If the RL Check standard fails to meet acceptance limits, a single reanalysis may be attempted without modification to the instrument operating conditions. Otherwise, the analysis must be terminated, the problem corrected, the instrument recalibrated, and the calibration re-verified.

9.8.4 Initial Calibration Verification (ICV)

The accuracy of the calibration standards is verified by testing a second source standard (ICV).

Acceptance Criteria: *For Methods 7470/7471*, the ICV recovery must be within 90-110%.

For Method 245.1, the ICV recovery must be 95-105%.

Corrective Action: If the ICV acceptance limit is exceeded, the analysis should be terminated, the accuracy of the calibration standards checked, and the instrument recalibrated.

9.8.5 Continuing Calibration Verification (CCV)

Calibration accuracy is monitored throughout the analytical run through the analysis of a known standard after every 10 samples and at the end of the run.

Acceptance Criteria: *For Methods 7470/7471*, the CCV recovery must be within 80-120%.

For Method 245.1, the CCV recovery must be 90-110%.

Correction Action: Sample results may be reported only when bracketed by valid CCV pairs. If a CCV fails, the analysis must be terminated, the problem corrected, the instrument recalibrated, the calibration verified, and the affected samples reanalyzed. If the cause of the CCV failure was not directly related to the instrument, the associated samples must be reanalyzed.

9.9 *Any extra QC that is analyzed in a batch or sequence must be evaluated using the same criteria as the corresponding QC above*.

10.0 Procedure

10.1 Sample Preparation

10.1.1 Liquid sample preparation methods 245.1 and 7470A.

10.1.1.1 Transfer 50mls, or an aliquot diluted to 50mls, to a digestion vessel. TCLP leachates are diluted 1:10 prior to digestion.

10.1.1.2 Add 2.5mls of concentrated sulfuric acid and 1.25mls of concentrated Nitric acid.

10.1.1.3 Add 7.5mL of potassium permanganate solution to each sample bottle

10.1.1.4 Add 4mls of potassium persulfate to each bottle and heat for 2 hours in the Digestion Bloc maintained at 90 - 95°C. *Record the corrected temperature of the digestion within the appropriate field of the batch prep sheet within the LIMS*. Monitor the Digestion Bloc temperature during digestion.

10.1.1.4.1 *If necessary, add more potassium permanganate until purple color persists for at least 15 minutes*

10.1.1.5 Cool and add 3mls of sodium chloride-hydroxylamine hydrochloride to reduce the excess permanganate.

10.1.1.6 *Bring the cooled solution to a final volume of 50mls with DI water*.

10.1.2 Solid sample preparation method 7471A.

10.1.2.1 *Check the Balance Logbook to determine if the daily calibration check was completed. If the balance requires a check, verify the calibration as detailed in SOP TA-QA-0014*.

10.1.2.2 *Using inert utensils*, mix the sample thoroughly to achieve homogeneity (refer to SOP TA-QA-0028 for subsampling procedures).

Soil samples submitted under the BP LaMP must be transferred from their field container to a plastic or Teflon pan and then mixed thoroughly with inert utensils while reducing it to BB-sized clumps. After subsampling for this preparation, return unused portion to the original field container.

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Document on the container and in the digestion log that sample was "BP LaMP Homogenized.

10.1.2.3 Using an inert utensil, weigh a 0.5 - 0.7 g portion of sample into a BOD bottle.

10.1.2.4 Add 2.5mls of Type II water, 0.6mls of nitric acid, and 1.8mls of hydrochloric acid to each sample, blank, and QC sample. Heat for 2 minutes in the Digestion Bloc maintained at 90 - 95°C. *Record the corrected temperature of the digestion within the appropriate field of the batch prep sheet within the LIMS.*

10.1.2.5 Cool and add 25mls Type II water and 7.5mls potassium permanganate solution to each sample vessel. Add more if necessary, until the purple color persists for at least 15 minutes.

10.1.2.6 Mix thoroughly and place in the Digestion Bloc for 30 minutes at 90 - 95°C. *Record the corrected temperature of the digestion within the appropriate field of the batch prep sheet within the LIMS.*

10.1.2.6.1 *If necessary, add more potassium permanganate until purple color persists for at least 15 minutes*

10.1.2.7 Cool and add 3mls of sodium chloride-hydroxylamine hydrochloride to reduce excess permanganate.

10.1.2.8 *Bring the cooled solution to a final volume of 50mls with DI water*.

10.2 Calibration

10.2.1 Initial Calibration Procedures. An instrument blank and five standards (*0.2*, 0.5, 2.0, 5.0, and 10.0ug/L) are injected in triplicate by the autosampler. The injection order is blank, *0.2ug/L*, 0.5ug/L, 2.0ug/L, 5ug/L, and finally the 10ug/L standard. The instrument calculates an average value for each standard and the instrument blank; the average instrument response is used to generate the calibration curve.

10.2.2 Continuing Calibration *Verification* Procedures. *After every 10 samples and at the end of the run, a continuing calibration verification (CCV) standard at 5.0ug/L, or other mid-range concentration is injected singly by an auto sampler. The analysis of the CCV is immediately following by the analysis of a continuing calibration blank (CCB)*.

10.3 Sample Analysis

10.3.1 Samples are poured into disposable culture tubes and placed in an autosampler rack for analysis.

10.3.2 Samples are analyzed using the Leeman system, following manufacturer's instructions. The solution concentrations are determined by the instrument data handling system and reported as raw instrument data.

10.3.3 When a sample concentration is above the upper calibration range the sample must be diluted and reanalyzed in order to bring the concentration within the calibration range.

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10.4 Following is a typical analytical sequence:

ICAL
ICV
ICB
CRDL (for BP and BNSF)
Method Blank
LCS and LCSD (in included)
7 injections or 8 if only LCS in included
CCV and CCB
10 injections
CCV and CCB
10 injections
CCV and CCB

10.5 *The instrument ID and the analyst initials must be documented on the raw data*.

10.6 **Instrument Maintenance**

10.6.1 *All instrument maintenance must be documented in the instrument maintenance logbook*

- *The logbook must include the instrument name, serial number for each major component (e.g., AA, autosampler) and the date of start-up.*
- *When an instrument is not capable of analyzing samples, it needs to be tagged "Out of Service".*
- *Routine Maintenance (which includes, but is not limited to daily, weekly, and semiannual maintenance) is completed periodically and does not necessary indicate the instrument is out of control is noted in the logbook with the notation "RM".*
- *For non-routine maintenance or repairs, logbook entries must include a description of the problem and what actions were taken to address the problem.*
- *When non-routine maintenance or repairs are complete, the instruments return to control is noted in the logbook with the notation "RTC".*

10.6.2 Daily Use and Maintenance.

10.6.2.1 These procedures are performed daily prior to instrument calibration.

10.6.2.2 Turn off the "overnight macro".

10.6.2.3 Check the stability of the diagnostics-aperture (should be ± 200 or better), zero detector, and acquisition 5-volt reference.

10.6.2.4 Check the rinse and SnCl levels. The reservoirs should be full.

10.6.2.5 Start the "warmstrt" macro.

10.6.2.6 Run calibration macro ("cal245").

10.6.3 Bi-monthly Maintenance

10.6.3.1 Change tubing as needed if pumping is not consistent.

10.6.3.2 Clean the pump clamps whenever tubing is changed.

10.6.3.3 Oil the autosampler bars.

10.6.4 Quarterly Maintenance

10.6.4.1 If the instrument counts drop below 500,000, clean the optic cell.

10.6.4.2 Clean out the interior of the instrument.

10.6.4.3 Change exhaust lines as needed.

10.6.5 Instrument QC Check

10.6.5.1 Whenever the optic cell is replaced, the "coldstrt" macro is run. This allows the optic cell to warm to a constant temperature, and will also condition new tubing. If the flow is consistent, the instrument is ready for calibration.

10.6.6 Spare Parts

10.6.6.1 Tubing

- Sample tubing.
- Reductant tubing.
- Drain tubing.
- Sample tips.
- Mixing Coil

10.6.6.2 Optics Cell

- Lenses
- Gaskets
- Complete spare optics cell

10.6.6.3 Other Parts

- Liquid gas separator
- Drying tube apparatus.

11.0 Calculations / Data Reduction

11.1 Accuracy

$$\textbf{ICV / CCV, LCS \% Recovery} = \frac{\text{observed concentration}}{\text{Known concentration}} \times 100$$

$$\textbf{MS \% Recovery} = \frac{\text{(spiked sample) - (unspiked sample)}}{\text{Spiked concentration}} \times 100$$

11.2 Precision (RPD)

$$\textbf{Matrix Duplicate (MD)} = \frac{|\text{orig. sample value - dup. sample value}|}{[(\text{orig. sample value + dup. sample value})/2]} \times 100$$

11.3 Concentration

11.3.1 Liquid samples, report as mg/L.

$$\text{mg/L} = \frac{\text{(instrument reading) * (final dilution)}}{\text{(Initial volume)}}$$

11.3.2 Solid samples (except filters), report as mg/kg:

$$\text{mg/kg} = \frac{\left[\frac{\text{(instrument reading) * (final dilution)}}{\text{(sample weight)}}\right]}{\text{(percent solids)}}$$

11.3.3 Filters, report as ug (or as ug/cm^3)

$$\text{ug} = \text{(instrument reading) * (final dilution)}$$

$$\text{ug/cm}^3 = \frac{\text{(instrument reading) * (final dilution) * (1000)}}{\text{(air volume in L)}}$$

NOTE: All dry weight corrections are made in LIMS at the time the final report is prepared.

12.0 Method Performance

12.1 Method Detection Limit Study (MDL)

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure (see SOP TA-QA-0602). MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method requirements require a greater frequency.

12.2 Demonstration of Capabilities

Analyst initial and continuing Demonstrations of Capability (DOC) are performed before any client samples are analyzed and are updated annually. See SOP TA-QA-0617 for details.

12.3 Training Requirements

See SOP TA-QA-0608 for detailed training requirements.

13.0 Pollution Control

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention".

14.0 Waste Management

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to SOP TA-EHS-0036. The following waste streams are produced when this method is carried out.

14.1 Waste Streams Produced by the Method

14.1.1 Aqueous Acidic (Metals) - Corrosive - (J). Acidic waste generated by the digestion with a mercury concentration less than two and rinse solutions are poured into the acid neutralization tank, neutralized and then discarded down the drain

14.1.2 Remaining standard and any sample digestion fluid with a mercury concentration greater than two are disposed of in the high mercury concentration satellite disposal container located in the analysis lab. When the container is full the waste technician disposes of it.

15.0 References / Cross-References

15.1 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition, Final Update II, Revision I, September 1994, Method 7471A (Mercury).

15.2 Department of Defense Quality Systems Manual for Environmental Laboratories, Final Version 4.1, April 2009.

15.3 EPA-600/4-79-020, Methods for Chemical Analysis of Water and Wastes, March 1983, Methods 245.1 and 245.2.

16.0 Method Modifications:

Item	Method	Modification
1	245.1 and 7470A	This SOP allows for the use of reduced sample volumes to decrease waste generation. Reagent levels are adjusted to maintain the same ratios as stated in the source methods. According to a letter from Robert Booth of EPA EMSL-Cinn to David Payne of EPA Region V, "Reduction in sample size and appropriate corresponding reduction in sample volume is (*sic*) not considered a significant change in the methodology."
2	7470A and 7471A	Methods 7470A and 7471A state that working mercury standards "should be prepared fresh daily." The laboratory frequently prepares up to three batches of mercury samples, including digested calibration standards, each day. The third batch is typically prepared and digested late in the day, and then is analyzed the morning of the next day. The laboratory has developed the following information demonstrating that analysis within 24 hours, but on the second calendar day from preparation produces reliable results and is acceptable to the EPA: • Successful proficiency testing PT results for samples that were prepared and analyzed within 24 hours, but on successive days (e.g., ERA WP-66); • Successful analysis of true NIST mercury standards within every analytical batch; and • A written comment from the EPA MICE Hotline stating that, with the supporting lab data, their opinion was that the laboratory's practice is "within the letter of the method as written
3	7471A	80 mL polyethylene digestion vessels and a Bloc Digester are used during the procedure in lieu of the 300 mL BOD bottles and water bath.
4	SW-846	Chapter 1 of SW846 specifies the use of reagent water with a purity equivalent to ASTM Type II water. This SOP specifies the use of a Millipore DI system or equivalent to produce reagent water. This SOP requires that reagent water must be free of the analytes of interest as demonstrated through the analysis of method blanks
5	7470A	Chapter 1 of SW-846 states that the method blank should not contain

Item	Method	Modification
		any analyte of interest at or above the MDL. This SOP states that the method blank must not contain any analyte of interest at or above the reporting limit.
6	7471A	Method 7471A does not state control criteria within the text of the method. The QC section of 7471A refers the analyst to Section 8.0 of Method 7000A, the generic atomic absorption method, which discusses flame and furnace methods. The ICV criteria stated in Method 7000A is ± 10%. This SOP requires ICV control limits of ± 20% based on the fact that the mercury ICV, unlike the ICV for the flame and furnace analytes, is digested and therefore is equivalent to an LCS. The CLP protocol 245.5 CLP-M recognizes this factor and requires control limits of ± 20%.
7	245.1	Method 245.1 Section 12.8 states that concentrations should be reported as follows: Between 0.1 and 1 µg/g, to the nearest 0.01 µg; between 1 and 10 µg/g, to the nearest 0.1µg; and above 10 µg/g, to the nearest µg. TestAmerica Seattle reports all mercury results under this SOP to two significant figures.

17.0 Attachments

Attachment 1: Summary of Quality Control Requirements

18.0 Revision History

- Revision 18, dated 16 April 2010
  - Added documentation of reagents and reagent preparation (Section 7.1).
  - Added documentation of standards and standard preparation (Section 7.18).
  - Added removal of expired standards Section (7.25).
  - Added Method 245.1 QC acceptance criteria for LCSs in section 9.6 and Attachment 1.
  - Added CRDL standard, section 9.8.3
  - Added Method 245.1 QC acceptance criteria for ICVs and CCVs in sections 9.8.3 and 9.8.4.
  - Added instructions to evaluate extra QC (Section 9.9)
  - Added section 10.1.1.6
  - Added verification of balance calibration check (Section 10.1.2.1)
  - Added BP sample homogenization requirements (Section 10.1.2.2)
  - Updated standard concentrations in section 10.2.1.
  - Added requirement to apply correction factor to temperature readings throughout section 10.1
  - Added maintenance documentation and return to service requirements, Section 10.6.1.
  - Clarified the order of analysis for CCVs and CCBs (Section 10.2.2)
  - Added documentation of analyst and instrument ID (Section 10.5)
  - Updated use of 1:1sulfuric:Nitric acid to concentrated sulfuric acid only(Sections 7.21.1.1.2 and 10.1.1.2)

- Revision 17, dated 5 May 2009
  - Updated Summary of Quality Control Requirements table to include requirements from the DoD QSM v. 4.1

- Revision 16, dated 27 March 2008
    - Integration for TestAmerica and STL operations.
    - This revision is a complete rewrite and an expansion of scope.

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Attachment 1.

Summary of Quality Control Requirements

QC PARAMETER	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
Minimum five-point Initial Calibration	Beginning of every analytical run, every 24 hours, when instrument is modified, or CCV fails.	r ≥ 0.995	Terminate analysis; Correct the problem; Prepare new standards; Recalibrate following system performance.
ICV	Immediately following ICAL	95 -105% for 245.1 90 - 110 % for 7470A/7471A including DoD	Terminate analysis; correct the problem; recalibrate or re-prepare and reanalyze batch.
ICB	Following ICB	Absolute value < RL **For DoD**: < LOD	Terminate analysis; correct the problem; recalibrate or re-prepare and reanalyze batch.
CCV	Every 10 samples and at the end of the run	90 -110% for 245.1 80 - 120 % for 7470A and 7471A including DoD	Terminate analysis; correct the problem; recalibrate and rerun all samples not bracketed by acceptable CCVs or re-prepare and reanalyze batch.
CCB	Immediately following each CCV	Absolute value < RL **For DoD**: < LOD	Terminate analysis; correct the problem; recalibrate and rerun all samples not bracketed by acceptable CCVs or re-prepare and reanalyze batch.
Method Blank	One per sample preparation batch of up to 20 samples.	≤RL; **For DoD**: ½ RL Sample results greater than 10% the blank concentration are acceptable. Samples for which the contaminant is < RL do not require re-digestion.	Re-digest and reanalyze samples. Note exceptions under criteria section.
Laboratory Control Sample (LCS)	One per sample preparation batch of up to 20 samples.	*85 - 115% for 245.1.* Recovery must be within statistical control limits, not to exceed 80 - 120% for 7470A/7471A.	Terminate analysis; correct the problem; redigest and reanalyze all samples associated with the failed LCS.
Matrix Spike	One per sample preparation batch of up to 20 samples.	Recovery must be within statistical control limits, not to exceed 75-125% (80-120% for DoD). 50-150% for TCLP Leachates	In the absence of client specific requirements, flag the data; no flag required if the sample level is > 4x the spike added.
Matrix Spike Duplicate	See Matrix Spike	Recovery within statistical control limits, not to exceed 75-125 % recovery; RPD ≤ 20% (80-120% for DoD)	See Corrective Action for Matrix Spike.

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Summary of Quality Control Requirements

QC PARAMETER	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION
Duplicate		≤20% RPD for water ≤35% RPD for solid ≤50% RPD for leachates **For DoD:** ≤20% RPD for all	See Corrective Action for Matrix Spike.

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Title: Inductively Coupled Plasma-Mass Spectrometry (ICP-MS) [Methods 6020, 200.8]

Approvals

Signatures on File

Fred Woo Chemist Date	Stan Palmquist Metals Department Manager Health & Safety Manager / Coordinator Date
Dave Wunderlich Quality Assurance Manager Date	Kathy Kreps Laboratory Director Date

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1.0 Scope and Application

1.1 This procedure describes multi-elemental analysis by inductively coupled plasma-mass spectrometry (ICP/MS) based on EPA Methods 200.8 and 6020.

1.2 Method 200.8 lists twenty-one elements approved for analysis by ICP/MS (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Hg, Mo, Ni, Se, Ag, Tl, Th, U, V, and Zn). Method 6020 lists fifteen elements approved for analysis by ICP/MS (Al, Sb, As, Ba, Be, Cd, Cr, Co, Cu, Pb, Mn, Ni, Ag, Tl, and Zn). This procedure has been developed for thirty-five elements (see Table VII), and additional elements may be included provided that the method performance criteria presented in Sections 9 and 10 are met. However, project approval may be required from the controlling agencies for compliance testing beyond the elements included in the promulgated methods. See Table XII for a list of elements and associated reporting limits.

1.3 The procedure is applicable to the analysis of acid digested waters, soils, and wastes. The preliminary acid digestion for aqueous samples is described in SOP TA-IP-0205, and the digestion procedure for soils is given in SOP *TA-IP-0220*.

1.4 On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in Section *12.2.1* in the Quality Assurance Manual.

2.0 Summary of Method

2.1 Aqueous samples, digestates, or leachates are nebulized into a spray chamber where a stream of argon carries the sample aerosol through the quartz torch and injects it into a R.F. plasma. There the sample is decomposed and desolvated.

2.2 The ions produced are entrained in the plasma gas and by means of a water-cooled, differentially pumped interface, introduced into a high-vacuum chamber that houses a quadrapole mass spectrometer capable of providing a resolution better than or equal to 0.9 amu (see Section 3.1) peak width at 10% of the peak height. For analysis by methods 200.8, the resolution requirement is 1.0 amu at 5% peak height. The ions are sorted according to their mass-to-charge ratio and measured with a channel electron multiplier.

2.3 Interference must be assessed and valid corrections applied, or the data flagged to indicate problems. Interference correction must include compensation for background ions contributed by the plasma gas, reagents, and the constituents of the sample matrix. Recommended elemental equations, which correct for many of these interferences, are listed in Table I. Use of the internal standard technique is required to compensate for suppressions and enhancements caused by sample matrices.

3.0 Definitions

3.1 *Atomic Mass Unit (amu)* – Obsolete term replaced by “unified atomic mass unit (u)” or “dalton (Da)”, which denotes a small unit of mass that is used to express atomic and molecular masses. It is defined to be 1/12 of the mass of one atom of carbon-12, or $1.66053886 \times 10^{-27}$ kg.

3.2 *Dissolved Metals* - Those elements which pass through a 0.45-µm membrane filter (sample is acidified after filtration).

3.3 *Suspended Metals* - Those elements which are retained by a 0.45-µm membrane filter.

3.4 *Total Metals* - The concentration determined on an unfiltered sample following vigorous acid digestion.

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3.5 *Total Recoverable Metals* - The concentration determined on an unfiltered sample following treatment with hot, dilute mineral acids.

3.6 *Instrument Detection Limit (IDL)* - See Section 12.1.1.

3.7 *Sensitivity* - The slope of the analytical curve (i.e., the functional relationship between raw instrument signal and the concentration).

3.8 *Tuning Solution* - This is a multi-element solution containing analytes which are representative of the entire mass range capable of being scanned by the instrument. It is used to optimize the sensitivity of the instrument and to verify the mass resolution meets method criteria.

3.9 *Initial Calibration Verification / Quality Control Standard (ICV/QCS)* - A multi-element standard of known concentrations prepared to verify instrument calibration. This solution must be an independent standard prepared near the mid-point of the calibration curve, and at a concentration other than that used for instrument calibration.

3.10 *Continuing Calibration Verification (CCV).* - A multi-element standard of known concentrations prepared to monitor and verify the instrument daily continuing performance.

3.11 *Interference Check Standard (ICS)* - A solution containing both interfering and analyte elements of know concentration that is used to verify background and interelement correction factors.

3.12 *Laboratory Control Sample / Laboratory Fortified Blank (LCS/LFB)* - A multi-element standard of known concentrations that is carried through the entire sample preparation and analysis procedure. This solution is used to verify the accuracy of the sample preparation.

3.13 *Reagent Blank* - High purity (> 18 megohm-cm) water containing the same acid matrix as the calibration standards that is carried through the entire digestion process.

3.14 *Calibration Blank* - High purity (> 18 megohm- cm) water acidified with the same acid concentrations present in the standards and samples. Also referred to as the Initial Calibration Blank (ICB) and Continuing Calibration Blank (CCB).

3.15 *Method Detection Limit (MDL)* - See section 12.1.2.

4.0 Interferences

4.1 Isobaric Interferences

4.1.1 Isobaric interferences in the ICPMS are caused by isotopes of different elements forming ions with the same nominal mass-to-charge ratio (m/z). Most interferences of this type are corrected for by the instrument software.

4.2 Isobaric Molecular and Doubly Charged Ion Interferences

4.2.1 Isobaric molecular interferences are caused by ions consisting of more than one atom or charge. Table III lists isobaric interferences which might possibly affect required analytes. When these interferences cannot be avoided by the use of another isotope with sufficient natural abundance, corrections must be applied and the data flagged to indicate the presence of interferences.

4.2.2 Chloride in samples can produce low recoveries for antimony and silver. If chloride interference is a concern, 1% HCl can be added during digestion, but calibration standards must be adjusted to include 1% HCl also.

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4.3 Physical Interferences

4.3.1 Physical interferences are associated with the transport and nebulization process. Internal standards are used to compensate for these types of interferences.

4.3.2 Internal standards should be added at a level to give greater than 1,000,000 counts of raw signal intensity. The mass of the internal standard should ideally be within 50 amu of the mass of the measured analyte.

4.3.3 Matrix effects are monitored by comparing the internal standard intensity in the sample to the internal standard intensity of the calibration blank. When performing method 6020, the internal standard intensities must be between 30% and 120% of the intensities in the calibration blank. If they fall outside this window, a five-fold dilution (1:4) is performed on the sample to correct for matrix effects and the sample is reanalyzed. When performing method 200.8, the internal standards must be between 60% and 125% of the calibration blank. If they are outside this window, the calibration blank is reanalyzed to verify internal standard intensities. If the intensities are within limits, the sample is diluted by a factor of 2 (1:1) and is reanalyzed.

4.3.4 Memory effects are dependent on the relative concentration differences between samples and/or standards which are analyzed sequentially. The rinse period between samples must be long enough to eliminate significant memory interference.

4.4 The use of hydrochloric and sulfuric acids should be minimized due to higher incidence of molecular-ion interferences with the presence of these acids. Excessive amounts of nitric acid can also lead to molecular interferences.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Safety Manual, Radiation Safety Manual and this document.

This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1 Specific Safety Concerns or Requirements

5.1.1 Eye protection that satisfies ANSI Z87.1, laboratory coat, and nitrile or latex gloves must be worn while handling samples, standards, solvents, and reagents. Disposable gloves that have been contaminated must be removed and discarded; non-disposable gloves must be cleaned immediately.

5.1.2 The ICP plasma emits strong UV light and is harmful to vision. All analysts must avoid looking directly at the plasma. The RF Generator produces strong radio frequency waves, most of which are unshielded. People with pacemakers should not go near the instrument while in operation.

5.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating.

NOTE: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.

A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Materials with Serious or Significant Hazard Rating

Material (1)	Hazards	Exposure Limit (2)	Signs and Symptoms of Exposure
Nitric Acid	Corrosive Oxidizer Poison	2 ppm-TWA 4 ppm-STEL	Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison. Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract. Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Hydrochloric Acid	Corrosive Poison	5 ppm-Ceiling	Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death. Can cause redness, pain, and severe skin burns. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.

(1) Always add acid to water to prevent violent reactions.
(2) Exposure limit refers to the OSHA regulatory exposure limit.

6.0 Equipment and Supplies

6.1 Instrumentation

- Inductively Coupled Plasma Mass Spectrometer (ICP/MS) capable of providing resolution, less than or equal to 0.9 amu at 10% peak height from 6-253 amu and 1.0 amu at 5% peak height from 6-253 amu with a data system that allows corrections for isobaric interferences and the application of the internal standard technique
- Autosampler with autosampler tubes
- A four-channel peristaltic pump
- Vacuum pump, Recirculating Chiller, Spray Chamber Cooling Power Pack

6.2 Supplies

- Calibrated automatic pipettes or Class A glass volumetric pipettes
- Argon gas: High purity grade (99.99%)

7.0 Reagents and Standards

7.1 *Document reagent/standards and reagent/standard preparation in TALS using the reagent module as described in SOP TA-QA-0619.*

7.2 Standards

7.2.1 Storage and Shelf-Life

7.2.1.1 All standards must be stored in FEP fluorocarbon or previously unused polyethylene or polypropylene bottles. Standards stored at concentrations as received from the vendor and mid-level dilutions must be replaced prior to the expiration date assigned by the vendor. If no expiration date is provided, the stocks and mid-level standards may be stored for up to one year. They must be replaced sooner if verification from an independent source indicates a problem.

7.2.1.2 Working standards, i.e., all standards at concentrations ready to analyze on the ICP/MS (all except tuning mixes, ICSA and ICSAB mixes, which are received at ready-to-use concentrations), are prepared every three months.

7.2.2 The tuning solution is purchased as a custom multi-element mix or as single element solutions. The elements and concentrations of the constituents are shown in Table VIII.

7.2.3 Initial calibration standards are purchased as custom multi-element mixes or as single element solutions. The standards are prepared every three months and diluted to working levels using a combination of 2% nitric acid and *0.5*% hydrochloric acid. The concentrations are given in Table XI.

7.2.4 Initial calibration verification (ICV) standards are obtained from a source different than the source for the calibration standards. The ICV standards are prepared every three months in a solution of 2% nitric acid and *0.5*% hydrochloric acid to the concentrations shown in Table XI.

7.2.5 Continuing calibration verification (CCV) standards are prepared from the same source as the calibration standards. The CCV standards are prepared every three months in a solution of 2% nitric acid and *0.5*% hydrochloric acid. The concentration is different than the ICV, as shown in Table XI.

7.2.6 Reporting limit (RL) verification standards are prepared every three months from the same stock as the calibration standards using a solution of 2% nitric acid and *0.5*% hydrochloric acid. The concentrations must be less than or equal to the reporting limits.

7.2.7 Linear dynamic range studies are conducted at 5,000 µg/L every six months.

7.2.8 Spiking solutions are CLP Sample Spike solution. Spike concentrations are listed in Table XI.

7.3 Reagents

7.3.1 Reagent Water

ASTM Type I or equivalent for the elements of interest, generated using an ion-exchange water polishing system capable of achieving 18.0 megohm-cm.

7.3.2 Acid Diluent, 2% HNO_3 and *0.5*% HCl

Carefully dilute 220 mL of concentrated HNO_3 and 55 mL of concentrated HCl to 11 L with reagent water. This solution is used to dilute samples, and it is used for calibration blanks.

7.4 *Managers/supervisors or a designee are expected to check their areas on a monthly basis for expired standards/reagents and dispose of them according to SOP TA-EHS-0036.*

8.0 **Sample Collection, Preservation, Shipment and Storage**

8.1 *Aqueous samples and digestates are stored at room temperature*.

8.2 Aqueous samples are preserved with nitric acid to a pH of 2, and may be stored in plastic or glass. Preservation must be verified prior to analysis.

8.3 Soil samples do not require preservation, but must be stored at *0-6℃* until the time of preparation.

8.4 The analytical holding times for metals are six months from the time of collection.

Matrix	Sample Container	Min. Sample Size	Preservation	Holding Time [1]	Reference
Waters	HDPE	50 mLs	HNO_3, pH < 2;	180 Days	40 CFR Part 136.3
Soils	Glass	1grams	Cool 4 ± 2°C	180 Days	N/A

[1] Inclusive of digestion and analysis.

9.0 **Quality Control**

9.1 Quality control requirements are also summarized in TABLE X.

9.2 Ongoing data quality checks are compared with established performance criteria to determine if the results of analyses meet the performance characteristics of the method. Control limits are maintained in the laboratory LIMS system. See QC SOP TA-QA-0620 for definition of QC terms, details about establishing control limits, minimum elements of a preparation batch, and general guidelines for evaluating batch QC.

9.3 Any QC result that fails to meet control criteria must be documented in a Nonconformance Memo (NCM). The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate and the NCM can be included in the report narrative. The QA department also receives NCMs by e-mail for tracking and trending purposes. The NCM process is described in more detail in SOP TA-QA-0610.

9.4 Method Blank / Laboratory Reagent Blank (MB/LRB)

For aqueous and soil samples, the method blank consists of reagent water that has been processed in the same manner as the samples. For soil samples analyzed under the DoD QSM, the method blank consists of polyethylene beads that have been processed in the same manner as the samples. One method blank must be processed with each preparation batch.

Acceptance Criteria: Method blank results are acceptable if the concentration for each analyte of interest is less than the applicable reporting limit (RL).

NOTE: *Some programs (e.g., DoD and BP LaMP) require control of method blanks to have a concentration less than or equal to one-half of the RL.*

Corrective Action: If the method blank does not meet the acceptance criteria, the source of contamination should be investigated to determine if the problem can be minimized or eliminated. Samples associated with the contaminated blank shall be reprocessed for analysis or, under the following circumstances, may be reported as qualified (qualifier flags or narrative comments):

- The same analyte was not detected in the associated samples;
- The method blank concentration is less than 1/10 of the measured concentration of any sample in the batch;
- The method blank concentration is less than 1/10 the specified regulatory limit; or
- The analyte is a common laboratory contaminant (copper, iron, lead, calcium, magnesium, potassium, sodium, or zinc) less than 2 times the RL. Note that some programs do not recognize common lab contaminants.

If the above criteria are not met and reanalysis is not possible, then the sample data must be qualified. **This anomaly must be addressed in the project narrative and the client must be notified.**

9.5 Laboratory Control Sample / Laboratory Fortified Blank (LCS/LFB)

The LCS consists of reagent water that is spiked with the analytes of interest as summarized in Table XI. For soil samples analyzed under the DoD QSM, the LCS consists of polyethylene beads that have been spiked with the analytes of interest and processed in the same manner as the samples. One LCS must be processed for each preparation batch.

Acceptance Criteria: LCS control limits are based on three standard deviations of past laboratory results. These limits are not to exceed 85-115% recovery for Method 200.8 or 80-120% for Method 6020. The control limits are maintained in the LIMS system.

Corrective Action: If the LCS % recovery falls outside of the control limits for any analyte, that analyte is judged to be out of control. All associated samples must be reprocessed for analysis. One possible exception is a recovery for a given element above the upper control limit with no detection for the same element in the samples*. (No such allowance is permitted for BP LaMP samples).*

9.6 Matrix Spike / Matrix Spike Duplicate / Laboratory Fortified Sample Matrix / Laboratory Fortified Matrix Duplicate (MS/MSD/LFM/LFMD)

An MS is prepared by taking a second aliquot of a selected sample and spiking it with the analytes of interest as summarized in Table XI. An MSD is prepared by taking a third aliquot of a selected sample and spiking it with the analytes of interest as summarized in Table XI. The MS and MSD are processed in the same manner as the samples. One MS/MSD pair must be processed for each preparation batch. The spike concentration should be the same level as the LCS. *(For BP LaMP samples a trip blank or field blank should not be used for MS/MSD).*

Acceptance Criteria: Control limits are based on three standard deviations of past laboratory results. These limits are not to exceed 75-125% recovery,

and 20% relative percent difference (RPD). The control limits are maintained in the LIMS system.

Corrective Action: If MS/MSD results do not meet the acceptance criteria and all other quality control criteria have been met, then matrix interference is suspected. Failed matrix spikes are flagged automatically, and are discussed in the final report case narrative.

9.7 Interference Check Solutions (ICSA/ICSAB) ***method 6020 only***

NOTE: *It may not be possible to obtain pure ICSA or ICSB standards*

The interference check solution is prepared with known concentrations of interfering elements so a determination may be made as to the magnitude of the interference on analytes of interest as well as a test of any software corrections. The required elements and their concentrations are listed in Table VI. The interference check solutions must be analyzed at the beginning of every analytical run or once every 12 hours (for BP LaMP samples - prior to analytical run, every 8 hours and after analysis), whichever is more frequent. The results of solution "A" and solution "AB" should be monitored for possible interferences. See Table VI for analyte concentrations.

Acceptance Criteria: *The results for the interference solution (A portion) must be $\leq$ LOD (unless they are a verified trace impurity form one of the spike analytes).*

Corrective Action: *If ICSA results exceed the LOD and the suspected trace impurities aren't verified, then the analysis sequence must be terminated. The problem must be investigated and fixed. The ICS and all affected samples must be re-analyzed. If the contamination can be confirmed by another method (e.g., ICPAES), acceptance criteria will be applied at that level and the data accepted.*

Acceptance Criteria: The results for the trace elements (B portion) must be within ± 20% of the expected value.

Corrective Action: If the ICSAB results exceed the 20% limit, then the analysis sequence must be terminated. The problem must be investigated and fixed. The ICS and all affected samples must be re-analyzed.

9.8 Internal Standards Evaluation for Samples

9.8.1 Method 6020

The IS recovery in samples must be between 30% and 120% of the intensity of the calibration blank. If sample IS recoveries fall outside of this criterion, a five-fold (1:4) dilution must be performed, the dilution analyzed, and the same acceptance criteria applied.

9.8.2 Method 200.8

The internal standards in samples must be between 60% and 125% of the intensity in the calibration blank. If the sample intensities fall outside this range, the calibration blank is reanalyzed to confirm the instrument has not drifted out of control. If the criteria are met, the sample is diluted by a factor of 2 (1:1) and reanalyzed.

9.8.3 IS limits and corrective actions for standards and blanks are described in Section 10.

9.9 Serial Dilution ***method 6020 only***

One serial five-fold dilution should be analyzed per batch for each matrix. If the analyte concentration is within the linear range of the instrument and sufficiently high (generally, a factor of 100 times above the MDL), the serial dilution must agree to within 10% of the original analysis. If not, an interference effect is suspected, which must be described in an anomaly report and included in the final report narrative. Samples identified as blanks cannot be used for serial dilution.

9.10 Post-Digestion Spike Addition (PDS) ***method 6020 only***

A PDS is performed for each batch. An analytical spike added to a portion of a prepared sample, or its dilution, should be recovered to within 75 - 125% of the known value. If the PDS fails to meet this criterion, matrix interference should be suspected**.**

9.11 *For analytical sequences that include BNSF and/or BP LAMP samples the RSD between multiple instrument integrations must be <20% if the analyte is greater than the reporting limit. If the RSD is above 20% then the laboratory must reanalyze the sample.*

9.12 *Any extra QC that is analyzed in a batch or sequence must be evaluated using the same criteria as the corresponding QC above.*

10.0 Procedure

One-time procedural variations are allowed only if deemed necessary in the professional judgment of supervision to accommodate variation in sample matrix, radioactivity, chemistry, sample size, or other parameters. Any variation in procedure shall be completely documented using an NCM. The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The QA department also receives NCMs by e-mail for tracking and trending purposes. The NCM process is described in more detail in SOP TA-QA-0610. The NCM shall be filed in the project file and addressed in the case narrative.

Any unauthorized deviations from this procedure must also be documented as a nonconformance, with a cause and corrective action described.

10.1 Sample Preparation

Solid and aqueous samples must be digested prior to analysis by the appropriate method (see SOPs TA-IP-0204 and TA-IP-0205).

10.2 Instrument Start Up

Set up the instrument according to manufacturer's operating instructions. Allow the instrument to become thermally stable for at least 30 minutes before tuning.

10.3 Instrument Tuning / Mass Calibration

10.3.1 Tune the instrument with a solution containing elements representing all of the mass regions of interest. The relative standard deviations must be less than 5% after running the tuning solution a minimum of 4 times. For method 200.8, the tuning solution must be analyzed 5 times with a relative standard deviation less than 5%.

10.3.2 Mass calibration and resolution checks using the tuning solution must be completed at the beginning of every day.

10.3.2.1 Mass Calibration Check - The mass calibration results must be within 0.1 amu from the true value. If this criterion is not met, the mass calibration must be adjusted before running samples.

10.3.2.2 Mass Resolution Check - The resolution must be verified to be less than 0.9 amu full width at 10% peak height. Due to a limitation of the instrument software, the resolution requirement for method 200.8 of 1.0 amu full width at 5% peak height cannot be verified automatically. If the mass resolution requirement of 0.9 amu at 10% peak height is met, the 200.8 requirement is also satisfied.

10.4 Initial Calibration

10.4.1 The ICP/MS is calibrated each day of operation using a blank and five standards (see Section 7.2.3). Report the average of at least three integrations.

10.4.2 The validity of the calibration is determined by the subsequent calibration verifications, which are performed at concentrations as described in the next sections.

10.5 Second-Source Initial Calibration Verification (ICV)

An ICV standard (see Section 7.2.4) is analyzed immediately after the initial calibration. This is a standard obtained from a different vendor than the standard used for calibration. This analysis also satisfies the Method 200.8 requirement for a Quality Check Standard (QCS).

Acceptance Criteria: The ICV recovery must be within 90-110%. Additionally, the internal standard recoveries for 6020 ICVs must fall between 30 and 120% of true values, and for 200.8 must fall between 60 and 125% of true values. The ICV can be reanalyzed, but must be successful twice in succession or corrective action must be taken.

Corrective Action: If the ICV results are outside of the acceptance limits, investigate the accuracy of the standards, correct as necessary, and recalibrate.

10.6 Calibration Blank

An initial calibration blank (ICB) is analyzed after the ICV. Continuing calibration blanks (CCBs) are analyzed after each continuing calibration verification.

Acceptance Criteria: Results for the calibration blanks must be less than the RL.

Note: *All projects that are under the DoD QSM will evaluate the calibration blanks to ensure the criteria of no analytes being detected above the LOD. Any analyte above the LOD will be qualified B on all associated samples.*

BP LAMP *requires control of calibration blanks to a concentration less than 1/ 2 RL.*

Corrective Action: If the calibration blank exceeds acceptance limits, then the possibility of instrument contamination should be examined, particularly the possibility of carry-over from high level samples. The blank can be reanalyzed, and if successful, analysis can continue. However, samples tested after high-level samples should be retested. If the reanalysis is not successful, then the

analysis should be terminated. After the problem is corrected, recalibrate and reanalyze all samples tested since the last acceptable CCB.

10.7 Reporting Limit (RL) Verification Standard

An independent standard is analyzed after the ICV to monitor the lab's ability to produce reliable results at RL-level concentrations. The RL verification standard (see Section 7.1.6) is analyzed after the daily ICB. *(For BP LaMP the RL verification standard is run prior to analysis, every 8 hours and after analysis. The standard must be within 2 times the RL concentration.)*

Acceptance Criteria: For project reporting limits at or above two times the MDL, the results should be within 50% of the expected value. *Note that the DoD QSM requires control of the low-level calibration check standard to ±20% of the expected value, in which case the RLs will need to be three or more times the MDL concentration.*

Corrective Action: If the RL verification fails to meet acceptance limits, data for the associated samples must be assessed. For example, if the results are high, consider blank contamination, and if the results are low, consider MDL verifications. At a minimum, sample results must be qualified in the final report.

10.8 Continuing Calibration Verification (CCV) Standard

A 50-µg/L CCV standard is analyzed after every set of ten samples and at the end of the analytical sequence.

Acceptance Criteria: The CCV recovery must be within 90-110%. In addition, the IS recovery must be within method limits: 30-120% for 6020, or 60-125% for 200.8. If CCV results are not within these limits, the CCV can be reanalyzed, but it must be successful twice in succession or further corrective action must be taken.

Corrective Action: If the CCV fails acceptance criteria, then the analysis should be terminated. Recalibrate and reanalyze all samples tested since the last acceptable CCB.

Calibration Controls	Sequence	Control Limit
Calibration Standards	5-point (minimum) linearity	r≥ 0.995
Cont. Cal. Verif. (CCV)	Prior to / after every 10 injections	Prior to/after every 10 injections
Cont. Cal. Blank (CCB)	Following ICV/CCB	<2X MDL

10.9 Sample Analysis

10.9.1 Report the average of at least three integrations for all field and QC samples analyzed.

10.9.1.1 *For analytical sequences that include BNSF and/or BP LAMP samples the RSD between multiple instrument integrations must be <20% if the analyte is greater than the reporting limit. If the RSD is above 20% then the laboratory must reanalyze the sample.*

10.9.2 Flush the system with the rinse blank for at least 30 seconds between samples and standards during the analytical run.

10.9.3 Masses, which would affect the data quality, must be monitored during the analytical run to determine the potential effects of matrix on a given element.

10.9.4 Dilute and reanalyze samples that are more concentrated than the linear range for an analyte or specific isotope of interest. No analyte may be reported from an analysis of a diluted sample in which the analyte concentration is less than 5 times the IDL. (The sample should be diluted to the approximate midrange of the analytical curve.)For samples analyzed under method 200.8, a 4-mL portion of digestate is diluted to 10 mL prior to analysis.

NOTE: Method 200.8 describes the digestion of 100 mL of sample, a final digestion volume of 50 mL, and Section 11.2.8 of the method adds a subsequent dilution of 20 mL of digestate to 50 mL prior to analysis. The digestion in TestAmerica Seattle's SOP TA-IP-0204 uses 50 mL of sample, a final digestion volume of 25 mL, and then 4 mL of digestate is diluted to 10 mL prior to analysis. The effective dilution factor is 1.25 in both the method and this SOP.

10.9.5 The analytical run sequence should be performed as follows to meet all quality control criteria:

Instrument initialization
Warm-up
Tune instrument
Perform mass calibration
Perform resolution check
Validate tuning criteria
- Calibration blank
- Calibration standards
- ICV
- ICB
- RL verification standard
- ICSA
- ICSAB
- CCV
- CCB
- 10 Samples (which can include all sample types)
- CCV
- CCB
- 10 samples
- CCV
- CCB
- Reslope
- CCV
- CCB

10.10 <u>Instrument Maintenance</u>

10.10.1 *All instrument maintenance must be documented in the instrument maintenance logbook*.

- *The logbook must include the instrument name, serial number for each major component (e.g., AA, autosampler) and the date of start-up.*
- *When an instrument is not capable of analyzing samples, it needs to be tagged "Out of Service".*
- *Routine Maintenance (which includes, but is not limited to daily, weekly, and semiannual maintenance) is completed periodically and does not necessary indicate the instrument is out of control is noted in the logbook with the notation "RM".*
- *For non-routine maintenance or repairs, logbook entries must include a description of the problem and what actions were taken to address the problem.*
- *When non-routine maintenance or repairs are complete, the instruments return to control is noted in the logbook with the notation "RTC".*

11.0 Calculations / Data Reduction

11.1 Accuracy

ICV / CCV, LCS % Recovery = $\frac{\text{observed concentration}}{\text{known concentration}} \times 100$

MS % Recovery = $\frac{\text{(spiked sample) - (unspiked sample)}}{\text{spiked concentration}} \times 100$

11.2 Precision (RPD)

Matrix Duplicate (MD) = $\frac{|\text{orig. sample value - dup. sample value}|}{[(\text{orig. sample value + dup. sample value})/2]} \times 100$

11.3 Concentration

The final concentration for an aqueous sample is calculated as follows:

$$\text{Result } (\mu\text{g/L}) = \frac{C \times V1 \times D}{V2}$$

Where:

C	=	Concentration from instrument readout, ppb
D	=	Instrument dilution factor
V1	=	Final volume in liters after sample preparation
V2	=	Initial volume of sample digested in liters

NOTE: Samples prepared for *total recoverable analytes* by Method 200.8 will have a preparation dilution factor of 1.25.

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The concentration determined in digested solid samples when reported on a wet weight basis is as follows:

$$\text{Result } (\mu\text{g/kg}) = \frac{C \times V \times D}{W}$$

Where:

C	=	Concentration from instrument readout, ppb
D	=	Instrument dilution factor
V	=	Final volume in liters after sample preparation
W	=	Weight, in g, of wet sample digested

NOTE: All dry weight corrections are made in LIMS at the time the final report is prepared.

12.0 Method Performance

12.1 Method Detection Limit Study (MDL)

12.1.1 Instrument Detection Limit (IDL) - IDLs are determined by analyzing seven replicates of low concentration undigested standards on each of three non-consecutive days, calculating the standard deviation for each day's results, and calculating the average of the three standard deviations. The IDL must be performed every three months.

12.1.2 The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure (see SOP TC-QSM-0602). MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method requirements require a greater frequency.

12.1.3 Linear Dynamic Range (LDR)

Linear range standards (see Section 7.2.7 for preparation) must be analyzed semiannually.

Acceptance Criteria:	The highest standard must produce a recovery within 90-110% of the expected value. Then the highest LDR is 90% of the highest successful standard.
Correction Action:	Samples producing results above the LDR must be diluted reanalyzed.

12.1.3.1 Linear Range Verification

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The LDR should be verified whenever, in the judgment of the analyst, a change in the analytical performance caused by either a change in instrument hardware or operating conditions would dictate the necessity to re-establish them.

Acceptance Criteria: The LDR verification standard must produce a result within 90-110% of the expected value.

Corrective Action: If this limit is not met, then a new LDR study is required.

Some programs (e.g., USACE/Navy) require verification of linear ranges in each analytical run or the samples must be diluted at the concentration of the high standard.

Acceptance Criteria: Results must be within 90-110% of the expected value.

Corrective Action: Samples producing results greater than the concentration of the daily check standard will be diluted and reanalyzed.

12.2 Demonstration of Capabilities

Analyst initial and continuing Demonstrations of Capability (DOC) are performed before any client samples are analyzed and are updated annually. See SOP TC-QSM-0617 for details.

12.3 Training Requirements

See SOP TC-QSM-0608 for detailed training requirements.

13.0 Pollution Control

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability).

14.0 Waste Management

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to Waste Disposal SOP TA-EHS-0036.

14.1 Waste Streams Produced by the Method

14.1.1 Metals acid waste – Waste Stream J

15.0 References / Cross-References

15.1 Test Methods For Evaluating Solid Waste, EPA SW-846, 3rd Edition, Final Update II, Method 6020: "Inductively Coupled Argon Plasma - Mass Spectrometry", Revision 0, September 1994.

15.2 Test Methods For Evaluating Solid Waste, EPA SW-846, 4th Edition, Draft Update IVA, Method 6020A: "Inductively Coupled Argon Plasma - Mass Spectrometry", Revision 1, January 1998.

15.3 Environmental Monitoring Systems Laboratory, EPA Method 200.8, "Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma - Mass Spectrometry", Revision 5.4, EMMC Version.

16.0 Method Modifications:

Item	Method	Modification
1	6020/200.8	Commercially available standards are purchased and verified at the laboratory rather than being prepared from the solid material. These verification records are kept on file.
2	6020/200.8	The results of the calibration blank as well as all other blanks must be less than the reporting limit, not 3 times the instrument IDL.
3	6020	The serial dilution results are evaluated when the original result is greater than 100 times the MDL rather than 100 times the concentration in the reagent blank.
4	6020	Corrective action for a PDS failure will be limited to generating an NCM indicating the failed analyte and the recovery rather than diluting and reanalyzing the sample.
5	6020	Internal standard recoveries are based on the intensities of the internal standards in the most recent calibration blank rather than the intensities of the internal standards in the initial calibration standard.
6	6020	The internal standard recovery limits for the ICV/CCV and ICB/CCB results is 30 - 120% for all analyses as stated in method 6020A rather than 80-120% as stated in method 6020.
7	200.8	Resolution criteria of the mass calibration are met if the resolution criteria for method 6020 are satisfied.

17.0 Tables

Table I: Recommended Elemental Equations

Table II: Contributions of Contaminant Elements when Resolution and Measurement Schemes Vary

Table III: Isobaric Molecular-Ion Interferences Which Could Affect the Analytes

Table IV: Changes in Isobaric Molecular-Ion Interferences with Changing Plasma Conditions

Table V: Recommended Internal Standards

Table VI: Interference Check Sample Components and Concentrations

Table VII: Suggested Mass Choices

Table VIII: Tuning Solution

Table IX: Suggested Tuning and Response Factor Criteria

Table X: Summary of Quality Control Requirements

Table XI: Calibration, Calibration Verification, and Spike Concentrations

Table XII: Reporting Limits

18.0 Revision History

- Revision 21, dated 16 April 2010
    - Added documentation of standards/reagents and standard/reagent preparation Section 7.1
    - Updated concentrations for nitric/hydrochloric acid mixture Section 7
    - Added removal of expired standards Section 7.4.
    - Updated Method Blank criteria for BP LaMP, Section 9.4
    - Updated LCS criteria for BP LaMP, Section 9.5
    - Updated 9.7 ICS-A/AB criteria for BP LaMP, Section 9.7
    - Added criteria for additional QC, Section 9.11.

- Updated Calibration Blank control criteria 10.6
- Updated MRL Standard criteria for BP LaMP, Section 10.7
- Added maintenance documentation and return to service requirements, Section 10.10.1
- Updated TableVI with interference check sample components and concentrations

- Revision 20, dated 13 August 2009
  - Added Table XII.X. Summary of Quality Control Requirements

- Revision 19, dated 28 February 2009
  - Updated RLs in Table XII.

- Revision 18, dated 22 February 2008
  - Integration for TestAmerica and STL operations.

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TABLE I: Recommended Elemental Equations

Element	Isobaric Correction	Mathematical Equation
Al	none	(1.0000)(27M)
Sb	none	(1.0000)(121M)
As	ArCl, Se	(1.0000)(75M) - (3.1278)(77M) + (1.0177)(78M)
Ba	none	(1.0000)(135M)
Be	none	(1.0000)(9M)
Cd	MoO, Sn	(1.0000)(114M) - (0.0268)(118M) - (1.0000)(135M)
Ca	none	(1.0000)(44M)
Cr	none	(1.0000)(52M)
Co	none	(1.0000)(59M)
Cu	none	(1.0000)(65M)
Fe	none	(1.0000)(57M)
Pb	none	(1.0000)(208M) + (1.0000)(207M) + (1.0000)(206M)
Mg	none	(1.0000)(25M)
Mn	none	(1.0000)(55M)
Hg	none	(1.0000)(200M)
Ni	none	(1.0000)(60M)
K	none	(1.0000)(39M)
Se	Ar2	(1.0000)(78M) - (1.1869)(76M)
Ag	none	(1.0000)(107M)
Na	none	(1.0000)(23M)
Tl	none	(1.0000)(205M)
V	ClO, Cr	(1.0000)(51M) - (3.1081)(53M) + (0.3524)(52M)
Zn	none	(1.0000)(66M)
6Li	Li (natural)	(1.0000)(6M) - (0.0813)(7M)
Sc	none	(1.0000)(45M)
Y	none	(1.0000)(89M)
Rh	none	(1.0000)(103M)
In	Sn	(1.0000)(115M) - (0.0149)(118M)
Tb	none	(1.0000)(159M)
Ho	none	(1.0000)(165M)
Bi	none	(1.0000)(209M)

Where M = Total ion count rate at the specified mass.

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TABLE II: Contributions of Contaminant Elements when Resolution and Measurement Schemes Vary

Concentrations listed are the approximate level (µg/L) measured when the interferent is present at 100 mg/L.

Analyte	Interferent Element	Peak Width at 10% of the Peak Height			
		1.0 amu Integration Width		0.8 amu Integration Width	
		0.9 amu	0.3 amu	0.9 amu	0.3 amu
^{121}Sb	^{120}Sn	820	5	10	1
^{121}Sb	^{122}Te	77	None	1	none
^{75}As	^{74}Se, ^{76}Se	910	4	3	none
^{9}Be	^{10}B	1,200	12	9	1
^{112}Cd	^{113}In	1,700	8	10	none
^{114}Cd	^{115}In	5,000	150	180	18
^{116}Cd	^{115}In	30	None	5	none
^{52}Cr	^{51}V	1.4	1.5	none	none
^{53}Cr	^{54}Fe	650	7	1	none
^{59}Co	^{58}Ni, ^{60}Ni	1,500	6	2	none
^{63}Cu	^{62}Ni, ^{64}Ni	190	1	none	none
^{63}Cu	^{64}Zn	4,000	14	9	none
^{65}Cu	^{64}Ni	1	1	none	none
^{65}Cu	^{64}Zn, ^{66}Zn	4,400	22	15	none
^{208}Pb	^{209}Bi	140	14	57	none
^{55}Mn	^{54}Fe, ^{56}Fe	900	8	4	none
^{58}Ni	^{59}Co	3,000	96	75	7
^{60}Ni	^{59}Co	9	4	10	5
^{62}Ni	^{63}Cu	8,500	690	4,500	16
^{107}Ag	^{106}Pd, ^{108}Pd	2,400	22	80	4
^{107}Ag	^{106}Cd, ^{108}Cd	130	3	5	2
^{109}Ag	^{108}Pd, ^{110}Pd	1,800	12	36	3
^{109}Ag	^{108}Cd, ^{110}Cd	1,600	10	37	3
^{51}V	^{52}Cr	2,100	45	410	1
^{64}Zn	^{65}Cu, ^{63}Cu	7,800	57	410	2
^{66}Zn	^{65}Cu	2	none	3	2

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TABLE III: Isobaric Molecular-Ion Interferences Which Could Affect the Analytes

Analyte	Interferences						
	Oxygen	Hydroxyl	Nitrogen	Chlorine	Sulfur	Carbon	Other
^{121}Sb	PdO		AgN			AgC	
^{123}Sb	AgO		AgN	SrCl	ZrS	CdC	
^{75}As	CoO	NiOH	NiN	ArCl	CaS	CuC	
^{138}Ba	SnO	SbOH					
^{137}Ba	SbO	SnOH		MoCl			
^{136}Ba	SnO	SnOH				SnC	
^{135}Ba	SnO	SnOH		MoCl			
^{134}Ba	SnO	SnOH	SnN	MoCl		SnC	
^{132}Ba	SnO, CdO	InOH	SnN	MoCl	MoS	SnC	
^{130}Ba	CdO	CdOH	SnN, CdN	MoCl	MoS	SnC	
^{9}Be							
^{114}Cd	MoO	MoOH	MoN	SeCl	SeS		
^{112}Cd	MoO, ZrO	MoOH	MoN	AsCl, SeCl	SeS	MoC	
^{111}Cd	MoO	MoOH	MoN	GeCl			
^{110}Cd	MoO, ZrO		MoN, ZrN	GeCl, AsCl	SeS	MoC	
^{113}Cd	MoO	MoOH		SeCl, AsCl			
^{116}Cd	MoO						
^{106}Cd	ZrO		MoN, ZrN		GeS	MoC, ZrC	
^{108}Cd	MoO, ZrO	ZrOH	MoN, ZrN	GeCl	SeS, GeS	MoC, ZrC	
^{52}Cr	ArO	ClOH				ArC	
^{53}Cr	ClO	ArOH	KN	NCl, OCl		KC	
^{50}Cr	SO		ArN		SO	ArC	Mo^{++}
^{54}Cr		ClOH	ArN, CaN			CaC	
^{59}Cr	CaO	CaOH	ScN	MgCl	AlS	TiC	Sn^{++}
^{63}Cu	TiO, PO_2	TiOH	TiN	SiCl, MgCl	PS	VC	ArNa
^{65}Cu	TiO	TiOH	VN	SiCl	SS, SO_2H	CrC	
^{208}Pb							
^{206}Pb							
^{207}Pb							
^{204}Pb							
^{55}Mn	KO	ArOH	KN		NaS	CaC	Cd^{++}

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TABLE III: (cont.) Isobaric Molecular-Ion Interferences Which Could Affect the Analytes

Analyte	Interferences						
	Oxygen	Hydroxyl	Nitrogen	Chlorine	Sulfur	Carbon	Other
^{202}Hg	WO						
^{200}Hg	WO	WOH	WN				
^{199}Hg	WO	WOH					
^{201}Hg		WOH					
^{198}Hg	WO	TaOH	WN			WC	
^{204}Hg							
^{196}Hg			WN				
^{58}Ni	CaO	KOH	CaN	NaCl	MgS	TiC	Cd^{++}, Sn^{++}
^{60}Ni	CaO	CaOH	TiN	MgCl, NaCl	SiS	TiC	Sn^{++}
^{62}Ni	TiO	ScOH	TiN	AlCl, MgCl	SiS	TiC, CrC	Sn^{++}
^{61}Ni	SeO	CaOH	TiN	MgCl	SiS	TiC	
^{64}Ni	TiO	TiOH	TiN, CrN	SiCl, AlCl	SS	CrC	
^{80}Se	ZnO	CuOH	ZnN	ScCl, CaCl	TiS	ZnC	
^{78}Se	NiO	NiOH	ZnN	CaCl, KCl	TiS	ZnC	
^{82}Se	ZnO	CuOH	ZnN	TiCl, ScCl	TiS, CrS		
^{76}Se	NiO	CoOH	NiN	KCl	CaS	ZnC	
^{77}Se	NiO	CuN	CuN	CaCl, ArCl	ScS	CuC	
^{74}Se	NiO	NiN	NiN	ClCl, KCl	CaS	NiC	
^{107}Ag	ZrO	ZrOH		GeCl	AsS	MoC	
^{109}Ag		MoOH	MoN	GeCl	SeS	MoC	
^{205}Tl							
^{203}Tl		WOH					
^{51}V	ClO	SOH	ClN	ClO, ClN	FS	KC	
^{50}V	SO		ArN			ArC	Mo
^{64}Zn	TiO	TiOH	TiN, CrN	SiCl, AlCl	SS	CrC	
^{66}Zn	TiO	TiOH	CrN	PCl, SiCl	SS	FeC	
^{68}Zn	CrO	VOH	FeN	PCl	ArS	FeC	Ba^{++}
^{67}Zn	VO	TiOH, Cr	CrN	SCl	ClS	MnC	Ba^{++}
^{70}Zn	FeO	CrOH	GeN	ClCl	ArS	NiC	

NOTE: The information provided in this table does not indicate that all of the described interferences need to be tested. However, the table can be consulted for informational purposes if unusual samples are encountered.

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Table IV: Changes in Isobaric Molecular-Ion Interferences with Changing Plasma Conditions**

	Molecular Interference	Nebulizer Flow Rate		
		High	Average	Low
Oxides	ScO/Sc	0.00326	0.00055	0.00116
	YO/Y	0.00568	0.00395	0.00353
	TbO/Tb	0.0156	0.00648	0.00614
	ClO, Cl	0.00725	0.00227	0.00233
Hydroxides	ScOH/Sc	0.00040	0.00011	0.00000
	YOH/Y	0.00078	0.00044	0.00048
	TbOH/Tb	0.00034	0.00008	0.00011
	ClOH/Cl	0.00048	0.00031	0.00029
Chlorine	ClO/Cl	0.00725	0.00227	0.00233
	ClOH/Cl	0.00048	0.00031	0.00029
	ArCl/Cl	0.00605	0.00091	0.00477

** Information for this table is being determined by the EPA.

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Table V: Recommended Internal Standards

Method 6020	Method 200.8
Li	Sc
Sc	Y
Y	In
Rh	Tb
In	Bi
Tb	
Ho	
Bi	
Ge	

Table VI: Interference Check Sample Components and Concentrations
(ICSAB minors are suggested spike levels)

Interference Component	Solution A Concentration (mg/L)	Solution AB Concentration (mg/L)
Al	100.0	100.0
Ca	*300.0*	*300.0*
Fe	*250.0*	*250.0*
Mg	100.0	100.0
Na	*250.0*	*250.0*
P	100.0	100.0
K	100.0	100.0
S	100.0	100.0
C	200.0	200.0
Cl	1000.0	1000.0
Mo	2.0	2.0
Ti	2.0	2.0
As	0.0	0.1
Cd	0.0	0.1
Cr	0.0	*0.2*
Co	0.0	*0.2*
Cu	0.0	*0.2*
Mn	0.0	*0.2*
Ni	0.0	*0.2*
Se	0.0	0.1
Ag	0.0	*0.05*
V	0.0	*0.2*
Zn	0.0	0.1

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Table VII: Suggested Mass Choices

Boldface masses indicate the masses which must have the most impact on data quality and the elemental equations used to collect the data. Suggested masses for method 200.8 are in "quotes."

Mass	Element of Interest
"**27**"	Aluminum
121, "**123**"	Antimony
"75"	Arsenic
138, "137", 136, **135**, 134, 132, 130	Barium
"9"	Beryllium
114, 112, "111", 110, 113, 116, 106	Cadmium
42, 43, **44**, 46, 48	Calcium
"**52**", **53**, **50**, 54	Chromium
"**59**"	Cobalt
"**63**", **65**	Copper
56, **54**, **57**, 58	Iron
"**208**", "**207**", "**206**", 204	Lead
24, **25**, **26**	Magnesium
"**55**"	Manganese
196, 198, 199, **200**, **201**, "**202**", 204	Mercury
58, "**60**", 62, **61**, 64	Nickel
39	Potassium
80, **78**, "**82**", **76**, **77**, 74	Selenium
"**107**", **109**	Silver
23	Sodium
"**205**", 203	Thallium
"**51**", **50**	Vanadium
64, "**66**", **68**, **67**, 70	Zinc
72	Germanium
139	Lanthanum
118	Tin
35, 37	Chlorine
"98", 96, 92, **97**, 94	Molybdenum

NOTE: It is strongly recommended that elements other than those of interest be monitored to indicate other potential molecular interferences that could affect the data quality.

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Table VIII: Tuning Solution

A tuning solution containing elements representing all of the mass regions of interest must be analyzed. Below are two groups of suggested solutions that cover a typical mass calibration range.

Method 6020

Element	Concentration (µg/L)
Solution A	
Mg	10
Rh	10
Pb	10
Solution B	
Li	10
Co	10
In	10
Tl	10

Method 200.8

Element	Concentration (µg/L)
Be	10
Mg	10
Co	10
In	10
Pb	10

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Table IX: Suggested Tuning and Response Factor Criteria

Minimum Response from Tuning Solution:

Be	>1,000
Mg	>2,000
Rh	>20,000
Pb	>10,000
Li	>2,000
Co	>20,000
In	>1,000
Tl	>1,000

Suggested Mass Calibration:

Be	9.0122
Mg	23.98
Rh	102.91
Pb	207.98
Li7.016	
Co	58.9332
In	114.904
Tl	204.9744

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Table X: Summary of Quality Control Requirements

QC Parameter	Frequency*	Acceptance Criteria	Corrective Action
ICV/QCS	Beginning of every analytical run.	90 - 110% recovery. 6020 IS, 30-120% rec. 200.8 IS, 60-125% rec.	Terminate analysis; correct the problem; recalibrate.
ICB/CB	Immediately after each ICV	The result is < RL. 6020 IS, 30-120% rec. 200.8 IS, 60-125% rec. ***For DoD QSM, < LOD.***	Terminate analysis; correct the problem; recalibrate.
CCV	Beginning and end of run and every 10 samples OR every 2 hours, whichever is more frequent. Beginning and end of each lot.	90 - 110% recovery. 6020 IS, 30-120% rec. 200.8 IS, 60-125% rec.	Reanalyze once. If acceptable, continue. If unacceptable, terminate analysis; correct the problem recalibrate the instrument, reverify calibration and rerun all samples since the last acceptable CCV.
CCB	Immediately following each CCV.	The result must be < RL. 6020 IS, 30-120% rec. 200.8 IS, 60-125% rec. ***For DoD QSM, < LOD.***	Reanalyze once. If acceptable, continue. If unacceptable, terminate analysis; correct the problem, recalibrate the instrument, verify calibration and rerun all samples since the last acceptable CCB.
ICSA	Beginning and every 12 hours.	Monitor for possible interferences. ***For DoD QSM, < LOD (unless they are a verified trace impurity form one of the spike analytes).***	See Section 9.7
ICSAB	Immediately following each ICSA.	Monitor for possible interferences. ***For DoD QSM, ± 20%.***	See Section 9.7

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Table X. Summary of Quality Control Requirements (continued)

QC Parameter	Frequency*	Acceptance Criteria	Corrective Action
Method Blank/Laboratory Reagent Blank	One per lot of 20 field samples or fewer.	The result must be < RL. Sample results greater than 10x the blank concentration or samples for which the contaminant is < RL, do not require redigestion or reanalysis. ***For DoD QSM, < ½ RL.***	Redigest and reanalyze samples. Note exceptions under criteria section. See Section 9.4 for additional requirements.
Laboratory Control Sample (LCS)	One per sample preparation batch of up to 20 samples.	LCS must be within 80 - 120% recovery or in-house control limits. (85-115% for 200.8) Samples for which the contaminant is < RL and the LCS results are > 120% (115% for 200.7) may not require redigestion or reanalysis (see Section 9.5).	Terminate analysis; Correct the problem; Redigest and reanalyze all samples associated with the LCS.
Matrix Spike (MS)	One per sample preparation batch of up to 20 samples.	75 – 125% recovery or tighter in-house control limits. **For DoD:** Use LCS control limits.	In the absence of client specific requirements, flag the data; no flag required if the sample level is > 4x the spike added.
Matrix Spike Duplicate (MSD)	One per sample preparation batch of up to 20 samples. 10% frequency for some programs (see **Error! Reference source not found.**)	75 – 125 % recovery; RPD ≤ 20% or tighter in-house control limits. **For DoD:** Use LCS conrrol limits.	See Corrective Action for Matrix Spike.
Serial Dilution (6020 Only)	One per batch of 20 field samples or fewer.	90 - 110% recovery	See Section 9.9 for additional requirements.
Post-Digestion Spike (6020 Only)	One per batch of 20 field samples or fewer.	75-125% recovery	See Section 9.10.

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QC Parameter	Frequency*	Acceptance Criteria	Corrective Action
Matrix Spike/Laboratory Fortified Matrix	One per lot of 20 field samples or fewer.	Must be within laboratory control limits	See Section 9.6 for additional requirements.

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Table XI: Calibration, Calibration Verification, and Spike Concentrations

Element	Initial Calibration Levels (µg/L)					ICV (µg/L)	CCV (µg/L)	LCS (µg/L)	MS/MSD (µg/L)
	1	2	3	4	5				
Aluminum	1	10	100	500	1000	400	500	80	80
Antimony	0.1	1	10	50	100	40	50	60	60
Arsenic	0.1	1	10	50	100	40	50	80	80
Barium	0.1	1	10	50	100	40	50	80	80
Beryllium	0.1	1	10	50	100	40	50	2	2
Cadmium	0.1	1	10	50	100	40	50	2	2
Calcium	10	100	1000	5000	10,000	4000	5000	400	400
Chromium	0.1	1	10	50	100	40	50	8	8
Cobalt	0.1	1	10	50	100	40	50	20	20
Copper	0.1	1	10	50	100	40	50	10	10
Iron	10	100	1000	5000	10,000	4000	5000	440	440
Lead	0.1	1	10	50	100	40	50	20	20
Magnesium	10	100	1000	5000	10,000	4000	5000	400	400
Manganese	0.1	1	10	50	100	40	50	20	20
Mercury	0.005	0.05	0.5	2.5	5	2	2.5	1.0	1.0
Molybdenum	0.1	1	10	50	100	40	50	10	10
Nickel	0.1	1	10	50	100	40	50	20	20
Potassium	1	10	100	500	1000	4000	5000	400	400
Selenium	0.1	1	10	50	100	40	50	10	10
Silver	0.1	1	10	50	100	40	50	12	12
Strontium	0.1	1	10	50	100	40	50	10	10
Thallium	0.1	1	10	50	100	40	50	80	80
Tin	0.1	1	10	50	100	40	50	10	10
Titanium	0.1	1	10	50	100	40	50	10	10
Uranium	0.1	1	10	50	100	40	50	10	10
Zinc	0.1	1	10	50	100	40	50	20	20

This procedure has been developed for thirty-five elements (See Table VIII). Additional elements may be included in the calibration solution at the above levels. Levels may be adjusted to meet specific regulatory or client programs.

Table XII: Reporting Limits

Element	Water 6020, 200.8 (µg/L)	Soil 6020 (µg/kg)
Aluminum	400	30,000
Antimony	2	200
Arsenic	2	200
Barium	6	200
Beryllium	2	200
Cadmium	2	200
Calcium	50,000	100,000
Chromium	2	200
Cobalt	2	200
Copper	5	200
Iron	200	20,000
Lead	2	200
Magnesium	4000	100,000
Manganese	2	500
Mercury	0.2	200
Molybdenum	4	400
Nickel	2	200
Potassium	50,000	100,000
Selenium	2	500
Silver	2	200
Strontium	2	200
Thallium	4	400
Tin	7	500
Titanium	5	200
Uranium	2	200
Vanadium	2	200
Zinc	7	700

Title: Determination of Volatile Organic Compounds by GC/MS [Methods 8260B and 624]

Approvals

Signatures on File

Tiffany Ryan — Date Volatiles Department Manager	Stan Palmquist — Date Health & Safety Manager / Coordinator
Dave Wunderlich — Date Quality Assurance Manager	Kathy Kreps — Date Laboratory Director

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1.0 Scope and Application

1.1 This method is applicable to the determination of volatile organic compounds (VOCs) in water, wastewater, soils, sludges, and other solid matrices. Standard analytes are listed in Tables 1, 2, and 3.

1.2 This SOP is applicable to Method 8260B, which is appropriate for compliance testing under RCRA regulations. Appendix A presents modifications to the procedures in the main SOP that are necessary for analysis of wastewater by Method 624 (CWA compliance testing). It is important that the differences among these methods are carefully observed.

1.2.1 In addition SIM (single ion monitoring) technique may also be used for samples that require more sensitive analysis. All GC conditions and QC apply to this technique except for the MS parameters

1.3 This method can be used to quantify most volatile organic compounds that have boiling points below 200 °C and are insoluble or slightly soluble in water. Volatile water-soluble compounds can be included in this analytical technique; however, for more soluble compounds, quantitation limits are approximately ten times higher because of poor purging efficiency.

1.4 The method is based upon a purge-and-trap, gas chromatograph/mass spectrometric (GC/MS) procedure. The approximate working range is 0.2 to 200 µg/L for 8260B waters, 0.8 to 200 µg/kg for low-level soils, and 8 to 8,000 µg/kg for high-level soils. The working range for Method 624 (5 mL purge) is 1-200 µg/L.

1.5 Reporting limits are listed in Tables 1, 2 and 3.

1.6 Method performance is monitored through the use of surrogate compounds, matrix spike/matrix spike duplicates (MS/MSD), and laboratory control spike samples (LCS).

1.7 On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in Section 13.3.1 in the Quality Assurance Manual.

2.0 Summary of Method

2.1 Volatile compounds are introduced into the gas chromatograph by the purge and trap method. The components are separated via the gas chromatograph and detected using a mass spectrometer, which is used to provide both qualitative and quantitative information.

2.2 Aqueous samples are purged directly. Generally, soils are preserved by extracting the volatile analytes into methanol. If especially low detection limits are required, soil samples may be preserved with sodium bisulfate; sampled directly into pre-tarred VOA vials which contain 5mL reagent free water, a magnetic stirrer bar, and are immediately frozen; or collected in a suitable container to be transferred in total or by aliquot to a VOA vial and purged directly.

2.3 In the purge-and-trap process, an inert gas (generally Helium) is bubbled through the solution at ambient temperature and the volatile components are efficiently transferred from the aqueous phase to the vapor phase. The vapor is swept through a sorbent column where the volatile components are trapped. After purging is completed, the sorbent column (trap) is heated and back flushed with inert gas to desorb the components onto a gas chromatographic column. The gas chromatographic column is then heated to elute the components, which are detected with a mass spectrometer.

2.4 Qualitative identifications are confirmed by analyzing standards under the same conditions used for samples and comparing the resultant mass spectra and GC retention times. Each identified component is quantified by relating the MS response for an appropriate selected ion produced by that compound to the MS response for another ion produced by an internal standard.

3.0 Definitions

3.1 Both SW-846 (RCRA) and drinking water (SDWA) terminology are used in this section for cross-reference purposes. Elsewhere in the SOP, the SW-846 terminology is used exclusively.

3.2 Batch

The batch is a set of up to 20 samples of the same matrix processed using the same procedures and reagents within the same time period. Using this method, each 4-bromofluorobenzene (BFB) analysis will normally start a new batch. Batches for high-level soils are defined at the sample preparation stage and may be analyzed on multiple instruments over multiple days, although reasonable effort should be made to keep the samples together.

The Quality Control batch must contain a matrix spike/spike duplicate pair (MS/MSD), a Laboratory Control Sample (LCS), and a method blank. If there is insufficient sample to perform the MS/MSD, a duplicate LCS is used to establish batch precision when requested by the client. Refer to SOP TA-QA-0620 for further details of the batch definition.

3.3 Method Blank (MB) or Laboratory Reagent Blank (LRB)

A method blank consisting of all reagents added to the samples must be analyzed with each batch of samples. The method blank is used to identify any background interference or contamination of the analytical system, which may lead to the reporting of elevated concentration levels or false positive data. Sparged water or water that has been boiled then cooled to ambient temperature is used as the blank medium for water batches and muffled Ottawa Sand for soil batches. Prepared (muffled *at 800C for at least 2 hours*) batches of Ottawa sand are tracked using the reagent data base in the Laboratory Information Management System (known as TALS) and are at the time of the writing of this SOP named with the following convention: voasand_XXXXX.

3.4 Laboratory Control Sample (LCS) or Laboratory Fortified Blank (LFB)

A blank matrix (reagent water or muffled Ottawa Sand) is spiked with the analytes of interest and is carried through the entire analytical procedure. Analysis of this sample with acceptable recoveries of the spiked materials demonstrates that the laboratory techniques for this method are acceptable.

3.5 Surrogates

Surrogates are organic compounds that are similar to the target analyte(s) in chemical composition and behavior in the analytical process, but that are not normally found in environmental samples. Each sample, blank, LCS, and MS/MSD is spiked with surrogate standards. Surrogate spike recoveries must be evaluated by determining whether the concentration (measured as percent recovery) falls within the required recovery limits.

3.6 Matrix Spike/Matrix Spike Duplicate (MS/MSD) or Laboratory Fortified Sample Matrix (LFM)

A matrix spike is an environmental sample to which known concentrations of target analytes have been added. A matrix spike duplicate is a second aliquot of the same sample, which is prepared and analyzed along with the sample and matrix spike. Matrix spikes and duplicates are used to evaluate accuracy and precision in the actual sample matrix.

3.7 Calibration Check Compound (CCC)

CCCs are a representative group of compounds that are used to evaluate initial calibrations and continuing calibrations. Relative percent difference for the initial calibration and % drift (%D) for the continuing calibration response factors are calculated and compared to the specified method criteria.

3.8 System Performance Check Compounds (SPCC)

SPCCs are compounds that are sensitive to system performance problems and are used to evaluate system performance and sensitivity. A response factor from the continuing calibration is calculated for the SPCC compounds and compared to the specified method criteria.

3.9 Initial Calibration Verification (ICV) or Quality Control Sample (QCS)

The ICV is a second-source calibration verification standard. The QCS is reagent water or an environmental sample that is fortified with target analytes at known concentrations. This too is a second-source standard, i.e., different than the source of calibration standards. In this SOP, the LCS and the MS/MSD spikes are second-source standards, and serve to meet method requirements for the QCS.

3.10 Continuing Calibration Verification (CCV) or Laboratory Performance Check Solution (LPC)

A solution of method analytes, surrogate compounds, and internal standards used to evaluate the performance of the instrument system with respect to a defined set of method criteria.

4.0 Interferences

4.1 Method interferences may be caused by contaminants in solvents, reagents, glassware, and other processing apparatus that lead to discrete artifacts. All of these materials must be routinely demonstrated to be free from interferences under conditions of the analysis by running laboratory method blanks as described in the Quality Control section. The use of ultra high purity gases, boiled and cooled to ambient *or sparged* purified reagent water, and approved lots of purge-and-trap-grade methanol will greatly reduce introduction of contaminants. In extreme cases, the purging vessels may be pre-purged to isolate the instrument from laboratory air contaminated by solvents used in other parts of the laboratory.

4.2 Samples can be contaminated by diffusion of volatile organics (particularly methylene chloride and fluorocarbons) into the sample through the septum seal during shipment and storage. A field blank prepared from reagent water and carried through the sampling and handling protocol can serve as a check on such contamination.

4.3 Matrix interferences may be caused by non-target contaminants that are co-extracted from the sample. The extent of matrix interferences will vary considerably from source to source depending upon the nature and diversity of the site being sampled.

4.4 Cross-contamination can occur whenever high-level and low-level samples are analyzed sequentially or in the same purge position on an autosampler. Whenever an unusually concentrated sample is analyzed, it should be followed by one or more blanks to check for

cross-contamination. The purge and trap system may require extensive bake-out and cleaning after a high-level sample.

4.5 Some samples may foam when purged due to surfactants present in the sample. When this kind of sample is encountered, an antifoaming agent (e.g., J.T. Baker's Antifoam B silicone emulsion) can be used.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001) and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1 Specific Safety Concerns or Requirements

5.1.1 The gas chromatograph and mass spectrometer contain zones that have elevated temperatures. The analyst needs to be aware of the locations of those zones, and must cool them to room temperature prior to working on them.

5.1.2 The mass spectrometer is under deep vacuum. The mass spectrometer must be brought to atmospheric pressure prior to working on the source.

5.1.3 There are areas of high voltage in both the gas chromatograph and the mass spectrometer. Depending on the type of work involved, either turn the power to the instrument off, or disconnect it from its source of power.

5.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material	Hazards	Exposure Limit (1)	Signs and symptoms of exposure
Methanol (MeOH)	Flammable Poison Irritant	200 ppm-TWA	A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Symptoms of overexposure may include headache, drowsiness and dizziness. Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure. Irritant to the eyes.
1 – Exposure limit refers to the OSHA regulatory exposure limit.			

6.0 Equipment and Supplies

6.1 Instrumentation

- Gas Chromatograph: The gas chromatograph (GC) system must be capable of temperature programming.
- Gas Chromatographic Columns: Capillary columns are used. Some typical columns are listed below:

  Column 1: 60 m X 0.32 ID DB-624 with 1.8 µm film thickness.

  Column 2: 75 m X 0.53 ID DB-624 wide bore with 3 µm film thickness.

  Column 3 20 M X 0.18 ID DB-624 micro 1.0um film thickness
- Mass Spectrometer: The mass spectrometer must be capable of scanning 35-300 amu every two seconds or less, using 70 volts electron energy in the electron impact mode and capable of producing a mass spectrum that meets the required criteria.
- GC/MS interface: In general glass jet separators are used but any interface (including direct introduction to the mass spectrometer) that achieves all acceptance criteria may be used.
- Data System: A computer system that allows the continuous acquisition and storage on machine-readable media of all mass spectra obtained throughout the duration of the chromatographic program. The computer must have software that allows searching any GC/MS data file for ions of a specified mass and plotting such ion abundances versus time or scan number. This type of plot is defined as an Extracted Ion Current Profile (EICP). Software must also be available that allows integrating the abundances in any EICP between the specified time or scan-number limits. In addition, for the non-target compounds, software must be available that allows for the comparison of sample spectra against reference library spectra. The most recent release of the NIST/EPA mass spectral library should be used as the reference library. The computer system must also be capable of backing up data for long-term off-line storage.
- Purge and Trap Device: The purge and trap device consists of the sample purger, the trap, and the desorber.
- Sample Purger: The recommended purging chamber is designed to accept between 5 mL and 25 mL samples with a water column at least 3 cm deep. The purge gas must pass through the water column as finely divided bubbles, each with a diameter of less than 3 mm at the origin. The purge gas must be introduced no more than 5 mm from the base of the water column. Alternative sample purge devices may be used provided equivalent performance is demonstrated. Low level soils are purged directly from a VOA vial.
- Trap: A variety of traps may be used, depending on the target analytes required. The O.I. #10 (Tenax/Silica gel/Carbon Molecular Sieve) is recommended. Other traps such as the Vocarb 3000 or Vocarb 4000 may be used if the Quality Control criteria are met.
- Desorber: The desorber should be capable of rapidly heating the trap up to 270 °C depending on the trap packing material. Many such devices are commercially available.
- Purge-and-trap Autosampler: An autosampler capable of sampling from a sealed vial, Varian Archon, or equivalent.

6.2 <u>Supplies</u>

- Microsyringes: 1.0 µL gas tight and larger, 0.006-inch ID needle
- Syringe: 5 or 25 mL glass with Luerlok tip, if applicable to the purging device
- Balance: Analytical balance capable of accurately weighing 0.0001 g, and a top-loading balance capable of weighing 0.1 g. *The balance used for sample preparation is calibrated daily by a designated primary analyst (a back-up analyst is also assigned*

should the primary be unavailable). Tthe analyst must perform this check according to SOP TA-QA-0014. It is also the responsibility of any analyst performing work on the balance to check the Balance logbook to determine if the daily calibration check has been completed, before beginning work.

- Scintillation Vials: 20 mL with screw caps.
- Volumetric flasks: 10 mL to 100 mL, class A with ground-glass or Teflon ® stoppers.
- Spatula: Stainless steel.
- Disposable pipettes: Pasteur.
- pH paper: Wide range *(0-14) and narrow range (0-2.5)*.
- Helium: Ultra high purity, gr. 5, 99.999%.
- Nitrogen: Ultra high purity, from cylinders or gas generators, may be used as an alternative to helium for purge gas.

  Note: The use of Nitrogen as a purge gas is not allowed for analysis of VOA contaminants in drinking waters.
- Compressed air: Used for instrument pneumatics.

7.0 Reagents and Standards

7.1 *Document reagent/standards and reagent/standard preparation in TALS using the reagent module as described in SOP TA-QA-0619.*

7.2 Reagents

7.2.1 Methanol: Purge and Trap Grade, High Purity

7.2.2 Reagent Water: High purity water that meets the requirements for a method blank when analyzed. (See Section 9.3.) Reagent water may be purchased as commercial distilled water and prepared by purging with an inert gas for a minimum of 1 hour or boiling and cooling to ambient temperature prior to use. Other methods of preparing reagent water are acceptable.

7.3 Standards

7.3.1 If stock or secondary dilution standards are purchased in sealed ampoules they may be used up to the manufacturer's expiration date.

7.3.1.1 *Purchased standards are stored at the manufacturer's specifications (i.e. ambient, freezer, refrigerator). Standards prepared from these purchased standards are stored in the freezer.*

7.3.2 Calibration Stock Standard Solutions: Components of stock solutions may be purchased as certified solutions from commercial sources or prepared from pure standard materials as appropriate. These standards are prepared in methanol and stored in Teflon-sealed screw-cap bottles with minimal headspace at ≤-10°C. Stock standards must be replaced at least every 6 months. Note: "Gases" standards may be prepared on a more frequent basis based on analyst observed signs of degradation or may require re-preparation due to component solutions which have manufacture assigned expiration dates of less than 6 months.

7.3.3 Calibration Working standards: A working solution containing the compounds of interest prepared from the stock solution(s) in methanol. These standards are stored in the freezer. Working standards are monitored by comparison to the initial calibration curve. If any of the calibration check compounds drift in response from the initial calibration by more than 20%, then corrective action is necessary. This

may include steps such as instrument maintenance, preparing a new calibration verification standard or tuning the instrument. If the corrective actions do not correct the problem *(two CCVs in a row fail)*, then a new initial calibration must be performed.

7.3.4 Aqueous calibration standards are prepared in reagent water using the secondary dilution standards. These aqueous standards must be prepared daily.

7.3.5 Internal standards (IS) are added to all samples, standards, and blank analyses. Refer to Table 5 for internal standard components.

7.3.6 Surrogate Standards: Refer to Table 6 for surrogate standard components and spiking levels.

7.3.7 Laboratory Control Sample Spiking Solutions: Refer to Tables 7 and 7a for LCS components and spiking levels.

7.3.8 Matrix Spiking Solutions: The matrix spike contains the same components as the LCS. Refer to Tables 7 and 7a.

7.3.9 Tuning Standard: A standard is made up that will deliver 50 ng of 4-Bromofluorbenzene on column upon injection.

7.4 *Managers/supervisors or a designee are expected to check their areas on a monthly basis for expired standards/reagents and dispose of them according to SOP TA-EHS-0036.*

8.0 **Sample Collection, Preservation, Shipment and Storage**

8.1 Water samples are normally preserved at pH < 2 with 1:1 hydrochloric acid. The holding time for acid-preserved samples is 14 days from sample collection. For compliance with Method 624 and 8260B, unpreserved samples must be tested within 7 days of collection.

8.2 There is an exception to the requirements stated in Section 8.1 above:

8.2.1 2-Chloroethyl vinyl ether is hydrolyzed in the presence of acid. For samples collected for analysis of this compound, a separate vial without acid should be recommended.

8.3 Preserved Soils

8.3.1 Solid samples can be field preserved with sodium bisulfate solution for low-level analysis, or with methanol for high-level analysis. The holding time for sodium bisulfate and methanolic preserved samples is 14 days.

8.3.2 Soil samples can also be collected using the EnCore™ sampler and preserved in the laboratory within 48 hours of sampling. At specific client request, unpreserved soil samples may be accepted, *but have a hold time of 48 hours from sample collection to be sub-sampled and preserved*. The holding time for EnCore™ samples varies based on client specifications and can be 48 hours, 7 days, or 14 days, see the table in Section 8.12.

8.3.3 Soil samples can also be preserved with deionized water and then frozen. The holding time for frozen samples varies based on client specifications and requirements and can be 48 hours, 7 days, or 14 days, see the table in Section 8.12.

8.4 There are several methods of sampling soil. The recommended method, which provides the minimum of field difficulties, is to collect a sample in an EnCore™ sampler. Following shipment back to the laboratory, the soil is preserved in methanol. This is the high-level

procedure. If very low detection limits are needed (i.e., < 50 µg/kg for most analytes) then it will be necessary to use two additional 5 g EnCore™ samplers or to use field preservation.

8.5 Sample collection for High-Level Analysis using in house extraction.

8.5.1 When extracting the sample, extrude (for 5 g EnCore™) or weigh (for 10 g in house soil extraction) the sample into a tared 20 mL scintillation vial. Record the weight of the sample in the batch record, either by direct read to the batch record, or by immediately typing the balance reading into the batch record.

8.5.2 If sufficient sample is available, one matrix spike (MS)/matrix spike duplicate (MSD) pair is extracted per extraction batch of up to 20 samples. If the sample set being extracted consists of products, waste oils, or other sample matrixes which based on analyst experience and discretion would not yield acceptable spike results due to matrix effects, a matrix duplicate (MD) and/or MD/MS may be prepared in lieu of and MS/MSD.

8.5.3 For each batch of up to 20 samples a method blank (MB) and a Laboratory Control Sample (LCS) are also extracted. A MB and an LCS sample consists of 10 g of muffled Ottowa Sand added to a scintillation vial then capped.

8.5.4 Add 5 mL (for EnCore™) or 10 mL (in house soil extraction) of methanol with surrogate (4 mg/L TFT 5035 MeOH preservation solution, Reagent ID: V-4TFT-EX_xxxxx) to all vials immediately after recording sample weight *unless the sample requires an analyte spike (LCS/LSCD/MS/MSD) and falls under LaMP regulations, see Section 8.5.5*. Cap the vial and place in vial rack.

8.5.5 Add the correct amount of matrix spiking solutions to all LCS, MS, and MSD samples. *For samples that fall under LaMP regulations, the spike must be added to the LCS/MS/MSD prior to adding the surrogated methanol.* An aliquot of 160 uL each of Reagent ID: V_LCS_G_50_xxxxx and Reagent ID: V_LCS_L_50_xxxxx is added to 10 mL extracts. The volume of each solution is halved (80 uL) for 5 mL extracts. The addition of spike introduces a slight error, which can be neglected in the calculations. When applicable (Tier II and non-DoD clients), a short list spike is used instead of the above mentioned spiking compounds. In this instance, an aliquot of 160 uL of Reagent ID: V_LCS_SL50_xxxx or V_SL_L_50_xxxxx is added to 10-mL extracts. The listed volumes are halved (80 uL) for 5-mL extracts.

8.5.6 Vortex the samples for approximately 10 to 30 seconds to break up any large clumps in the extraction vials. This is especially important for extruded samples as they may be compacted in the EnCore™ sampling device and come out as a pellet. If after 30 seconds a pellet still remains, vortex for an additional 30 seconds. If pellet still remains, further vortex mixing is not recommended, proceed to next step. It should be noted that the MB and LCS must be vortex mixed the same amount of time as the longest associated sample.

8.5.7 After all samples have been vortex mixed, place all samples for the extraction batch into shaker box and set timer for five minutes. It is recommended that the caps of all vial are checked and tightened before placing in shaker box to prevent leaking. If samples are present which still contain pelletized sample after vortex mixing in step 8.5.6, set the timer for 10 to 15 minutes. It is not recommended to shake samples for more than 15 minutes. If a sample still contains pelletized sample after shaking for 15 minutes, vortex the sample for an additional 15 seconds and shake entire batch for additional 5 minutes. Any pelletized sample

remaining after second shaking is noted in batch record and an "other anomaly" NCM is generated to accompany the extraction batch.

8.5.8 After samples are shaken, place samples four at a time into centrifuge with inserts for scintillation vials. Spin samples for a sufficient time to create a transparent but not necessarily uncolored layer of methanol extract above the extracted material. The time will vary depending on the nature and particle size of the extracted material. Three to five minutes at 50% speed is usually sufficient. Again it should be noted that the MB and LCS must be centrifuged at the same rate and for the same time as the longest centrifuged associated sample.

8.6 Sample Collection for High-Level Analysis using Field Methanol Preservation

8.6.1 A pre-tared four ounce volatile soil jar with an accompanying VOA vial containing 25ml of solution Reagent ID: V-4TFT-EX_xxxxx, or VOA vial containing 10 mL of solution Reagent ID: V-4TFT-EX_xxxxx is sent out by sample control for each sample required. In addition the appropriate amount of trip blanks containing either 25 g or 10 g of muffled Ottowa sand are also sent out. All bottles sent to the field are labeled and tracked by number in an Excel™ spreadsheet titled "AK101/8260B container shipment log" which is located on the network. There is a shortcut to this spreadsheet on the volatiles prep area PC. Note that the entry cells on this spreadsheet must be write protected by the prep analyst after each use of the spreadsheet.

8.6.2 Twenty-five gram field samples are collected by placing an appropriate amount of sample in the four ounce soil jar and then adding one VOA vial containing 25 mL of Reagent ID: V-4TFT-EX_xxxxx. Ten gram field samples are collected by adding an appropriate amount of sample to a 40 mL VOA vial containing 10 mL of Reagent ID: V-4TFT-EX_xxxxx.

8.6.3 Sample weights are calculated in the laboratory by adding the received weight of the sample jar to the received weight column of the "AK101/8260B container shipment log" spreadsheet of the corresponding sample container ID. This can be done by either a direct read from the balance in the volatiles prep area (preferred method), or by manually entering the weight in the spreadsheet.

8.6.4 For each batch of up to 20 samples a method blank (MB) and a Laboratory Control Sample (LCS) are prepared by the laboratory prior to sample analysis. A MB and an LCS sample consists of 10 g of muffled Ottowa Sand added to a scintillation vial followed by 10-mL of Reagent ID: V-4TFT-EX_xxxxx then capped.

8.6.5 Add the correct amount of matrix spiking solutions to all LCS samples. *For samples that fall under LaMP regulations, the spike must be added to the LCS prior to adding the surrogated methanol.* An aliquot of 160 uL each of Reagent ID: V_LCS_G_50_xxxxx and Reagent ID: V_LCS_L_50_xxxxx is added to 10 mL extracts. The addition of the spike solutions introduces a slight error, which can be neglected in the calculations. When applicable (Tier II and non-DoD clients), a short list spike is used instead of the above mentioned spiking compounds. In this instance, an aliquot of 160 uL of Reagent ID: V_LCS_SL50_xxxx or V_SL_L_50_xxxxx is added to 10-mL extracts. The listed volumes are halved (80 uL) for 5-mL extracts.

8.6.6 The MB, LCS and any received samples which appear to contain "clumps" of sample which could be broken up with agitation are vortex mixed for up to 1

minute. If no samples require agitation, only the MB and LCS are vortex mixed for approximately 15 seconds to ensure mixing of the sand and added solutions.

8.7 Low-Level Procedure

8.7.1 If low detection limits are required (typically < 50 µg/kg) samples may be collected in 5g EnCore™ sampling device (it is recommended that a minimum of two 5g EnCore™ samples are collected, but three are preferred) or sample may be collected in vendor purchased pretared VOA vials containing 5 *or 10* mL of 20% Sodium Bisulfate solution with a magnetic stir bar. Due to the exhibited potential of positive interferences in the purchased prepared vials (most notably ketones and BTEX compounds). Clients should be advised that 5g EnCore™ sampling devices are preferred. If samples are collected in Sodium Bisulfate preserved vials, each analytical batch (12 hour tune shift) must be analyzed with two continuing calibration standards (CCC's), two MB's, and two LCS's. One prepared in a purchased preserved vial of the same lot as the samples, and one prepared in an unpreserved 40 mL VOA vial. The unpreserved vial CCC, MB, and LCS can be used via "other observation" NCM's and the case narrative to demonstrate that any failures in the CCC, MB, or LCS are possibly due to sample preservation and not another source.

8.7.2 A purge-and-trap autosampler capable of sampling from a sealed vial is required for analysis of samples collected using this method.

8.7.3 Soil samples collected in a 5g EnCore™ sampling device and returned to the laboratory are frozen upon receipt. It is recommended that at least two EnCore™ samplers be used for each field sample position, but three is preferred, to allow for any reruns that may be necessary.

8.7.3.1 Prior to analysis low level soil samples collected in 5g EnCore™ sampling devices are removed from the freezer in the sample control area and allowed to partially thaw in order to facilitate extrusion from the sampling device. Samples should not be allowed to remain at room temperature for more than 30 minutes prior to extrusion into a VOA vial for analysis. Prior to placing on the autosampler samples are extruded from the 5g EnCore™ sampling device into a VOA vial and the weight is accurately recorded by either direct connection from the analytical balance to the batch record (preferred method) or by typing the balance reading into the batch record.

8.7.3.2 The extruded sample then has a cleaned magnetic stir bar and five mLs of reagent water added to it.

8.7.4 Samples collected in pre-tared Sodium Bisulfate preserved sample vials are stored at 0-6°C in the volatile laboratory soils refrigerator until sample analysis. Prior to sample analysis VOA vials are weighed and the sample weight is calculated and added to the extraction batch record. *A copy of the calculation sheet is scanned in and attached to the preparation batch in TALS. The original is stored with the samples.*

8.7.4.1 Soils containing carbonates may effervesce when added to the sodium bisulfate solution. If this is the case at a specific site, samples should be taken in a 5g EnCore™ sampling device, and stored at ≤–10°C until analysis.

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8.7.4.2 If client specifications require field preservation, samples may be collected in pre-tared VOA vials containing a magnetic stir bar and 5 mL of reagent water. Sample collected in this manner must be received and frozen by the laboratory within 48 hours of sampling. Samples stored in this manner **MUST** be frozen on their sides to minimize possible breakage of the sample container due to expansion of water as it freezes.

8.8 Unpreserved Soils

When specifically requested by a client, unpreserved soils packed into glass jars or brass tubes may be accepted and subsampled in the laboratory *but have a hold time of 48 hours from sample collection to sub-sampled and preserved*. This is the old procedure based on Method 5030A. It is generally no longer practiced as it is likely to generate results that are biased low. This is the 10 g "in house soil extraction" referred to in section 8.5.

8.9 Aqueous samples are stored in glass containers with Teflon lined septa at 0-6°C, with minimum headspace.

8.10 High-level solid extracts are stored in the scintillation vial used for extraction and are stored at 0-6°C. The extracts are removed from cold storage and are allowed to return to ambient temperature prior to analysis.

8.11 A refrigerator *or freezer* blank is stored in each refrigerator *or freezer* with the samples. This is analyzed at minimum every 14 days, but may be analyzed more frequently as needed (see SOP TA-QA-0616). *The refrigerator or freezer blank should be run immediately after the method blank.*

8.12 Listed below are the holding times and the references that include preservation requirements.

Matrix	Sample Container	Min. Sample Size	Preservation	Holding Time [1]	Reference
Waters	40-mL VOA vial	40 mLs	HCl, pH < 2; Cool 0-6°C	14 Days	40 CFR Part 136.3
Waters	40-mL VOA vial	40 mLs	Cool 0-6°C	7 Days	
Soils	Encore Sampler	5 grams	Sodium bisulfate or Methanol Cool 0-6°C	48 Hrs for Preservation 14 Days	
Soils	Encore Sampler	5 grams	DI Water and Freezing	7 or 14 Days	
Soils	Glass Jar	10 grams	Cool 0-6°C	*48 Hrs for Preservation* 14 Days	N/A

[1] Inclusive of preparation and analysis.

9.0 Quality Control

9.1 The minimum quality controls (QC), acceptance criteria, and corrective actions are described in this section. When processing samples in the laboratory, use the LIMS QC program code and special instructions to determine specific QC requirements that apply.

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9.1.1 The laboratory's standard QC requirements, the process of establishing control limits, and the use of control charts are described more completely in the TestAmerica *Seattle* QAM.

9.1.2 Specific QC requirements for Federal programs, e.g., USACE and Navy projects, are described in DoD QSM v3 or the latest promulgated version.

9.1.3 Project-specific requirements can override the requirements presented in this section when there is a written agreement between the laboratory and the client, and the source of those requirements should be described in the project documents. Project-specific requirements are communicated to the analyst via special instructions in the LIMS and may also come in the form of email or written notifications distributed at "project kick off" meetings.

9.1.4 Any QC result that fails to meet control criteria must be documented in a Nonconformance Memo (NCM). The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The QA group also receives NCMs by e-mail for tracking and trending purposes. The NCM process is described in more detail in SOP TA-QA-0610. This is in addition to the corrective actions described in the following sections.

9.2 Batch Definition

Batches are defined at the sample preparation stage. The batch is a set of up to 20 samples of the same matrix, plus required QC samples, processed using the same procedures and reagents within the same time period. Batches should be kept together through the whole analytical process as far as possible, but it is not mandatory to analyze prepared extracts on the same instrument or in the same sequence. The method blank must be run on each instrument and in each analytical batch.

9.3 Method Blanks

For each batch of samples, analyze a method blank. The method blank is analyzed after the calibration standards and before any samples. For low-level volatiles in water, the method blank consists of reagent water. For low-level volatiles in soil, the blank medium is muffled Ottawa sand. For high-level volatiles, the method blank consists of 10 mL of Reagent ID: V-4TFT-EX_xxxxx and ten grams of muffled Ottawa sand. Surrogates are added and the method blank is carried through the entire analytical procedure.

Acceptance Criteria: The method blank must not contain any analyte of interest at or above one-half the reporting limit except common laboratory contaminants as listed below (contamination up to the reporting limit is allowed for non DoD clients) or at or above 5% of the measured concentration of that analyte in the associated samples, whichever is higher.

The method blank must have acceptable surrogate recoveries.

Corrective Actions: If the analyte is a common laboratory contaminant (i.e., methylene chloride, acetone, 2-butanone, ethyl ether, acetonitrile and hexane), the data may be reported with qualifiers if the concentration of the analyte is less than five times the reporting limit for non-DoD clients and less than the RL for DoD clients. Such action must be taken in consultation with the client.

Reanalysis of samples associated with an unacceptable method

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blank is required when reportable concentrations are determined in the associated samples.

If there is no target analyte greater than the RL (less than one half the RL for DoD clients) in the samples associated with an unacceptable method blank, the data may be reported with qualifiers. Such action should be done in consultation with the client.

If surrogate recoveries in the blank are not acceptable, the data must be evaluated to determine if the method blank has served the purpose of demonstrating that the analysis is free of contamination. If surrogate recoveries are low and there are reportable analytes in the associated samples, re-extraction of the blank and affected samples will normally be required. Consultation with the client should take place.

If reanalysis of the batch is not possible due to limited sample volume or other constraints, the method blank is reported, all affected analytes in the associated samples are flagged with a "B", and appropriate comments may be made in a narrative to provide further documentation.

9.4 Surrogates

Every sample, blank *(including instrument blanks)*, and QC sample is spiked with surrogates. Surrogate recoveries in samples, blanks, and QC samples must be assessed to ensure that recoveries are within established limits. The compounds included in the surrogate spiking solutions are listed in Table 6.

Acceptance Criteria: Acceptance limits for surrogate recoveries are set at ± 3 standard deviations around the historical mean. Surrogate recovery limits are updated at a fixed frequency by QA and stored in the LIMS

Corrective Actions: If any surrogates are outside limits, the following corrective actions must take place (except for dilutions):

- Check all calculations for error.
- Ensure that instrument performance is acceptable.
- Recalculate the data and/or reanalyze if either of the above checks reveal a problem.
- Re-prepare and reanalyze the sample or flag the data as “Estimated Concentration” if neither of the above resolves the problem.

The decision to reanalyze or flag the data should be made in consultation with the client. It is necessary to re-prepare/reanalyze a sample only once to demonstrate that poor surrogate recovery is due to matrix effect, unless the analyst believes that the repeated out of control results are not due to matrix effect.

If the surrogates are out of control for the sample, matrix spike, and matrix spike duplicate, then matrix effect has been

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demonstrated for that sample and re-preparation/reanalysis is not necessary. If the sample is out of control and the MS and/or MSD is in control, then reanalysis or flagging of the data is required.

NOTE: *For LaMP client samples, if the surrogate percent recovery fails, the recovery must be confirmed by re-extraction and reanalysis with the following exceptions:*

- *The lab has unequivocally demonstrated a sample matrix effect and informed the LaMP client representative.*
- *The recovery exceeds control limits and all target analytes in the sample are non-detect.*

9.5 Laboratory Control Samples (LCS)

An LCS is analyzed for each batch. The LCS is analyzed after the calibration standard and the method blank, and normally before any samples. The LCS is prepared from a different source than are the calibration standards. The LCS contains a representative subset of the analytes of interest (See Table 7), and must contain the same analytes as the matrix spike.

Acceptance Criteria: The LCS recovery for the control analytes must be within established control limits. Unless otherwise specified in a reference method or project requirements, the control limits are set at ± 3 standard deviations around the mean of the historical data. An LCS that is determined to be within acceptance criteria effectively demonstrates that the analytical system is in control and validates system performance for the samples in the associated batch. Recovery limits are updated at a set frequency by QA and are stored in the LIMS.

If there are a large number of analytes in the LCS, then a specified number of results may fall beyond the LCS control limit (3 standard deviations), but within the marginal exceedance (ME) limits, which are set at ± 4 standard deviations around the mean of historical data. Marginal exceedances are recognized and allowed by NELAC and the DoD. The number of marginal exceedances is based on the number of analytes in the LCS, as shown in the following table:

# of Analytes in LCS	# of Allowed Marginal Exceedances
> 90	5
71 – 90	4
51 – 70	3
31 – 50	2
11 – 30	1
< 11	0

If more analytes exceed the LCS control limits than is allowed, or if any analyte exceeds the ME limits, the LCS fails and corrective action is necessary. Marginal exceedances must be random. If the same analyte repeatedly fails the LCS control limits, it is an indication of a systematic problem. The source of the error must be identified and corrective action taken.

Corrective Actions: If any analyte or surrogate is outside established control limits as described above, the system is out of control and corrective action must occur. Corrective action will normally be re-preparation and reanalysis of the batch.

If the batch is not re-extracted and reanalyzed, the reasons for accepting the batch must be clearly presented in the project records (via NCMs and the case narrative) and in the final report. Examples of acceptable reasons for not reanalyzing might be that the matrix spike and matrix spike duplicate are acceptable, and sample surrogate recoveries are good, demonstrating that the problem was confined to the LCS. This type of justification should be reviewed and documented with the client before reporting.

If re-extraction and reanalysis of the batch is not possible due to limited sample volume or other constraints, the LCS is reported, all associated samples are flagged, and appropriate comments are made in a narrative to provide further documentation.\

9.6 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

For each QC batch, analyze a matrix spike and matrix spike duplicate. Spiking compounds and levels are given in Tables 7 and 7a. The matrix spike/duplicate must be analyzed at the same base dilution as the unspiked sample, even if the matrix spike compounds will be diluted out, dilutions (beyond the base dilution if necessary) of MS/MSD analyses are not required unless there are specific client instructions to do so. If necessary, this requirement will be passed to the laboratory through the PM by means of the mechanisms described in section 9.1.3 of this SOP.

Acceptance Criteria: The MS/MSD recovery for the control analytes must be within established control limits. Unless otherwise specified in a reference method or project requirements, the control limits are set at $\pm$ 3 standard deviations around the mean of the historical data. The relative percent difference (RPD) between the MS and the MSD must be less than the established RPD limit, which is based on statistical analysis of historical data. MS/MSD recovery and RPD limits are updated at a regular frequency by QA and are stored in the LIMS.

Corrective Actions: If any individual recovery or RPD falls outside the acceptable range, corrective action must occur. The initial corrective action will be to check the recovery of that analyte in the LCS. Generally, if the recovery of the analyte in the LCS is within limits, then the laboratory operation is in control and analysis

may proceed. The reasons for accepting the batch must be documented.

If the recovery for any component is outside QC limits for both the matrix spike/matrix spike duplicate and the LCS, the laboratory is out of control and corrective action must be taken. Corrective action will normally include reanalysis of the batch, except in cases where a high bias is indicated and no target is detected above the reporting limit in any associated sample.

If an MS/MSD is not possible due to limited sample, then an LCS duplicate should be analyzed whenever requested by the client. The RPD between the LCS and LCSD is compared to the established acceptance limit.

9.7 *If batch QC samples or trip blanks are re-analyzed to confirm a recovery or result, and an improvement in results would cause the re-analysis to be reported, then the associated client samples must also be re-analyzed. The only exception to this protocol would be if an obvious analytical problem occurred during the initial analysis (i.e. no internal standard added, bent autosampler needle, etc).*

9.8 *Any extra QC that is analyzed in a batch or sequence must be evaluated using the same criteria as the corresponding QC above.*

10.0 Procedure

10.1 *Samples scheduled for EPA 624 will be analyzed separately (different ICAL and sequence) from samples scheduled for EPA 8260B. Refer to appendix A for Modifications for Method 624.*

10.2 One time procedural variations are allowed only if deemed necessary in the professional judgment of management to accommodate variation in sample matrix, radioactivity, chemistry, sample size, or other parameters. Any variation shall be completely documented using a Nonconformance Memo and approved by a Supervisor or group leader and QA Manager. If contractually required, the client shall be notified. The Nonconformance Memo shall be filed in the project file.

10.3 Any unauthorized deviations from this procedure must also be documented as a nonconformance, with a cause and corrective action described.

11.0 Calibration

11.1 Summary

Prior to the analysis of samples and blanks, the GC/MS system must be tuned and calibrated. Tuning is accomplished by analyzing 4-bromofluorobenzene (BFB) to establish that the GC/MS system meets the standard mass spectral abundance criteria. The GC/MS system must be calibrated initially at a minimum of five concentrations to determine the linearity of the response utilizing target calibration standards. The calibration must be verified each twelve-hour time period for each GC/MS system. The use of separate calibrations is required for water, low level water (25-mL purge), methanolic extracts, 8260_SIM (*5 or* 10 mL Purge) and low level soil matrices.

11.2 Recommended Instrument Conditions

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11.2.1 General

Electron Energy:	70 volts (nominal)
Mass Range:	35–300 amu
Scan Time:	to give at least 5 scans/peak, ≤ 2 seconds/scan
Injector Temperature:	200 – 250 ˚C
Source Temperature:	According to manufacturer's specifications
Transfer Line:	Temperature: 250 – 300 ˚C
Purge Flow:	40 mL/minute *(± 5 mL/min)*
Carrier Gas Flow:	1-15 mL/minute, dependent upon column specifications

11.2.2 Gas Chromatograph Temperature Program

The temperature programs vary with the column type and instrumentation used. The actual individual method parameters used are stored in each individual instrument methods folder on the network and can be referenced there.

11.2.3 SIM (Single Ion Monitoring) Mass spectrometer conditions. For current sublist, see Table 1A . SIM is a less selective method than full scan. To compensate for the selectivity issues it is necessary to add additional qualifiers. SIM parameters are divided in to groups. Each group is divided by retention times. When possible each group should have similar ions. Dwell times affect the scanning rate of the instrument. Optimal scan rate should be no less than 3 cycles/sec. Default dwell time is 100 for each ion added to a group the scan rate will go down. In order to achieve the optimal scan rate the dwell time for the ions must be adjusted. The groups each ion is in can be flexible. Any changes in groups a new ICAL must be initiated. The groups retention times may be adjusted with out a new ICAL.

11.2.3.1 Group 1. Vinyl: Mass: 62, 64, 59. Dwell time 90; Group 2. 1,1DCE: Mass 61, 63, 96, 98. Dwell time 65; Group 3. PFB: Mass 168, 97, 99, 117, 119, 121. Dwell time 30; Group 4. Benzene: Mass 78, 77, 51, 62, 64, 49. Dwell time 50; Group 5. Tric. Group 6. Tol-d8: Mass 98, 100, 166, 164, 168. Dwell time 50; Group 7. EDB: Mass 107, 109, 81, 98, 116. Dwell time 50; Group 8. BFB: 174, 176, 95, 83, 85. Dwell time 50; Group 9. 14DCBD4: Mass 152, 150, 146, 148. Dwell time 50.

11.3 Instrument Tuning

Each GC/MS system must be hardware-tuned to meet the abundance criteria listed in Table 8 for a maximum of a 50 ng injection or purging of BFB. Analysis must not begin until these criteria are met. These criteria must be met for each twelve-hour time period. The twelve-hour time period begins at the moment of injection of BFB.

11.4 Initial Calibration

11.4.1 A series of five or more initial calibration standards is prepared and analyzed for the target compounds and the surrogate compound Trifluorotoluene. Nominal calibration levels for a 5 mL water purge and 5 mL methanolic extract purge are 0.2, 1, 2, 5, 10, 20, 50, 100, 150 and 200 µg/L. Five mL methanolic curves are prepared with a matrix matched methanol concentration to an undiluted methanolic sample extraction analysis (i.e. all methanolic standards are one fortieth P & T

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methanol). Nominal calibration levels for direct sparge soil (low level) analysis are prepared at 1, 2, 5, 10, 20, 50, 100, 150 and 200 ug/Kg concentrations. Low level (25 ml Purge) waters curves are prepared at 0.02, 0.04, 0.10, 0.20, 0.40, 1, 2, 5, 10, 20, 40, and 100 ug/L. Certain analytes are prepared at higher concentrations due to poor purge performance. Table 4 shows the calibration levels for each analysis. The purge volume for Method 624 is 5 mL. Other calibration levels and purge volumes may be used depending on the capabilities of the specific instrument or program requirements. Calibration levels may also vary based on analyst discretion in so far as the minimum number of calibration points are met for the curve type utilized (five for average response factor and first order curves, six for second order curves) and the lowest point on the curve is at or below the current TestAmerica Seattle reporting limit. Calibration levels below the reporting limit may be removed provided that the minimum number of points criteria listed above is met, and the lowest standard is at or below the TestAmerica Seattle reporting limit.

11.4.2 8260_SIM calibration levels typically 0.02, 0.05, 0.1, 0.5, 1, *2* ug/Kg with a *5 or* 10 ml purge.

11.4.3 The same purge volume must be used for calibration and sample analysis, and the low level standard must be at or below the reporting limit.

11.4.4 It may be necessary to analyze more than one set of calibration standards to encompass all of the analytes required for some tests.

11.4.5 Internal standard calibration is used. The internal standards are listed in Table 5. Target compounds should reference the nearest internal standard. Each calibration standard is analyzed and the response factor (RF) for each compound is calculated using the area response of the characteristic ions against the concentration for each compound and internal standard. See equation 1, Section 12, for calculation of response factor.

11.4.6 The % RSD of the calibration check compounds (CCC) must be less than or equal to 30% even in cases where a first or second order regression is used for the calibration curve. Refer to Table 10.

11.4.7 The average RF must be calculated for each compound. A system performance check is made prior to using the calibration curve. The five system performance check compounds (SPCC) are checked for a minimum average response factor. Refer to Table 9 for the SPCC compounds and required minimum response factors.

11.4.8 If the average of all of the %RSD values in the calibration is ≤ 15%, then all analytes may use average response factor for calibration.

11.4.9 If the software in use is capable of routinely reporting curve coefficients for data validation purposes and the necessary calibration reports can be generated, then the analyst should evaluate analytes with %RSD < 15% for calibration on a curve. If it appears that substantially better accuracy would be obtained using quantitation from a curve then the appropriate curve should be used for quantitation. The correlation coefficient (r) must be ≥ 0.990 for SW-846 and must be ≥ 0.995 for DoD clients. For non-linear curves, the coefficient of determination (r^2) must be ≥ 0.990 for both SW-846 and DoD requirements.

11.4.10 If the software in use is capable of routinely reporting curve coefficients for data, and if the average of all the %RSD values in the calibration is > 15%, then calibration on a curve must be used for all analytes with %RSD > 15%. The analyst should consider instrument maintenance to improve the linearity of response. Otherwise, the correlation coefficient (r) must be ≥ 0.990 for SW-846 and must be ≥ 0.995 for DoD clients. For non-linear curves, the coefficient of determination (r^2) must be ≥ 0.990 for both SW-846 and DoD requirements.

11.4.11 Once the initial calibration has been evaluated and determined to be valid, the calibration must be verified with an Initial Calibration Verification (ICV) using a standard prepared from an alternate source. All compounds in the ICV which are listed in the DoD QSM v 4.1 must be <20 % drift when compared to the initial calibration in order to be reported under that document. The ICV is generally run at 50 ug/L for 5 mL water and 5 mL methanolic calibration curves, 50 ug/Kg for direct sparge soil curves, and 10 ug/L for 25 mL purge water curves. As the ICV concentration must not be equal to or greater than the highest calibration level, other ICV levels than those previously listed may be used or multiple levels of ICV may be needed to validate all compounds in the initial calibration curve.

11.4.12 If time remains in the 12-hour period initiated by the BFB injection before the initial calibration, samples may be analyzed. Otherwise, proceed to continuing calibration, Section 11.5.

11.5 Continuing Calibration

11.5.1 The initial calibration must be verified every twelve hours.

11.5.2 Continuing calibration begins with analysis of BFB as described in Section 11.3. If the system tune is acceptable, the continuing calibration standard(s) are analyzed. The level 7 calibration standard is generally used as the continuing calibration standard.

11.5.3 The RF data from the standards are compared with the initial multi-point calibration to determine the percent drift of the CCC compounds

11.5.4 The % drift of the CCCs must be ≤ 20% for the continuing calibration to be valid. The SPCCs are also monitored. The SPCCs must meet the criteria described in Table 9.

11.5.4.1 If none of the CCCs are required analytes, project specific calibration specifications (which may include the use of the CCCs listed in Table 10) must be agreed with the client.

11.5.4.2 Non CCC targets that are >20% Drift or Difference should be flagged

11.5.4.3 Sublists having less then 15 target analytes should have all target <20% Drift or Difference before analysis proceeds.

11.5.5 The retention time of the internal standards in the continuing calibration standard cannot change by more than 30 (0.5 min) seconds when compared to the most recent multi-point calibration. The internal standard areas must not change by more than a factor of 2 (50 - 200 %) from the mid point standard of the most recent multi-point calibration.

11.5.6 If the CCCs and/or the SPCCs do not meet the criteria in Section 11.5.3, the system must be evaluated and corrective action must be taken. The BFB tune and continuing calibration must be acceptable before analysis begins. Extensive

corrective action, such as a different type of column, will require a new initial calibration. *If two CCVs in a row fail, a new initial calibration must be performed.*

11.5.7 Once the above criteria have been met, sample analysis may begin. Initial calibration average RFs (or the calibration curve) will be used for sample quantitation, not the continuing calibration RFs. Analysis may proceed until 12 hours from the injection of the BFB have passed. (A sample *desorbed* less than or equal to 12 hours after the BFB is acceptable.)

11.6 **Sample Analysis**

11.7 Preliminary Evaluation

11.7.1 Where possible, samples are screened by headspace or GC/MS off-tune analysis to determine the correct aliquot for analysis. Alternatively, an appropriate aliquot can be determined from sample histories.

11.7.2 Dilutions should be done just prior to the GC/MS analysis of the sample. Dilutions are made directly into a VOA vial. A vial volume of 43 mL has been established and is assumed for all vials. The vial should be filled with reagent water and the appropriate amount of water should be removed from the vial using a volumetric pipette or syringe. Sample is then added to the vial using volumetric pipette or syringe and the vial is immediately capped.

11.8 Sample Analysis Procedure

11.8.1 All analysis conditions for samples must be the same as for the continuing calibration standards (including purge volume, time and flow, desorb time and temperature, column temperatures, multiplier setting etc.).

11.8.2 All samples must be analyzed as part of a batch. The batch is a set of up to 20 samples of the same matrix processed using the same procedures and reagents within the same time period. The batch also must contain a MS/MSD (if sufficient sample volume allows), an LCS, and a method blank.

11.8.2.1 Laboratory generated QC samples (Blank, LCS, MS/MSD) do not count towards the maximum 20 samples in a batch. Field QC samples are included in the batch count.

11.8.2.2 It is not necessary to reanalyze batch QC (except for the method blank) with reanalyses of samples. However, any re-runs must be as part of a valid batch.

11.9 Water Samples

11.9.1 All samples and standard solutions must be at ambient temperature before analysis.

11.9.2 Water samples are sub sampled by the autosampler at the appropriate volume (5, 10, or 25 mL).

11.9.3 Reagent ID: vwrkISandsur_xxxxx, an Internal standards and surrogates mix with the exception of Trifluorotoluene (TFT) is added by the autosampler.

11.9.4 All water samples have the surrogate TFT added to them by direct injection of Reagent ID: v-surtftwk_xxxxx through the VOA vial septa using a bevel tipped syringe. Five mL purge water samples have between10-20 uL added, 10 mL between 5-10 uL, and 25 mL samples have between 2 and 5 uL added.

11.9.5 MS/MSD samples are prepared by injecting Reagent ID: V_LCS_G_50_xxxxx and Reagent ID: V_LCS_L_50_xxxxx through the VOA vial septa using a bevel tipped syringe. Five mL purge water and methanolic post spikes (for field preserved methanolic samples) have between 10 and 20 uL of each solution added, and 25 mL samples have between 2-5 uL of each solution added. When applicable (Tier II and non-DoD clients), a short list spike is used instead of the above mentioned spiking solutions. In this instance, MS/MSD samples are prepared by injecting Reagent ID: V_LCS_SL50_xxxx or V_SL_L_50_xxxxx through the VOA vial septa using a bevel tipped syringe. Solution volumes added are the same as listed above for each matrix and sample size.

11.9.6 Purge the sample at ambient temperature with a trap temperature of 40°C.

11.9.7 After purging is complete, dry purge and desorb the sample, start the GC temperature program, and begin data acquisition. After desorption, bake the trap for 5-10 minutes to condition it for the next analysis. When the trap is cool, it is ready for the next sample.

11.9.8 Purge Time, dry purge time, desorb time, bake time, and temperature are optimized for the type of trap in use and the analytical system. The same conditions must be used for samples and standards. Current at the time of writing this SOP, purge time for all instruments is 8 minutes, dry purge is 1 minute or 2 minutes, bake time is 6 to 8 minutes, desorb temperature is 260°C, and bake temperature is 270°C.

11.10 Methanol Extract samples

11.10.1 Fill a VOA vial with reagent water, and remove 900 uL of water using a volumetric pipette.

11.10.2 Add 1075 uL of methanolic extract to the vial and immediately cap the VOA vial invert the vial to ensure that no air bubble larger than 4 mm is present. If there is an air bubble and it is greater than 4 mm, reprepare sample.

11.10.3 Load the sample in the autosampler and proceed to analyze against the methanolic extract curve.

11.10.4 As with water samples, Reagent ID: vwrkISandsur_xxxxx, an Internal standards and surrogates mix with the exception of Trifluorotoluene (TFT) is added by the autosampler. TFT is added to the methanolic extract in the extraction fluid and is therefore not added prior to analysis.

11.10.5 MS/MSD samples for in house extracts are prepared at time of extraction and are prepared for analysis as above. For field preserved samples, an in house post spike of the prepared sample is necessary, and is prepared by injecting Reagent ID: V_LCS_G_50_xxxxx and Reagent ID: V_LCS_L_50_xxxxx through the VOA vial septa using a bevel tipped syringe. A volume between 10-20 uL of each solution is added. When applicable (Tier II and non-DoD clients), a short list spike is used instead of the above mentioned spiking solutions. In this instance, MS/MSD samples are prepared by injecting Reagent ID: V_LCS_SL50_xxxx or V_SL_L_50_xxxxx through the VOA vial septa using a bevel tipped syringe. Five mL purge methanolic samples have between 10-20 uL added.

11.10.6 Dilutions of methanolic extracts are made by adding proportional amounts of 1075 uL to the VOA vial with an appropriate proportionally adjusted amount of

water removed. Samples of greater than 20x do not require the removal of water from the VOA vial prior to addition of methanolic extract.

11.10.7 Purge the sample at ambient temperature with a trap temperature of 40°C.

11.10.8 After purging is complete, dry purge and desorb the sample, start the GC temperature program, and begin data acquisition. After desorption, bake the trap for 5-10 minutes to condition it for the next analysis. When the trap is cool, it is ready for the next sample.

11.10.9 Purge Time, dry purge time, desorb time, bake time, and temperature are optimized for the type of trap in use and the analytical system. The same conditions must be used for samples and standards. Current at the time of writing this SOP, purge time for all instruments is 8 minutes, dry purge is 1 minute or 2 minutes, bake time is 6 to 8 minutes, desorb temperature is 260°C, and bake temperature is 270°C.

11.11 Low-Level Solids Analysis using Discrete Autosamplers

11.11.1 Sample collection and initial preparation for low level soil samples has been discussed in section 8.7.

11.11.2 All low level soil samples have the surrogate TFT added to them by direct injection of Reagent ID: v-surtftwk_xxxxx through the VOA vial septa using a bevel tipped syringe. A volume of 2.5 uL is added. It is recommended that the needle is pushed through the vial septa, and the vial is tilted sufficiently to allow the tip of the needle to enter the water in the vial prior to pushing the plunger and expelling the solution. This facilitates a more accurate dispensing by ensuring that a drop of solution does not remain on the tip of the syringe as it is pulled back out of the vial septa.

11.11.3 MS/MSD samples for low level soil samples prepared by injecting Reagent ID: *V_LCS_G_50_xxxxx and Reagent ID: V_LCS_L_50_*xxxxx through the VOA vial septa using a bevel tipped syringe. The same techniques recommended for TFT addition (see 11.11.2) should be followed. When applicable (Tier II and non-DoD clients), a short list spike is used instead of the above mentioned spiking solutions. In this instance, MS/MSD samples are prepared by injecting Reagent ID: V_LCS_SL50_xxxx or V_SL_L_50_xxxxx through the VOA vial septa using a bevel tipped syringe. Direct purge soil analyses are spiked during the preparation of the extraction batch with 2-uL of the appropriate solution(s) through the septa after capping (as applicable).

11.11.4 When it is feasible to perform dilutions of low level soils, a smaller amount of sample is weighed and analyzed. When dilutions of low level soil samples are not possible, any analyte that exceeds the calibration range must be E flagged on the appropriate reporting form, NCM filled out, and must be noted in the case narrative. In addition, if sufficient volume was provided, a methanolic extract must be prepared and analyzed.

11.11.5 Purge the sample at ambient temperature with a trap temperature of 40°C.

11.11.6 After purging is complete, dry purge and desorb the sample, start the GC temperature program, and begin data acquisition. After desorption, bake the trap for 5-10 minutes to condition it for the next analysis. When the trap is cool, it is ready for the next sample.

11.11.7 Purge Time, dry purge time, desorb time, bake time, and temperature are optimized for the type of trap in use and the analytical system. The same

conditions must be used for samples and standards. Current at the time of writing this SOP, purge time for all instruments is *6 to 11* minutes, dry purge is 1 minute or 2 minutes, bake time is *6 to 8* minutes, desorb temperature is 260°C, and bake temperature is 270°C.

11.12 Initial Review and Corrective Actions

11.12.1 If the retention time for any internal standard in the continuing calibration changes by more than 0.5 minute from the mid-level initial calibration standard, the chromatographic system must be inspected for malfunctions and corrected. Reanalysis of samples analyzed while the system was malfunctioning is required.

11.12.2 If the internal standard response in the continuing calibration is more than 200% or less than 50% of the response in the mid-level of the initial calibration standard, the chromatographic system must be inspected for malfunctions and corrected. Reanalysis of samples analyzed while the system was malfunctioning is required.

Sample internal standard areas are compared to the continuing calibration internal standard areas. Responses from 50% to 200% are acceptable. If a sample fails to meet these internal standard criteria, further investigation is necessary. If the change in sensitivity is a matrix effect confined to an individual sample, reanalysis is not necessary. If the change in sensitivity is due to instrumental problems, all affected samples must be reanalyzed after the problem is corrected.

11.12.3 The surrogate standard recoveries are evaluated to ensure that they are within limits. Corrective action for surrogates out of control will normally be to reanalyze the affected samples. However, if the surrogate standard response is out high and there are no target analytes or tentatively identified compounds, reanalysis may not be necessary. Out of control surrogate standard response may be a matrix effect. It is only necessary to reanalyze a sample once to demonstrate matrix effect (this may be demonstrated by a MS/MSD analysis as well). Reanalysis at a dilution should be considered if appropriate. If a diluted analysis is necessary and surrogate recoveries are in control or less affected, this is sufficient to demonstrate matrix interference.

11.13 Dilutions

If the response for any compound exceeds the working range of the GC/MS system, a dilution of the sample/extract is prepared and analyzed. A dilution should be prepared to ensure that the majority of compounds being diluted for fall in the middle to upper part of the calibration curve (i.e. from 40-90% of their respective calibration range). All reported dilutions must be within the calibration range of the respective analytes and should be compared to other dilutions to ensure that the diluted data “makes sense” as a check for possible dilution errors. If this cannot be accomplished with a single dilution, multiple sample dilutions are necessary. Dilution levels should be considered carefully and it is recommended that a “complicated” sample (one which has more than three compounds which require dilution) is discussed with another analyst or area supervisor as necessary in order to minimize the number of dilutions required. Samples may be screened to determine the appropriate dilution for the initial run or historical site data may be used to determine initial dilutions.

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11.13.1 Guidance for Dilutions Due to Matrix

If the sample is initially run at a dilution and the baseline rise is less than half the height of the internal standards, or if individual non target peaks are less than twice the height of the internal standards, then the sample should be reanalyzed at a more concentrated dilution. This requirement is approximate and subject to analyst judgment and reasonable client requirements and requests.

11.13.2 Reporting Dilutions

The most concentrated dilution will be reported as the base dilution. Other dilution levels will report only the required diluted compounds and all other compounds and surrogates in the dilution will be set to acceptable in the LIMS system and not reported. Other reporting techniques may be required by specific project requirements or client request and will be transferred to the laboratory by the PM using the mechanisms previously discussed. See Section 9.1.3.

11.14 Instrument Maintenance

11.14.1 Agilent 5973 Inert, 5973 Network, 5975, 5975B, and 6890N

11.14.1.1 All circuit boards and peripheral attachments are dusted and vacuumed of debris and all plumbing and electrical connections inspected and adjusted; any replacement of worn parts is also done at this time.

11.14.1.2 The injection port is cleaned of debris by removing the injector and column nut and forcing clean methanol through the top of the injector into a waste container at the bottom. The ion source is disassembled, cleaned, and reassembled with new filaments and insulators, if needed.

11.14.2 Column installation is performed when the following conditions are encountered;

- Heavy column bleed that cannot be eliminated by thermal conditioning.
- Loss of early eluting peaks due to column cutting.
- Inability to chromatographically resolve method performance compound peaks.
- Distortion of peak shapes i.e.; broadening, ghost peaks, split peaks that can't be resolved by injection port maintenance or flow control.

11.14.2.1 Turn the GC oven off and let the system cool to room temperature. Remove the column nut, liner, septum, and presstight inlet connector. Dispose of old column appropriately.

11.14.2.2 Cut approximately six inches off of the end of new columns. Install new column using appropriate sized ferrules and nuts.

11.14.2.3 Turn the GC on and set the injector temperature to 230 °C, oven to the manufacturers recommended isotherm temperature or 10°C below the manufacturers max temperature if an isotherm is not provided and condition for five minutes.

11.14.2.4 Perform an air water check on the system. When the air water spectrum shows acceptable levels, proceed with the mass calibration procedure. For additional information of column replacement see the manufacturer's operator's manual.

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11.14.3 Tekmar 3000 Thermal Purge and Trap Concentrator Unit

11.14.3.1 A new Supelco K-trap (Vocarb 3000) is installed and conditioned by stepping the unit through to the bake setting. A new trap should be conditioned for a minimum of one hour prior to use, but an initial conditioning of overnight is recommended as time allows.

11.14.3.2 Sample lines, internal valves, sparge cells, and sparge cell mounts and fittings are rinsed with purge and trap grade methanol or replaced as necessary.

11.14.3.3 All dust and debris is removed from the circuit boards and tubing replaced where necessary.

11.14.3.4 *The purge gas flow rate (40 mL/min ± 5 mL/min) should be measured at the vent and recorded in the maintenance logbook.*

11.14.4 Archon 2000 or equivalent type auto sampler.

11.14.4.1 Remove debris and perform a calibration per manufacturer's instructions.

11.14.4.2 All dust and debris is removed from the circuit boards and tubing replaced where necessary.

11.14.5 *All maintenance and repairs need to be documented in the instrument's maintenance logbook. The logbook must include the instrument name, serial number for each major component (e.g., GC, autosampler) and the date of start-up. When an instrument is not capable of analyzing samples, it needs to be tagged "Out of Service". Logbook entries must include a description of the problem and what actions were taken to address the problem. After an instrument has undergone maintenance or repairs, the system is evaluated using a tune, CCV or ICAL. If the evaluation is successful, the analyst documents in the logbook that the "System returned to control as indicated by a passing CCV" (or ICAL, MB, tune, etc as may be the case).*

12.0 Calculations / Data Reduction

12.1 Qualitative Identification

12.1.1 An analyte is identified by retention time and by comparison of the sample mass spectrum with the mass spectrum of a standard of the suspected compound (standard reference spectrum). Mass spectra for standard reference may be obtained on the user's GC/MS by analysis of the calibration standards or from the NIST Library (same library as used for routine sample analysis). Two criteria must be satisfied to verify identification: (1) elution of sample component at the same GC retention time as the standard component; and (2) correspondence of the sample component and the standard component characteristic ions.

NOTE: Care must be taken to ensure that spectral distortion due to co-elution is evaluated.

12.1.1.1 The sample component retention time must compare to within ± 0.06 RRT units. of the retention time of the standard component. For reference, the standard must be run within the same twelve hour tune as the sample.

12.1.1.2 All ions present in the standard mass spectra at a relative intensity greater than 10% (most abundant ion in the spectrum equals 100%) should be present in the sample spectrum.

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12.1.1.3 The relative intensities of ions should agree to within ±30% between the standard and sample spectra. (Example: For an ion with an abundance of 50% in the standard spectra, the corresponding sample abundance must be between 20 and 80%.)

12.1.2 If a compound cannot be verified by all the above criteria, but in the technical judgment of the analyst, the identification is correct, then the analyst shall report that identification and proceed with quantitation.

12.1.3 All data are subject to two levels of technical review, as described in SOP TA-QA-0635.

12.2 Tentatively Identified Compounds (TICs)

12.2.1 If the client requests components not associated with the calibration standards, a search of the NIST library may be made for the purpose of tentative identification. The following guidelines apply:

12.2.1.1 Relative intensities of major ions in the reference spectrum (ions > 10% of the most abundant ion) should be present in the sample spectrum.

12.2.1.2 The relative intensities of the major ions should agree to within 20%. (Example: If an ion shows an abundance of 50% in the standard spectrum, the corresponding sample ion abundance must be between 30% and 70%).

12.2.1.3 Molecular ions present in the reference spectrum should be present in the sample spectrum.

12.2.1.4 Ions present in the sample spectrum but not in the reference spectrum should be reviewed for possible background contamination or presence of co-eluting compounds.

12.2.1.5 Ions present in the reference spectrum but not in the sample spectrum should be reviewed for possible subtraction from the spectrum because of background contamination or co-eluting peaks. (Data system reduction programs can sometimes create these discrepancies.)

12.2.1.6 Computer-generated library search routines should not use normalization routines that would misrepresent the library or unknown spectra when compared to each other. Only after visual inspection of the sample with the nearest library searches should the analyst assign a tentative identification.

12.2.1.7 Once tentative identifications are assigned, these results are uploaded into LIMS with the other data and the TICs are automatically reported to the client from the LIMS.

12.3 **Accuracy**

ICV / CCV, LCS % Recovery $= \frac{\text{observed concentration}}{\text{known concentration}} \times 100$

MS % Recovery $= \frac{(\text{spiked sample}) - (\text{unspiked sample})}{\text{spiked concentration}} \times 100$

12.4 Precision (RPD)

Matrix Duplicate (MD) = |orig. sample value - dup. sample value| x 100
[(orig. sample value + dup. sample value)/2]

12.5 Response Factor (RF)

$$RF = \frac{A_x C_{is}}{A_{is} C_x}$$

Where:

A_x = Area of the characteristic ion for the compound to be measured.
A_{is} = Area of the characteristic ion for the specific internal standard.
C_{is} = Concentration of the specific internal standard, ng.
C_x = Concentration of the compound being measured, ng.

12.6 Standard deviation (SD)

$$SD = \sqrt{\frac{\sum_{i=1}^{n}\left(X_i - \overline{X}\right)^2}{n-1}}$$

Where:

X_i = Value of X at i through n.
n = Number of points.
$\overline{X}$ = *Average value of Xi.*

12.7 Percent relative standard deviation (%RSD)

$$\%RSD = \frac{SD}{\overline{RF}} \times 100\%$$

Where $\overline{RF}$ is the mean of RF values for the calibration.

12.8 Percent drift between the initial calibration and the continuing calibration:

$$\%Drift = \frac{C_{expected} - C_{found}}{C_{expected}} \times 100\%$$

Where:

$C_{expected}$ = Known concentration in standard.
C_{found} = Measured concentration using selected quantitation method.

12.9 Concentration = mg/kg or L = $\frac{C \times V \times D}{W}$

Where:

C = sample concentration in extract (ppm)
V = Volume of extract (mL)
D = Dilution Factor

W = Weight/Volume of sample aliquot extracted (grams or mLs)

NOTE: All dry weight corrections are made in LIMS at the time the final report is prepared.

Note: For all methanolic samples with a % Moisture of greater than 10%, it is necessary to adjust the extraction final volume of the sample in order to allow for the miscible solvents effect. This is done by the following equation:

Corrected FV = ((g of samples * % moisture/100) + ml of MeOH) * 40

In these situations, an "other observation" NCM must be generated and the correction and above formula must be noted in the case narrative.

12.10 Upon completion of the analytical sequence:

12.10.1 Review chromatograms online and determine whether manual data manipulations are necessary.

12.10.2 All manual integrations must be justified and documented. See Corporate SOP CA-Q-S-002 for requirements for manual integration.

12.10.3 Manual integrations may be processed using Chrom, which stores the before and after chromatograms and the reason for the change, and attaches the analyst's electronic signature.

12.10.4 Alternatively, the manual integration may be processed manually. In the latter case, print both the both the before and after chromatograms and record the reason for the change and initial and date the after chromatogram. Before and after chromatograms must be of sufficient scale to allow an independent reviewer to evaluate the manual integration.

12.10.5 Confirm that run logs have printed on them the instrument ID, the analyst and the method used. If this is not printed on the run logs, this must be entered by hand prior to completing the package.

12.11 Compile the raw data for all the samples and QC samples in a batch. The analytical batch is defined as containing no more than 20 field samples.

12.11.1 Perform a level 1 data review and document the review on the data review checklist (GCMS Data Review Checklist).

12.11.2 Submit the data package and review checklist to the peer reviewer for the level 2 review. The data review process is explained in SOP TA-QA-0635.

13.0 Method Performance

13.1 Method Detection Limit Study (MDL)

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure (see SOP TA-QA-0602). MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses

performed; these are verified at least *quarterly* unless method requirements require a greater frequency.

For instruments that run samples which fall under LaMP regulations, a yearly MDL Study must be performed and MDLV starting at 1X the MDL.

13.2 Demonstration of Capabilities

Analyst initial Demonstrations of Capability (DOC) are performed *after completing a read and understand memo for the SOP and* before any client samples are analyzed. DOCs are updated annually (continuing DOC). See SOP TA-QA-0617 for details.

13.3 Training Requirements

See SOP TA-QA-0608 for detailed training requirements.

14.0 Pollution Control

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention".

15.0 Waste Management

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to Waste Disposal SOP TA-EHS-0036.

15.1 Waste Streams Produced by the Method

15.1.1 VOA vials containing acidic water. Used and unused samples and sample extracts discarded into satellite collection areas. When the satellite collection area is full these samples and extracts are transported to the waste room were they are disposed of by the sample waste technician.

15.1.2 VOA vials containing extracted acidic water and small amounts of methanol. Used and unused samples and sample extracts discarded into satellite collection areas. When the satellite collection area is full these samples and extracts are transported to the waste room were they are disposed of by the sample waste technician.

15.1.3 VOA vials containing extracted soil samples, which will contain small amounts of methanol and possibly sodium bisulfate. Unused sample extracts are held for at least 40 days, in case further testing is deemed necessary. After at least 40 days have passed these sample extracts are transported to the waste room were they are disposed of by the sample waste technician.

16.0 References / Cross-References

16.1 Method 8260B, Volatile Compounds by Gas Chromatography/Mass Spectrometry (GC/MS), Revision 2, December, 1996, SW-846, Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Third Edition and all promulgated updates, EPA Office of Solid Waste, January 2005.

16.2 Method 5035A, Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples, Revision 1, July, 2002, SW-846, Test Methods for Evaluating

Solid Waste, Physical/Chemical Methods, Third Edition and all promulgated updates, EPA Office of Solid Waste, January 2005.

16.3 40CFR, Part 136, Appendix A (Method 624).

17.0 Method Modifications:

Item	Method	Modification
1	8260B	The quantitation and qualifier ions for some compounds have been changed from those recommended in SW-846 in order to improve the reliability of qualitative identification.
2	5035A	The aliquot of methanol extract taken for analysis is 125 uL rather than the 100 uL specified in Table 1 of the method.

18.0 Tables and Appendices

Table 1. TestAmerica Primary List Reporting Limits for 8260B
Table 1a. TestAmerica 8260_SIM list Reporting Limits
Table 2. 8260B Additional Analyte List Reporting Limits
Table 3. Appendix IX List Reporting Limits
Table 4. Typical Calibration Levels
Table 5. Internal Standards
Table 6. Surrogate Standards
Table 7. Standard LCS and Matrix Spike Standard
Table 7a. Full List LCS and Matrix Spike Standard
Table 8. BFB Key Ion Abundance Criteria
Table 9. SPCC Compounds and Minimum Response Factors
Table 10. CCC Compounds
Table 11. Poorly Performing Compounds
Table 12. Summary of QC Requirements

Appendix A - Modifications for Method 624

Table A-1. Method 624 Analytes and Reporting Limits, 5-mL Purge

Appendix DoD

19.0 Changes from last revision

- Revision 17, dated 16 April 2010
    - Removed Chlorobenzen-D5 from Table 5. Added Pentafluorobenzene and 1,4-Dichlorobenzene and updated quatitation ion.
    - Added Sections on 8260_SIM. Including MS pararameters and recommended ICAL and spike ranges. Updates Scope section 1.2.1. Updated Calibration 11.4.2. Added section 11.2.3.1 SIM parameters
    - Added a range of spiking amounts and added 10mL purge spiking amounts to sections 11.9
    - Added documentation of standards/reagents and standard/reagent preparation Section 7.1
    - Added clarifications about standard storage conditions, section 7.3.1
    - Added removal of expired standards Section 7.4.
    - Added instructions for the analysis of storage blanks, section 8.11

- Added clarification about re-analyzing batch QC and trip blanks, section 9.7
- Added criteria for additional QC, Section 9.8.
- Added daily balance check to Section 6.2.
- Added LaMP client surrogate criteria, Section 9.4.
- Added requirement for running 624 and 8260 methods on separate sequences Section 10.1.
- Added measurement of gas flow rate, Section11.14.3.4.
- Added maintenance logbook documentation requirements, section 11.14.5
- Added specifications (MDLs) and clarifications (DOCs), section 13
- Updated appendix A to include purge and desorb requirements for method 624.
- Integration for TestAmerica Seattle and TestAmerica Tacoma operations.

- Revision 16, dated 16 September 2009
  - Description of preparation requirements for reagent water have been updated in sections 3.3 and 7.1.2 to reflect current practice of by purging with an inert gas for a minimum of 1 hour prior to use rather than for a period of overnight.
- Revision 15, dated 22 July 2009
  - Method modifications section updated to identify volume of methanol extract used for analysis.
  - References section updated to include Method 5035A.
  - Nomenclature for spiking solutions has been updated.
  - Spiking volumes have been updated.
  - Calibration levels have been updated.
  - Corrected typographical errors.
  - Updated RLs in Tables 1, 2, 3, and A-1.
  - Added Table 12. Summary of QC Requirements
- Revision 14, dated 16 March 2009
  - Method modifications section updated to identify volume of methanol extract used for analysis.
  - References section updated to include Method 5035A.
  - Nomenclature for spiking solutions has been updated.
  - Spiking volumes have been updated.
  - Calibration levels have been updated.
  - Corrected typographical errors.
  - Updated RLs in Tables 1, 2, 3, and A-1.

- Revision 13, dated 22 March 2008
  - Integration for TestAmerica and STL operations.
  - This revision is a complete rewrite and an expansion of scope.
  - This SOP is the combination of SOPs 0312.12, 0327.5, and 0381.6.

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Table 1. TestAmerica Primary List Reporting Limits for 8260B[2]

Compound	CAS Number	Reporting Limits[1]			
		5 mL Water (µg/L)	25 mL Water (µg/L)	Low Soil (µg/kg)	Med Soil (µg/kg)
Dichlorodifluoromethane	75-71-8	1.0	0.4	1.0	40
Chloromethane	74-87-3	1.0	0.1	1.0	400
Bromomethane	74-83-9	5.0	0.1	1.0	140
Vinyl chloride	75-01-4	1.0	0.02	1.0	8
Chloroethane	75-00-3	1.0	0.2	1.0	400
Trichlorofluoromethane	75-69-4	1.0	0.1	1.0	40
Acetone	67-64-1	5.0	2.0	5.0	400
Carbon disulfide	75-15-0	1.0	0.1	1.0	40
Methylene chloride	75-09-2	1.0	0.1	1.0	40
1,1-Dichloroethene	75-35-4	1.0	0.1	5.0	20
1,1-Dichloroethane	75-34-3	1.0	0.1	1.0	40
trans-1,2-Dichloroethene	156-60-5	1.0	0.1	1.0	40
Methyl *tert*-butyl ether (MTBE)	1634-04-4	1.0	0.1	1.0	40
cis-1,2-Dichloroethene	156-59-2	1.0	0.1	1.0	40
Chloroform	67-66-3	1.0	0.1	1.0	40
1,2-Dichloroethane	107-06-2	1.0	0.1	1.0	40
Dibromomethane	74-95-3	1.0	0.1	1.0	40
2-Butanone (MEK)	78-93-3	10.0	0.5	5.0	400
1,1,1-Trichloroethane	71-55-6	1.0	0.1	1.0	40
Carbon tetrachloride	56-23-5	1.0	0.1	1.0	20
Bromodichloromethane	75-27-4	1.0	0.1	1.0	40
1,2-Dichloropropane	78-87-5	1.0	0.1	1.0	12
cis-1,3-Dichloropropene	10061-01-5	1.0	0.1	1.0	16
Trichloroethene	79-01-6	1.0	0.1	1.0	16
Dibromochloromethane	124-48-1	1.0	0.1	1.0	40
1,2-Dibromoethane (EDB)	106-93-4	1.0	0.1	1.0	40
1,2,3-Trichloropropane	96-18-4	1.0	0.2	1.0	40
1,1,2-Trichloroethane	79-00-5	1.0	0.1	1.0	12
Benzene	71-43-2	1.0	0.1	1.0	16
trans-1,3-Dichloropropene	10061-02-6	1.0	0.1	1.0	16
Bromoform	75-25-2	1.0	0.1	1.0	40

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Table 1. TestAmerica Primary List Reporting Limits for 8260B[2]

Compound	CAS Number	Reporting Limits[1]			
		5 mL Water (µg/L)	25 mL Water (µg/L)	Low Soil (µg/kg)	Med Soil (µg/kg)
4-Methyl-2-pentanone (MIBK)	108-10-1	5.0	0.5	5.0	200
2-Hexanone	591-78-6	5.0	1.0	5.0	200
Tetrachloroethene	127-18-4	1.0	0.1	1.0	20
Toluene	108-88-3	1.0	0.1	1.0	40
1,1,2,2-Tetrachloroethane	79-34-5	1.0	0.1	1.0	10
Chlorobenzene	108-90-7	1.0	0.1	1.0	40
Ethylbenzene	100-41-4	1.0	0.1	1.0	40
Styrene	100-42-5	1.0	0.1	1.0	40
m- and p-Xylenes	136777-61-2	2.0	0.2	2.0	40
o-xylene	95-47-6	1.0	0.1	1.0	40
1,3-Dichlorobenzene	541-73-1	1.0	0.2	1.0	40
1,4-Dichlorobenzene	106-46-7	1.0	0.2	1.0	40
1,2-Dichlorobenzene	95-50-1	1.0	0.2	1.0	40
2,2-Dichloropropane	590-20-7	1.0	0.1	1.0	40
Bromochloromethane	74-97-5	1.0	0.1	1.0	40
1,1-Dichloropropene	563-58-6	1.0	0.1	1.0	40
1,3-Dichloropropane	142-28-9	1.0	0.1	1.0	40
Bromobenzene	108-86-1	1.0	0.1	1.0	40
n-Propylbenzene	103-65-1	1.0	0.1	1.0	40
2-Chlorotoluene	95-49-8	1.0	0.1	1.0	40
4-Chlorotoluene	106-43-4	1.0	0.2	1.0	40
1,3,5-Trimethylbenzene	108-67-8	1.0	0.1	2.0	40
tert-Butylbenzene	98-06-6	1.0	0.1	1.0	40
1,2,4-Trimethylbenzene	95-63-6	1.0	0.1	1.0	40
sec-butylbenzene	135-98-8	1.0	0.1	1.0	40
4-Isopropyltoluene	99-87-6	1.0	0.2	1.0	40
n-Butylbenzene	104-51-8	1.0	0.1	1.0	40
1,2,4-Trichlorobenzene	120-82-1	1.0	0.2	2.0	40
Napthalene	91-20-3	1.0	0.4	5.0	40
Hexachlorobutadiene	87-68-3	1.0	0.2	1.0	40
1,2,3-Trichlorobenzene	87-61-6	1.0	0.4	2.0	40
1,1,1,2-Tetrachloroethane	630-20-6	1.0	0.1	1.0	40

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Table 1. TestAmerica Primary List Reporting Limits for 8260B[2]

Compound	CAS Number	Reporting Limits[1]			
		5 mL Water (µg/L)	25 mL Water (µg/L)	Low Soil (µg/kg)	Med Soil (µg/kg)
1,2-Dibromo-3-chloropropane (DBCP)	96-12-8	2.0	0.2	1.0	200
Isopropylbenzene	98-82-8	1.0	0.1	1.0	40

1 Reporting limits listed for soil/sediment are based on wet weight. The reporting limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

Table 1a TestAmerica 8260_SIM List Reporting limits

Compound	CAS Number	Reporting Limits	
Benzene	71-43-2	0.100	ug/L
Carbon tetrachloride	56-23-5	0.050	ug/L
1,2-Dibromo-3-Chloropropane	96-12-8	0.100	ug/L
Ethylene Dibromide	106-93-4	0.100	ug/L
1,4-Dichlorobenzene	106-46-7	0.100	ug/L
1,2-Dichloroethane	107-06-2	0.100	ug/L
1,1-Dichloroethene	75-35-4	0.050	ug/L
cis-1,2-Dichloroethene	156-59-2	0.050	ug/L
trans-1,2-Dichloroethene	156-60-5	0.100	ug/L
1,1,2,2-Tetrachloroethane	79-34-5	0.100	ug/L
Tetrachloroethene	127-18-4	0.050	ug/L
1,1,1-Trichloroethane	71-55-6	0.100	ug/L
Trichloroethene	79-01-6	0.050	ug/L
Vinyl chloride	75-01-4	0.020	ug/L

Table 2. 8260B Additional Analyte List Reporting Limits

Compound	CAS Number	Reporting Limits[1]			
		5 mL Water µg/L	25 mL Water µg/L	Low Soil µg/kg	High Soil µg/kg
Acrolein	107-02-8	5.0	2.0	5.0	200
1,1,2-Trichloro-1,2,2-trifluoroethane	76-13-1	1.0	0.2	1.0	40
Iodomethane	74-88-4	5.0	0.5	5.0	200
2-Chloroethyl vinyl ether[2]	110-75-8	5.0[2]	2.0[2]	5.0	200
Vinyl acetate	108-05-4	5.0	0.5	5.0	200
Methyl acetate	79-20-9	6.0	--	5.0	1000
2-Methyl-2-propanol	75-65-0	25.0	10.0	10.0	400
tert-Butyl Ethyl Ether	637-92-3	1.0	0.5	10.0	40
trans-1,4-Dichloro-2-butene	110-57-6	5.0	1.0	5.0	200
Total Xylenes	1330-20-7	2.0	0.1	2.0	40
Acrylonitrile	107-13-1	5.0	2.0	5.0	200
Hexane	110-54-3	1.0	--	1.0	40
Tetrahydrofuran	109-99-9	5.0	--	5.0	200
1,4-Dioxane	123-91-1	50	5.0	25	1000
Cyclohexane	110-82-7	1.0	--	1.0	40
tert-Amyl Methyl Ether	994-05-8	1.0	0.5	10.0	40
Methylcyclohexane	108-87-2	1.0	--	1.0	40
cis-1,4-Dichloro-2-butene	1476-11-5	5.0	--	5.0	200
Hexachloroethane	67-72-1	1.0	0.1	1.0	40
2-Ethyl-1-hexanol	104-76-7	50	--	5.0	1000
1,3,5-Trichlorobenzene	108-70-3	1.0	0.2	1.0	40

1 Reporting limits listed for soil/sediment are based on wet weight. The reporting limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.
2 2-Chloroethyl vinyl ether cannot be reliably recovered from acid preserved samples

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Table 3. Appendix IX List Reporting Limits

Compound	CAS Number	Reporting Limits[1]			
		5 mL Water µg/L	25 mL Water µg/L	Low Soil µg/kg	High Soil µg/kg
Acetonitrile	75-05-8	10	--	10.0	400
Isopropyl ether	108-20-3	1.0	--	10.0	40
n-Butanol	71-36-3	100	--	100	4000
Methacrylonitrile	126-98-7	5.0	--	5.0	200
Isobutanol	78-83-1	100	--	100	4000
Ethyl ether	60-29-7	5.0	--	5.0	200
Ethyl Acetate	141-78-6	10	--	5.0	200

[1] Reporting limits listed for soil/sediment are based on wet weight. The reporting limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

Table 4. Typical Calibration Levels

5-mL water purge	**Calibration Levels, µg/L**											
	0.2	**1.0**	**2.0**	**5.0**	**10.0**	**20.0**	**50.0**	**100**	**150**	**200**		
5-mL methanolic extract purge	**Calibration Levels, µg/L**											
	0.2	**1.0**	**2.0**	**5.0**	**10.0**	**20.0**	**50.0**	**100**	**150**	**200**		
Direct sparge soil (low level)	**Calibration Levels, µg/kg**											
	1.0	**2.0**	**5.0**	**10.0**	**20.0**	**50.0**	**100**	**150**	**200**			
25-mL water purge (Low level)	**Calibration Levels, µg/L**											
	0.02	**0.04**	**0.10**	**0.20**	**0.40**	**1.0**	**2.0**	**5.0**	**10.0**	**20.0**	**40.0**	**100**

Table 5. Internal Standards

Internal Standard	Standard Concentration (mg/L)	Quantitation Ion
vwrkIS&sur_xxxxx		
Pentafluorobenzene	250	168
1,4-Difluorobenzene	250	114
1,4-Dichlorobenzene-d_4	250	152

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Table 6. Surrogate Standards

Surrogate Compounds	Standard Concentration (mg/L)
vwrkIS&sur_xxxxx	
Fluorobenzene	50
Ethylbenzene-d_{10}	50
Toluene-d_8	50
4-Bromofluorobenzene	50

NOTES:

1) Recovery and precision limits for the surrogates are generated from historical data and are maintained by the QA department.

Table 7. Standard LCS and Matrix Spike Standard

Compound	Standard Concentration (mg/L)
V_LCS_SL50_xxxxx and V_SL_50_xxxxx	
1,1-Dichloroethene	50
Trichloroethene	50
Toluene	50
Benzene	50
Chlorobenzene	50

NOTES:

1) Recovery and precision limits for the LCS, MS, and MSD are generated from historical data and are maintained by the QA department.
2) Full analyte spikes may also be used at the laboratory's option or at client request.

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Table 7a. Full List LCS and Matrix Spike Compounds

Compound	Standard Concentration (mg/L)
V_LCS_G_50_xxxxx	
Acrolein	250
Vinyl acetate	250
2-Chloroethyl vinyl ether	250
1,4-Dioxane	1250
2-Butanone (MEK)	250
2-Ethyl-1-hexanol	1250
2-Hexanone	250
2-Methyl-2-propanol	250
4-Methyl-2-pentanone (MIBK)	250
Acetone	250
Acetonitrile	500
Acrylonitrile	250
Bromomethane	250
Chloroethane	50
Chloromethane	50
Cis-1,4-Dichloro-2-butene	50
Dichlorodifluoromethane	50
Ethyl acetate	250
Ethyl ether	250
Iodomethane	250
Isopropyl ether	50
Methyacrylonitrole	250
Methyl acetate	250
Methyl tert-butyl ether	50
Tert-amyl methyl ether	50
Tert-butyl ethyl ether	50
Tetrahydrofuran	250

Trans-1,4-Dichloro-2-butene	250
Trichlorfluoromethane	50
Vinyl chloride	50
V_LCS_L_50_xxxxx	
1,1,1,2-Tetrachloroethane	50
1,1,1-Trichloroethane	50
1,1,2,2-Tetrachloroethane	50
1,1,2-Trichloro-1,2,2-trifluoroethane	50
1,1,2-Trichloroethane	50
1,1-Dichloroethane	50
1,1-Dichloroethene	50
1,1-Dichloropropene	50
1,2,3-Trichloropropane	50
1,2,4-Trichlorobenzene	50
1,2,4-Trimethylbenzene	50
1,2-Dibromo-3-chloropropane	50
1,2-Dichlorobenzene	50
1,2-Dichloroethane	50
1,2-Dichloropropane	50
1,3,5-Trichlorobenzene	50
1,3,5-Trimethylbenzene	50
1,3-Dichlorobenzene	50
1,3-Dichloropropane	50
1,4-Dichlorobenzene	50
2,2-Dichloropropane	50
2-Chlorotoluene	50
4-Chlorotoluene	50
4-Isopropyltoluene	50
Benzene	50
Bromobenzene	50
Bromoform	50

Carbon disulfide	50
Carbon tetrachloride	50
Chlorobenzene	50
Chlorobromomethane	50
Chlorodibromomethane	50
Chloroform	50
Cis-1,2-Dichloroethene	50
Cis-1,3-Dichloropropene	50
Cyclohexane	50
Dibromomethane	50
Dichlorobromomethane	50
Ethylbenzene	50
Ethylene Dibromide	50
Hexachlorobutadiene	50
Hexachloroethane	50
Hexane	50
Isobutyl alcohol	5000
Isopropylbenzene	50
Methylcyclohexane	50
Methylene chloride	50
m- & p-Xylene	100
Naphthalene	50
n-Butanol	5000
n-Butylbenzene	50
n-Propylbenzene	50
o-Xylene	50
sec-Butylbenzene	50
Styrene	50
tert-Butylbenzene	50
Tetrachloroethene	50
Toluene	50

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trans-1,2-Dichloroethene	50
trans-1,3-Dichloropropene	50
Trichloroethene	50

NOTES:

1) Recovery and precision limits for the LCS, MS, and MSD are generated from historical data and are maintained by the QA department.

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Table 8. BFB Key Ion Abundance Criteria

Mass	Ion Abundance Criteria
50	15 to 40 % of Mass 95
75	30 to 60 % of Mass 95
95	Base Peak, 100 % Relative Abundance
96	5 to 9 % of Mass 95
173	Less than 2 % of Mass 174
174	Greater than 50 % of Mass 95
175	5 to 9 % of Mass 174
176	Greater than 95 %, but less than 101 % of Mass 174
177	5 to 9 % of Mass 176

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Table 9. SPCC Compounds and Minimum Response Factors

Compound	8260B Min. RF
Chloromethane	0.10
1,1-Dichloroethane	0.10
Bromoform	0.10
1,1,2,2-Tetrachloroethane	0.30
Chlorobenzene	0.30

Table 10. CCC Compounds

Compound	Max. %RSD from Initial Calibration	Max. %D for continuing calibration
Vinyl Chloride	≤ 30	≤ 20
1,1-Dichloroethene	≤ 30	≤ 20
Chloroform	≤ 30	≤ 20
1,2-Dichloropropane	≤ 30	≤ 20
Toluene	≤ 30	≤ 20
Ethylbenzene	≤ 30	≤ 20

Table 11. Poorly Performing Compounds

Acetone	Iodomethane
Acetonitrile	Dichlorofluoromethane
Acrolein	**1,2-Dibromo-3-chloropropane (DBCP)**
Acrylonitrile	1,4-Dioxane
n-Butanol	Ethyl acetate
2-Butanone (MEK)	**2-Hexanone**
Bromomethane	Methacrylonitrile
Carbon disulfide	Methyl acetate
2-Chloroethyl vinyl ether	**4-Methyl-2-pentanone (MIBK)**
Chloroethane	Tetrahydrofuran
Chloromethane	1,1,2-Trichloro-1,2,2-trifluoroethane
Dichlorodifluoromethane	**Trichlorofluoromethane**
cis-1,4-Dichloro-2-butene	Vinyl acetate
trans-1,4-Dichloro-2-butene	Tert butyl alcohol

The laboratory's GC/MS group identified this list of compounds based on current and historical performance. The recovery performance was reviewed against full spike recovery data and method performance data, where available, to validate each compound as a "poor performer." This is not a comprehensive list and is subject to change. *Each DoD projects' target analyte list should be evaluated for poor performers.*

Analytes that are in bold are also represented in Table 1 Reporting Limits for Standard Analytes.

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Table 12. Summary of QC Requirements

QC Parameter	Frequency	Acceptance Criteria	Corrective Action
BFB Tune	Prior to ICAL and at the beginning of each 12-hour period.	See Section 11.3	Retune instrument and verify. Rerun affected samples.
Minimum 5-point Initial Calibration (minimum 3-point Initial Calibration for Method 624)	Initial calibration prior to sample analysis	For Method 624: RSD for RFs: ≤ 35% for all analytes. For Method 8260B: 1. Average Response Factor for SPCCs: ≥ 0.30 for chlorobenzene, and 1,1,2,2-tetrachloroethane; ≥ 0.10 for chloromethane, bromoform, and 1,1-dichloroethane 2. RSD for RFs for CCCs: ≤ 30% **For DOD requirements above and one option below:** Option 1: RSD for each analyte ≤ 15% Option 2: Linear regression r ≥ 0.995 Option 3: Non linear regression r^2 ≥ 0.990 and 6 points must be used.	Terminate analysis; correct the problem; recalibrate. Problem must be corrected. No samples may be run until ICAL has passed.
ICV or QCS for Method 624 and 8260B	Following initial calibration.	Method control limits of all analytes under method 624; 60-140% for non-DoD projects and 45-155% for poor performers **For DoD:** 80 - 120% recovery	Terminate analysis; correct the problem; recalibrate.
Relative Retention Times	With each sample	RRT of each target	Correct problem, then

QC Parameter	Frequency	Acceptance Criteria	Corrective Action
(RRT)		analyte within ± 0.06 RRT units.	rerun ICAL. Laboratory may update RTs based on the CCV to account for minor performance fluctuations or after routine system maintenance (e.g. column clipping).
CCV	Daily before sample analysis and every 12 hours of analysis time.	1. Avg RF for SPCCs: ≥ 0.30 for chlorobenzene and 1,1,2,2-tetrachloroethene; ≥ 0.10 for chloromethane, bromoform, and 1,1-dichloroethane; 2. %D/Drift for CCCs ≤ 20%D. **For DoD:** 1. Avg RF for SPCCs: ≥ 0.30 for chlorobenzene and 1,1,2,2-tetrachloroethane; ≥ 0.1 for chloromethane, bromoform, and 1,1-dichloroethane; 2. %D/Drift for all target compounds and surrogates ≤ 20%D.	Correct problem, then rerun CCV. If that fails, then repeat ICAL. Reanalyze all sample since the last successful CCV.
Internal Standards (IS) verification	Every field sample, standard, and QC sample	Retention time ± 30 seconds from RT of the midpoint standard in ICAL; EICP area within -50% to +100% of ICAL midpoint standard.	Inspect mass spectrometer and GC for malfunctions. Reanalysis of samples while system was malfunctioning is mandatory.
Method Blank	One per batch of 20 field samples or fewer.	The result must be < RL or < *5%* the amount measured in any sample or 1/10 the regulatory limit. **For DoD:** No analytes detected > ½ RL and > *5%* the amount measured in any sample	Re-extract and reanalyze samples. Note exceptions under criteria section. See Section 9.3 for additional requirements.

QC Parameter	Frequency	Acceptance Criteria	Corrective Action
		or 1/10 the regulatory limit. For common laboratory contaminants no analytes detected > RL.	
LCS	One per batch of 20 field samples or fewer.	Must be within laboratory control limits. **For DoD:** Must contain all analytes to be reported. QC acceptance criteria specified by DoD, if available. Otherwise, use in-house control limits.	See Section 9.5 for additional requirements.
Surrogate	All field and QC samples.	Must be within laboratory control limits, *unless it fails high and the sample is ND, or matrix interference is confirmed by a reanalysis or MS/MSD performed on the sample, or client specific requriements exist.* **For DoD:** QC acceptance criteria specified by DoD, if available. Otherwise, use in-house control limits.	See Section 9.4 for additional requirements.
Matrix Spike/Laboratory Fortified Matrix	One per lot of 20 field samples or fewer.	Must be within laboratory control limits. **For DoD:** Must contain all analytes to be reported and must use LCS control limits.	See Section 9.5 for additional requirements.

Appendix A - Modifications for Method 624

Requirements for EPA 624

1. Method 624 is required for demonstration of compliance with CWA permits, e.g., NPDES wastewater discharge permits. This method can be applied only to aqueous matrices. The standard analyte list and reporting limits are listed in Table A-1. If compounds are added to the analysis, all of the method criteria must be satisfied for the additional compounds.
2. The tune period for this method is defined as 24 hours, which is the maximum elapsed time before the tune check is performed. Calibration verifications are done at the same 24 hour frequency.
3. The initial calibration curve for this method requires at least three points.
4. Sample concentrations are calculated using the average RRF from the initial calibration curve.
5. CCC evaluation is the same as shown in 11.0.
6. Each target analyte is assigned to the closest eluting internal standard.
7. Initial demonstration of Proficiency
   - The spiking level for the four replicate initial demonstration of proficiency is 20 µg/L.
8. Initial calibration curve requirements:
   - Target compounds must have RSD ≤ 35%.
   - If this requirement can not be met, a regression curve must be constructed for the non-compliant compounds. There is no correlation coefficient requirement for the regression curve.
9. Continuing calibration verification requirements:
   - *The continuing calibration standard is from a different source than the initial calibration standard. The daily CCAL concentration is 20 ug/L." should be "The laboratory control standard is from a different source than the initial calibration standard. The daily CCAL concentration is 50 ug/L. The LCS concentration is 20 ug/L.*
10. Matrix Spike and LCS Requirements
    - The matrix spike and LCS/LCSD are spiked at 20 µg/L, prepared from the same source containing all analytes of interest. A matrix spike duplicate is not necessary for this method.
11. Consistent with the other volatile methods, corrections for recovery are not allowed.
12. Qualitative Identification - The relative intensities of ions should agree to within ±20% between the standard and sample spectra. (Example: For an ion with an abundance of 50% in the standard spectra, the corresponding sample abundance must be between 30 and 70 percent.)
13. Method clarifications, modifications and additions
    - Section 5.2.2 of the source method describes the trap packing materials as Tenax GC, Methyl silicone, silica gel and coconut charcoal. TestAmerica routinely employs the

Supelco VOCARB 3000, which consists of Carbopack B and Carboxen 1000 and 1001.

- Section 5.3.2 of the source method describes a packed analytical column. TestAmerica routinely employs capillary columns when performing this method.
- The source method provides a suggested list of compounds for internal and surrogate standards. Others are permitted by the method. TestAmerica uses three internal standards, including 1,4-dichlorobenzene-d4, which are not listed in Table 3 of the source method. Toluene-d8 is used as a surrogate compound, which is also not listed in the source method.
- The lab is preparing internal standards at 10 ug/L and applying the same criteria designed for 30 ug/L in the Method. The lower the concentration is consistent with the greater sensitivity provided by capillary columns as compared to the older packed columns described in the method. It could only be more challenging for the lab to meet the acceptance criteria at 10 ug/L; it provides a higher level of data quality.
- Method 624 describes a mass scan range of 25 to 260 amu. Table 13 lists all of the ions used for analysis. None of the ions are below 35 amu. Therefore, we scan from 35 to 300 and include all ions needed for analysis.
- Method 624 describes dilutions “if response of any m/z” exceeds the response for the highest m/z in the ICAL. As the m/z ratio is always directly proportional to the concentration, evaluation based on dilution (per 11.13) is equivalent.
- Method 624 has criteria for unresolved isomers. The problems of isomeric resolution for the routine analytes listed in this SOP were worked through when the laboratory developed its implementation of the method. For example, we know through experience that meta and para xylenes will not be resolved and it was not necessary to include an evaluation for the xylenes in each analysis. Any development work to add compounds would take this into account.
- *Method 624 has requirements for purge time and desorb conditions. Purge time for samples is 11 minutes ± 0.1 minutes at ambient temperature. After the 11-minute purge time, attach the trap to the chromatograph, adjust the purge and trap system to the desorb mode, and begin to temperature program the gas chromatograph. Introduce the trapped materials to the GC column by rapidly heating the trap to 180°C while backflushing the trap with an inert gas for four minutes.*
- *The purge gas flow rate (40 mL/min ± 5 mL/min) should be measured at the vent and recorded in the maintenance logbook.*

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Table A-1. Method 624 Analytes and Reporting Limits, 5-mL Purge

Analytes	µg/L
Acrolein	~~5~~
Acrylonitrile	~~5~~
Benzene	1
Bromodichloromethane	1
Bromoform	1
Bromomethane	5
Carbon tetrachloride	1
Chlorobenzene	1
Chloroethane	1
2-Chloroethyl vinyl ether	5
Chloroform	1
Chloromethane	1
Dibromochloromethane	1
1,2-Dichlorobenzene	1
1,3-Dichlorobenzene	1
1,4-Dichlorobenzene	1
1,1-Dichloroethane	1
1,2-Dichloroethane	1
1,1-Dichloroethene	1
trans-1,2-Dichloroethene	1
1,2-Dichloropropane	1
cis-1,3-Dichloropropene	1
trans-1,3-Dichloropropene	1
Ethylbenzene	1
Methylene chloride	1
1,1,2,2-Tetrachloroethane	1
Tetrachloroethene	1
Toluene	1
1,1,1-Trichloroethane	1
1,1,2-Trichloroethane	1
Trichloroethane	1
Trichlorofluoromethane	1
Vinyl chloride	1

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Appendix DoD

Table G-4. LCS Control Limits for Volatile Organic Compounds SW-846 Method 8260 Water Matrix[2]

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
1,1,1,2-Tetrachloroethane	105	8	80	130	75	135
1,1,1-Trichloroethane	100	11	65	130	55	145
1,1,2,2-Tetrachloroethane	96	11	65	130	55	140
1,1,2-Trichloroethane	100	8	75	125	65	135
1,1-Dichloroethane	101	11	70	135	60	145
1,1-Dichloroethene	99	10	070	130	55	140
1,1-Dichloropropene	102	10	75	130	65	140
1,2,3-Trichlorobenzene	99	14	55	140	45	155
1,2,3-Trichloropropane	98	9	75	125	65	130
1,2,4-Trichlorobenzene	100	11	65	135	55	145
1,2,4-Trimethylbenzene	103	10	75	130	65	140
1,2-Dibromo-3-chloropropane	91	14	50	130	35	145
1,2-Dibromoethane	100	7	80	120	75	125
1,2-Dichlorobenzene	96	9	70	120	60	130
1,2-Dichloroethane	100	10	70	130	60	140
1,2-Dichloropropane	100	8	75	125	65	135
1,3,5-Trimethylbenzene	102	10	75	130	65	140
1,3-Dichlorobenzene	100	8	75	125	65	130
1,3-Dichloropropane	100	9	75	125	65	135
1,4-Dichlorobenzene	99	8	75	125	65	130
2,2-Dichloropropane	103	11	70	135	60	150
2-Butanone	91	20	30	150	10	170
2-Chlorotoluene	100	9	75	125	65	135
2-Hexanone	92	12	55	130	45	140
4-Chlorotoluene	101	9	75	130	65	135
4-Methyl-2-pentanone	96	13	60	135	45	145
Acetone	91	17	40	140	20	160
Benzene	102	7	80	120	75	130
Bromobenzene	100	8	75	125	70	130
Bromochloromethane	100	11	65	130	55	140

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Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Bromodichloromethane	97	8	75	120	70	130
Bromoform	98	10	70	130	60	140
Bromomethane	99	19	30	145	10	165
Carbon disulfide	88	21	35	160	15	185
Carbon tetrachloride	100	12	65	140	55	150
Chlorobenzene	102	7	80	120	75	130
Chlorodibromomethane	102	13	60	135	45	145
Chloroethane	96	12	60	135	50	145
Chloroform	99	12	65	135	50	150
Chloromethane	100	15	40	125	25	140
cis-1,2-Dichloroethane	83	9	70	125	60	135
cis-1,3-Dichloropropene	99	10	70	130	60	140
Dibromomethane	100	8	75	125	65	135
Dichlorodifluoromethane	101	21	30	155	10	175
Ethylbenzene	93	9	75	125	65	135
Hexachlorobutadiene	100	15	50	140	35	160
Isopropylbenzene	97	9	75	125	65	135
m,p-Xylene	101	9	75	130	65	135
Methyl tert-butyl ether	102	10	65	125	55	135
Methylene chloride	96	14	55	140	40	155
Naphthalene	96	14	55	140	40	150
n-Butylbenzene	103	11	70	135	55	150
n-Propylbenzene	101	9	70	130	65	140
o-Xylene	100	7	80	120	75	130
p-Isopropyltoluene	102	10	75	130	65	140
sec-Butylbenzene	100	9	70	125	65	135
Styrene	100	11	65	135	55	145
tert-Butylbenzene	99	10	70	130	60	140
Tetrachlorethene	96	18	45	150	25	165
Toluene	100	7	75	120	70	130
trans-1,2-Dichloroethene	99	13	60	140	45	150
trans-1,3-Dichloroethene	98	15	55	140	40	155
Trichloroethene	99	9	70	125	60	135

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Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Trichlorofluoromethane	103	15	60	145	455	160
Vinyl chloride	99	16	50	145	35	165

[2]A number of sporadic marginal exceedances of the control limits is allowed depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits. LCS control limits are not available for Total Xylene. Xylene may be reported on a project-specific basis as a total number; however, for the purposes of the DoD QSM, it will be analyzed and reported as m,p-Xylene and o-Xylene.

Table G-5. LCS Control Limits for Volatile Organic Compounds SW-846 Method 8260 Solid Matrix[3]

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
1,1,1,2-Tetrachloroethane	100	9	75	125	65	135
1,1,1-Trichloroethane	101	11	70	135	55	145
1,1,2,2-Tetrachloroethane	93	13	55	130	40	145
1,1,2-Trichloroethane	95	11	60	125	50	140
1,1-Dichloroethane	99	9	75	125	65	135
1,1-Dichloroethene	100	12	65	135	55	150
1,1-Dichloropropene	102	11	70	135	60	145
1,2,3-Trichlorobenzene	97	12	60	135	50	145
1,2,3-Trichloropropane	97	11	65	130	50	140
1,2,4-Trichlorobenzene	98	11	65	130	55	140
1,2,4-Trimethylbenzene	100	12	65	135	55	145
1,2-Dibromo-3-chloropropane	87	16	40	135	25	150
1,2-Dibromoethane	97	9	70	125	60	135
1,2-Dichlorobenzene	97	7	75	120	65	125
1,2-Dichloroethane	104	11	70	135	60	145
1,2-Dichloropropane	95	8	70	120	65	125
1,3,5-Trimethylbenzene	99	11	65	135	55	145
1,3-Dichlorobenzene	98	9	70	125	65	135
1,3-Dichloropropane	100	8	75	125	70	130
1,4-Dichlorobenzene	98	9	70	125	65	135
2,2-Dichloropropane	101	11	65	135	55	145
2-Butanone	94	22	30	160	10	180
2-Chlorotoluene	98	10	70	130	60	140

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
2-Hexanone	97	16	45	145	30	160
4-Chlorotoluene	100	9	75	125	65	135
4-Methyl-2-pentanone	97	17	45	145	30	165
Acetone	88	23	20	160	10	180
Benzene	99	9	75	125	65	135
Bromobenzene	93	9	65	120	55	130
Bromochloromethane	99	9	70	125	60	135
Bromodichloromethane	100	9	70	130	60	135
Bromoform	96	13	55	135	45	150
Bromomethane	95	21	30	160	10	180
Carbon disulfide	103	19	45	160	30	180
Carbon tetrachloride	100	11	65	135	55	145
Chlorobenzene	99	8	75	125	65	130
Chlorodibromomethane	98	11	65	130	55	140
Chloroethane	98	20	40	155	20	175
Chloroform	98	9	70	125	65	135
Chloromethane	90	13	50	130	40	140
cis-1,2-Dichloroethane	96	10	65	125	55	135
cis-1,3-Dichloropropene	99	9	70	125	65	135
Dibromomethane	100	9	75	130	65	135
Dichlorodifluoromethane	85	17	35	135	15	155
Ethylbenzene	101	9	75	125	65	135
Hexachlorobutadiene	98	15	55	140	40	155
Isopropylbenzene	103	9	75	130	70	140
m,p-Xylene	102	8	80	125	70	135
Methylene chloride	97	14	55	140	40	155
Naphthalene	84	14	40	125	25	140
n-Butylbenzene	101	12	65	140	50	150
n-Propylbenzene	99	12	65	135	50	145
o-Xylene	101	8	75	125	70	135
p-Isopropyltoluene	104	10	75	135	65	140
sec-Butylbenzene	97	11	65	130	50	145
Styrene	101	9	75	125	65	135

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
tert-Butylbenzene	99	11	65	130	55	145
Tetrachlorethene	103	12	65	140	55	150
Toluene	99	9	70	125	60	135
trans-1,2-Dichloroethene	100	11	65	135	55	145
trans-1,3-Dichloroethene	96	10	65	125	55	140
Trichloroethene	101	8	75	125	70	130
Trichlorofluoromethane	106	27	25	185	10	215
Vinyl chloride	92	11	60	125	45	140

[3]A number of sporadic marginal exceedances of the control limits is allowed depending on the number of analytes spiked in the LCS. Refer to section G.2 and Table G-1 for guidance on the appropriate application of control and ME limits. LCS control limits are not available for Methyl tert-butyl ether and Total Xylene. Sufficient data to perform statistically significant analyses were not received for MTBE during the LCS study. Xylene may be reported on a project-specific basis as a total number; however, for the purposes of the DoD QSM, it will be analyzed and reported as m,p-Xylene and o-Xylene.

Table G-6. Surrogates

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit
8260 Water:				
1,2-Dichloroethane-d_4	95	8	70	120
4-Bromofluorobenzene	98	7	75	120
Dibromofluoromethane	100	5	85	115
Toluene-d_8	102	6	85	120
8260 Solid:				
4-Bromofluorobenzene	101	6	85	120
Toluene-d_8	100	5	85	115

Title: Gasoline Range Organics/MBTEX Analysis [Methods 8015B/8260B, AK101, NWTPH-Gx]

Approvals

Signatures on File

Tiffany Ryan — Date Volatiles Department Manager	Stan Palmquist — Date Health & Safety Manager / Coordinator
Dave Wunderlich — Date Quality Assurance Manager	Kathy Kreps — Date Laboratory Director

This SOP was previously identified as SOP No. 0376.6.

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1.0 Scope and Application

1.1 Analytes, Matrix(s), and Reporting Limits

This SOP delineates the specific requirements for analyzing TPH as gasoline and for MTBE, BTEX and other aromatic compounds. This method is applicable to soil analysis via 5035, water analysis via 5030 and providing simultaneous confirmation above the RL-secondary column confirmation is not required. Gasoline may be reported without the associated individual analytes, per client request. Table 1 provides a list of target analytes and associated RLs.

On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in Section *12.2.1* in the Quality Assurance Manual.

2.0 Summary of Method

This method describes the analysis of Gasoline Range Organics, MTBE, BTEX and other individual compounds in soil and water matrices. Soil samples are extracted in methanol. An aliquot of this extract is diluted in water and the sample is analyzed by purge and trap GC/MS with FID. Water samples are analyzed with no dilution, or diluted with reagent water; the sample is analyzed using purge and trap GC/MS *(or GC)* with FID.

3.0 Definitions

3.1 Gasoline Range Organics (GRO): All chromatographic peaks eluting between the following ranges are attributed to GRO:

AK101: The area including n-Hexane to the start of n-Decane

8015B: Toluene through n-Dodecane, inclusive

Hawaii: Hexane through n-Dodecane, inclusive

California 8015B: 2-methylpentane through 1,2,4-trimethylbenzene

NWTPH-GX: at a minimum Toluene through 1-Methylnaphthalene inclusive is integrated and plotted against the known concentration of gasoline standard added.

Quantitation is based on a direct comparison of the area within this range to the total area of the calibration standard within this range.

4.0 Interferences

4.1 High levels of heavier petroleum products such as diesel fuel may contain some volatile components that produce a response within the retention time range for gasoline. Other organic compounds, including chlorinated solvents, ketones, and ethers are measurable.

4.2 Samples contaminated with a single compound that is detectable using this method may result in a biased value for the compound. This is caused by the different response factors for gasoline and other various solvents.

4.3 Samples can become contaminated by diffusion of volatile organics during shipment and storage. A trip blank prepared from reagent water or methanol and carried through sampling, storage, and handling is recommended.

4.4 Contamination by carryover can occur whenever high-level and low-level samples are sequentially analyzed. Whenever an unusually concentrated sample is encountered, it should be followed by an analysis of a solvent blank of reagent water to check for cross contamination. For volatile samples containing high concentrations of water-soluble

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materials, suspended solids, high boiling compounds or organohalides, it may be necessary to wash the syringe or purging device with a detergent solution, rinse with distilled water, and then dry in a 105°C oven between analyses. The trap and other parts of the system are also subject to contamination; therefore, frequent bake-out and purging of the entire system may be required.

4.5 Any co-eluting compound with a quantitation ion identical with the compounds of interest will affect results.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Environmental Health and Safety Manual (CW-E-M-001) and this document. This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1 Specific Safety Concerns or Requirements

5.1.1 Eye protection that satisfies ANSI Z87.1 (per the Corporate Safety Manual), laboratory coat, and appropriate gloves must be worn while samples, standards, solvents, and reagents are being handled. Latex, nitrile, or vinyl gloves must be worn while handling samples, standards, solvents, and reagents. Cut resistant gloves must be worn when using sharp tools or when washing glassware. Disposable gloves that have been contaminated will be removed and discarded; other gloves will be cleaned immediately.

5.1.2 Purge vessels on purge-and-trap instruments can be pressurized by the time analysis is completed. Vent the pressure prior to removal of these vessels to prevent the contents from spraying out.

5.1.3 GC VOA instruments use an ultraviolet (UV) light source, which must be shielded from view. There should also be a warning label/sticker on each instrument that identifies it as a UV light source.

5.1.4 The gas chromatograph contains zones that have elevated temperatures. The analyst needs to be aware of the locations of those zones, and must cool them to room temperature prior to working on them.

5.1.5 There are areas of high voltage in the gas chromatograph. Depending on the type of work involved, either turn the power to the instrument off, or disconnect it from its source of power.

5.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

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Material	Hazards	Exposure Limit (1)	Signs and symptoms of exposure
Methanol (MeOH)	Flammable Poison Irritant	200 ppm-TWA	A slight irritant to the mucous membranes. Toxic effects exerted upon nervous system, particularly the optic nerve. Symptoms of overexposure may include headache, drowsiness and dizziness. Methyl alcohol is a defatting agent and may cause skin to become dry and cracked. Skin absorption can occur; symptoms may parallel inhalation exposure. Irritant to the eyes.
1 – Exposure limit refers to the OSHA regulatory exposure limit.			

6.0 Equipment and Supplies

6.1 Instrumentation

- Gas chromatograph and detector: Varian 3400 GC equipped with an ITS-40 Mass spectrometer
- Chromatographic column: DB-624, 30 meters x 0.25 mm ID x 1.4 um film thickness (J & W Scientific) or equivalent with DB-Wax, 15 meters x 0.25 mm ID x 0.5 um film thickness (J & W Scientific) post column OR
- Agilent 5973 Network MSD with FID detector option
- Chromatographic columns: split post column DB-624, 30 meters x 0.32 mm ID x 1.4 um film thickness (J & W Scientific) or equivalent to FID, 1.0 meter 0.18 inert column to MS.
- Data acquisition system: Magnum converted for HP Chemstation
- Varian Archon Autosampler
- Purge/Trap Liquid Concentrator, Tekmar 3000 or equivalent
- Analytical balance, 0.0001 g accuracy
- Drying oven

6.2 Supplies

- Scintillation vials
- Volumetric flasks: 10-mL, 50-mL, and 100-mL
- Glass standard vials with screw caps and Teflon-coated septum

7.0 Reagents and Standards

7.1 *Document reagent/standards and reagent/standard preparation in TALS using the reagent module as described in SOP TA-QA-0619.*

7.2 Methanol, Baker Purge and Trap Grade or equivalent.

7.3 Neat standards used for surrogate/standard solution preparation should be purchased from Aldrich or other certified supplier. Analyte list below:

7.3.1 1,4-Difluorobenzene

7.3.2 1-Bromo-4-fluoro-benzene

7.3.3 Toluene-d8

7.3.4 Ethylbenzene-d10

7.3.5 Fluorobenzene

7.3.6 α,α,α-Trifluorotoluene

7.3.7 2-Methylpentane

7.3.8 1,2,4-Trimethylbenzene

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7.4 Internal Standard for Initial Calibration: A 500 mg/L standard is prepared by diluting 85.5-uL 1,4-Difluorobenzene to 200.0-mL in methanol.

7.5 Working Internal Standard plus Surrogates: A 500 mg/L standard is prepared by adding 46.7-uL 1-Bromo-4-fluorobenzene, 79.5-uL Toluene-d8, 79.0-uL Ethylbenzene-d10, and 73.2-uL Fluorobenzene to 150.0-mL of the Internal Standard for Initial Calibration solution.

7.6 TFT Stock Solution: A 10,000 mg/L solution is prepared by diluting 421.0-uL α,α,α-Trifluorotoluene to 50.00-mL in methanol.

7.7 Water Surrogate Solution: A 400 mg/L TFT solution is prepared by diluting 33.65-uL α,α,α-Trifluorotoluene to 100-mL in methanol.

7.8 TFT Preservation Solution: A 4.00 mg/L TFT solution is prepared by diluting 1.00-mL TFT Stock Solution to 1.00 L in methanol.

7.9 Surrogate Stock Solution: A 20,000 mg/L solution is prepared by diluting neat standards to 25.00-mL in methanol as follows:

Surrogate	Volume of Neat (uL)	Final Volume (mL)	Final Concentration (mg/L)
4-Bromofluorobenzene	312	25.00	20,000
Toluene-d8	531	25.00	20,000
Ethylbenzene-d10	527	25.00	20,000
Fluorobenzene	488	25.00	20,000

7.10 Working Surrogate Solution for Initial Calibration: A 4000.0 ug/L solution is prepared by diluting 2.50-mL Surrogate Stock Solution to 25.0-mL in methanol.

7.11 WA VPH Standard mix: 20,000 mg/L purchased as certified mixture from Ultra Scientific or other equivalent supplier.

7.12 Retention Time Standard: A 20.0 mg/L solution is prepared by diluting to 50.00-mL in methanol as follows:

RT Standard Component	Volume of Source (uL)	Final Volume (mL)	Final Concentration (mg/L)
WA VPH	50.0	50.00	20.0
2-Methylpentane	1.00	50.00	20.0
1,2,4-Trimethylbenzene	1.00	50.00	20.0

7.13 Unleaded Gasoline Composite Standard: 50,000-ug/mL purchased from Restek or other certified supplier.

7.14 GRO ICAL/CCAL Solution: A 1,000 mg/L solution is prepared by diluting 4-mL Unleaded Gasoline Composite Standard to 200-mL in methanol.

7.15 GRO Working Solution (ICV/LCS): A 5,500-ug/mL solution purchased from Restek or other certified supplier. This standard will at a minimum be of a different lot as the standard used for calibration.

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7.16 Custom RBCA List Mix Stock: 1,000 mg/L (m & p-Xylene @ 2,000 mg/L) purchased from Ultra Scientific or other certified supplier.

7.17 BTEX ICAL/CCAL Solution: A 50.0 mg/L solution is prepared by diluting 1250-uL of Custom RBCA List Mix Stock and 125.0-uL of the Surrogate Stock Solution to 25.0-mL in methanol.

7.18 RBCA ICV/LCS Stock: 1,000 mg/L (m & p-Xylene @ 2,000 mg/L) purchased from Restek or other certified supplier.

7.19 BTEX Working Solution (ICV/LCS): A 50 mg/L (m & p-Xylene @ 100 mg/L) solution is prepared by diluting the appropriate stocks to 25.0-mL in methanol as indicated in the following table or can be purchased mix from a certified supplier.

Component	Volume of Stock (uL)	Final Volume (mL)	Final Concentration (mg/L)
RBCA/ICV/LCS Stock	1250.0	25.00	50.0

7.20 GRO Initial Calibration: An initial calibration is prepared using 9 calibration points as follows:

Level	Volume of GRO ICAL/CCAL Stock (uL)	Volume of Surr. Stock (uL)	Volume of Methanol (uL)	Final Volume (mL)	Final Concentration (ug/L)
1	5.0	5.0	2500	100.0	50.0
2	10.0	10.0	2500	100.0	100.0
3	25.0	15.0	2500	100.0	250.0
4	50.0	20.0	2450	100.0	500.0
5*	100.0	25.0	2400	100.0	1000.0
6	500.0	37.5	2000	100.0	5000.0
7	1000.0	50.0	1500	100.0	10,000
8	1500.0	--	1000	100.0	15,000
9	2500.0	--	--	100.0	25,000
* *This level is used as the Continuing Calibration Verification (CCV) standard.*					

7.21 A GRO initial calibration verification standard is prepared at the 1,100-ug/L concentration by diluting the GRO working solution in ASTM Type II water in a 100-mL volumetric flask as follows:

Level	Volume of GRO ICAL/CCAL Stock (uL)	Volume of Surr. Stock (uL)	Volume of Methanol (uL)	Final Volume (mL)	Final Concentration (ug/L)
ICV	25.0	20.0	2500	100.0	1100.0

7.22 BTEX Initial Calibration: An initial calibration is prepared using 9 calibration points, currently these points are 0.2 ug/L, 0.5 ug/L, 1 ug/L, 5 ug/L, 10 ug/L, 25 ug/L, 50 ug/L, 75 ug/L, 100 ug/L. These points are prepared by diluting the working surrogate solution for initial calibration and BTEX ICAL/CCAL solution to the appropriate concentration in ASTM Type II water in 100-mL volumetric flasks. In addition, an initial calibration verification

standard is prepared at the 25-ug/L concentration by diluting the BTEX working solution in ASTM Type II water in a 100-mL volumetric flask.

Level	Volume of BTEX ICAL/CCAL Stock (uL)	Final Volume (mL)	Final Concentration (ug/L)
1	0.4	100.0	0.2
2	2.0	100.0	1.0
3	4.0	100.0	5.0
4	10.0	100.0	10.0
5*	20.0	100.0	25.0
6	50.0	100.0	50.0
7	300.0	100.0	150.0
* *This level is used as the Continuing Calibration Verification (CCV) standard.*			

7.23 A BTEX initial calibration verification standard is prepared at the 25-ug/L concentration by diluting the BTEX working solution in ASTM Type II water in a 100-mL volumetric flask.

Level	Volume of BTEX ICAL/CCAL Stock (uL)	Volume of Working Surr. Stock (uL)	Final Volume (mL)	Final Concentration (ug/L)
ICV	50.0	25.0	100.0	25.0

7.24 *Managers/supervisors or a designee are expected to check their areas on a monthly basis for expired standards/reagents and dispose of them according to SOP TA-EHS-0036.*

8.0 Sample Collection, Preservation, Shipment and Storage

8.1 All samples are to be stored at 0-6°C in 43-mL VOA vials or jars with Teflon-lined caps. Water samples should be preserved to a pH <2.0 with HCl. *Unpreserved soil samples should be preserved in methanol within 48 hours of collection.*

8.2 *The holding time for preserved waters and soil (from date of collection to date of analysis is 14 days. Unpreserved waters should be analyzed within 7 days of collection*. AK101 GRO 5035 field preserved samples have a 28-day holding time limit.

8.3 VOA vials are inverted to check for air bubbles. If at all possible, samples should not be opened prior to analysis.

8.4 Field preserved soil sampling procedure. Soil samples must be collected in appropriately sized containers and submerged in methanol containing surrogate at 1:1 ratio. The tare weight of the sample container, the weight of the methanol, and the weight of the sample must be known in order to accurately quantitate gasoline range organics. Soil samples must be stored below 25°C. Methanol preserved soil samples must be analyzed within 28 days of collection.

9.0 Quality Control

9.1 The minimum quality controls (QC), acceptance criteria, and corrective actions are described in this section. When processing samples in the laboratory, use the LIMS QC program code and special instructions to determine specific QC requirements that apply.

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9.1.1 The laboratory's standard QC requirements, the process of establishing control limits, and the use of control charts are described more completely in the TestAmerica Seattle QAM.

9.1.2 Specific QC requirements for Federal programs, e.g., USACE and Navy projects, are described in DoD QSM v*4.1*.

9.1.3 Project-specific requirements can override the requirements presented in this section when there is a written agreement between the laboratory and the client, and the source of those requirements should be described in the project documents. Project-specific requirements are communicated to the analyst via special instructions in the LIMS and may also come in the form of email or written notifications distributed at "project kick off" meetings.

9.1.4 Any QC result that fails to meet control criteria must be documented in a Nonconformance Memo (NCM). The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The QA group also receives NCMs by e-mail for tracking and trending purposes. The NCM process is described in more detail in SOP TA-QA-0610. This is in addition to the corrective actions described in the following sections.

9.2 Batch Definition

Batches are defined at the sample preparation stage. The batch is a set of up to 20 samples of the same matrix, plus required QC samples, processed using the same procedures and reagents within the same time period. Batches should be kept together through the whole analytical process as far as possible, but it is not mandatory to analyze prepared extracts on the same instrument or in the same sequence. The method blank must be run on each instrument and in each analytical batch.

9.3 Method Blanks

For each batch of samples, analyze a method blank. The method blank is analyzed after the calibration standards and before any samples. For aqueous samples, the method blank consists of reagent water. For solid samples, the method blank consists of 10 mL of Reagent ID: **TFT STD** and ten grams of *muffled* Ottawa sand *(reagent ID VOA-Sand_xxxxx)*. Additional surrogates and internal standard are added automatically by the autosampler at the time of analysis. The method blank is carried through the entire analytical procedure.

Acceptance Criteria: The method blank must not contain any analyte of interest at or above one-half the reporting limit or above 5% of the measured concentration of that analyte in the associated samples, whichever is higher.

The method blank must have acceptable surrogate recoveries.

Corrective Actions: Reanalysis of samples associated with an unacceptable method blank is required when reportable concentrations are determined in the associated samples.

If there is no target analyte greater than the RL (less than one half the RL for LaMP and DoD clients) in the samples associated with an unacceptable method blank, the data may be reported with qualifiers. Such action should be done in consultation with the client.

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If surrogate recoveries in the blank are not acceptable, the data must be evaluated to determine if the method blank has served the purpose of demonstrating that the analysis is free of contamination. If surrogate recoveries are low and there are reportable analytes in the associated samples, re-extraction of the blank and affected samples will normally be required. Consultation with the client should take place.

If reanalysis of the batch is not possible due to limited sample volume or other constraints, the method blank is reported, all affected analytes in the associated samples are flagged with a "B", and appropriate comments may be made in a narrative to provide further documentation.

9.4 Laboratory Control Samples (LCS)

An LCS is analyzed for each batch. The LCS is analyzed after the calibration standard, and normally before any samples. The LCS is prepared from a different source than are the calibration standards. The LCS contains all the required analytes of interest (See Table 4), and must contain the same analytes as the matrix spike.

Acceptance Criteria: The LCS recovery for the control analytes must be within established control limits. Unless otherwise specified in a reference method or project requirements, the control limits are set at ± 3 standard deviations around the mean of the historical data. An LCS that is determined to be within acceptance criteria effectively demonstrates that the analytical system is in control and validates system performance for the samples in the associated batch. Recovery limits are updated at a set frequency by QA and are stored in the LIMS

Corrective Actions: If any analyte or surrogate is outside established control limits as described above, the system is out of control and corrective action must occur. Corrective action will normally be re-preparation and reanalysis of the batch.

If the batch is not re-extracted and reanalyzed, the reasons for accepting the batch must be clearly presented in the project records (via NCMs and the case narrative) and in the final report. Examples of acceptable reasons for not reanalyzing might be that the matrix spike and matrix spike duplicate are acceptable, and sample surrogate recoveries are good, demonstrating that the problem was confined to the LCS. This type of justification should be reviewed and documented with the client before reporting. (LaMP: Bias high recoveries– NCM and flag ND samples)

If re-extraction and reanalysis of the batch is not possible due to limited sample volume or other constraints, the LCS is reported, all associated samples are flagged, and appropriate comments are made in a narrative to provide further documentation.

9.5 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

For each QC batch, analyze a matrix spike and matrix spike duplicate if sufficient sample

volume is received. Spiking compounds and levels are given in Table 4. The matrix spike/duplicate must be analyzed at the same base dilution as the unspiked sample, even if the matrix spike compounds will be diluted out, dilutions (beyond the base dilution if necessary) of MS/MSD analyses are not required unless there are specific client instructions to do so. If necessary, this requirement will be passed to the laboratory through the PM by means of the mechanisms described in section 9.1.3 of this SOP.

LaMP: MS required if >10 samples. The client consultant is to identify the sample to be used.

Acceptance Criteria: The MS/MSD recovery for the control analytes must be within established control limits. Unless otherwise specified in a reference method or project requirements, the control limits are set at ± 3 standard deviations around the mean of the historical data. The relative percent difference (RPD) between the MS and the MSD must be less than the established RPD limit, which is based on statistical analysis of historical data. MS/MSD recovery and RPD limits are updated at a regular frequency by QA and are stored in the LIMS.

Corrective Actions: If any individual recovery or RPD falls outside the acceptable range, corrective action must occur. The initial corrective action will be to check the recovery of that analyte in the LCS. Generally, if the recovery of the analyte in the LCS is within limits, then the laboratory operation is in control and analysis may proceed. The reasons for accepting the batch must be documented.

If the recovery for any component is outside QC limits for both the matrix spike/matrix spike duplicate and the LCS, the laboratory is out of control and corrective action must be taken. Corrective action will normally include reanalysis of the batch, except in cases where a high bias is indicated and no target is detected above the reporting limit in any associated sample.

If an MS/MSD is not possible due to limited sample, then an LCS duplicate should be analyzed whenever requested by the client. The RPD between the LCS and LCSD is compared to the established acceptance limit.

9.6 Surrogates

Every sample, blank, and QC sample is spiked with surrogates. Surrogate recoveries in samples, blanks, and QC samples must be assessed to ensure that recoveries are within established limits. The compounds included in the surrogate spiking solutions are listed in Table 3.

Acceptance Criteria: Acceptance limits for surrogate recoveries are set at ± 3 standard deviations around the historical mean. Surrogate recovery limits are updated at a fixed frequency by QA and stored in the LIMS

Corrective Actions: If any surrogates are outside limits, the following corrective actions must take place (except for dilutions):

- Check all calculations for error.

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- Ensure that instrument performance is acceptable.
- Recalculate the data and/or reanalyze if either of the above checks reveal a problem.
- Re-prepare and reanalyze the sample or flag the data as "Estimated Concentration" if neither of the above resolves the problem.

The decision to reanalyze or flag the data should be made in consultation with the client. It is necessary to re-prepare/reanalyze a sample only once to demonstrate that poor surrogate recovery is due to matrix effect, unless the analyst believes that the repeated out of control results are not due to matrix effect.

If the surrogates are out of control for the sample, matrix spike, and matrix spike duplicate, then matrix effect has been demonstrated for that sample and re-preparation/reanalysis is not necessary. If the sample is out of control and the MS and/or MSD is in control, then reanalysis or flagging of the data is required.

NOTE: *For LaMP samples, if the surrogate percent recovery fails, the recovery must be confirmed by re-extraction and reanalysis with the following exceptions:*

- *The lab has unequivocally demonstrated a sample matrix effect and informed the LaMP representative.*
- *The recovery exceeds control limits and all target analytes in the sample are non-detect.*

9.7 *If batch QC samples or trip blanks are re-analyzed to confirm a recovery or result, and an improvement in results would cause the re-analysis to be reported, then the associated client samples must also be re-analyzed. The only exception to this protocol would be if an obvious analytical problem occurred during the initial analysis (i.e. no internal standard added, bent autosampler needle, etc).*

9.8 *Any extra QC that is analyzed in a batch or sequence must be evaluated using the same criteria as the corresponding QC above.*

10.0 Procedure

One-time procedural variations are allowed only if deemed necessary in the professional judgment of management to accommodate variation in sample matrix, chemistry, sample size, or other parameters. Any variation in procedure shall be completely documented using an NCM. The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The QA department also receives NCMs by e-mail for tracking and trending purposes. The NCM process is described in more detail in SOP # TA-QA-0610. The NCM shall be filed in the project file and addressed in the case narrative.

10.1 Sample Preparation

10.1.1 *Check the Balance logbook to determine if the daily calibration check has been completed. If it has not, the analyst must perform this check according to SOP TA-QA-0014.*

10.1.2 Soil Extraction

10.1.2.1 Method 5035 Laboratory preserved:

10.1.2.1.1 A sample aliquot (approximately 10 g) is placed into a scintillation vial, the exact weight recorded and 10-mL of TFT Preservation Solution (section7.7) is added to the sample.

10.1.2.1.2 To prepare the blank spike (LCS)/blank spike duplicate (LCSD), add 80-uL of GRO Working Solution or 160-uL of BTEX Working Solution and 10-mL of the TFT Preservation Solution to 10 g *muffled* Ottawa sand.

10.1.2.1.3 To prepare the matrix spike (MS)/matrix spike duplicate (MSD), add 80-uL of GRO Working Solution or 160-uL of BTEX Working Solution and 10-mL of the TFT Preservation Solution to 10 g pre-weighed soil samples. To prepare the method blank (MB); add 10-mL of the TFT Preservation Solution to 10 g Ottawa sand. All extracts are homogenized via a vortex apparatus then placed in the shaker table for 10 minutes.

10.1.2.1.4 All extracts are centrifuged to remove soil particulate matter.

10.1.2.1.5 A 1075-uL aliquot of each methanol extract is added to 43-mL of ASTM Type II water contained in appropriately labeled VOA vials.

10.1.2.2 Method 5035 Field preserved:

10.1.2.2.1 The methanol preserved sample jar is first weighed and the sample weight recorded.

10.1.2.2.2 A 1075-uL aliquot of each methanol extract is added to 43-mL of ASTM Type II water contained in appropriately labeled VOA vials.

10.1.2.2.3 To prepare the blank spike (LCS)/blank spike duplicate (LCSD), add 80-uL of GRO Working Solution or 160-uL of BTEX Working Solution and 10-mL of the TFT Preservation Solution to 10 g *muffled* Ottawa sand.

10.1.2.2.4 To prepare the **matrix spike** (MS)/**matrix spike duplicate** (MSD), add a 1075-uL aliquot of sample methanol extract and 10-uL of GRO Working Solution or 5.5-uL of BTEX Working Solution to each of two additional samples prepared as described in 10.1.1.2.2.

10.1.2.2.5 To prepare the **method blank** (MB), add 1075-uL of the TFT Preservation Solution (section 7.7) to 43-mL ASTM Type II water contained in an appropriately labeled VOA vial.

10.1.2.3 If the water solution becomes milky or cloudy in appearance, this is an indication of potential high concentrations of target and/or non-target compounds and a higher dilution may be prepared at this time.

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10.1.2.4 Dry Weight. Percent solids (dry weight) is determined by weighing approximately 10 grams of sample, completely drying the sample and then re-weighing and recording the difference in weight. SOP TA-WC-0160 describes this procedure in further detail.

10.1.3 Water Extraction

10.1.3.1 All aqueous samples will be spiked with 10.75-uL of Water Surrogate Solution (section7.6) and analyzed as received.

10.1.3.2 Samples may be screened for gasoline by analyzing a spare VOA, if available.

10.1.3.3 To prepare the Laboratory Control Sample /Laboratory Control Sample Duplicate (LCS/LCSD), add 25-uL of Water Surrogate Solution and 23.25-uL of GRO Working Solution or 50-uL of BTEX Working Solution to a 100-mL volumetric flask partially filled with and brought to final volume with ASTM Type II water. The volumetric is then gently inverted several times to ensure homogenization and transferred to two appropriately labeled VOA vials.

10.1.3.4 To prepare the matrix spike/matrix spike duplicate (MS/MSD), add 10-uL of GRO Working Solution or 17.25-uL of BTEX Working Solution to each of two additional samples provided before adding surrogate. To prepare the method blank (MB), add 12.5-uL of the Water Surrogate Solution to a 50-mL volumetric flask partially filled with and then brought to volume with ASTM Type II water. The volumetric is then gently inverted several times to ensure homogenization and transferred to an appropriately labeled VOA vial.

10.2 Calibration

10.3 Summary

Prior to the analysis of samples and blanks, the GC/MS system must be tuned and calibrated. Tuning is accomplished by analyzing 4-Bromofluorobenzene (BFB) to establish that the GC/MS system meets the standard mass spectral abundance criteria. The GC/MS system must be calibrated initially at a minimum of five concentrations to determine the linearity of the response utilizing target calibration standards. The calibration must be verified each twelve-hour time period for each GC/MS system.

10.4 Recommended Instrument Conditions

10.4.1 General

Electron Energy:	70 volts (nominal)
Mass Range:	35–300 amu
Scan Time:	to give at least 5 scans/peak, ≤ 2 seconds/scan
Injector Temperature:	200 – 250 ˚C
Source Temperature:	According to manufacturer's specifications
Transfer Line:	Temperature: 250 – 300 ˚C
Purge Flow:	40 mL/minute
Carrier Gas Flow:	1-15 mL/minute, dependent upon column specifications

10.4.2 Gas Chromatograph Suggested Temperature Program

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The following temperature programs vary with the column type used.

BFB Analysis

Isothermal:	170 – 200 ˚C
	Or may be taken during an initial instrument blank check or during the shift continuing calibration check (CCC), and as such conditions will be the same as sample analysis.

Sample Analysis

Injector Temperature:	230˚C
Detector Temperature:	250˚C
Initial Temperature:	45˚C
Initial Hold Time:	3.5 minutes
Temperature Program:	45°C to 75°C at 15°C/min hold for 0.50 minutes 75°C to 130°C at 20°C/min hold for 0.50 minutes 130°C to 230°C at 25°C/min hold for 1.75 minutes Total run time is 15.00 minutes.
Final Temperature:	184 ˚C
Final Temperature:	230 ˚C
Final Hold Time:	1.75 minutes

10.5 Instrument Tuning (Required for BTEX analysis only)

Each GC/MS system must be hardware-tuned to meet the abundance criteria listed in Table 8 for a maximum of a 50 ng injection or purging of BFB. Analysis must not begin until these criteria are met. These criteria must be met for each twelve-hour time period. The twelve-hour time period begins at the moment of injection of BFB.

10.5.1 A single scan at the peak apex (defined as the highest point on the peak) or an average of the apex ± 1 scan from which a single background scan no more than 30 seconds preceding the BFB peak has been subtracted. The background spectra cannot contain any other analytes.

10.6 Initial Calibration

10.6.1 A series of five or more initial calibration standards is prepared and analyzed for the target compounds and each surrogate compound. Nominal calibration levels for GRO and BTEX are listed in sections 7.21 and 7.23. Other calibration levels may be used depending on the capabilities of the specific instrument or program requirements. Calibration levels below the reporting limit may be removed provided that there is a minimum of five calibration points, and the lowest standard is at or below the TestAmerica Seattle reporting limit.

10.6.1.1 For GRO the following carbon ranges are determined:

AK101: The area including n-Hexane to the start of n-Decane

8015B: Toluene through n-Dodecane, inclusive

Hawaii: Hexane through n-Dodecane, inclusive

California 8015B: 2-methylpentane through 1,2,4-trimethylbenzene

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NWTPH-GX: at a minimum Toluene through 1-Methylnaphthalene inclusive is integrated and plotted against the known concentration of gasoline standard added.

10.6.2 The same purge volume must be used for calibration and sample analysis, and the low level standard must be at or below the reporting limit.

10.6.3 It may be necessary to analyze more than one set of calibration standards to encompass all of the analytes required for some tests.

10.6.4 Internal standard calibration is used. The internal standard is listed in Table 5. Each calibration standard is analyzed and the response factor (RF) for each compound or range is calculated using the area response of the characteristic ions or total summed area against the concentration for each compound and internal standard. See equation 1, Section 12, for calculation of response factor.

10.6.5 Calibration is valid when the following conditions have been met: a correlation coefficient (r) value ≥0.995 for each target analyte, a higher order polynomial that is continuous and monotonic with a coefficient of determination (r^2) ≥ 0.990, or the mean RSD of each target analyte is less than 15 %. NOTE: When using a higher order polynomial, there must be an additional calibration standard for each degree beyond linearity (i.e. 5 for linear, 6 for quadratic, etc.). Recalibration occurs when either the continuing calibration standard value falls outside +/-20 % of the true value for, the linear coefficient (r) falls below 0.995, or other conditions such as a major instrument changes warrant recalibration.

10.6.6 For all DoD project the following criteria will apply to ICAL when performing method 8260B:

10.6.6.1 The RSD for each analyte is equal to or less than 15%. If this is not met then one of the following must be met.

10.6.6.2 The linear least squares regression (r) must be equal to or greater than 0.995. If the above and this criterion are not met then the following must be met.

10.6.6.3 A non-linear regression coefficient of determination (r) must be ≥ 0.995. A minimum of six calibration points must be used for second order. For non-linear curves, the coefficient of determination (r^2) must be ≥ 0.990. Third order curves are **not** used.

10.6.6.4 The ICAL must pass one of the above criteria prior to any samples being analyzed.

10.6.7 Initial surrogate calibration is performed by average RF of all standards used unless matrix effects are observed. Calculation is performed using average of response factors when less than or equal to 15 %, linear regression with coefficient value (r) >0.995 for each target analyte, or higher order polynomial that is continuous and monotonic with a coefficient value (r) > 0.995. Recalibration occurs when surrogate recoveries consistently fail to meet established control limits.

10.6.8 A daily secondary source QC check standard (LCS) is performed using a Certified Gasoline with certified individual analytes standard from a source separate from that used for the calibration. Quantitation is performed identically as samples and standards and the result compared to the true value. Acceptance criteria for each parameter is determined by performance based empirical data.

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10.6.8.1 For all DoD projects a second source calibration verification will be performed immediately following the initial calibration. The value for all analytes must be within +/- 20% of the expected value. This criterion must be met before any samples are analyzed.

10.6.9 A retention time standard (5.5.11) is analyzed each analytical day and every 12 hours for 8015B. The standard concentration is approximately 500 ug/L and contains at a minimum n-Hexane, Toluene, n-Decane, n-Dodecane, and 1-Methylnaphthalene. Adjustments in the retention time windows for the respective hydrocarbon groups are made, if necessary, prior to any standard or sample quantitation. See attachment I for an example retention time standard chromatogram.

The default retention time ranges are established as follows:

Gasoline Range Organics NWTPH-Gx:	Toluene to 1-Methylnapthalene
Gasoline Range Organics AK101:	Hexane to the start of Decane
Gasoline Range Organics CA 8015:	2-methylpentane to 1,2,4-Trimethylbenzene
Gasoline Range Organics HI 8015:	Hexane to Dodecane

10.6.9.1 For all DoD projects the retention time window position will be established for each analyte and surrogate once per ICAL and at the beginning of the analytical shift. The position must be set using the midpoint standard of the calibration curve or the value in the CCV run at the beginning of the analytical shift.

10.6.10 If time remains in the 12-hour period initiated by the BFB injection before the initial calibration, samples may be analyzed. Otherwise, proceed to continuing calibration, Section 10.7.

10.7 Continuing Calibration

10.7.1 The initial calibration must be verified every twelve hours.

10.7.2 A continuing calibration check standard is analyzed at the beginning of each analytical sequence (for both GRO and BTEX) and at the end of each analytical sequence (for GRO). The percent recovery must be within +/-15 %, 20 %, 25 % of the true value for 8015 California-G, 8015 Hawaii-G and NWTPG-Gx, and AK101, respectively. Individual analytes must be within +/-20 of the true value for 8260. In addition, analysis for BTEX analytes must be conducted under a valid tune as described in section 10.5.

10.7.2.1 For all DoD projects an initial calibration verification (ICV) will be run daily before sample analysis and a continuing calibration verification (CCV) will be analyzed after every ten field samples and at the end of the analytical run. All analytes must achieve within +/- 20% of the expected values. If this criterion is not met for the ICV no samples should be analyzed. If this criterion is not met for the CCV, the CCV should be reanalyzed along with all samples since the last successful CCV. If it is not possible to reanalyze the samples then the appropriate analytes should be qualified. *If two sequential CCVs fail the system must be re-calibrated.*

10.7.2.2 *For BP LaMP projects CCV is run at beginning and end of sequence and every 10 samples. Recoveries should be between 85% and 115%.*

10.7.3 Once the above criteria have been met, sample analysis may begin.

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10.8 Sample Analysis

10.8.1 Analysis - All samples are injected into the GC/MS using the auto sampler and the purge and trap system to increase reproducibility. Data is acquired from the GC/MS detector on the Chrom data acquisition system. The resultant area amounts are compared to the calibration curve, and the concentration of each analyte is calculated.

10.8.2 The presence of Gasoline is indicated if compounds are detected in the appropriate hydrocarbon range.

10.8.3 The presence of BTEX analytes is indicated when the ion profile of each analyte is detected and matched to the ion profile in the calibration.

10.9 An example analysis sequence log is provided as Attachment 1.

10.10 Instrument Maintenance

10.10.1 See SOP TA-MV-0312.

10.10.2 *All maintenance and repairs need to be documented in the instrument's maintenance logbook. The logbook must include the instrument name, serial number for each major component (e.g., GC, autosampler) and the date of start-up. When an instrument is not capable of analyzing samples, it needs to be tagged "Out of Service". Logbook entries must include a description of the problem and what actions were taken to address the problem. After an instrument has undergone maintenance or repairs, the system is evaluated using a tune, CCV or ICAL. If the evaluation is successful, the analyst documents in the logbook that the "System returned to control as indicated by a passing CCV" (or ICAL, MB, tune, etc as may be the case).*

10.11 Calculations / Data Reduction

10.12 Accuracy

ICV / CCV, LCS % Recovery = $\frac{\text{observed concentration}}{\text{known concentration}} \times 100$

MS % Recovery = $\frac{\text{(spiked sample) - (unspiked sample)}}{\text{spiked concentration}} \times 100$

10.13 Precision (RPD)

Matrix Duplicate (MD) = $\frac{|\text{orig. sample value - dup. sample value}|}{[(\text{orig. sample value + dup. sample value})/2]} \times 100$

10.14 Response Factor (RF)

$$RF = \frac{A_x C_{is}}{A_{is} C_x}$$

Where:

A_x = Area of the characteristic ion for the compound to be measured.
A_{is} = Area of the characteristic ion for the specific internal standard.
C_{is} = Concentration of the specific internal standard, ng.
C_x = Concentration of the compound being measured, ng.

10.15 Standard deviation (SD)

$$SD = \sqrt{\frac{\sum_{i=1}^{n}\left(X_i - \overline{X}\right)^2}{n-1}}$$

Where:

X_i = Value of X at i through n.
n = Number of points.
$\overline{X}$ = *Average value of Xi.*

10.16 Percent relative standard deviation (%RSD)

$$\%RSD = \frac{SD}{\overline{RF}} \times 100\%$$

Where $\overline{RF}$ is the mean of RF values for the calibration.

10.17 Percent drift between the initial calibration and the continuing calibration:

$$\%Drift = \frac{C_{expected} - C_{found}}{C_{expected}} \times 100\%$$

Where:

$C_{expected}$ = Known concentration in standard.
C_{found} = Measured concentration using selected quantitation method.

10.18 Concentration = mg/kg or L $= \frac{C \times V \times D}{W}$

Where:
C = sample concentration in extract (ppm)
V = Volume of extract (mL)
D = Dilution Factor

W = Weight/Volume of sample aliquot extracted (grams or mLs)

NOTE: All dry weight corrections are made in LIMS at the time the final report is prepared.

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11.0 Method Performance

11.1 Method Detection Limit Study (MDL)

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure (see SOP TA-QA-0602). MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method requirements require a greater frequency.

11.2 Demonstration of Capabilities

Analyst initial and continuing Demonstrations of Capability (DOC) are performed before any client samples are analyzed and are updated annually. See SOP TA-QA-0617 for details.

11.3 Training Requirements

See SOP TA-QA-0608 for detailed training requirements.

12.0 Pollution Control

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability). Employees must abide by the policies in Section 13 of the Corporate Environmental Health and Safety Manual (CW-E-M-001) for "Waste Management and Pollution Prevention".

13.0 Waste Management

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to SOP TA-EHS-0036.

13.1 Waste Streams Produced by the Method

13.1.1 Methanol with trace levels of volatile analytes described by this method is temporarily stored in appropriately constructed (i.e. plastic) waste containers throughout the preparation area. When filled, the container is drained into a solvent specific waste drum in the sample disposal area.

13.1.2 All sample VOA vials submitted are removed from the refrigerator and temporarily stored in large plastic bins once analysis is complete. When the bins are full, the contents are transferred to the sample disposal area where the aqueous and vial material are separated and appropriately discarded.

14.0 References / Cross-References

14.1 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition, Methods 5030B, and 8015B, 8260B.

14.2 Method AK101 for the Determination of Gasoline range organics Version 4-8-02.

14.3 NWTPH-Gx Volatile Petroleum Products Method for Soil and Water. Washington DOE Publication No. ECY 97-602, June 1997.

14.4 Department of Defense Quality Systems Manual for Environmental Laboratories, prepared by DoD Environmental Quality Workgroup, Final Version 4.1, April 2010.

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15.0 Method Modifications:

Item	Method	Modification
1	NWTPH-Gx	The method states one duplicate and one method blank per 10 samples. TestAmerica Seattle batches 2 duplicate sets (if sufficient sample exists), one LCS/LCSD set, and one method blank per 20 samples
2	NWTPH-Gx	The method states 5 g of soil is to be added to 10-mL Methanol followed by a 100-uL aliquot added to 5-mL water. TestAmerica Seattle extracts 10 g of soil with 10-mL Methanol followed by an 1075-uL aliquot added to 43-mL water
3	8015B	GRO range organics are quantitated via GC/MS TIC as opposed to FID, were appropriate

16.0 Attachments

Attachment 1: Example Instrument Sequence
Attachment 2. Example Chromatogram for RT Standard

Table 1: Reporting Limits
Table 2: Internal Standard
Table 3: Surrogate Standards
Table 4: BFB Key Ion Abundance Criteria
Table 5: LCS and Matrix Spike Compounds

Tables *G-4 and G-5 DoD QSM Version 4.1* for analyte criteria

17.0 Revision History

- Revision 8, dated 16 April 2010
    - Added documentation of standards/reagents and standard/reagent preparation Section 7.1
    - Added removal of expired standards Section 7.24.
    - Added LaMP matrix spike requirements Section 9.5
    - Added BP LaMP surrogate requirements, Section 9.6.
    - Added criteria for additional QC, Section 9.7.
    - Added daily balance check to Section 10.1.1.
    - Added BP LaMP CCV criteria Section 10.7.2.2
    - Added maintenance logbook documentation requirements, section 11.14.5
    - Updated DoD Table (Attachment)
    - Integration for TestAmerica Bothell and TestAmerica Tacoma operations.

- Revision 7, dated 17 December 2008
    - Integration for TestAmerica and STL operations.
    - This revision is a complete rewrite and an expansion of scope.

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Attachment 1. Example Instrument Sequence

Page 1

Sequence Log

Directory : i:\1\DATA\01092009

#	Filename	Sample Name	Date/Time
1	ms176640.d	Fife Rinse	01/09/09 11:43
2	ms176641.d	Rinse/Tune	01/09/09 12:04
3	ms176642.d	RT standard	01/09/09 12:26
4	ms176643.d	1000 ug/L GRO ccal	01/09/09 12:47
5	ms176644.d	25 ug/L 8260 ccal	01/09/09 13:08
6	ms176645.d	MB 580-39682/1-A	01/09/09 13:30
7	ms176646.d	LCS 580-39682/2-A	01/09/09 13:51
8	ms176647.d	580-12421-E-1-A	01/09/09 14:12
9	ms176648.d	580-12421-E-3-A	01/09/09 14:34
10	ms176649.d	580-12421-E-3-B MS	01/09/09 14:55
11	ms176650.d	580-12421-E-3-C MSD	01/09/09 15:17
12	ms176651.d	580-12421-B-5-A	01/09/09 15:38
13	ms176652.d	Rinse/Tune	01/09/09 16:00
14	ms176653.d	1000 ug/L GRO ccal	01/09/09 16:21

Attachment 2. Example Chromatogram for RT Standard

```
File        : I:\2\DATA\04282006\CS165056.D
Operator    : jc
Acquired    : 4-28-2006 09:33:19 AM using AcqMethod GBTEX.M
Instrument  :   Instrumen
Sample Name: rt std
Misc Info   : 1369-18-1
Vial Number: 3
```

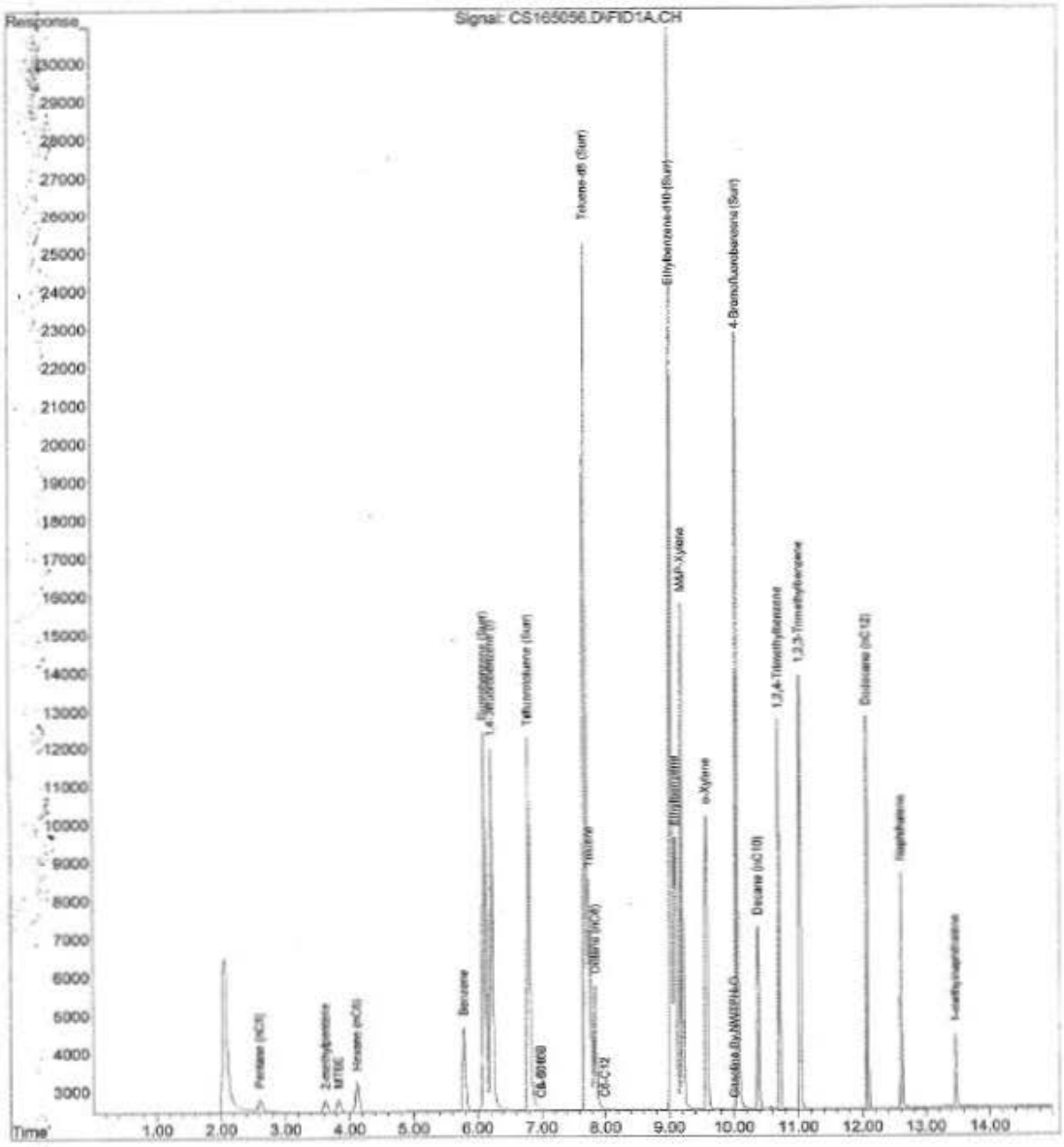

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Table 1. Reporting Limits

Compound	CAS Number	Reporting Limits[1]	
		Water (µg/L)	Soil (mg/kg)
Gasoline Range Organics, NWTPH-Gx	STL00228	100	4.0
Gasoline Range Organics, AK101	8006-61-9	50	4.0
Gasoline Range Organics, Hawaii-Gx	STL00061	50	2.0
Gaoline Range Organics, CA 8015B	STL00215	50	4.0
Benzene	71-43-2	0.5	0.008
Toluene	108-88-3	1.0	0.040
Ethylbenzene	100-41-4	1.0	0.040
M&p-Xylene	136777-61-2	2.0	0.080
o-Xylene	95-47-6	1.0	0.040
Xylenes, Total	1330-20-7	1.0	0.040
Methyl *tert*-butyl ether (MTBE)	1634-04-4	1.0	0.040
Hexane	110-54-3	1.0	0.040
Cyclohexane	110-82-7	1.0	0.040
1,2-Dichloroethane	107-06-2	1.0	0.008
Isopropylbenzene	98-82-8	1.0	0.040
n-Propylbenzene	103-65-1	1.0	0.040
1,3,5-Trimethylbenzene	108-67-8	1.0	0.040
1,2,4-Trimethylbenzene	95-63-6	1.0	0.040
Naphthalene	91-20-3	1.0	0.040

[1] Reporting limits listed for soil/sediment are based on wet weight. The reporting limits calculated by the laboratory for soil/sediment, calculated on dry weight basis, will be higher.

Table 2. Internal Standard

Internal Standard	Standard Concentration (mg/L)	Quantitation Ion
vwrkIS_xxxxx		
1,4-Difluorobenzene	500	

Table 3. Surrogate Standards

Surrogate Compounds	Standard Concentration (mg/L)
Fluorobenzene	4000
Trifluorotoluene	4000
Ethylbenzene-d_{10}	4000
Toluene-d_8	4000
4-Bromofluorobenzene	4000

NOTES:

1) Recovery and precision limits for the surrogates are generated from historical data and are maintained by the QA department.

Table 4. BFB Key Ion Abundance Criteria

Mass	Ion Abundance Criteria
50	15 to 40 % of Mass 95
75	30 to 60 % of Mass 95
95	Base Peak, 100 % Relative Abundance
96	5 to 9 % of Mass 95
173	Less than 2 % of Mass 174
174	Greater than 50 % of Mass 95
175	5 to 9 % of Mass 174
176	Greater than 95 %, but less than 101 % of Mass 174
177	5 to 9 % of Mass 176

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Table 5. LCS and Matrix Spike Compounds

Compound	Standard Concentration (mg/L)
Gasoline Range Organics	5500
1,2,4-Trimethylbenzene	200
1,2-Dichloroethane	200
1,3,5-Trimethylbenzene	200
Benzene	200
Cyclohexane	200
1,2-Dibromoethane	200
Ethylbenzene	200
Hexane	200
Isopropylbenzene	200
m- & p-Xylene	200
Methyl *tert*-butyl ether (MTBE)	200
Naphthalene	200
n-Propylbenzene	200
o-Xylene	200
Toluene	200

NOTES:

1) Recovery and precision limits for the LCS, MS, and MSD are generated from historical data and are maintained by the QA department.

Taken from Table *G-4 and G-5 DoD QSM Version 4* for Analyte Criteria

Table D-4 LCS Control Limits for Volatile Organics Compounds SW-846 Method 8260 Water Matrix

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Benzene	102	7	80	120	75	130
Toluene	100	7	75	120	70	130
Ethyl Benzene	100	9	75	125	65	135
m&p-Xylene	102	9	75	130	65	135
o-Xylene	100	7	80	120	75	130
MTBE	94	10	65	125	55	135

Table D-5 LCS Control Limits for Volatile Organics Compounds SW-846 Method 8260 Solid Matrix

Analyte	Mean	Standard Deviation	Lower Control Limit	Upper Control Limit	Lower ME Limit	Upper ME Limit
Benzene	99	9	75	125	65	135
Toluene	99	9	70	125	60	*135*
Ethyl Benzene	101	9	75	125	65	135
m&p-Xylene	102	8	80	125	70	135
o-Xylene	101	8	75	125	70	135

Title: Sample Receipt and Log-in

Approvals

Signatures on File

Kim Presley — Date Sample Receiving Leader	Stan Palmquist — Date Health & Safety Manager / Coordinator
Dave Wunderlich — Date Quality Assurance Manager	Kathy Kreps — Date Laboratory Director

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1.0 Purpose

The purpose of this procedure is to describe the procedure for receiving samples into the laboratory for analysis and verifying the preservation of samples. This procedure also describes the process of preserving samples by the laboratory.

2.0 Summary of Method

Sample control personnel receive samples either directly from the client, company courier, or from an appropriate delivery service/carrier and assume custody of the samples when they sign and date the chain of custody. They perform an initial assessment immediately for rush and short hold projects and within an hour of receipt for standard turn around time. Log-ins are prioritized based on hold and turn around times. All sample delivery groups are assigned a unique laboratory job number. After a job number is assigned, the condition of the samples is evaluated. The custodian unloads the samples, lines up the containers, verifies the correct containers have been added to the job, labels the containers, completes the sample receiving checklist, the sample information is logged into the Laboratory Information Management System (LIMS), and a master folder is generated. Specific clients may require documentation on their own cooler receipt forms. Aqueous samples submitted for analysis and marked as "preserved" are verified at the time of sample receipt by the sample custodian or other qualified person designated by the sample custodian. Samples are placed in the appropriate storage unit. If required by a specific project or client, the samples are stored under controlled custody.

Rushes and projects with short holds are dealt with immediately. A page is made over the intercom that rushes or short holds have arrived. Rushes and short holds must be logged-in within 1 hour of receipt. For projects that are on a standard turn, the sample containers/cooler are tagged and then placed in the appropriate storage.

COCs for rush or new projects will be given to a project manager to review, set-up in LIMS and notify the laboratory. Rush projects must be set up within 15 minutes of the paperwork being handed to the PM. When the PM review of new or rush project paperwork is completed sample control is notified by the PM.

The master folder is either given to the project manager (in the case of rushes) or placed in the project manager's bin. The project manager then reviews the work order for correctness and updates the status of the samples in LIMS. After the project manager has reviewed the information contained in the master folder for completeness and accuracy and notified the lab of any short holding time samples or rush samples, the COC is scanned and placed into TALS and the paperwork is filed in the master file area.

Definitions and Acronyms

2.1 Sample - a field derived material of various matrices that is put into a container and removed from the environment under controlled conditions and then brought to the laboratory to undergo analyses or archiving.

2.2 Relinquish - to release, surrender, retire, to let go. Relinquishing a sample is to put it in someone else's charge or responsibility.

2.3 Sample Custodian - an employee that receives samples

2.4 pH - a measurement of acidity or alkalinity (the negative log value of the molar H^+ concentration)

2.5 Preservative - any agent that prolongs the useful life of a material

3.0 Responsibilities

3.1 Sample Custodian or designee is responsible to:

- Receive samples including logging into the corporate LIMS, checking temperatures, filling out sample receipt check lists, verifying sample preservation and condition, and noting sample location within the laboratory.
- Inform the Project Manager (or designee) when samples are received and that login review is required.
- Send out a nonconformance memorandum (NCM) that will also notify the project manager when problems are encountered.
- Prepare and ship bottle orders to clients.

3.2 Project Manager or designee is responsible to:

- Inform sample receiving of upcoming bottle orders and sampling events.
- Inform sample receiving of any special requirements such as special sample receipt procedures.
- Build the project to include all requested analyses and analytes.
- Inform the client of sample receipt.
- Verify the login to ensure that the proper samples are linked to the correct analyses and analyte lists.
- Notify clients of any NCMs that are deemed to affect sample results.

4.0 Safety

Employees must abide by the policies and procedures in the Corporate Safety Manual, Radiation Safety Manual and this document.

This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1 Specific Safety Concerns or Requirements

5.1.1 Appropriate protective clothing (eyewear, gloves, and lab coat) should be worn when preserving samples, or handling preserved samples.

5.1.2 Make sure if glass capillary tubes or disposable pipettes are used that they are disposed of in properly marked glass disposal containers.

5.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Nitric Acid	Corrosive Oxidizer Poison	2 ppm-TWA 4 ppm-STEL	Nitric acid is extremely hazardous; it is corrosive, reactive, an oxidizer, and a poison. Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract. Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Sulfuric Acid	Corrosive Oxidizer Dehydra-dator	1 mg/m^3	This material will cause burns if comes into contact with the skin or eyes. Inhalation of vapors will cause irritation of the nasal and respiratory system.
Hydrochloric Acid	Corrosive Poison	5 ppm-Ceiling	Inhalation of vapors can cause coughing, choking, inflammation of the nose, throat, and upper respiratory tract, and in severe cases, pulmonary edema, circulatory failure, and death. Can cause redness, pain, and severe skin burns. Vapors are irritating and may cause damage to the eyes. Contact may cause severe burns and permanent eye damage.
Sodium Hydroxide	Corrosive Poison	2 ppm, 5 mg/m^3	This material will cause burns if comes into contact with the skin or eyes. Inhalation of Sodium Hydroxide dust will cause irritation of the nasal and respiratory system.
1 – Always add acid to water to prevent violent reactions. 2 – Exposure limit refers to the OSHA regulatory exposure limit.			

5.0 Equipment and Supplies

5.1 Equipment

- Oakton InfraPro Infrared Thermometer Model InfraPro 3, or equivalent
- Digital readout battery operated thermocouple thermometer
- Laboratory fume hood

5.2 Supplies

- Sample containers (40-mL VOA vials, 1 liter, 500-mL, 250-mL, and 125-mL HDPE bottles, 1 liter, 125-mL amber bottles, clear wide mouth bottles (for soils) and En Core or Soil Capsules (soil volatiles))
- Dropper bottles

6.0 Reagents and Standards

6.1 *Document reagent/standards and reagent/standard preparation in TALS using the reagent module as described in SOP TA-QA-0619.*

6.2 Nitric acid, concentrated, Trace Metals grade or equivalent.

6.3 Sulfuric acid, concentrated, Trace Metals grade or equivalent.

6.4 Hydrochloric acid (HCl), 1:1, in pre-preserved VOA vials, ESS or equivalent.

6.5 Sodium Hydroxide pellets.

6.6 Zinc Acetate dihydrate, Analytical Reagent Grade or equivalent.

6.7 Ascorbic acid, reagent grade.

6.8 Indicator pH strips, universal 0-14 indicator strips, and more specific ranges as needed.

6.9 Potassium iodide starch paper

6.10 3N HCl

6.11 *Managers/supervisors or a designee are expected to check their areas on a monthly basis for expired standardsreagents and dispose of them according to SOP TA-EHS-0036.*

7.0 **Sample Collection, Preservation, Shipment and Storage**

7.1 Various samples/analyses will have different handling, preservation and holding time requirements see Attachment 6 Environmental Sampling Guide for the appropriate preservation, handling and hold times of the various analyses. Attachment 7, Table Recommended VOC Sample Preservation Techniques and Holding Times outlines the unique preservation schemes for volatile organic analysis.

7.2 The sample pH or free chlorine should be verified as soon as possible.

7.3 This information is then documented on the sample check in list if possible. However due to constraints within the LIMS the comment tab found in the receipt tab of the login module of the LIMS can be used.

8.0 **Quality Control**

9.0 **Procedure**

9.1 *Upon receipt, sign and date the Chain of Custody. Samples delivered by the TestAmerica courier do not need to be relinquished by the courier and received by sample control. If the cooler is in the possession of the courier at all times, a note on the bottom of the COC stating "at lab" and the time is sufficient. The "at lab" time will be the time of receipt. If samples are received without a COC, the following steps must be taken:*

9.1.1 Sample control must notify the appropriate PM upon receipt of cooler (not at the time the cooler is actually logged in) using the cooler receipt form and initiate a nonconformance memorandum (NCM).

9.1.2 If the samples were sent by an inter-company subcontract lab, sample control must notify the subcontract lab's sample control supervisor by e-mail (cc: the TA Seattle/Seattle PM) upon receipt of the cooler. Include additional information as needed (i.e. short hold times).

9.1.3 If the samples were submitted by a party other than an inter-company lab, a TA Seattle/Seattle PM must notify the point of contact at that organization.

9.1.4 If a response is not received within 24 hours, either the TA Seattle/Seattle PM or sample control are responsible for the follow-up.

9.1.5 The process must be fully documented using e-mails, NCMs and phone logs. Copies of this documentation must be maintained in the master job folder.

9.2 Open or supervise the opening of sample coolers or containers in the sample receiving area of the laboratory. If it suspected that a sample has broken or is leaking into the cooler, open the cooler inside the hood.

Client-specific note: *open all USACE coolers in the hood.*

9.3 TestAmerica Seattle does not accept radioactive samples. It is the client's responsibility to ensure that samples being sent for analyses within the TestAmerica Seattle facility not have radioactivity above background.

9.4 For samples received in a cooler, record temperature *of the cooler. If provided, record the temperature blank reading. If a temperature blank was provided, take its temperature using the digital thermometer. Remove the cap of the temperature blank, insert the thermometer, wait 15 to 30 seconds for the reading to stabilize, and then take the temperature. If a temperature blank wasn't provided, select a sample container that appears most representative of the other containers in the cooler and their relative distance to the coolant source and take the temperature this container using the IR gun. Adjust the gun's emissivity to match the container's composition, position the IR gun 1/3 of the distance from the base of the container at a distance of approximately 1 to 3 inches from the label, press the trigger of the gun and direct the IR beam to the label at a 70 to 90 degree angle. Note if the temperature blank was received frozen on the receipt checklist.*

Note: ***The IR gun cannot be used to measure the temperature of metal tubes.*** *If a temperature blank or more suitable sample container was not packed in the cooler with the metal tubes, take the temperature of a tube at one of its plastic end caps. Describe the anomaly in a NCM.*

9.5 *BP Lamp requires that during the unloading and labeling of BP, Arco, and OPLC samples that temperatures are monitored every 15 minutes until samples have been placed in appropriate cold storage units.*

9.6 *The samples and accompanying chain of custody undergo an initial inspection by sample control staff for items 9.2.1 through 9.2.9 within 15 minutes of rush/short hold projects and 60 minutes of receipt for standard turn projects using the TA Seattle Sample Acceptance Criteria Checklist (see Section 9.15.2 for LIMS checklist questions or Attachment 2 for example client checklist) and Sample Acceptance Policy (see Attachment 3). Sample inspection information, non-conformances and corrective actions must be documented in an NCM in the LIMS. Non-conformances documented in LIMS include: limited sample volume, air bubbles in VOA vials that are larger than a ¼ inch, replacement of cracked lids, broken containers, samples received out of hold, samples received with less than ½ of their hold time remaining, samples preserved incorrectly and samples not received.*

9.7 A cooler receipt form is completed in LIMS. The form may be custom for the client, or the standard receipt form designed by the corporate LIMS developer group. (See Attachment 1.)

9.8 Verify that the chain-of-custody information is complete, including unique sample identification, location, time and date of sample collection, preservation type, sample type, collector's name, and any special remarks concerning the samples.

9.9 Verify that the proper sample containers were used and adequate sample volume was collected. *For any sample submitted in an inappropriate container, determine if extra volume exists in a correct container type. If required, preserve the additional volume using the appropriate reagent as described in Section 9.14. When required by contract and for all aqueous samples scheduled for metals testing, pH adjustments must be documented in the LIMS via an NCM.*

Note: When a BP consultant submits soil samples for volatiles in a bulk container, Sample Control or lab personnel will preserve the samples within 48 hours of collection according to one of the options specified by BP in Attachment 8. In the event that

samples are received beyond the 48-hours of collection, the laboratory PM should request the consultant to authorize (in writing) the preservation and analysis of the soil samples.

9.10 Verify that the tests indicated on the accompanying chain of custody match the tests indicated on the sample containers received.

9.11 Verify the remaining holding time for each sample and parameter. If the shipment contains samples with short holding time tests required, sample receiving will enter the information on the Short Holding Time Analyses notification form (Attachment *4)* which is posted on a clipboard located near the time clock. Sample receiving will then announce over the paging system that samples with short holding time tests *or rush turnaround times* have been received and are available for analysis. If the shipment contains samples with rapidly expiring holding times or rush turnaround times, sample receiving will complete the Special Handling Form (Attachment 5). This form is placed in the master job file which is specially color coded to denote immediate attention required by all staff. The file is expedited to the project manager for log-in review and communication to the laboratory about the rush or short holding time status. The PM will record notes regarding lab personnel notification on the Special Handling Form and it will be retained in the master job file.

9.12 *Geographical Area of Origin*

9.13 *Sample control personnel must note the geographical origin for each sample shipment. The laboratory maintains a USDA permit to receive samples from foreign countries (including Hawaii and Canada), quarantined areas within the continuous United States and other permitted laboratories. Areas currently under quarantine in the U.S. can be identified on the USDA map posted in the department. The permit requires the lab to follow a compliance agreement. According to this agreement and as it relates to sample receipt,*

1) Only an authorized sample custodian may handle and process foreign and regulated domestic soil shipments.

2) The laboratory shall not receive regulated soil samples or water residues (e.g., leachates) from other laboratories without written approval from the local USDA PPQ office AND unless such laboratories have valid Soil Permits and Compliance Agreements for the import of foreign soil.

3) Upon receipt and until such time it is heat-treated but no longer than six months, store regulated soils in the walk in cooler.

5) As appropriate, label each sample container as "Regulated Soil under USDA Permit (Autoclave Before Disposal)".

9.14 If aqueous non-volatile samples are specified as being preserved, verify the preservation following procedures described in the following paragraphs. This check is documented by the checklist if applicable, if not then the receipt comment tab in the receipt tab of the login module in LIMS is used.

9.14.1 Open sample containers inside the fume hood if needed. There is a plastic shelf to put over the sink in the fume hood if more space is needed.

9.14.1.1 Checking the pH: Basically two methods can be employed one is to take a small aliquot from the sample bottle using a capillary tube or disposable glass pipette. Drop the aqueous sample onto the pH paper. The other is to pour a small amount of the sample into a plastic cup container and then dip the pH paper into

the aqueous sample in the plastic container. If further confirmation of the pH is needed, then a more narrow range of pH paper is used. The range is dependent on the pH being checked. For further instruction consult the work instruction WI-pHPScheck.

9.14.1.2 Checking the chlorine: Wet potassium iodide starch paper with a few drops of 3 N HCl. Pour a small amount of the sample into the plastic cup container onto the potassium iodide starch paper. If a bluish discoloration is noted chlorine may be present. For analysis such as cyanide and COD the sample must be treated to remove the chlorine according to the analysis method.

9.14.2 Discard any sample remaining in the plastic container and discard the plastic cup container.

9.14.3 For samples that are properly preserved create a statement to that affect (i.e. all samples marked as preserved were checked and noted to be at proper pH). If there is a comment such as this to check on the sample receipt check list use that for documenting. However if there is no statement on the sample check in sheet then use the receipt comment tab, found in the receipt tab in the login module of the LIMS.

9.14.4 For samples that are not properly preserved, record the sample ID and generate an NCM which notes the samples found to not be properly preserved. Preserve samples as soon as possible following the instructions in section 10.10.

9.14.5 *A special requirement exists for water samples submitted for metals analysis (EPA Methods 200.7, 200.8, 245.1, 6010, 6020 and 7470). If the pH is < 2, no corrective action is required. If the pH is > 2, 1:1 nitric acid is added with mixing to lower the pH to < 2 and then it's allowed to stand for at least 24 hours before re-verifying the pH. The sample is labeled as preserved by sample receiving (green label) and the time of preservation is noted on the label to insure that the 24 hour period has passed prior to the read back by the analyst prior to digestion.*

9.14.6 ***Note: For BP samples needing a pH adjustment, remember to add the same amount of preservative to the field blank. If a field blank wasn't provided, prepare a method blank from laboratory grade deionized water and add the same amount of preservative to the method blank.***

9.15 *While a project is awaiting log-in or labeling, the associated samples may be repacked with ice in the original shipping container or a TA cooler. A tagged or properly labeled and iced cooler may be stored in the walk-in or allowed to sit out in the sample control area.*

9.16 The samples are then logged into the corporate LIMS as follows:

9.16.1 A job number is generated for each batch of samples received into the laboratory; the following information is recorded:

- Date and Time received
- Sample custodian
- Shipping method
- State or Province and Country of origination
- Cooler information
- Container information and laboratory storage location
- The laboratory assigned sample number (sequential, starting with 1)
- The laboratory assigned container number (sequential, starting with A)

- Any additional comments

9.16.2 The Standard checklist is completed which includes the following questions:

- The cooler's custody seal, if present.
- The cooler or samples do not appear to have been compromised or tampered with.
- Samples were received on ice.
- Cooler Temperature is acceptable.
- Cooler Temperature is recorded.
- COC is present.
- COC is filled out in ink and legible.
- COC is filled out with all pertinent information.
- There are no discrepancies between the sample IDs on the containers and the COC.
- Samples are received within Holding Time.
- Sample containers have legible labels.
- Containers are not broken or leaking.
- Sample collection date/times are provided.
- Appropriate sample containers are used.
- Sample bottles are completely filled.
- There is sufficient vol. for all requested analyses, incl. any requested MS/MSDs
- VOA sample vials do not have headspace or bubble is <6mm (1/4") in diameter.
- If necessary, staff have been informed of any short hold time or quick TAT needs
- Multiphasic samples are not present
- Samples do not require splitting or compositing

9.16.3 Samples are logged into the laboratory LIMS, a central database for project tracking and includes the following information:

- Client Sample ID;
- Sample matrix;
- Sample Date and Time;
- Time Zone

9.16.4 Tests are associated with the sample information previously completed as follows:

- Attach the specific project number which automatically stipulates the following:
  - Client address;
  - Client contact;
  - Purchase order number (if applicable);
  - The TestAmerica Seattle project manager;
  - The "requested" due date;
- All requested analyses for each sample.

9.16.5 The LIMS assigns a unique identifier to each sample as follows:

- Three digit laboratory code (this is 580 for Seattle);

- Four digit job number (as assigned in 10.10.1);
- Letter container identifier (alpha sequential, can be multiple letters);
- Single digit sample number (numeric sequential).
- Example: 580-9772-A-3

9.16.6 The LIMS then generates a label with the unique identifier and a bar code for each sample container of each sample received, which is placed upon the container. See example label in Attachment 1.

9.16.7 Place the samples into the refrigerator or (upon client request for complete custody samples) relinquish to the sample custodian. *For suspected highly contaminated samples, place the container into a Ziploc bag that is securely fastened before placing the sample into the refrigerator designated for contaminated samples.* All volatile samples are stored in the volatiles refrigerator in the volatiles laboratory (water samples are in refrigerator #31 and soil samples are in refrigerator #5). Any suspected highly contaminated samples for volatiles is placed into a Ziploc bag and placed in the refrigerator designated for contaminated samples (refrigerator #15) to try to prevent contamination of other samples. The volatiles department is in its own building, so the sample refrigerators have sample logbooks; the sample custodian relinquishes the samples to the volatiles department and records the samples within the appropriate logbook.

9.16.8 The completed Job number login summary report form is placed in a master folder. The master folder is identified by the job number on the tab. The login summery report, Chain-of-Custody form, and all other documents that pertain to the project are also placed in the master folder. Any special instructions are recorded in the method comments, sample comments, job comments or "sticky notes" in the LIMS.

9.16.9 The project manager (or designee) reviews the contents of the master folder against the login info in LIMS prior to distribution to ensure that all chain of custody, project, and/or client requirements are clearly communicated in the LIMS. The Project Manager checks the login review task in LIMS to indicate that this review has been completed before returning the master folder to sample receiving. The Project Manager checks the pricing review task in LIMS to indicate that this review has been completed. *(See Attachment 9 for more detailed instructions)*

9.16.10 The laboratory only accepts samples outside of normal business hours when the client has discussed the issue with the project manager. The samples delivery/receipt is then addressed on a project to project as needed basis between the project manager and client.

9.17 If samples are received after regular business hours and login personnel are not available to complete the entire receiving and log-in process, the person accepting the samples must check the custody seals, if any and the temperature of the samples and sign the Chain-of-Custody. The temperature and condition of custody seals are noted on the COC.

9.18 For all samples preserved in the laboratory, the preservation must be recorded in the NCM that discussed the incorrect preservation found upon receipt. For DoD work, the lot number of the preservative used must be recorded in the same NCM. Preserve samples as follows:

9.18.1 Nitric Acid Preservation (for samples collected for metals analysis).

1:3 Nitric acid is prepared in the laboratory using Trace Metal Grade concentrated nitric acid and deionized water, in either a graduated cylinder or volumetric glassware. The 1:3 nitric acid is stored in dropper bottles, in the Sample Receiving department.

Containers are preserved using 20 drops of 1:3 nitric acid (for a large number of sample containers to be preserved, a 2 mL dispensing pipette may be used). ***Mark on the sample bottle the date and time of preservation.***

9.18.2 Sulfuric Acid Preservation (for samples collected for TOC, Oil and Grease, TOX, or ammonia analyses).

1:1 Sulfuric acid is prepared in the laboratory using Trace Metal Grade concentrated sulfuric acid and deionized water, in either a graduated cylinder or volumetric glassware. The 1:1 sulfuric acid is stored in dropper bottles, in the Sample Receiving department. Containers are preserved using 20 drops of 1:1 sulfuric acid (for a large number of sample containers to be preserved, a 2 mL dispensing pipette may be used).

9.18.3 Ascorbic Acid/Sodium Thiosulfate and Hydrochloric Acid Preservation (for samples collected for volatile organic analysis from a water source containing residual chlorine).

For drinking water samples add 25 mg ascorbic acid to an unpreserved 40 ml VOA vial purchased from ESS. For non-drinking water samples add 10 mg sodium thiosulfate to an unpreserved 40 ml VOA vial purchased from ESS. Include a dropper bottle with 1:1 Hydrochloric acid and instructions for preservation of samples with sample containers. Containers are stored in the ***volatiles laboratory***.

9.18.4 Hydrochloric Acid Preservation (for samples collected for volatile organic analysis).

Sample containers are purchased from ESS, and contain 0.5 ml of 1:1 Hydrochloric acid. Containers are stored in the ***volatiles laboratory***.

9.18.5 Sodium Hydroxide Preservation (for samples collected for cyanide analysis).

10 N sodium hydroxide is prepared in the laboratory using 40 grams of sodium hydroxide pellets diluted to a final volume of 100 mL using deionized water, in either a graduated cylinder or volumetric glassware. The 10N sodium hydroxide is stored in dropper bottles, in the Sample Receiving department. Containers are preserved using 20 drops of 10N sodium hydroxide (for a large number of sample containers to be preserved, a 2 mL dispensing pipette may be used).

9.18.6 Sodium Hydroxide/Zinc Acetate Preservation (for samples collected for sulfide analysis).

2 N sodium hydroxide is prepared in the laboratory by weighing 40 grams of sodium hydroxide pellets and diluting to a final volume of 500 mL using deionized water, in either a graduated cylinder or volumetric glassware. 2 N zinc acetate is prepared in the laboratory by weighing 110 grams of zinc acetate (dihydrate form) and diluting to a final volume of 500 mL using deionized water, in either a graduated cylinder or volumetric glassware. The 2 N sodium hydroxide and 2 N zinc acetate solutions are stored in dropper bottles, in the Sample Receiving department. Containers are preserved using 20 drops of each reagent (for a large number of sample containers to be preserved, a 2 mL dispensing pipette may be used).

9.19 Calibration

Digital thermometers are calibrated once per quarter as described in SOP TA-QA-0024 unless otherwise specified by the manufacturer.

10.0 Pollution Control

It is TestAmerica's policy to evaluate each procedure and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability).

11.0 Waste Management

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to Waste Disposal SOP TA-EHS-0036.

11.1 Waste Streams Produced by the Method

11.1.1 There is no special waste produced by this method.

12.0 References / Cross-References

12.1 Standard Methods for the Examination of Water and Wastewater, Online Edition, Method 1060.

12.2 USEPA Method 5035A "Closed-System Purge-and-Trap and Extraction for Volatile Organics in Soil and Waste Samples, Draft Revision 1, July 2002

12.3 Federal Register March 12, 2007, also known as the Methods Update Rule

12.4 State of Washington Department of Health Memorandum, Volatile Organic Chemical (VOC) Testing Program, September 25, 1995.

12.5 TestAmerica Seattle Quality Assurance Manual, Revision 2, Holding Times, Preservation, and Container Requirements.

13.0 Attachments

Attachment 1: Example Sample Label
Attachment 2. Cooler Receipt Form
Attachment 3: Sample Acceptance Policy
Attachment 4: Short Holding Time Analyses Form
Attachment 5: Special Handling Form
Attachment 6: Environmental Sampling Guide
Attachment 7: Table Recommended VOC Sample Preservation Techniques and Hold Times
Attachment 8: BP Preservation Options
Attachment 9: LIMS Instructions

14.0 Revision History

- Revision 20, dated 26 March 2010
    - Added procedures for handling rush TAT samples Sections. 2.0 and 9.6
    - Added documentation of standards/reagents and standard/reagent preparation Section 7.1
    - Added removal of expired standards Section 7.11.
    - Added information on foreign soils Sections. 9.12 and 9.13
    - Added information on handling samples awaiting log-in. Section 9.15
    - Added sample acceptance criteria. Section 9.6 and Attachment 3
    - Added procedures for handling samples without a COC Section. 9.1.
    - Added procedure for handling high concentration samples. Section 9.16.7
    - Added description of how and when the IR gun will be used. Section 9.4
    - Added procedure for ensuring samples do not warm excessively during log-in. Section

9.5
  - Added procedure for BP bulk volatile containers. Section 9.9
  - Added procedure for BP sample pH adjustment and preservation options. Section 9.14.6 and attachement 8
  - Added procedure for metals requiring preservation at receipt. Section 9.14.5

  - Added step 10.7 to verify tests indicated on the COC match the tests indicated on sample containers.
  - Updated section 10.8 to remove reference to the color flags used to notify wet chemistry staff regarding short holding time tests.
  - Updated Attachment 4: Short Holding Time Analyses Form
  - Updated Attachment 5: Special Handling Form.

- Revision 19, dated 19 March 2009
  - Added step 10.7 to verify tests indicated on the COC match the tests indicated on sample containers.
  - Updated section 10.8 to remove reference to the color flags used to notify wet chemistry staff regarding short holding time tests.
  - Updated Attachment 4: Short Holding Time Analyses Form
  - Updated Attachment 5: Special Handling Form.

- Revision 18 dated 31 March 2008
  - Integration for TestAmerica and STL operations.
  - This revision is a complete rewrite and an expansion of scope.
  - This SOP is the combination of SOPs 0001.17, 0006.12, and 0038.11.

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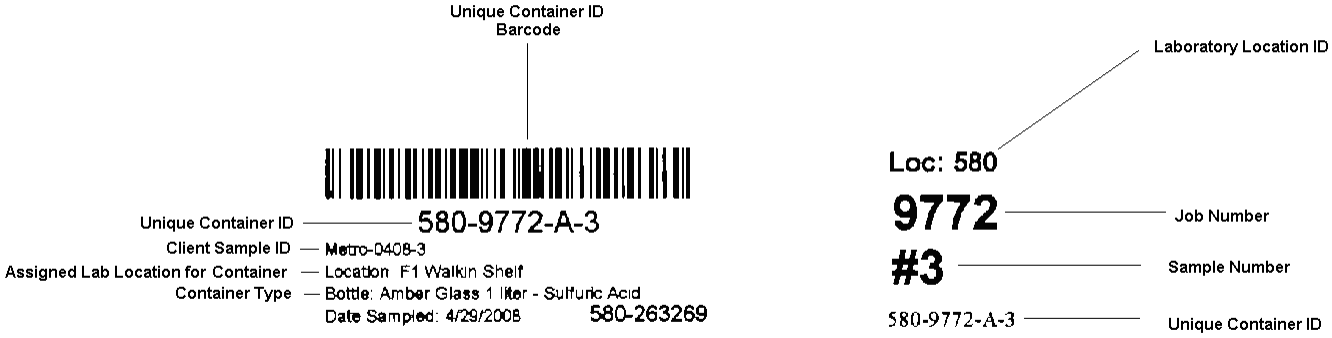
Attachment 1. Example Sample Label



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Attachment 2. Cooler Receipt Form

Cooler ID No. _____ TestAmerica Work Order _____

COOLER RECEIPT FORM

Project _____

Cooler received on ____ and opened on _____ by _____

_____
(signature)

Temperature upon receipt: Cooler _____ oC.
Temp. Blank _____ oC.

1.	Were custody seals on outside of cooler and intact? a. If yes, how many and where: _____ b. Were signature and date correct?	YES	NO
2.	Were custody papers taped to lid inside cooler?	YES	NO
3.	Were custody papers properly filled out(ink, signed, etc)?	YES	NO
4.	Did you sign custody papers in the appropriate place?	YES	NO
5.	Did you attach shipper's packing slip to this form?	YES	NO
6.	What kind of packing material was used? _____		
7.	Was sufficient ice used?	YES	NO
8.	Were all bottles sealed in separate plastic bags?	YES	NO
9.	Did all bottles arrive in good condition (unbroken)?	YES	NO
10.	Were all bottle labels complete (no., date, signed, pres, etc)?	YES	NO
11.	Did all bottle labels and tags agree with custody papers?	YES	NO
12.	Were correct bottles used for the test indicated?	YES	NO
13.	If present, were voa vials checked for absence of airbubbles and noted if found?	YES	NO
14.	Adequate volume of voa vials received per sample?	YES	NO
15.	Was sufficient amount of sample sent in each bottle?	YES	NO
16.	Were correct preservatives used?	YES	NO
17.	Were extra labels added to pre-tared containers?	YES	NO
18.	Corrective action taken, if necessary: a. Name of person contacted: _____ b. Date: _____		

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Attachment 3. TA Seattle Sample Acceptance Policy

Samples shipped to TA Seattle must meet the following conditions:

- The sample shall be completely documented on the chain of custody (sample identification, location, date and time of collection, preservation type, sample type/matrix, number of containers and transfer signatures);
- The sample shall be identified by a unique identifier using durable labels completed in indelible ink;
- The sample shall be collected in an appropriate container;
- The sample shall be collected in adequate volume for the analysis and necessary QC;
- The sample shall be preserved according to the requirements of the requested analytical method;
- The sample shall be delivered within at least one-half the holding time;
- The sample, if submitted for Volatile Organic analyses, shall be accompanied by a Trip Blank;
- The sample shall not contain asbestos or exceed allowed radioactivity levels; and
- The sample shall not show signs of contamination or breakage

A sample that contains asbestos, is radioactive, or shows signs of contamination or breakage shall be rejected outright at the time of receipt and will be returned to the client. Upon receipt of a sample that does not meet any of the other criteria stated above, the Project Manager shall request information from the client before proceeding. If the client can provide the information, the results obtained for the sample may be reported. Sample receipt discrepancies will be disclosed in the final report and results may be qualified.

Attachment 4. Example Short Holding Time Analyses Form

TestAmerica Seattle/Tacoma

Short Holding Time Analyses

Analyte	Collection Date	Collection Time	Job Number	Sample Number(s)	Location	Login Initials	Date	Time	Analyst Initials	Date	Time

Notes:

Collection Date and **Time** are the date and time the field sample was collected.
Login Initials, Date, and **Time** are the initials of the sample receiving person completing the short holding time analyses form and the date and time the form was completed.
Analyst Initials, Date, and **Time** are the initials of the analyst acknowledging notification of the short holding time and the date and time the analyst completed the form.

Rev. 1
10/3009

Attachment 5. Special Handling Form

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TestAmerica Seattle

Special Handling Form

Job_____ Client_____

	Initials	Date	Time
Sample Receiving			
Project Manager			

❑ ***Short Hold Tests (72 hours or less)***

❑ ***Notified via Short Hold Form on clipboard***

The following conditions require PM notification to the lab:

❑ ***Rapidly Expiring Samples (72 hours or less)***

❑ ***Quick Turn (TAT 72 hours or less)***

Analyst/Extractionist notified	Date/Time

Attachment 6. ENVIRONMENTAL SAMPLING GUIDE

The following guide can be used to assure the integrity of samples that are submitted for analysis. For each parameter the water method is listed first followed by the solid waste method. The water methods were updated based on the Federal Register dated March 12, 2007 also known as the Methods Update Rule, this update only covered waters so soils were not affected.

Parameter	EPA or Standard Method (Considering Federal Register March 12, 2006 Method Update Rule)	Minimum Sample Volume	Container	Preservative	Holding Time
Alkalinity	SM 2320 B	100 mls	250 ml HDPE (acceptable P, FP, and G)	Cool ≤6° C not frozen	14 days
	310.2	100 mls	250 ml HDPE (acceptable P, FP, and G)	Cool ≤6° C not frozen	14 days
Ammonia nitrogen	350.1	50 mls	125 ml HDPE (acceptable P, FP, and G)	H_2SO_4 pH<2, Cool ≤6° C not frozen	28 days
	350.1M	10 g	4 oz cwm	Cool ≤6° C not frozen	28 days
Ammonia nitrogen	SM 4500-NH_3-B	500 mls	1 liter HDPE (acceptable P, FP, and G)	H_2SO_4 pH<2, Cool ≤6° C not frozen	28 days
	350.2M (this method is no longer supported by MUR which is for waters)	10 g	4 oz cwm	Cool ≤6° C not frozen	28 days
Bromide	300.0 or 9056	50 mls	125 ml HDPE	Cool ≤6° C not frozen	28 days
BOD	SM 3500-B	1 liter	1 liter HDPE (acceptable P, FP, and G)	Cool ≤6° C not frozen	48 hours
COD	SM 5220-B or C or EPA 410.3 or 410.4	50 mls	125 ml HDPE (acceptable P, FP, and G)	H_2SO_4 pH<2 Cool ≤6° C not frozen	28 days
Chloride	300.0 or 9056	50 mls	125 ml HDPE (acceptable P, FP, and G)	None required, Cool ≤6° C not frozen, suggested	28 days
	300.0M or 9056	10 g	4 oz cwm	Cool ≤6° C not frozen	28 days
Chlorine, residual	330.5	200 mls	250 ml HDPE (acceptable P and F)	None required, Cool ≤6° C not frozen, suggested	immediate

Parameter	EPA or Standard Method (Considering Federal Register March 12, 2006 Method Update Rule)	Minimum Sample Volume	Container	Preservative	Holding Time
Chlorine	9076				
Color	SM 2120 E	50 mls	125 ml HDPE (acceptable P, FP, and G)	Cool ≤6° C not frozen	48 hours
Conductivity	120.1	100 mls	250 ml HDPE (acceptable P, FP, and G)	Cool ≤6° C not frozen	28 days
Cyanide (total & amenable)	335.4 and SM 4500-CN-E	500 mls	1 L HDPE (acceptable P, FP, and G)	NaOH pH 12 Cool ≤6° C not frozen (reducing agent as needed)	14 days
	9012	10 g	4 oz cwm	Cool ≤6° C not frozen	14 days
Fluoride	300.0 or 9056	50 mls	125 ml HDPE (acceptable P)	None required, Cool ≤6° C not frozen, suggested	28 days
Hardness	130.1	100 mls	125 ml HDPE (acceptable P, FP, and G)	HNO_3 to pH<2 Cool ≤6° C not frozen	6 months
Kjeldahl nitrogen	351.1	50 mls	125 ml HDPE (acceptable P, FP, and G)	H_2SO_4 pH<2 Cool ≤6° C not frozen	28 days
	351.1M	10 g	4 oz cwm	Cool ≤6° C not frozen	28 days
Kjeldahl nitrogen	351.3 (this method is no longer supported by MUR which is for waters) 351.2 is acceptable	500 mls	1 liter HDPE (acceptable P, FP, and G)	H_2SO_4 pH<2 Cool ≤6° C not frozen	28 days
	351.3 (this method is no longer supported by MUR which is for waters)	10 g	4 oz cwm	Cool ≤6° C not frozen	28 days
Nitrate nitrogen	300.0 or 9056	50 mls	125 ml HDPE (acceptable P, FP, and G)	Cool ≤6° C not frozen	48 hours
	300.0M or 9056	10 g	4 oz cwm	Cool ≤6° C not frozen	48 hours
Nitrite nitrogen	300.0 or 9056	50 mls	125 ml HDPE (acceptable P, FP, and G)	Cool ≤6° C not frozen	48 hours

Parameter	EPA or Standard Method (Considering Federal Register March 12, 2006 Method Update Rule)	Minimum Sample Volume	Container	Preservative	Holding Time
	300.0M or 9056	10 g	4 oz cwm	Cool ≤6° C not frozen	48 hours
Nitrate + nitrite	300.0 or 9056	50 mls	125 ml HDPE (acceptable P, FP, and G)	H_2SO_4 pH<2 Cool ≤6° C not frozen	28 days
	300.0M or 9056	10 g	4 oz cwm	Cool ≤6° C not frozen	28 days
Oil & Grease (HEM)	1664	1 liter	1 liter BR (only G is acceptable)	H_2SO_4 or HCl pH<2 Cool ≤6° C not frozen	28 days
	9071B	100 g	4 oz cwm	HCl pH<2 Cool ≤6° C not frozen	28 days
Orthophosphate	365.1, 365.2, 300.0 / 9056A / SM 4500-P E	50 mls	125 ml HDPE (acceptable P, FP, and G)	Cool ≤6° C not frozen	Filter within 15 minutes, analyzed within 48 hours
	300.0M	10 g	4 oz cwm	Cool ≤6° C not frozen	48 hours
Oxygen, Dissolved	4500-O	300 mls	300 ml BOD	Cool ≤6° C not frozen	Immediate
pH	SM 4500-H^+ B/ 9040	50 ml	125 ml HDPE (acceptable P, FP, and G)	None required, Cool ≤6° C not frozen, suggested	immediate
	9045	50 g	4 oz cwm	Cool ≤6° C not frozen	28 days
Phenols	420.1	500 ml	1 liter BR (only G is acceptable	H_2SO_4 pH<2 Cool ≤6° C not frozen	28 days
	9065	10 g	4 oz cwm	Cool ≤6° C not frozen	28 days
Phosphorus, total	365.1 / SM 4500-P E	50 mls	125 ml HDPE (acceptable P, FP, and G)	H_2SO_4 pH<2 Cool ≤6° C not frozen	28 days
	365.1M	10 g	4 oz cwm	Cool ≤6° C not frozen	28 days
Solids, total	SM 2540 B	100 ml	125 ml HDPE (acceptable P, FP, and G)	Cool ≤6° C not frozen	7 days

Parameter	EPA or Standard Method (Considering Federal Register March 12, 2006 Method Update Rule)	Minimum Sample Volume	Container	Preservative	Holding Time
	160.3M (this method is no longer supported by MUR which is for waters)	10 g	4 oz cwm	Cool ≤6° C not frozen	7 days
Solids, dissolved	SM 2540 C	500 ml	1 liter HDPE (acceptable P, FP, and G)	Cool ≤6° C not frozen	7 days
Solids, suspended	SM 2540 D	500 ml	1 liter HDPE (acceptable P, FP, and G)	Cool ≤6° C not frozen	7 days
Solids, volatile	160.4	500 ml	1 liter HDPE (acceptable P, FP, and G)	Cool ≤6° C not frozen	7 days
Solids, settleable	SM 2540 F	1 liter	1 liter HDPE (acceptable P, FP, and G)	Cool ≤6° C not frozen	48 hours
Specific Conductance	120.1	100 mls	250 ml HDPE	Cool ≤6° C not frozen	28 days
Sulfate	300.0 or 9056	50 mls	125 ml HDPE (acceptable P, FP, and G)	Cool ≤6° C not frozen	28 days
	300.0M	10 g	4 oz cwm	Cool ≤6° C not frozen	28 days
Sulfide	376.1/376.2	500 mls	1 liter HDPE (acceptable P, FP, and G)	Zinc acetate and NaOH pH>9 Cool ≤6° C not frozen	7 days
	9030	100 g	4 oz cwm	Cool ≤6° C not frozen	7 days
Total Organic Carbon	SM 5310	25 mls	125 ml HDPE (acceptable P, FP, and G)	H_2SO_4 or HCl or H_3PO_4 to pH<2 Cool ≤6° C not frozen	28 days
	9060	10 g	4 oz cwm	Cool ≤6° C not frozen	28 days
Turbidity	180.1 / SM2130B	100 mls	125 ml HDPE (acceptable P, FP, and G)	Cool ≤6° C not frozen	48 hours
METALS					
Hexavalent Chromium	218.5 / 7195 / 7196A	100 mls	250 ml HDPE (acceptable P, FP, and G)	PH to 9.3-9.7 and cool ≤6° C not frozen	28 days

Parameter	EPA or Standard Method (Considering Federal Register March 12, 2006 Method Update Rule)	Minimum Sample Volume	Container	Preservative	Holding Time
Hexavalent Chromium	7196	100 mls	250 ml HDPE	Cool ≤6° C not frozen	24 hours
Mercury	245.2/7470	100 mls	250 ml HDPE (acceptable P, FP, and G)	HNO_3 pH<2	28 days
	7471	10 g	4 oz cwm	Cool ≤6° C not frozen	28 days
All other metals (ICP/ICPMS)	200.7/200.8/ 6010/6020	100 mls	250 ml HDPE (acceptable P, FP, and G)	HNO_3 pH<2 or at least 24 hours prior to analysis	6 months
	6010/6020	10 g	4 oz cwm	Cool ≤6° C not frozen	6 months
ORGANICS (Semi VOA)					
Semivolatiles/PAH	625/8270	1000 mls	1 liter BR	Cool ≤6° C not frozen	7 days ext 40 days
	8270	30 g	8 oz cwm	Cool ≤6° C not frozen	14 days ext 40 days
Chlorinated Pesticides & PCBs	608/8081 or 8082	1000 mls	1 liter BR	Cool ≤6° C not frozen	7 days ext 40 days
	8081 or 8082	10 g	8 oz cwm	Cool ≤6° C not frozen	14 days ext 40 days
Organophosphorous Pesticides	8141M	1000 mls	1 liter BR	Cool ≤6° C not frozen	7 days ext 40 days
	8141M	10 g	8 oz cwm	Cool ≤6° C not frozen	14 days ext 40 days
Chlorinated Herbicides	8151M	1000 mls	1 liter BR	Cool ≤6° C not frozen	7 days ext 40 days
	8151M	10 g	8 oz cwm	Cool ≤6° C not frozen	14 days ext 40 days
EDB and DBCP	504.1 / 8011	500 ml	500 ml or 1 liter BR	Cool ≤6° C not frozen	7 days ext 40 days
UST PARAMETERS					
Hydrocarbon ID	NWTPH-HCID	50 g	8 oz cwm	Cool ≤6° C not frozen	14 days

Parameter	EPA or Standard Method (Considering Federal Register March 12, 2006 Method Update Rule)	Minimum Sample Volume	Container	Preservative	Holding Time
Gasoline Range Organics	NWTPH-Gx / 8015 AK101/ VPH	(2) 40 ml	40 ml VOA	HCl pH<2 Cool ≤6° C not frozen	14 days (VPH 7 days if not preserved)
	NWTPH-Gx / 8015 / VPH	10 g	4 oz cwm	Cool ≤6° C not frozen	14 days
	AK101	5 g	4 oz cwm with Teflon-lined septum	25-mL surrogated MeOH Cool ≤6° C not frozen	28 days
Diesel Range Organics	NWTPH-Dx / AK102/103 / EPH	1000 mls	1 liter BR	HCl pH<2; cool ≤6° C not frozen	14 days ext 40 days
	NWTPH-Dx / 8015	1000 mls	1 liter BR	Cool ≤6° C not frozen	7 days ext 40 days
	NWTPH-Dx / 8015 AK102/103 / EPH	50 g	8 oz cwm	Cool ≤6° C not frozen	14 days ext 40 days

HDPE = High Density Polyethylene CWM = Clear Wide Mouth glass BR = Amber Boston Round glass

P - polyethylene

FP - fluoropolymer

G - Glass

PA is any plastic that is made of sterilizble material

LDPE - low density polyethylene

Attachment 7. Table Recommended VOC Sample Preservation Techniques and Holding Times

Sample Matrix	Preservative	Holding Time	Comments
Aqueous Samples with no Residual Chlorine	Cool to ≤6°C not frozen	7 days	If MTBE and other fuel oxygenate ethers are present do not acid preserve samples. If samples are suspected of biologically active compounds or aromatics, acid preservation is necessary and the holding time is extended to 14 days.
Aqueous Samples with no Residual Chlorine	Adjust pH to ≤2 with HCl or solid $NaHSO_4$.	14 days	Reactive compounds such as 2-chloroethylvinyl ether break down under acidic conditions. If these are analytes of interest collect a second set of samples without acid preservation.
Aqueous Samples with Residual Chlorine	Collect samples in prepreserved container containing either 25 mg ascorbic acid or 3 mg of $Na_2S_2O_3$ per 40 mL of chlorinated sample containing less than 5 mg/L residual chlorine.	7 days	If more than 5 mg/L of residual chlorine is present, additional dechlorinating agent may be required. Note that acidification of samples can interfere with some analytes.
Aqueous Samples with Residual Chlorine	Collect samples in prepreserved container containing either 25 mg ascorbic acid or 3 mg of $Na_2S_2O_3$ per 40 mL of chlorinated sample containing less than 5 mg/L residual chlorine. Cool to ≤6°C not frozen and adjust pH to ≤2 HCl or solid $NaHSO_4$.	14 days	If more than 5 mg/L of residual chlorine is present, additional dechlorinating agent may be required. Note that acidification of samples can interfere with some analytes CAUTION: Never add acid preserve directly to a dechlorinating agent prior to sample collection.
Solid Samples	Sample extruded into a empty sealed vial and frozen on-site to < -7°C.	14 days	Sample vials should not be frozen below -20°C due to potential vial seals problems and loss of constituents upon thawing.

Sample Matrix	Preservative	Holding Time	Comments
Solid Samples	Sample extruded into a empty sealed vial and cooled to ≤6°C not frozen for no more than 48 hours and then frozen to < -7°C.	14 days	Analysis must be completed within 48 hours if samples are not frozen. (see above comments regarding freezing.)
Solid Samples	Sample extruded into a empty sealed vial and cooled to ≤6°C not frozen for no more than 48 hours and then preserved with methanol.	14 days	Analysis must be completed within 48 hours if samples are not preserved with methanol
Solid Samples	Sample extruded into a empty sealed vial and cooled to ≤6°C not frozen.	48 hours	
Solid Samples	Cool to ≤6°C not frozen the coring tool used as a transport device.	48 hours	The hold time can be extended if the sample is either frozen to < 7°C or chemically preserved.
Solid Samples	Freeze to < -7°C the coring tool used as a transport device	48 hours	The hold time can be extended if the sample is either frozen to < 7°C or chemically preserved.
Solid Samples	Sample extruded into a sealed vial containing reagent water and frozen on site to < -7°C.	14 days	
Solid Samples	Sample extruded into a sealed vial containing reagent water cooled to ≤6°C not frozen for 48 hours or less and then frozen to < -7°C upon laboratory receipt.	14 days	
Solid Samples	Sample extruded into a sealed vial containing reagent water and 1 g $NaHSO_4$ and cooled to ≤6°C not frozen.	14 days	Reactive compounds readily break down under acidic conditions. If these are analystes of interest two sets of samples should be collected, one without the acid preservation.

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Sample Matrix	Preservative	Holding Time	Comments
Solid Samples	Sample extruded into a sealed vial containing methanol and cooled to ≤6°C not frozen.	14 days	

Volatiles are collected in 40-mL VOA vials that have septa seals.

If samples are to be frozen they should be placed horizontally.

Attachment 8. BP Preservation Options (for VOA Samples Shipped in Bulk Containers)

Laboratories receiving unpreserved solid samples in Method 5030/5030A sampling vessels must perform one of the following options within 48 hours from sample collection in order for a 14-day collection-to-analysis holding time to apply:

- Within 48 hours of collection, the laboratory may quickly transfer 5 grams of the solid sample into one or more 40-mL VOA vials containing a stir bar and freeze the sample.
- Within 48 hours of collection, the laboratory may quickly transfer 5 grams of the solid sample into one or more 40-mL VOA vial containing 10 mL of deionized water and a stir bar and freeze the sample.
- Within 48 hours of collection, the laboratory may quickly transfer 5 grams of the solid sample into one or more 40-mL VOA vial containing 10 mL of sodium bisulfate and a stir bar.
- Within 48 hours of collection, the laboratory may quickly extract the sample with methanol.
- The laboratory may quickly transfer 5 grams of the sample into a 40-mL VOA vial containing 10 mL of deionized water and a stir bar and analyze the sample within 48 hours from collection.

In the event samples are received beyond 48 hours of collection, the laboratory should request that the consultant project manager authorize (in writing) the preservation and analysis of the soil samples.

Attachment 9. Sample login procedure

Sign-on to the TALS

Click the plus sign (+) next to **Sample Management**

Double-click Login to start the **LOGIN MODULE**

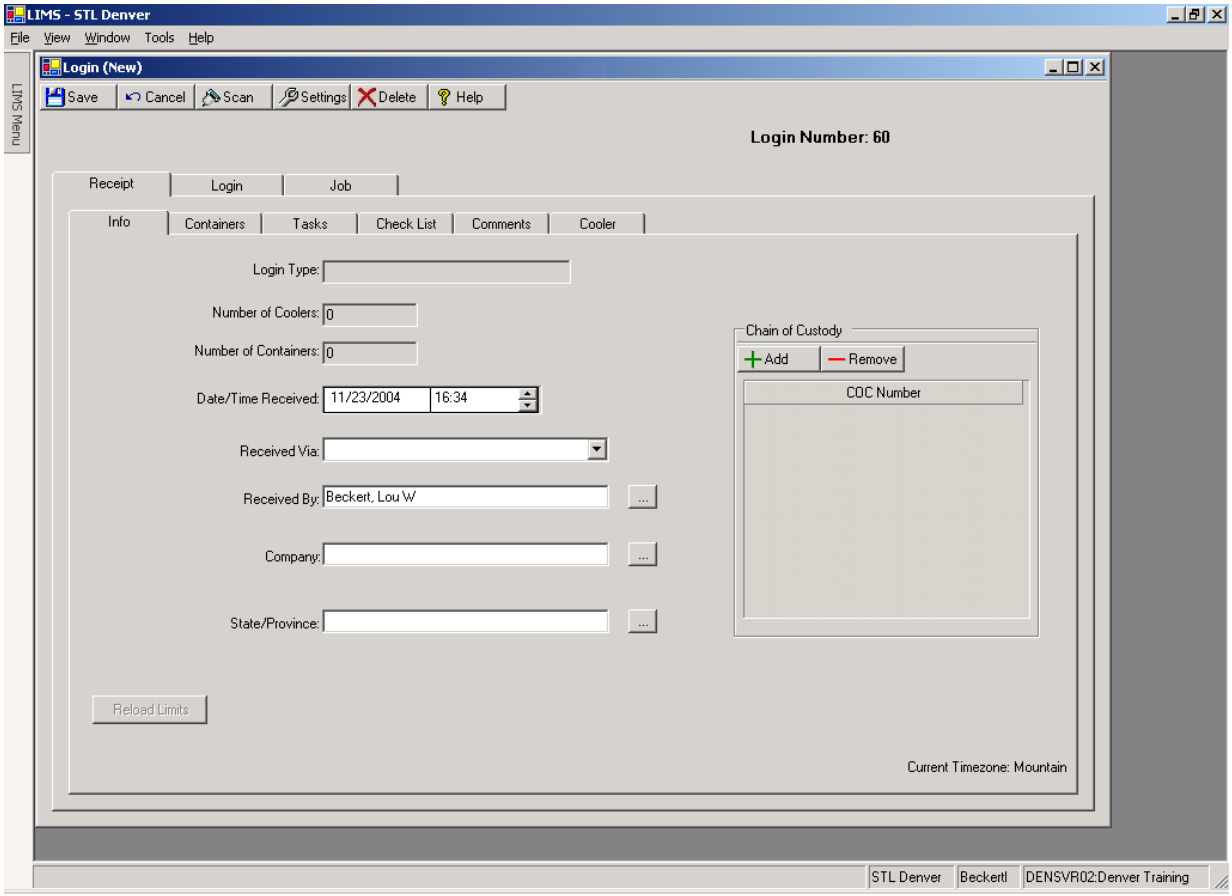
Click the **FIND Button** to search for an existing login

-or-

Click the **NEW Button** to create a new login

CREATE A NEW LOGIN:

Click **YES** to confirm that you are creating a new login



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RECEIPT TAB - INFO sub-TAB

Enter the correct **DATE/TIME RECEIVED** in the field provided

Use the drop-down arrow to choose the appropriate **RECEIVED VIA** designation

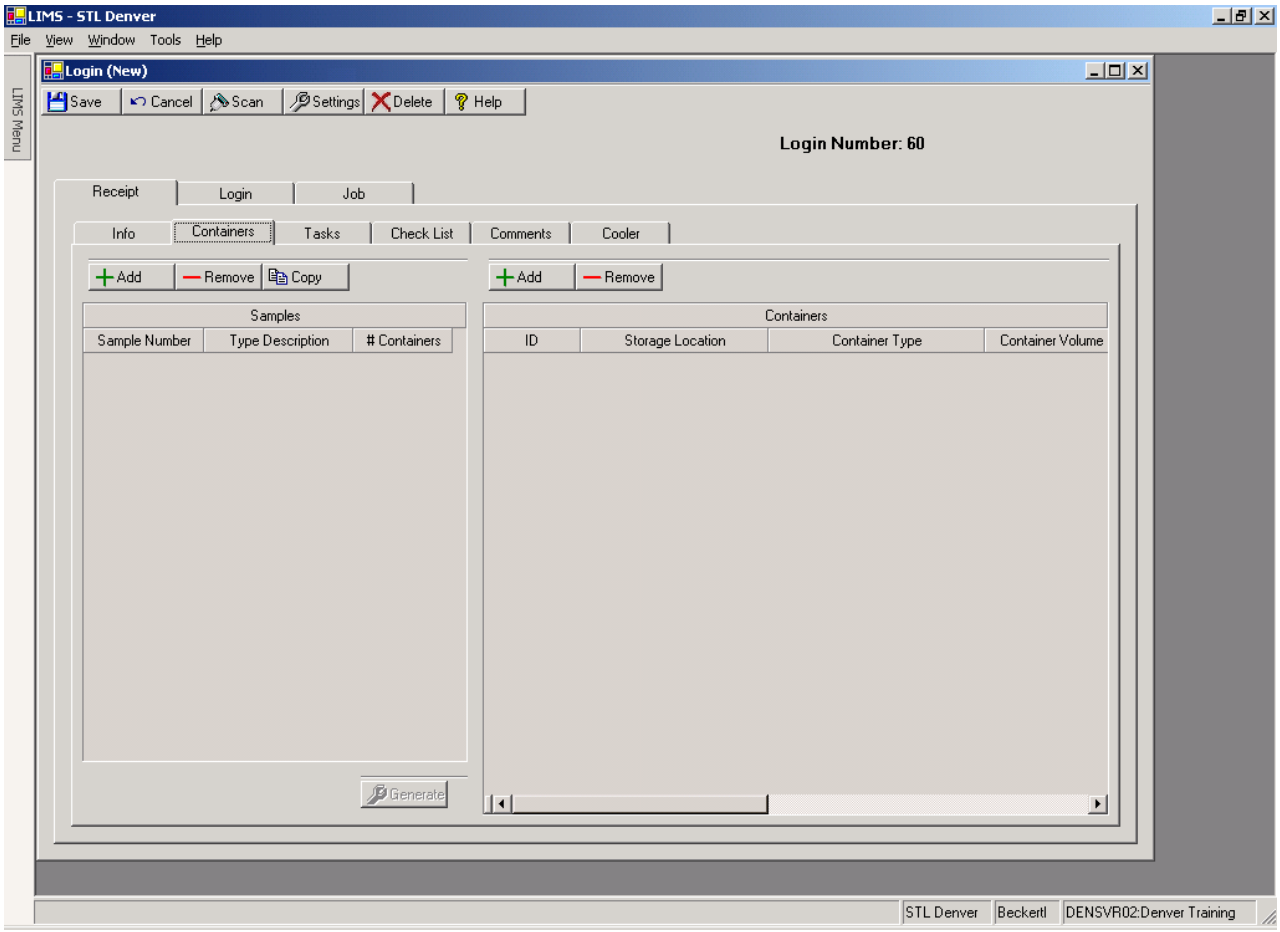
Click the "…" LOOKUP BUTTON to choose the appropriate **RECEIVED BY** employee

The **COMPANY and STATE/PROVINCE** fields are optional. Fill in as necessary.

*If your location has different departments to "receive" the samples and "log in" the samples, you may choose to use these fields. This allows you to designate where the coolers came from and from which company, yet does not log the samples into the system. Please note if you choose a company in this field, the **PROJECT LOOKUP** on the **LOGIN TAB** will automatically be filtered to display active projects from only that company.*

The **CHAIN of CUSTODY** field is optional. Click ADD to enter the chain of custody ID(s).

RECEIPT TAB - CONTAINERS sub-TAB



Click **ADD** to enter the number of SAMPLES RECEIVED in the SAMPLES Section of the form.

Enter the total number of containers received per sample in the space provided in the **#Containers** field.

Click **Generate** to create the container records in the CONTAINERS Section of the form.

Note: *You can also add each CONTAINER record manually by clicking on the ADD button in the CONTAINERS Section of the form (as long as you have first highlighted the sample in the SAMPLES Section of the form)*

After generating the CONTAINER records, fill in the information in the grid in the CONTAINERS Section of the form:

<u>Storage Location:</u> use the drop-down arrow to select pre-determined storage locations

Container Type: use the drop-down arrow to select pre-determined containers

Container Volume/Container Units: will auto-fill based on the selection in Container Type

Condition: condition of container when received. If the bottle is intact, leave this blank. Only use to list exceptions.

COC: use the drop-down arrow to select available Chain of Custody(s). If you did not enter any COCs on the INFO TAB, this list will be blank. Alternatively, if you only entered ONE COC on the INFO TAB, the selection will automatically fill in for you

Cooler: fill in appropriate Cooler ID (optional)

ID/Lab ID/TAG: internal use/ CLP tags, etc.

Note: *This information must be completed for all containers/all samples. Some shortcuts are available:*

A) Simultaneously pressing the ***<CTRL>*** *key and the* ***<DOWN>*** *arrow will automatically fill in the field below the field you are on (as long as the new field is blank).*

B) Some fields allow filling in every row of a column automatically. Simply highlight the HEADER of a column (Storage Location for example). This will turn the entire column BLUE. Right-Click in the blue, highlight and make your choice with a left-click. All fields in this column will now have your selection.

C) Use the ***COPY Button*** *in the SAMPLES Section of the form. Simply fill out all of the information in the CONTAINERS Section of the form for one sample. Click on COPY. Choose the sample you completed on the left-side of the form ("copy from") by clicking the left-most grey square (causing that row to be completely highlighted) and then choose the samples to "copy to" in the right-side of the form by clicking the left-most grey square of the row (causing that row to be completely highlighted). For more samples, simply hold the mouse button down when selecting your first sample and "drag" the highlight down the list of samples until all of the samples you want to copy are highlighted. Click OK and the container information will be copied to the new records.* **Note***: The copy function only works if the 2 samples have the same number of containers.*

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RECEIPT TAB - CHECKLIST sub-TAB

Answer all questions.

You must enter a FAILURE REASON to any negative response.

If the question does not apply to this set of samples (ie… a question pertaining to solid samples for a shipment of only waters) N/A may be used as a response.

The shortcut to highlight the entire column of ANSWERS is available. Simply highlight the HEADER of the ANSWER COLUMN. This will turn the entire column BLUE. Right-Click in the blue highlight and make your choice with a left-click. All fields in this column will now have your selection.

RECEIPT TAB - COMMENTS sub-TAB

Free-form area to enter any comments, notes, etc.

RECEIPT TAB - COOLER sub-TAB

(Optional) If your location chooses to use cooler tracking, this tab will record coolers received.

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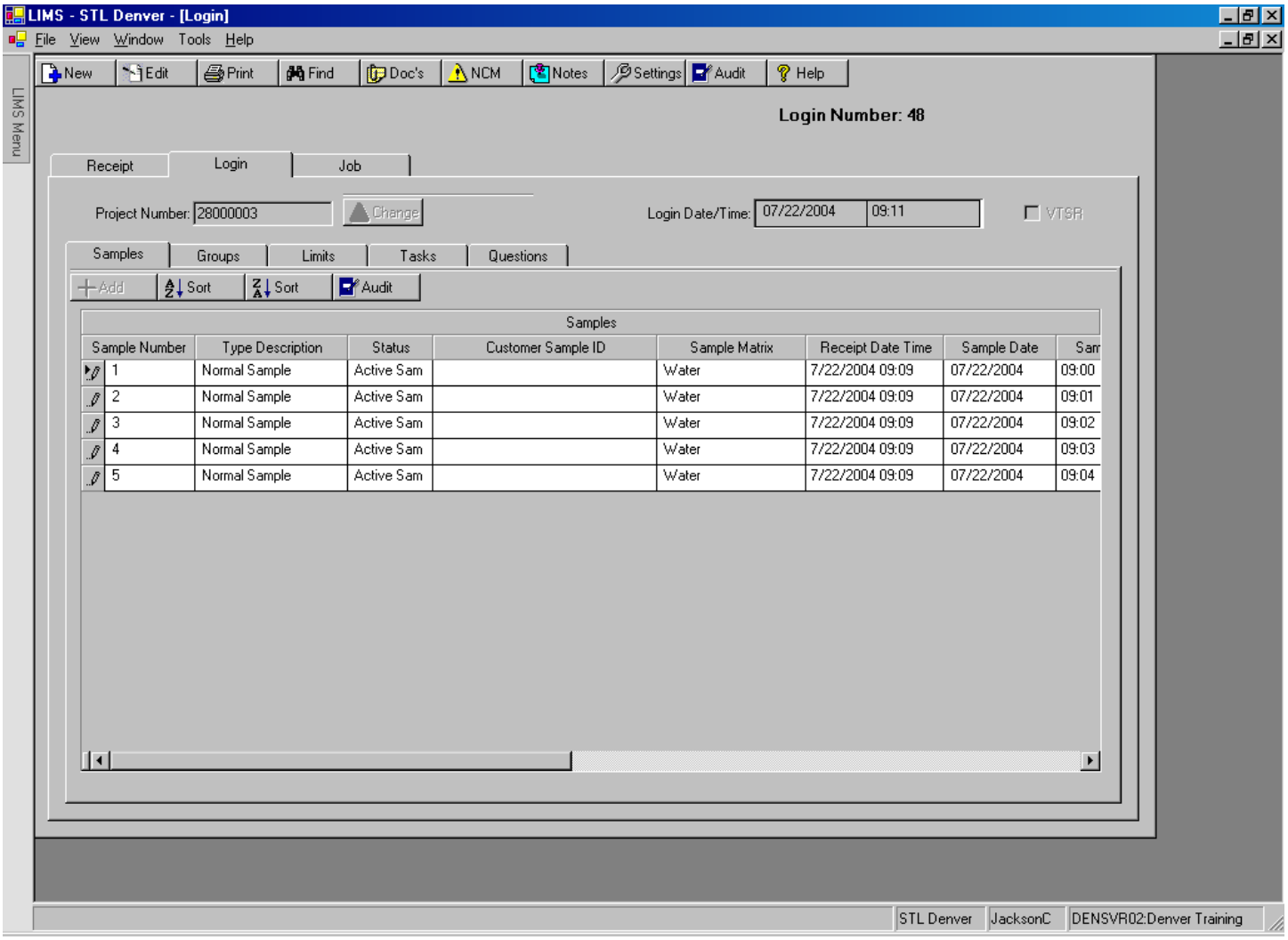
LOGIN TAB

Click the **ADD** button next to the PROJECT NUMBER field. If you chose a COMPANY on the RECEIPT TAB, this list will be filtered based on that information. Otherwise the complete list will be displayed. You can filter the list based on the pop-up screen. Choose the appropriate project.

Click OK.

Note: If the wrong PROJECT was chosen, you are able to change. Save your work. Click on the **Change Button** and follow the instructions.

LOGIN TAB - SAMPLES sub-TAB



Enter the information for each Client Sample. Some fields will already be filled in for you, based on information from the previous tabs and the Project. Update information as needed.

Customer Sample ID: Enter the Client Sample ID accurately. If the Project has "Sites" associated with it, and the PM elected to verify against the site samples list, this field will NOT be free-form, but will be a drop-down list for you to choose the appropriate Client Sample ID.

Sample Matrix: Enter the Sample Matrix from the drop-down list

Sample Date/Sample Time: Enter the complete date/time

If the samples were collected in another state/time zone, this field is also available for edits. Choose the appropriate time zone from sampling.

Action Limit Set: If ONE Action Limit Set has been associated with this PROJECT, the list name will automatically fill in. If more than one exists, you must choose the appropriate list form the drop-down choices.

Some fields are not mandatory (based on your location). The default for some of the fields is BLANK. Refer to your local lab for specifics. Shortcuts are available for these fields as well.

If sample QC is received from the client and it is necessary to create this QC at login (MS/MSD/Duplicates, etc.) this is performed in this subtab. Choose the correct sample and click on the sample Number or Type Description field. Right Click to pull up the **Sample Options** menu and choose **Add QC SAMPLES.** Choose the appropriate QC types from the popup box which will appear and click Add. Populate the appropriate information for the QC samples and if there were bottles received specifically for the QC, click back to the **LOGIN TAB – CONTAINERS SUBTAB** to add the appropriate information.

LOGIN TAB - GROUPS sub-TAB

The analyses associated with each sample are contained in LOGIN GROUPS. Sample Receiving will build these groups from the information contained in the PROJECT.

The groups can be created a variety of ways, ranging from easy to complex. The most straight-forward way is to organize your groups in relationship to the samples and the analyses requested on each sample.

For example:

If sample #1 and #3 are both waters and are requesting GCMS VOA8260 Standard List and Lead … create a LOGIN GROUP with these two parameters and associate this group to these samples.

If sample #2 is only getting Lead … create another LOGIN GROUP that only contains Lead and associate this group to this sample.

In this example, you would have two login groups, and the correct analyses on each sample.

To CREATE A NEW LOGIN GROUP:

Click on the **NEW Button**.

From the pop-up menu chick "**Analysis Groups**" (or CANCEL. METHODS is not used at this time).

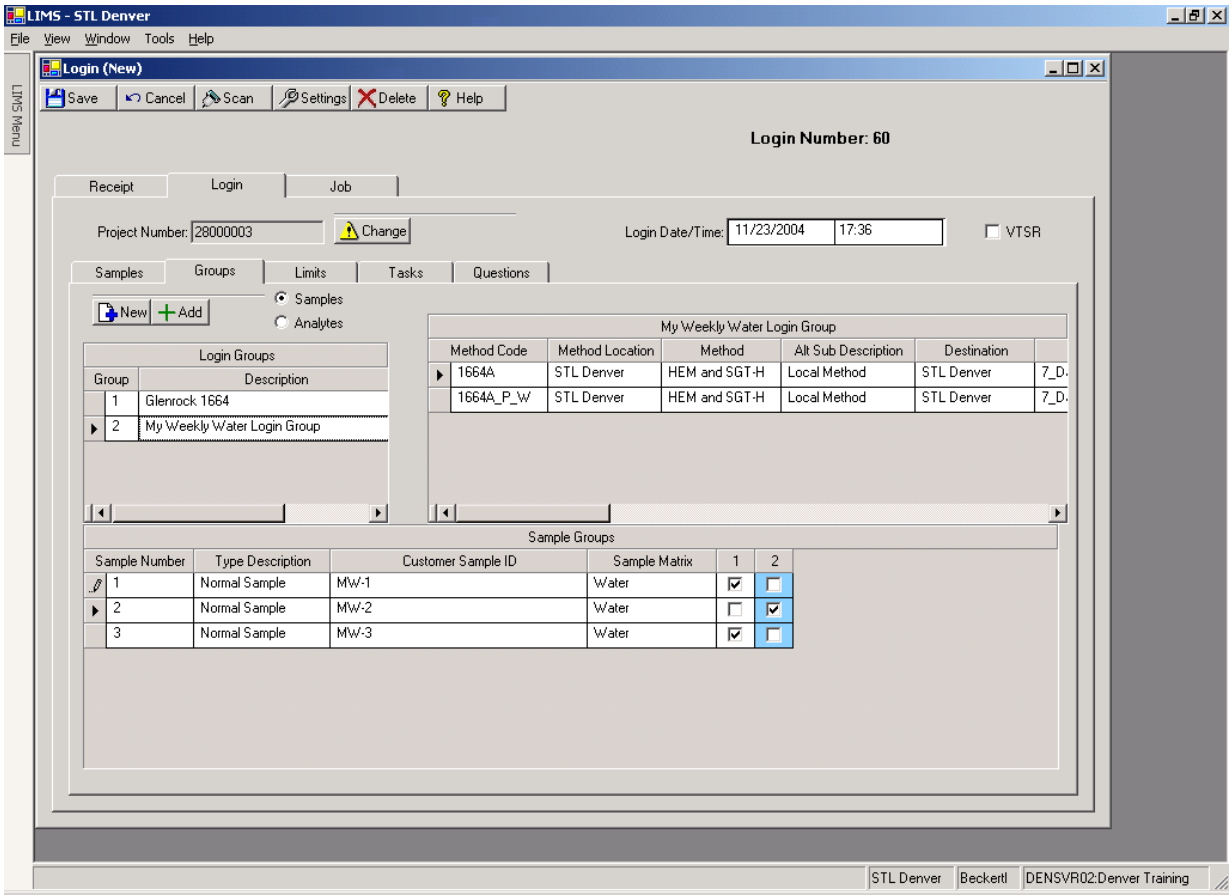
You are now viewing all of the methods/groups the Project Manager has created in the PROJECT. Paying attention to the Matrix and the Group Description, choose the Group that contains the methods of interest. Once you choose a group, the associated METHODS will appear in the lower grid of this pop up. Highlight the method(s) of choice and click on **Select Method**.

You now have a LOGIN GROUP with the chosen Methods and their corresponding preps.

Click **ADD** to add more methods to this LOGIN GROUP

-or-

Click **NEW** to create a new LOGIN GROUP



You may view each LOGIN GROUP created by highlighting the LOGIN GROUP in the “Login Groups” grid by clicking the left-most grey square and highlighting the entire row. Once highlighted, the corresponding methods/preps will be displayed in the grid to the right. The grid will be titled with the LOGIN GROUP NAME (which automatically comes from the PROJECT, but can be renamed by you simply by typing over the title in the LOGIN GROUPS grid).

Note: *A “grey background” in the METHODS/PREP window indicates this login group is not associated to the sample highlighted in the “SAMPLE GROUPS” grid. A “white background” indicates this group is associated to the sample highlighted. Additionally, the LOGIN GROUP in the “Sample Groups” grid will turn blue to indicate which LOGIN GROUP has the focus.*

Once the LOGIN GROUP(S) has been created, you will associate the LOGIN GROUP to the correct sample(s). Simply put a check-mark in the square corresponding to the correct sample and the correct login group. A shortcut is available here as well. Simply highlight the HEADER of the LOGIN GROUP in the “Sample Group” grid (shown above by the “1” and “2”) by right-clicking, then left-click on your selection.

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LOGIN TAB - LIMITS sub-TAB

This tab will be reviewed by the Project Manager to assure all of the appropriate limits have been loaded into the LOGIN.

LOGIN TAB - QUESTIONS sub-TAB

This tab may have information that needs completion. If a client need (ie. EDD, etc.) requires us to collect additional information that is not normally captured in the LIMS, we will record this information via a "question". Simply answer the question to store the answer.

Example:

Question: What is the sample depth listed on the Chain of Custody?
Answer: 4.5

Note: The answer to a particular question may be answered by the appropriate group, depending on the question. Just because this tab is in the LOGIN doesn't imply that the answer will come from Sample Receiving.

SAVE the LOGIN.

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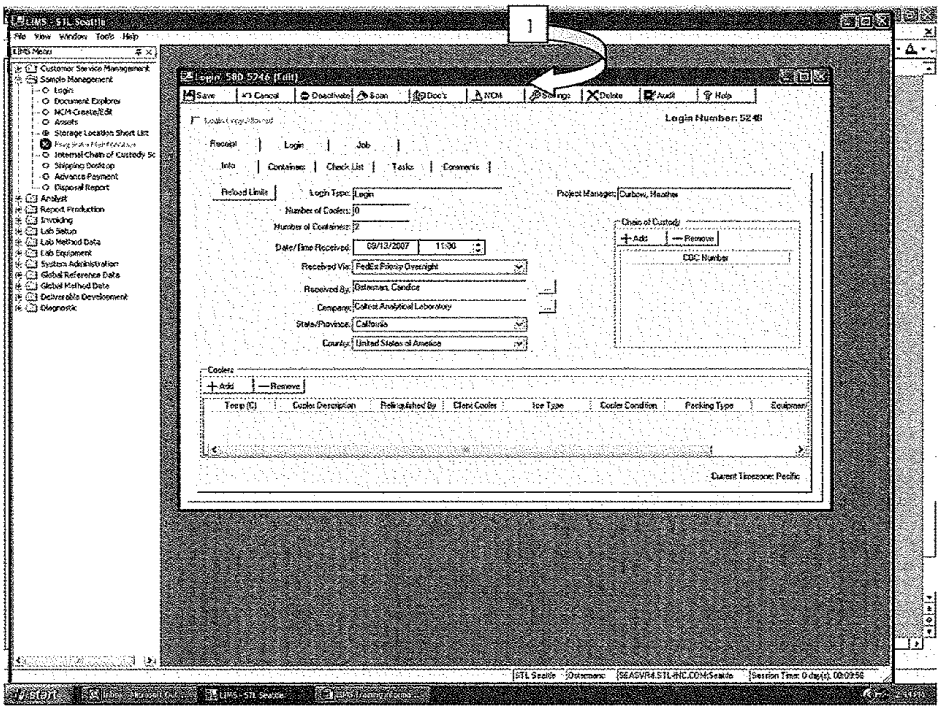
Create an NCM!

There are two ways to do this and this will show you both

To create an NCM while you are entering your samples.

1. After you have completed and saved your login for new samples hit the NCM button (1)



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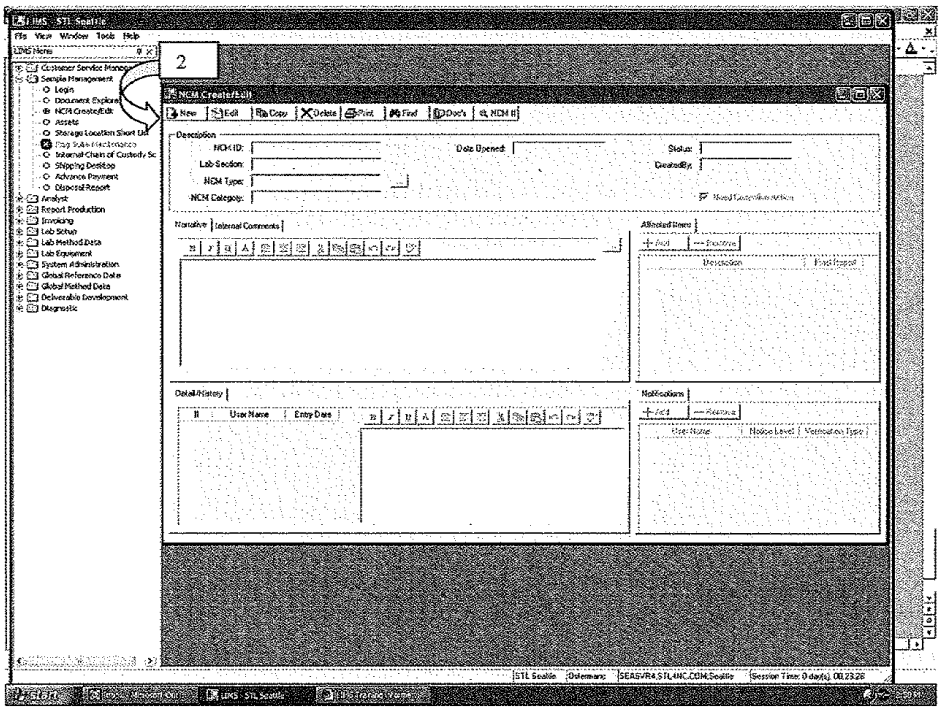
2. Select New (2)



2

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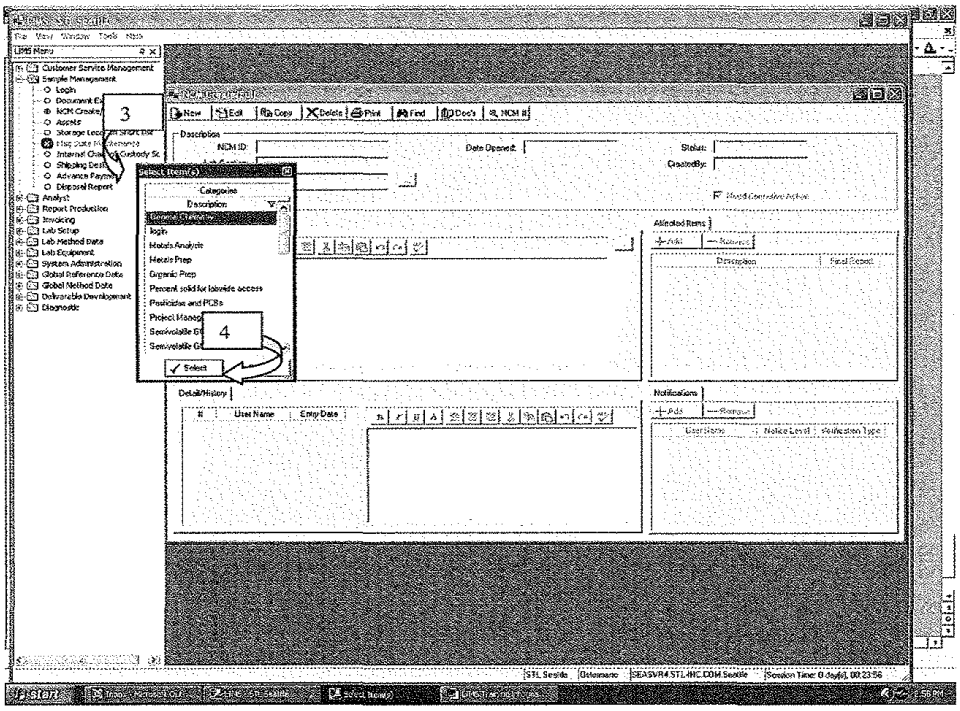
3. Now you will need to select the best description from the menu in pop up window (3)
4. Click Select (4)



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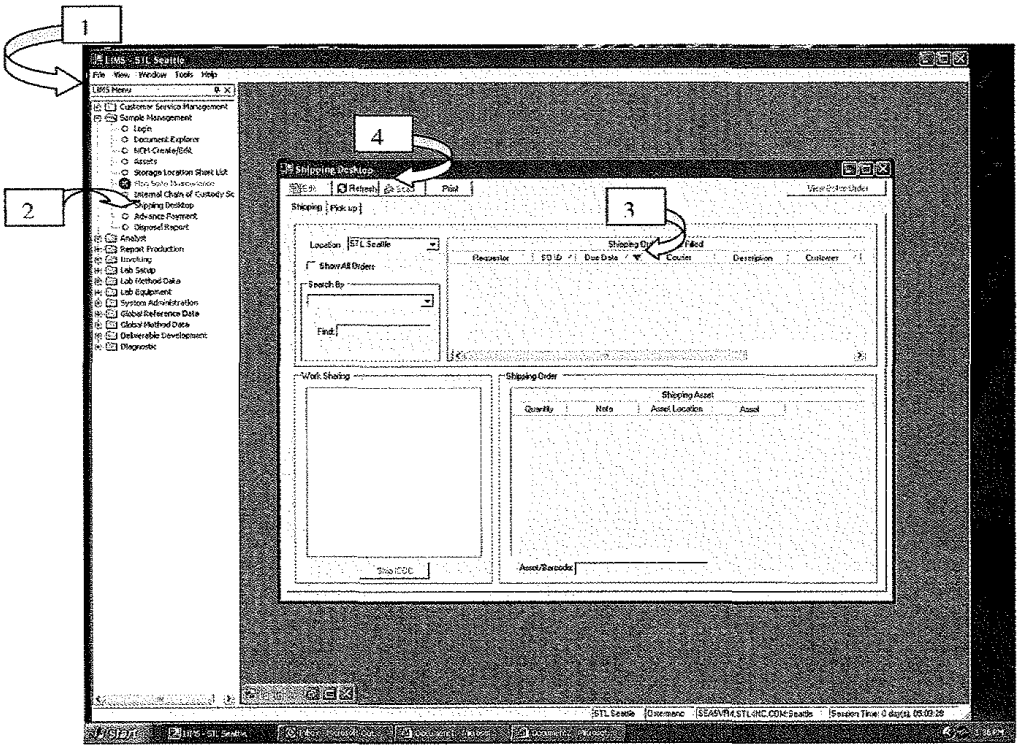
To ship the order off of the desktop

1. From the LIMS Menu (1) Double click on shipping desktop (2)
2. You may need to click on the small down arrow in the Shipping Orders to be filed screen (3)
3. Then you will need to click the Refresh Button (4)



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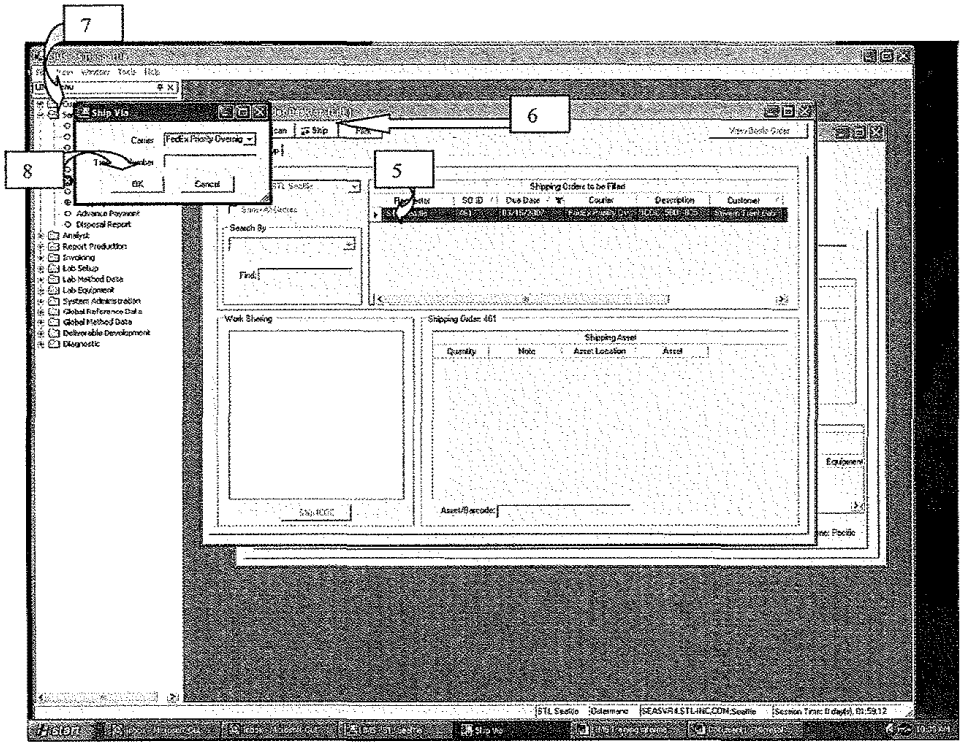
4. Select the order you wish to ship out by clicking the small arrow (5) to the left of the order
5. Then click on ship (6)
6. A Ship Via Window (7) will pop up you can enter the tracking number for this order if you wish or some other kind of reminder for this order if you would like.
7. Click OK (8) Your shipping order will disappear from your desktop.



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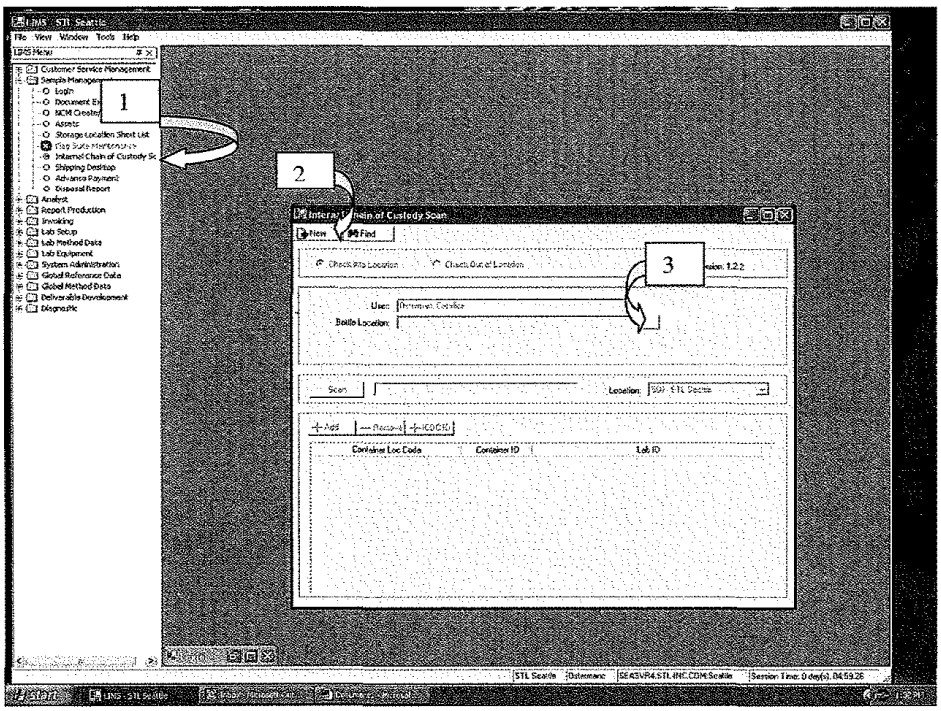
ICOC Scan (How to check in another LIMS Lab Samples)

1. From the LIMS Menu (1) double click Internal Chain of Custody Scan
2. When this window opens up you will want to click NEW (2)
3. You will then need to change the Bottle Location (place the sample on one of your shelves.) (3)



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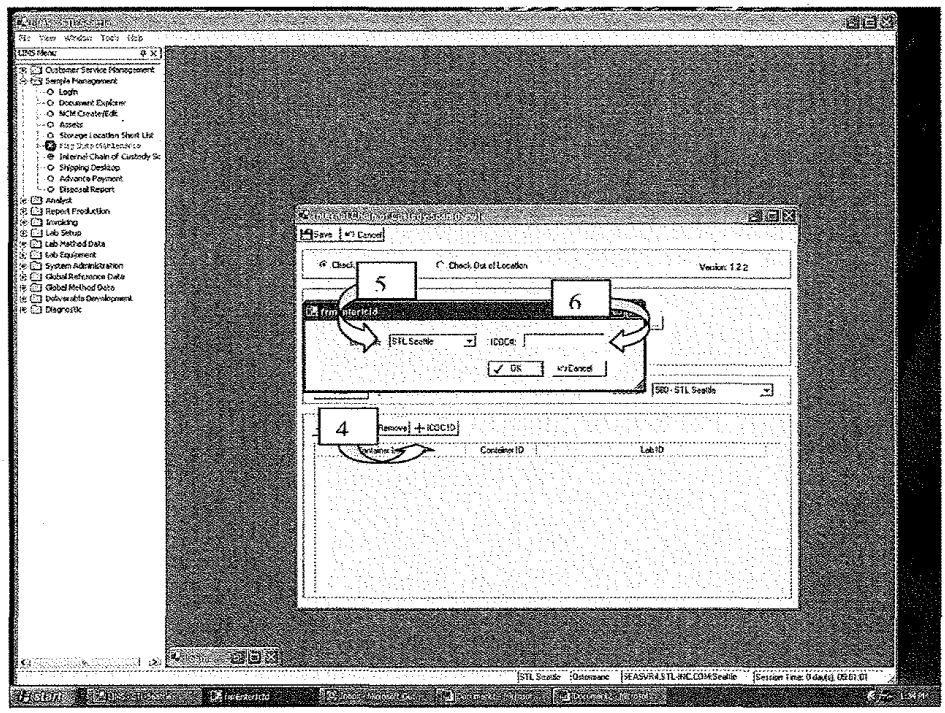
4. When you choose ICOD ID (4)
5. This window will pop up at this point you will need to choose what lab sent you the samples (the drop down list has all STL LIMS Labs on it) (5)
6. Now add the ICOC # (6) found on the other labs chain (please see sample on next page)
7. Click OK



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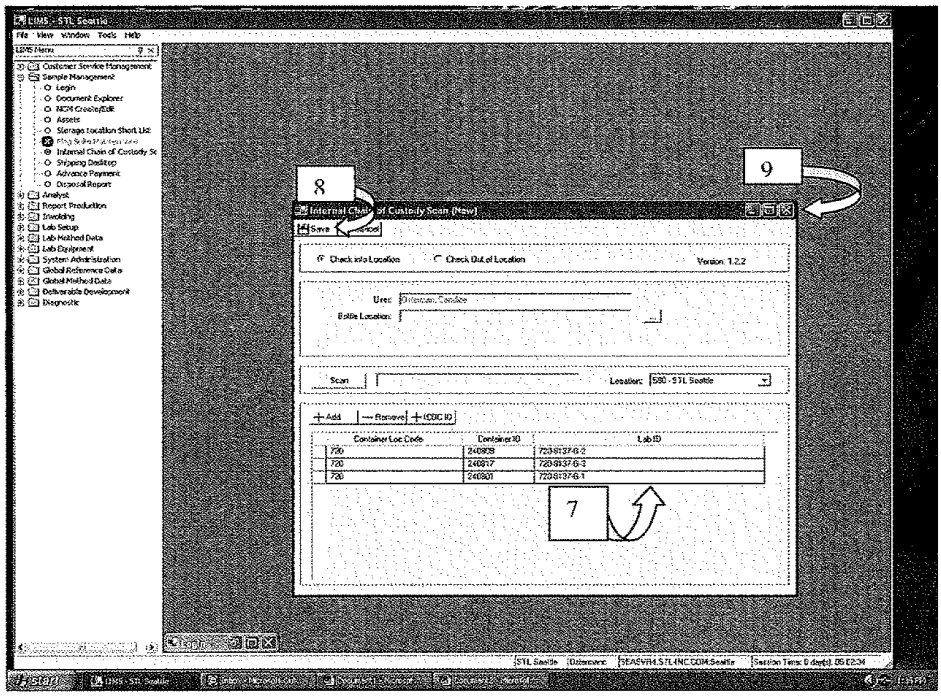
8. After pressing OK you will see the sample ID's on the screen (7).
9. Verify that you received the correct containers then you will want to click Save (8)
10. When you click Save there should be yet another window that will pop up and ask you if you received all the samples and correct containers from sending lab.
11. Click yes…….after that you are able to close the whole window (9)



FYI

In our lab when we receive samples from another lab we send out an email that lets the whole lab know that the samples have arrived and what shelf they are on and if all the containers came in for all tests.

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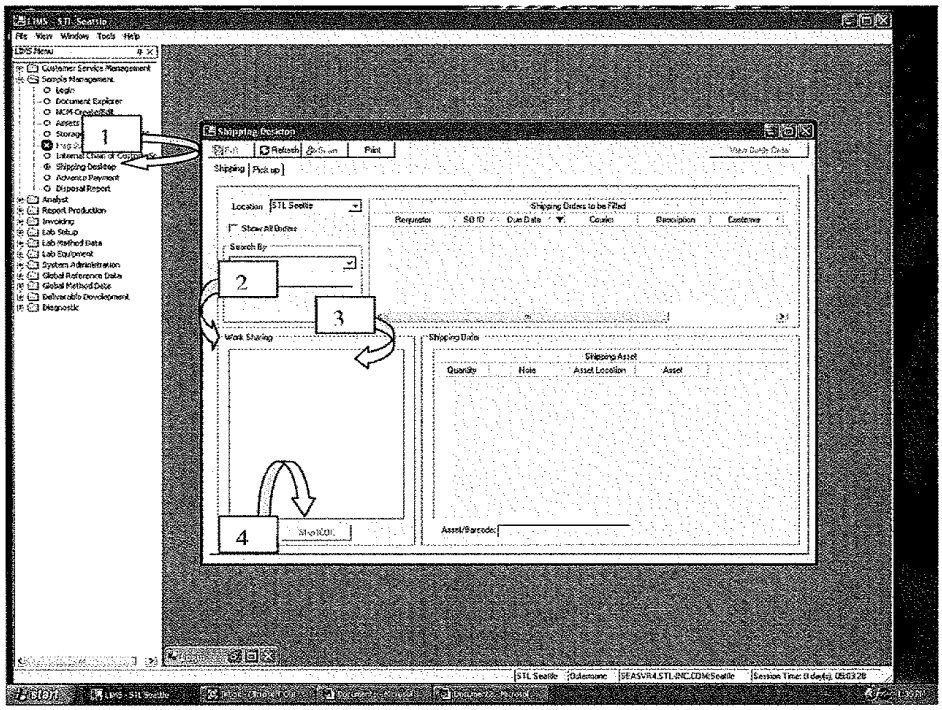
Shipping Desktop

1. From the LIMS Menu (1) double click on Shipping Desktop
2. Under the Work Sharing Menu (2) you will the company (3) you are sending your samples to.
3. Select the company and then press Ship ICOC (4)



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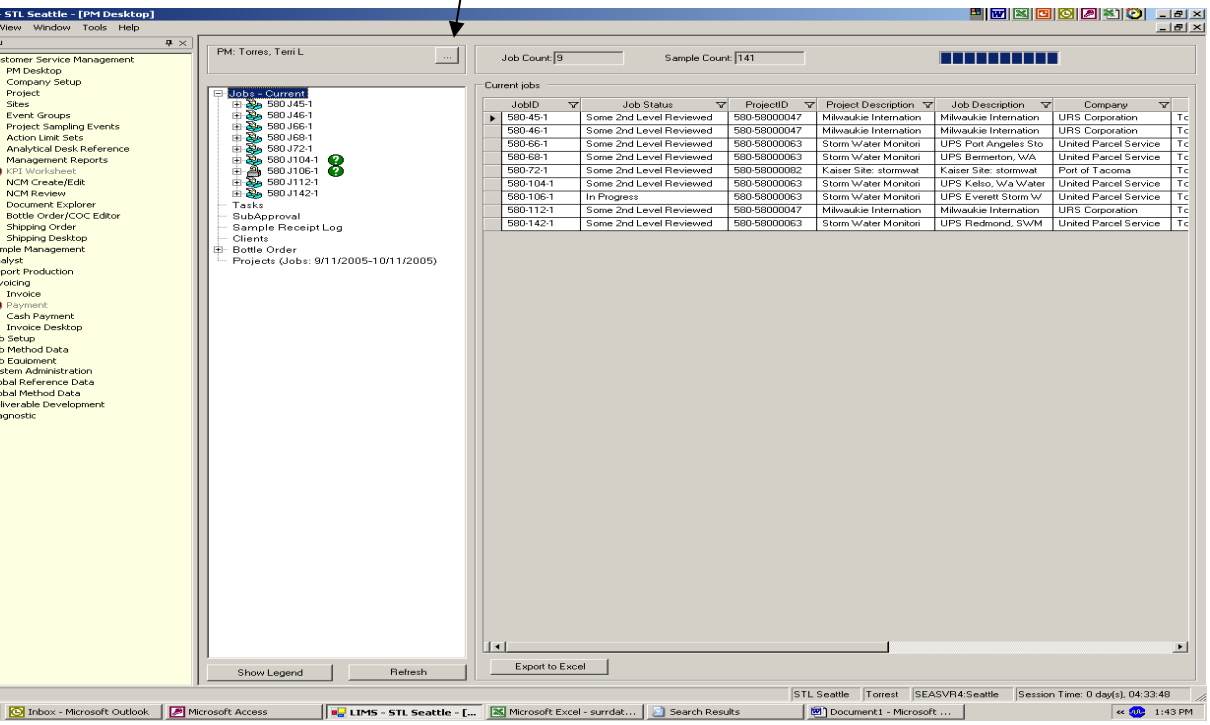
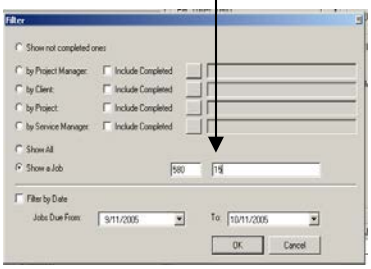
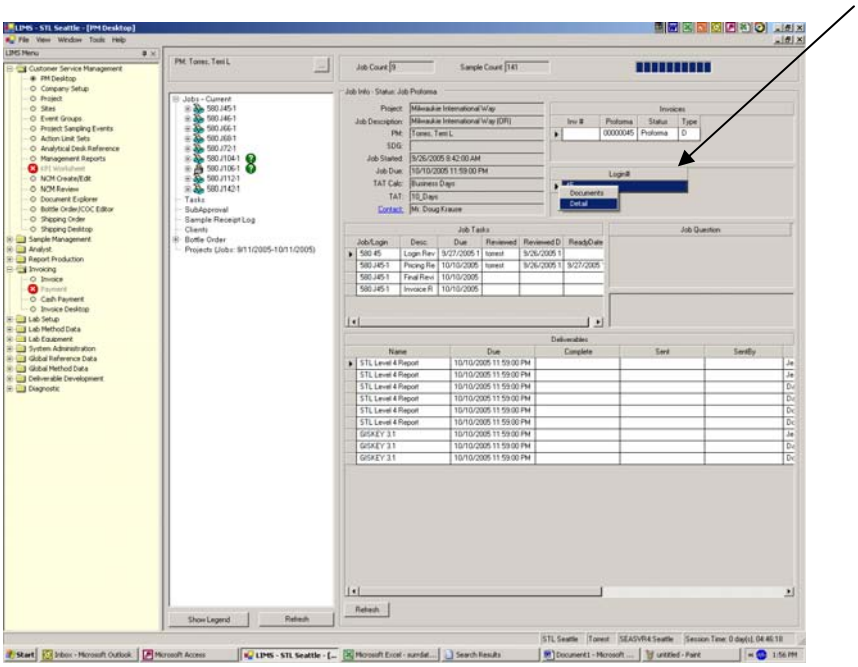
Login Job Review:

Under Customer Service Management double click on PM Desktop. If you are the assigned PM for the Job it should show up on the desktop. If it does not show up or you are reviewing for another PM click on the box with the three dots just to the right of the PM name and select to show a job and enter the job number to be reviewed.



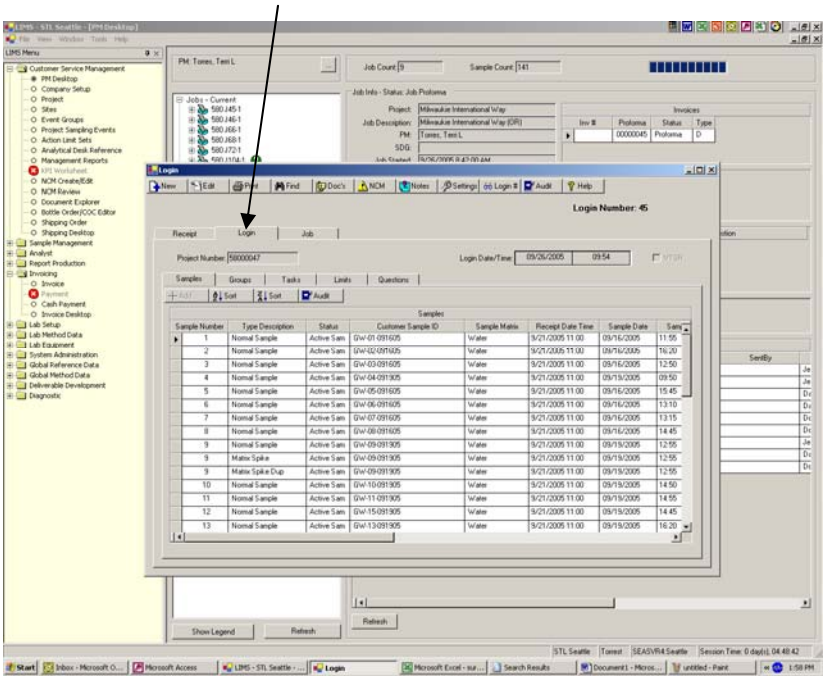


Review the client ID's, date and time sampled, TAT and analysis and analytes requested to insure that they match the COC. This can be done partially with the sample login summery form that should be included in the folder with the COC. This is also done by opening up the login desktop for the Job. To do this click on the job to be reviewed, highlight and then right click on the login # and select details.



This will open up the login desktop for this job where you can review all the login info.

The client ID and date and time sampled are located on the login tab on the samples tab.



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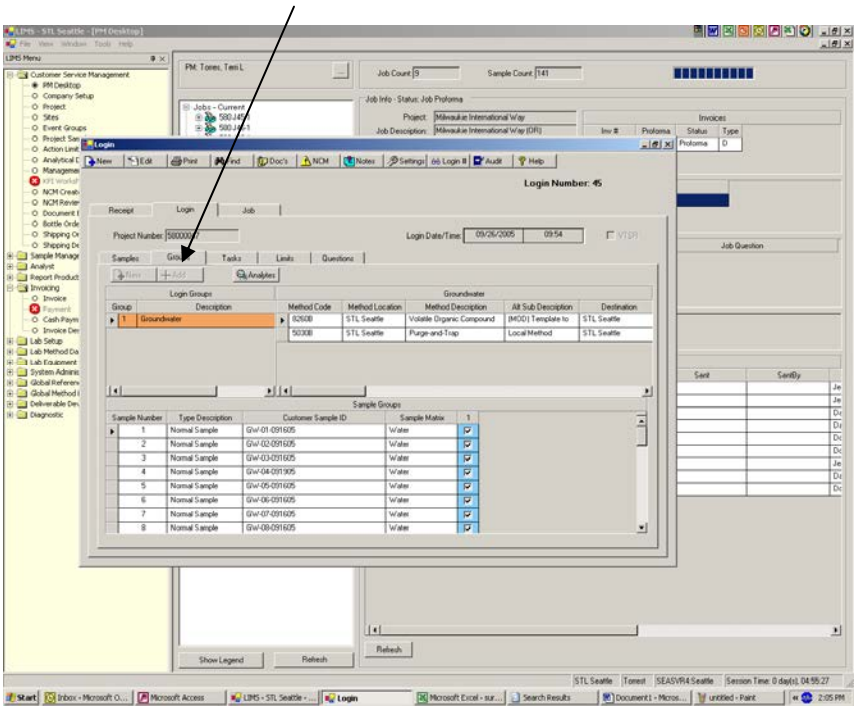
The Tests requested are located on the login tab on the Groups tab.



Each group is assigned a number and this number is then checked off by each sample it is assigned to. Each group can contain several analysis. The example above only has one analysis (8260) with the extraction method (5030B) that proceeds it.

In order to verify the analytes that were logged in for a given test you must highlight the analysis test of interest and then select the analytes button.

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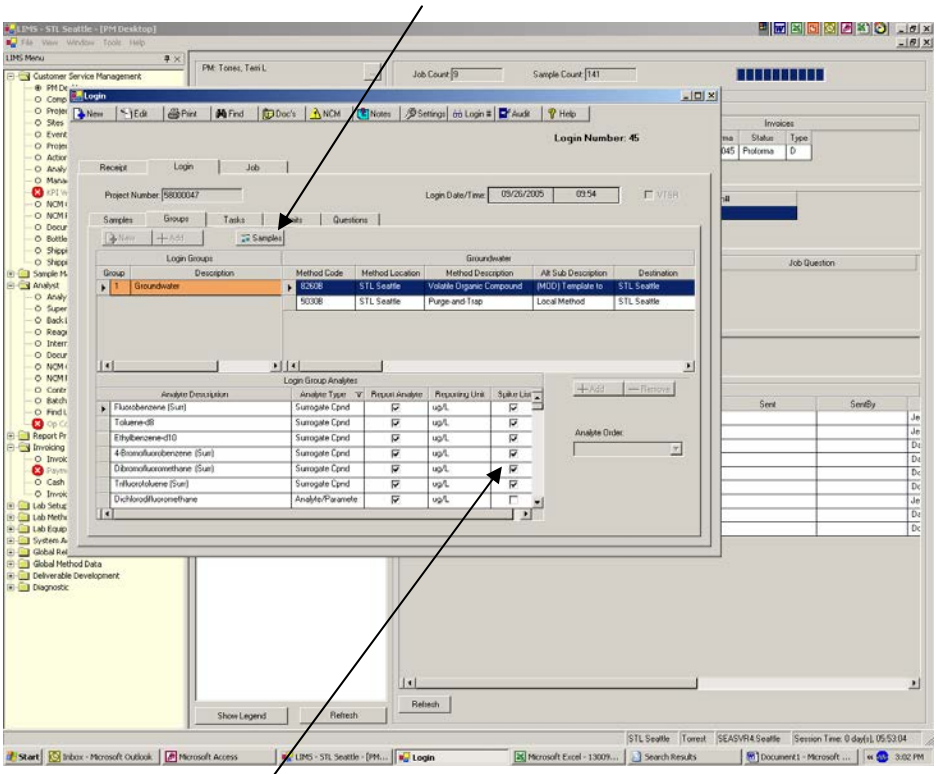
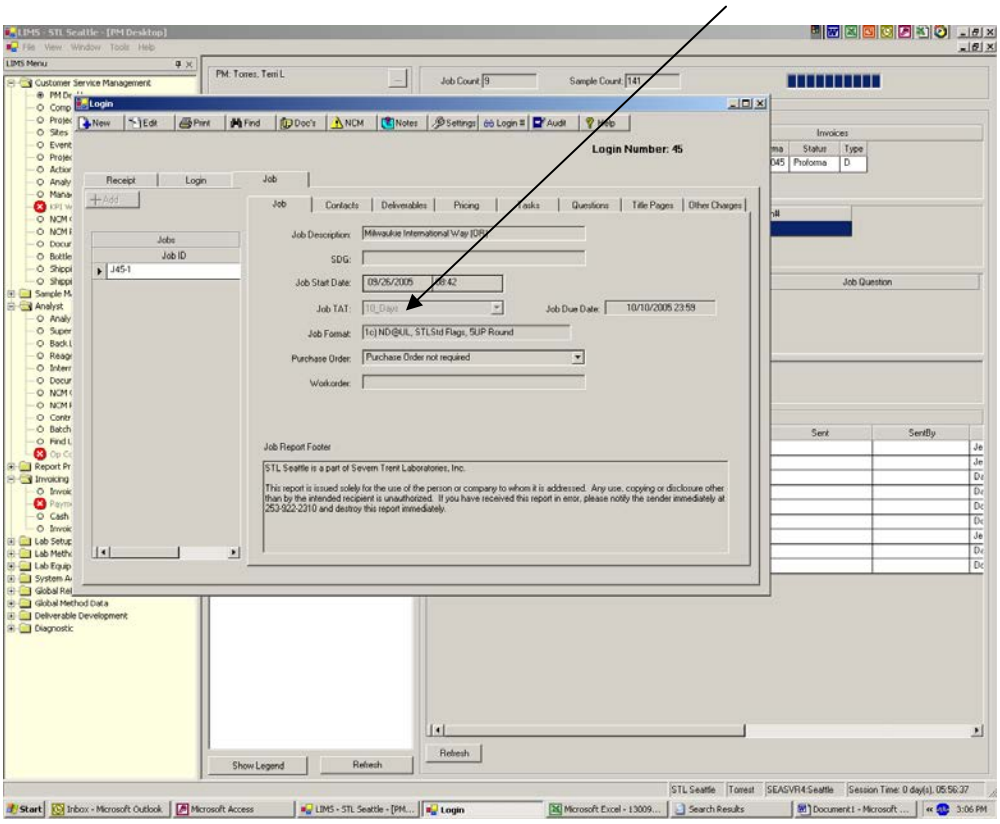
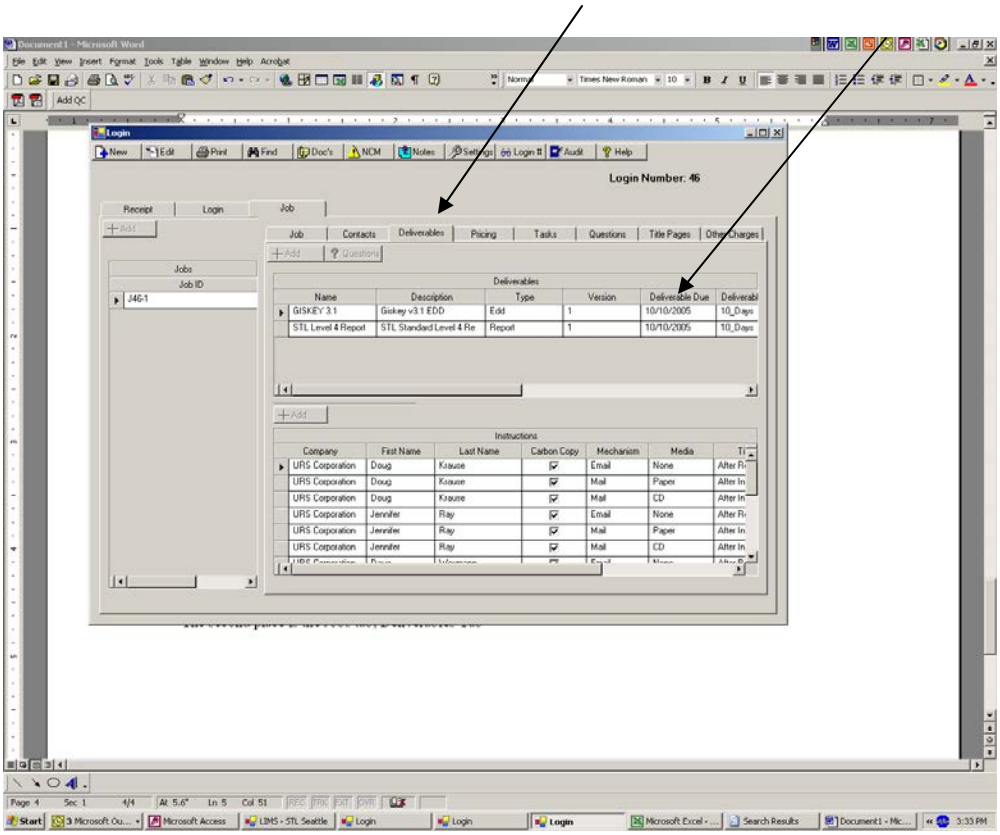


You will also want to insure that all analytes that need to be reported as a LCS/LCSD or MS/MSD are selected as spike list.

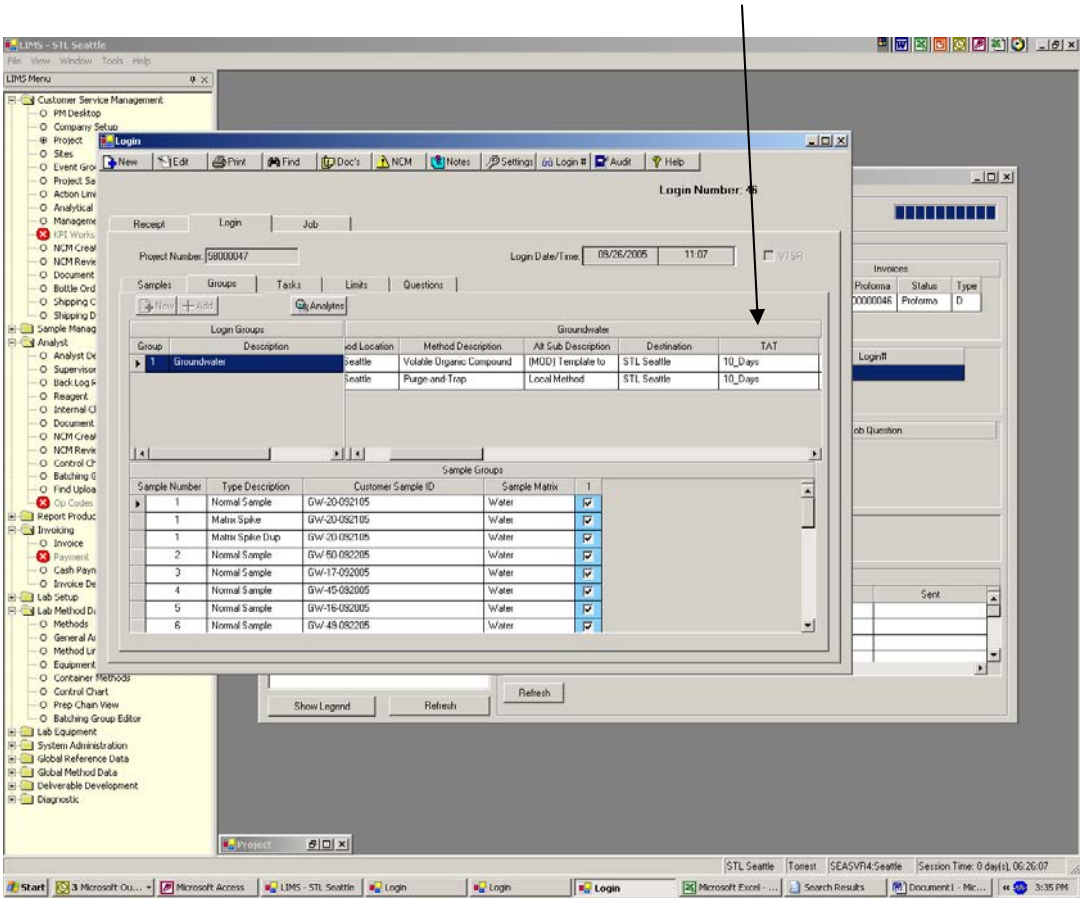
The TAT is located in several places the first of which is the Job tab, Job tab:



The second place is the Jobs tab, Deliverables Tab Under the Deliverable Date

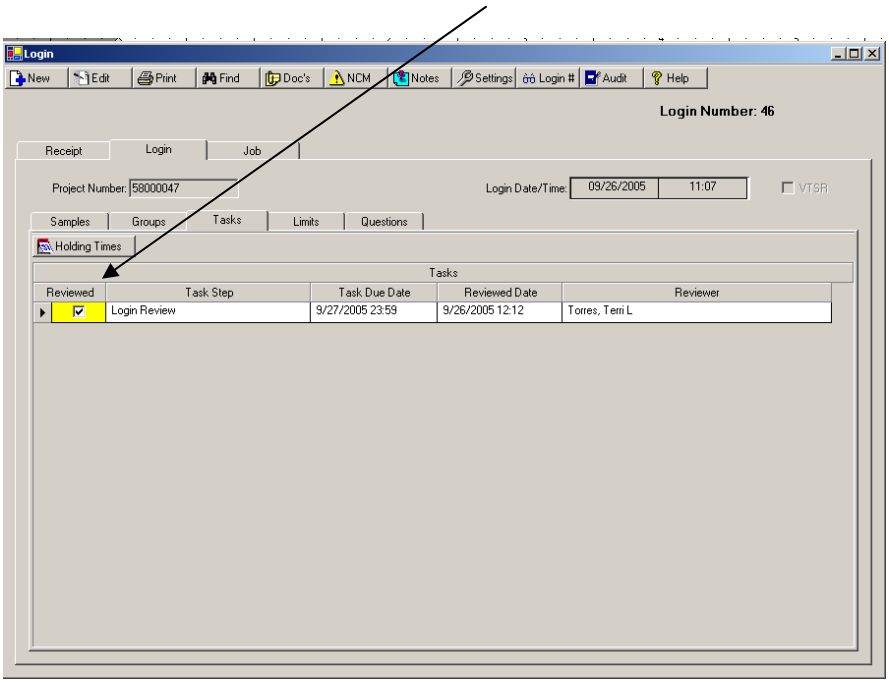


The final place is back under the login tab, Groups tab, under each analysis

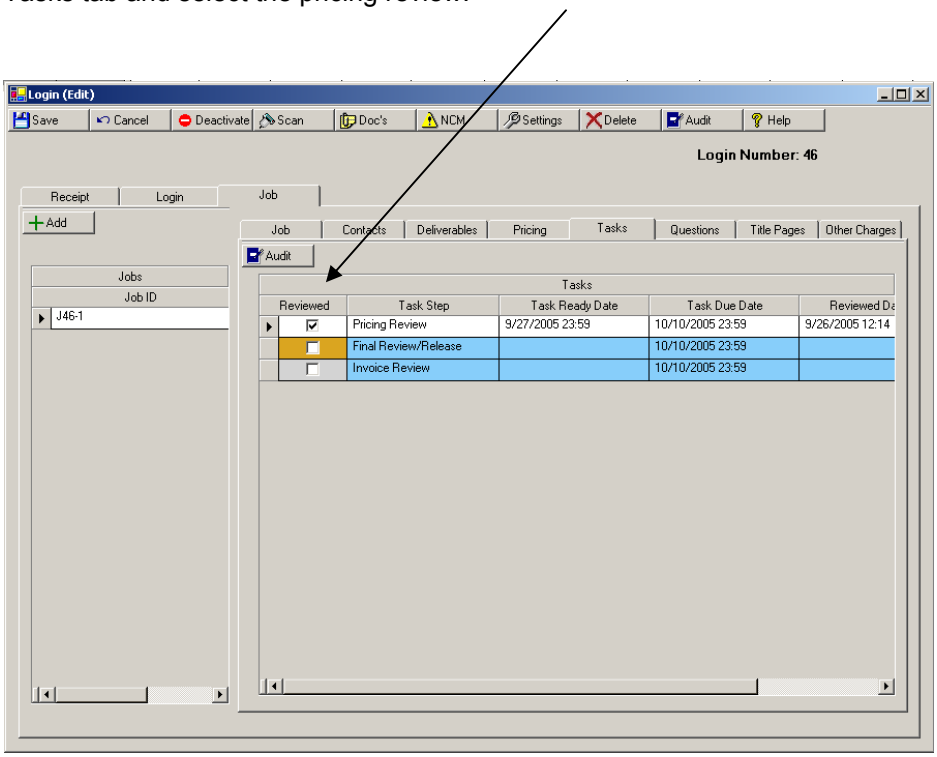


The analysis TAT can not be set any longer than either the Job TAT or a deliverables TAT.

Once you have reviewed these items select Edit and under the Login tab, Tasks tab check the login review.



Next you will want to review the pricing. This is located under the Job tab, Pricing tab. You can filter and sort by the method, matrix, etc. if this helps to review the prices. Once the pricing is reviewed you must go to the Job tab, Tasks tab and select the pricing review.



Now you need to select the save button. At this point you will be prompted for your login and then you will be asked if you want to create the proforma invoice. Lastly if you have selected one of your contacts to receive a sample confirmation you will be asked if you would like to send it at this time.

Remember if you found problems in login that have to do with the way the project was set up, go and fix the project before you forget. This will save you the hassle of having to fix the next login for this project!

Sample Data Processing

Approvals

Signatures on File

Terri Torres Date
Customer Services Manager

Dave Wunderlich Date
Quality Assurance Manager

Kathy Kreps Date
Laboratory Director

This SOP was previously identified as SOP No. 0003.12.

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1.0 PURPOSE

This SOP describes the procedure for internal processing of sample data.

2.0 SAFETY

3.1 There are no specific safety hazards associated with this SOP.

3.2 During the course of performing this procedure it may be necessary to go into laboratory areas to consult with appropriate staff members, therefore employees performing this procedure must be familiar with the Laboratory Health & Safety Plan, and take appropriate precautions and wear appropriate attire and safety glasses.

3.0 PROCEDURE

3.1 For each batch of samples received into the laboratory, the chain-of-custody documentation is signed and dated when the samples are received. If a COC is not submitted with the samples a sample receiving technician will fill out a COC or assist the client in doing so. If the client is present, a copy of the completed documented is given to the client.

3.2 Upon completion of the custody documentation, a job number is generated, the sample receipt checklist is completed, and the login process is initiated. All relevant sample information is recorded, as described in SOP TA-QA-0001.

3.3 The original copy of the login summery report and the COC is placed in a master folder. The job number on the tab identifies the master folder; master folders are organized sequentially by job number. All other documents that pertain to the project are also placed in the master folder. The default due dates (10 business days) are automatically generated from the LIMS system.

3.4 The information contained in the master folder and LIMS is reviewed and approved by the project manager, as indicated by the login review task in LIMS. The master folder is given to office personnel who scan the COC and attach it as a pdf to the report section of the job in LIMS. The office personnel then place the folder in the work in progress file box in the project management room.

3.5 When the analyst is ready to perform sample extraction or analysis, a specific backlog for the analysis is performed.

3.6 When the analyst has completed the analysis for a batch of samples the raw data and appropriate bench notes/non-conformances are reviewed within the department. The laboratory raw is compiled into a data folder for each job in the batch. After the data has been reviewed an approved the data folders are place in the data receiving cart in the report filing area. All associated paperwork is then taken from the folders and consolidated into the master file.

3.7 A project manager or other designee will assemble any tier III, IV or V data package. All raw data for tier III, IV or V data packages are scanned and attached as a pdf to the report section of the job in LIMS. The Project manager also performs a final review insuring completeness of deliverable, writes any narrative required and assembles and completes the reports and EDDs in LIMS indicating their approval for release to the client. The report / EDD is then faxed, e-mailed and/or mailed to the client, along with copies of the custody information and any appropriate copies of raw data. The project manager or designee with mark when each deliverable has been sent in the LIMS. The custody information, the raw data (level III, IV or V data report), a copy of the report and invoice are archived in LIMS. The original custody information, the raw data, checklists and a

copy of the report title page are archived in the paper filing system.

3.8 Sample Tracking

From the time a sample is logged into the LIMS, a summary of its progress through the laboratory is available to the project manager that is assigned to the sample job. Project specific quote information, which may include site-specific QC information, sample turn around time information, contact numbers, etc. can be retrieved upon sample login. The LIMS login contains a sample or job number text box, which can be used to provide special sample handling or reporting requirements to the laboratory personnel and project managers. After secondary review the samples are marked as complete in the LIMS. When all the samples have been reviewed the entire job is marked as complete. When the work order is billed this is indicated in the LIMS with the invoice number and the invoice review task. Project managers have access to the LIMS and can check the status of a sample or job at any stage in the laboratory.

3.9 Electronic Deliverables

The laboratory routinely reports sample data in the USACOE EDF version 1.2 format. Several other formats are also available, and customized electronic reports can be accommodated. Electronic deliverables are subjected to checks for transcription and import accuracy, as well as format validity. Electronic deliverables can be provided on a wide variety of electronic media, or as attachments via email. Direct access to the TestAmerica Seattle computer network and sample results is not provided to clients.

4.0 RESPONSIBILITIES

4.1 It is the sample receiving technician's responsibility to insure that samples are logged in and all relevant sample information is recorded, as described in SOP TA-QA-0001.

4.2 It is the project manager's responsibility to insure that the job has been correctly logged in according to the client/project requirements.

4.3 It is the project manager's responsibility to insure that the client has been notified in a timely fashion of any non-conformances noted during login.

4.4 It is the analyst/peer reviewer's responsibility to insure that the analytical has been performed according to client/project requirements and that all appropriate raw data is included in the folder submitted for filing in the job main folder.

4.5 It is the project manager's responsibility to insure that any nonconformances noted during prep and/or analysis has been relayed to the client either prior to the release of data or in a narrative with the release of data, depending on the non-conformance.

4.6 It is the project manager's responsibility to insure the completeness of the final report and invoice.

5.0 REFERENCES / CROSS-REFERENCES

None

6.0 ATTACHMENTS

None

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7.0 REVISION HISTORY

Revision 14, dated 26 March 2010

- Integration for TestAmerica and STL operations

Revision 13, dated 19 April 2008

- Integration for TestAmerica and STL operations

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Title: Sample Documentation

Approvals

Signatures on File

Dave Wunderlich	Date	Kathy Kreps	Date
Quality Assurance Manager		Laboratory Director	

This SOP was previously identified as SOP No. 0032.9.

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1.0 PURPOSE

1.1 This SOP describes the recommendations and procedures for documentation to be completed for samples collected and submitted to the laboratory. Evidence of collection, shipment, and laboratory receipt and custody of samples until disposal should be documented, to create an accurate written record which can be used to trace the possession and handling of the samples.

1.2 Documentation of custody prior to laboratory receipt is best accomplished by means of a Chain-of-Custody Form that records each sample and the individuals responsible for sample collection, shipment, and receipt, and complete labels for each sample collected

2.0 SAFETY

2.1 There are no specific safety hazards associated with this SOP.

2.2 During the course of performing this procedure it may be necessary to go into laboratory areas to consult with appropriate staff members, therefore employees performing this procedure must be familiar with the Laboratory Health & Safety Plan, and take appropriate precautions and wear appropriate attire and safety glasses.

3.0 DEFINITIONS

3.1 Sample Custody: a sample is considered in custody if it is: in a person's actual possession, in view after being in a person's actual possession, in a secured area, or restricted to authorized personnel.

4.0 PROCEDURE

4.1 Field Chain of Custody (COC) Procedures. Each individual who has the samples in his or her possession shall sign the sample Chain-of-Custody record. The recommended Chain-of-Custody form preparation procedure is as follows:

- The person collecting the sample initiates the Chain-of-Custody record in the field. Every sample is assigned a unique identification that is entered on the Chain-of-Custody form;
- The record is completed in the field to indicate the project name and/or number, project leader, sample matrix, number of samples, analyses requested, date and time of sample collection, and any other information deemed necessary by the sample collector;
- If the person collecting the sample does not transport the samples to the laboratory or deliver the sample containers for shipment, the first block for Relinquished By_____, Received By_____, is completed in the field, including the dates and times relinquished and received;
- The person transporting the samples directly to the laboratory or delivering them for shipment, signs the record form as Relinquished By_____, including date and time relinquished;
- If a commercial carrier ships the samples to the laboratory, the signed Chain-of-Custody form is sealed in a watertight container and placed in the shipping container. The shipping container is sealed prior to giving it to the carrier. For samples shipped by commercial carrier, the waybill serves as an extension of the Chain-of-Custody record between relinquishment by the final field custodian and receipt in the laboratory; and,

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- The original Chain-of-Custody forms are maintained in the project files.
- Sample labels. It is recommended that every sample be labeled to identify:
  - Client name;
  - Site name;
  - Sampling date and time;
  - Sample identifier;
  - *Sample location or description*
  - Sample preservation method; and,
  - Analyses requested.
- Labels should be filled out using black, waterproof ink. Labels should be filled out before collection to minimize handling of the sample container. Labels must be firmly affixed to the sample containers and must match the documentation on the COC.

4.2 RECORDS MANAGEMENT/DOCUMENTATION

4.2.1 Individual samples must be clearly identified to be received at the laboratory. Sample field documentation should include a COC.

4.2.2 TestAmerica Seattle Chain of Custody Forms. TestAmerica Seattle has two Chain of Custody forms; copies of the forms are provided as attachments to this SOP. The sampler should use the form most appropriate for the samples being collected.

4.2.3 TestAmerica Seattle provides sample container labels for all clients.

4.2.4 Laboratory Tracking of Chain of Custody Documentation. The original Chain-of-Custody document is kept in the master folder, unless otherwise requested by the client; a copy of the Chain-of-Custody is provided to the client at the time samples are relinquished, and again with the final report. The Chain-of-Custody document is kept in the permanent data file, unless the sample is returned to the client. If samples are returned to the client, a copy of the Chain-of-Custody documents are relinquished with the samples. Once the sample has been destroyed, the original Chain-of-Custody documents may be returned to the client upon request; in this case, a copy is maintained in the laboratory archives.

5.0 REFERENCES / CROSS-REFERENCES

None

6.0 RESPONSIBILITIES

6.1 Sampler: It is the responsibility of the field sampler to complete the COC and sample labels.

6.2 Sample Receiving Personnel: It is the responsibility of the sample receiving personnel to provide to the client sample labels, and COC forms along with bottle orders, if requested by the client. Sample receiving personnel will sign and date the COC upon acceptance of samples.

6.3 Project Managers: It is the responsibility of Project Managers to provide a copy of the COC to the client, upon request, following sample destruction.

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7.0 ATTACHMENTS

Attachment 1: Example Chain-of-Custody
Attachment 2: Example Drinking Water Request for Laboratory Services

8.0 REVISION HISTORY

Revision 11, dated 31 March 2010
- Labeled Attachment 2
- Integration for TestAmerica Bothell and Tacoma operations.

Revision 10, dated 19 April 2008
- Integration for TestAmerica and STL operations.

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Attachment 1.

Example Chain-of-Custody

Chain of Custody Record

Temperature on Receipt _____

Drinking Water? Yes ☐ No ☐

TestAmerica
THE LEADER IN ENVIRONMENTAL TESTING

TAL-4124 (1007)

Client	Project Manager	Date	Chain of Custody Number 05178
Address	Telephone Number (Area Code)/Fax Number	Lab Number	Page _____ of
City / State / Zip Code	Site Contact	Lab Contact	Analysis (Attach list if more space is needed)
Project Name and Location (State)	Carrier/Waybill Number		
Contract/Purchase Order/Quote No.			Special Instructions/ Conditions of

Sample I.D. No. and Description (Containers for each sample may be combined on one line)	Date	Time	Matrix: Air	Aqueous	Sed.	Soil		Containers & Preservatives: Unpres.	H2SO4	HNO3	HCl	NaOH	NaOH+ZnAc	NaOH+											

Possible Hazard Identification
☐ Non-Hazard ☐ Flammable ☐ Skin Irritant ☐ Poison B ☐ Unknown

Sample Disposal
☐ Return To Client ☐ Disposal By Lab ☐ Archive For _____ Months (A fee may be assessed if samples are retained longer than 1 month)

Turn Around Time Required
☐ 24 Hours ☐ 48 Hours ☐ 7 Days ☐ 14 Days ☐ 21 Days ☐ Other_____

QC Requirements (Specify)

Relinquished By	Date	Time	Received By	Date	Time
1.			1.		
2.			2.		
3.			3.		

Comments

DISTRIBUTION: WHITE - Returned to Client with Report; CANARY - Stays with the Sample; PINK - Field Copy

Attachment 2.

Example Drinking Water Request for Laboratory Services

TestAmerica
Seattle
5755 - 8th Street East
Tacoma, WA 98424

Phone: 253.922.2310 Fax: 253.922.5047

Drinking Water
Request for Laboratory Services
TestAmerica Lab No. _____

Group A ☐ Copy of report will be sent to the WA State Department of Health
Group B ☐ Copy of report will be sent to your County Health Department

		Analyses Requested						
Company/System:		# of containers	Primary Inorganics	Complete Inorganics	Volatile Organics (VOCs)	Other	Other	Other
Contact:								
Address:								
City/State/Zip:								
Phone No.:								
Fax No.:								

Lab #	Sample ID	Date/Time							
1									
2									
3									
4									
5									
6									
7									
8									
9									
10									
11									
12									

	Printed Name	Signature	Date/Time	Special Instructions
Relinquished By				
Received By				
Relinquished By				
Received By				

Title: Quality Assurance Audit Procedures

Approvals

Signatures on File

Dave Wunderlich	Date	Kathy Kreps	Date
Quality Assurance Manager		Laboratory Director	

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1.0 PURPOSE

The laboratory must undergo periodic quality assurance audits to ensure that QA systems are in place, data is appropriately generated and reviewed, documentation is adequate, and method/Standard Operating Procedure (SOP) requirements are being met throughout the laboratory. The quality assurance audits are conducted at least once annually for each department in the laboratory

2.0 SAFETY

2.1 There are no specific safety hazards associated with this SOP.

2.2 During the course of performing this procedure it may be necessary to go into laboratory areas to consult with appropriate staff members, therefore employees performing this procedure must be familiar with the Laboratory Health & Safety Plan, and take appropriate precautions and wear appropriate attire and safety glasses.

3.0 PROCEDURE

3.1 The QA manager or qualified designee is responsible for submitting monthly metrics reports to the Corporate QA. These reports are specified by the corporate QA personnel and are used for tracking the quality systems. The monthly QA report is in Excel® and has several spreadsheets all of which are discussed below

3.1.1 Narrative: This sheet contains a narrative on several topics including key issues for each month, general QA concerns, corrective actions, audits, PT studies, SOPs, MDLs, client complaints and complements, holding time violations, status of certifications, and regulatory updates, and training.

3.1.2 Metrics: This sheet lists the metrics. Rows that are in yellow generally have a formula to calculate the value. Rows that are green near the bottom may vary and are typically new items that have been added to the metric by the corporate QA office.

3.1.2.1 Revised Reports. This is used to establish a percentage of revised reports due to Lab Error. Enter the total number of reports issued for the month and the number of revised reports due to lab error. The number of reports reviewed by QA is also entered. It is not the expectation that QA become involved in the lab data review process. However, if a large number of reports are revised it may be valuable to see how many reports are evaluated by QA as part of the internal audit or quality review processes. Include the number of reports that are reviewed during the normal course of QA activities. These reviews may be initiated or completed through the QA technical audits, internal investigations, data quality review requests by clients or validators, or if a QAPP requires QA review of a specific % of reports for a project.

3.1.2.2 Data Recalls. This is used to track the closure of data recall investigations.

3.1.2.3 Client Complaints and Compliments. This is used to track client complaints. The goal is to register at least 3 complaints per month. The concept being that barring unusual circumstances laboratories receive client complaints (opportunities for improvement) each month and < 3 complaints generally indicates that there is not a good tracking and/or corrective action mechanism established to handle complaints and improvement opportunities may be lost. Itemize any client compliments received by the

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lab. This is an opportunity to garner credit for positive feedback from your clients.

3.1.2.4 QA Technical Data Audits is used to track the authenticity audits performed on reports and raw data. Tracking of this metric will be based on methods however; analyst, instrument, mint miner and raw data reviews will be included in these evaluations. It is expected that 50% of the laboratory methods be audited during a year. Each lab is to prepare an audit schedule for each year using the 'Technical Data-Method Audit' tab. Labs may use a different tracking tool as long as the required information is included. If a different tool is used it should be appended to this spreadsheet for inclusion in the monthly report.

3.1.2.5 Internal Departmental Quality Systems Audits will be used in conjunction with the 'Internal Dept. Audit Summary' tab to schedule and track the quality systems audits of each lab department. A single comprehensive audit may be performed, in which case the scheduled date on the summary tab will be the same for each department. When this option is used, it is expected that the QA Manager will still perform an ancillary audit at least once per quarter. Department audits may also be scheduled throughout the year with the expectation that the entire lab is assessed by the end of 2009. A cumulative total for number of planned audits for the year will be tracked and the cumulative total for the entire year must be planned during January and entered and approved by your Quality Director. Row 17 will hold a cumulative total for the number of audits completed. At least one audit must be performed each quarter.

3.1.2.6 Audit Findings (internal and external combined) is the total number of audit findings and includes findings from both the QA Technical Data Audits, Internal Departmental Audits and External Audits. Enter the total findings noted for the calendar year. This section also tracks any audit findings that were opened in the previous year but are not yet closed. This metric provides information on the lab's corrective action closure system but is not scored.

3.1.2.7 Performance Testing is used to track the lab's average PT score for the calendar year. The goal is to maintain an average of 97%. Repeat PT failures are also tracked. The goal is to maintain fewer than 6 repeat failures over the last 4 studies for the same program (WP, WS, Soil are different programs). The concept is that repeat failures over the past 4 studies will be identified in an attempt to address problems before accreditations are affected. It is expected that corrective action reports will be initiated for PT failures, included in the lab's Corrective Action System.

3.1.2.8 Corrective Actions details the total number of corrective actions including CA reports generated from audit findings, PT failures and lab requested investigations into system or method failures. This metric is NOT related to routine NCMs or single point data reviews. (an example of a lab requested investigation: There is a bias in the TKN procedure and all results are biased low and are lower than Ammonia results). CAs that are not closed by their assigned due date are listed. The goal is that less than 15% of the Corrective Actions will be past due. Points will be pro-rated for values between 15-30% past due.

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3.1.2.9 The Standard Operating Procedures item is used to assess the laboratory's departmental ability to keep their SOPs current with the required regulatory review schedule. It is intended that during the SOP review/revision process, the laboratory departments ensure that the SOPs are compliant with both the method and current laboratory practice. In general SOPs must be reviewed or updated on at least a 24 month cycle. For DOD work or Drinking Water methods the requirement is a 12 month update/review cycle. The lab is to assess any SOPs that are past their required review cycle. The goal is to have 100% SOPs current.

3.1.2.10 The Ethics Training item is used to track the status of initial and annual Ethics training for all lab staff. The goal is always 100% being current based on new employees receiving comprehensive training from the Lab Directors within 90 days of their hire date.

3.1.2.11 The MDLs item is used to evaluate the laboratory's status for completion of MDLs and/or MDL Verifications. The goal is to have 100% MDLs current.

3.1.2.12 Training Documentation is used for the laboratory to estimate the current status of their training documentation. The ratings are Good (>90%), Fair (>70%), and Poor (<70%).

3.1.2.13 Holding Time Violation is used for tracking the number of monthly Holding Time violations due to lab error. Do not count pH or other Field tests (15 minute HTs). The formatting is based on the average monthly HTs reported during the previous year. The monthly average for the previous year must be calculated and entered for the formatting to show correctly. The goal is to have less than 1.5 times the 2008 monthly average.

3.1.2.14 The Certifications item is used to assess the lab's status for updating Total Access with accreditation information. This is currently used for information only. This includes tracking certifications (method/analyte) that have been lost due to lab performance issues (e.g. poor audit or PT performance). This is a cumulative value that increases over the entire year with a goal of zero.

3.1.2.15 Last NELAC Audit is the beginning date of your last NELAC audit. This metric is used for tracking of occurrences of NELAC audits and provide an estimate of when the next one will be scheduled for the lab.

3.1.2.16 The Quality Assurance Manual item is used to ensure that the Quality Assurance Manual is current based on the Effective Date.

3.1.2.17 Last Management Quality System Review. The Management staff at each laboratory is required to perform a Review of their Quality System in accordance with the 2003 NELAC standard and identify/assign action items for improvement.

3.1.3 Audits. There are several sheets devoted discussing audits including Technical Data-Method audits, internal department audits, and external audits. These sections discuss recent audits and the status of open items.

3.1.4 PT Score Summary. This details all PT studies that the laboratory has participated in for the year and the results of each study.

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3.1.5 Data Recall Summary. This discusses the nature and extent of data recall events as well as the schedule for completing report revisions.

3.2 *Performance Testing*

3.2.1 *At least two single-blind proficiency tests for hazardous waste, fuels, potable and non-potable water testing are conducted each year to satisfy L-A-B, national and state accreditation requirements. In addition, a special proficiency test for the Alaska fuel methods is conducted during the annual certification renewal window in December-February. The proficiency tests cover all of the parameters listed on the various scopes of accreditation for which performance test (PT) samples are commercially available. Scopes of accreditation to consider currently include NELAP and WDOE. Aqueous and solid matrices must be represented in these audits. The laboratory's annual schedule for proficiency testing studies is provided in Attachment 01, while Attachment 02 lists the methods/analytes for which PT studies are not currently available.*

Where accredited PT programs are not available, on-going proficiency must be demonstrated through commercially available or round robin (unaccredited) programs or internal performance and repeatability studies (see L-A-B Policy 002).

In the course of a year, the laboratory may also participate in proficiency studies arranged by clients or regulating agencies. These studies won't count towards the two mandatory studies identified above. Double-blind proficiency testing will be arranged when authorized by the laboratory director or company president.

The retesting of retained samples is scheduled semiannually and focuses on the most frequently requested methods.

3.2.2 *Single-blind proficiency or round robin studies are obtained from a vendor. Wibby, Environmental Resource Associates (ERA) and RTC are approved by most state agencies and are also L-A-B-approved and A2LA accredited. When ordering proficiency tests, it's advisable to order the samples as part of a complete study that encompasses as many of the analytes/methods as possible for which proficiency samples are available.*

Upon receipt of single-blind PTs (or round-robin samples), the samples are listed and the testing program is specified on a COC by the QA Manager or designee. The samples are logged into the LIMs by sample receiving or designee in the same manner as field samples. The supplier's instructions are copied and distributed to the appropriate departments.

PT samples are prepared and analyzed according to the testing program specified by QA at the time of log-in and the supplier's instructions. PT samples are to be handled in the same manner as environmental samples utilizing the same staff, equipment, facilities and frequency of analysis. It's expected that the quality control requirements and criteria identified in the method SOPs are achieved in the course of analyzing PT samples. Under no circumstances should the staff subcontract a PT sample, share PT results with another lab, analyze a PT sample more frequently or with special QC than would be afforded to a field sample, deviate from the PT sample preparation instructions by preparing a more concentrated sample (unless the PT falls below the range of laboratory's analytical method, see below), communicate with any individual at another lab concerning a PT sample or attempt to obtain the assigned value of any PT sample from the

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supplier prior to the time the results of the study are released.

When determining low level PT samples, the lab must follow their SOPs for the determination of low level samples. For instrumentation methods, a more sensitive technique such as SIM, High Volume or EPA 6020 could be selected. Concentration preparations or increasing the purge volume may be necessary. Whichever technique is selected, it must be fully validated.

PT results are reviewed by the primary analyst and the supervisor or peer analyst according to the data review procedures specified in SOP TA-QA-0635. When applicable, this review should include an assessment of the correlation of results for different parameters or different methods. Corrective action should be initiated if discrepancies are identified.

3.2.2.1 *The department supervisor shall ensure that all raw data associated with the PT samples is complete and accessible.*

3.2.2.2 *The QA Manager or designee reports PT or round robin results by the due date specified by the PT/Round Robin provider and according to the instructions provided by the supplier and the regulating agency.*

3.2.2.3 *When submitting results to a PT provider, direct the provider to supply final WP, RCRA and UST reports to ORELAP (NELAP accrediting authority) and final EPH/VPH and WS reports to WDOE.*

3.2.3 *Unacceptable results are documented by the QA Manager or designee on a corrective action report (CAR). They require a root cause investigation and corrective action as assigned by the QA Manager or designee and an accounting of those actions, which should also be documented in the CAR. Corrective action plans must also consider and be tailored to the specific program requirements for which they are intended. For the various programs applicable to this laboratory, the remedial action requirements of NELAC are the most stringent.*

3.2.3.1 *NELAC – The laboratory may elect to participate in supplemental PT studies when it fails a PT study and wishes to re-establish its history of successful performance. If the laboratory fails to maintain a record of passing two out of the most recent three PT studies, it may be subject to revocation of its accreditation for one or more fields of testing on its scope, unless it successfully participates in a supplemental PT study for demonstrating corrective action. These supplemental PT studies must be obtained from an L-A-B Approved and A2LA accredited supplier and have a ship date of at least fifteen calendar days from the closing date of the first study. When ordering a supplemental study, make sure the vendor understands that it's intended to demonstrate corrective action. The PT provider must supply the lab with a PT sample that was never previously sent to the lab and whose analytes of concern (namely the analytes that were evaluated as Not Acceptable in the previous study) are not assigned a zero value (with the exception of qualitative PCB and microbiology tests). Wibby's Rapid Return PT program was designed to meet these needs.*

A copy of the completed CAR must be promptly provided to L-A-B, ORELAP and WDOE

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3.2.4 *The laboratory is required to complete and maintain an up-to-date L-A-B Form 28.12 – PT/ILC Tracking Form when participating in an approved PT/ILC program. This schedule must be provided to L-A-B for review and approval.*

3.2.5 *For any proficiency test, interlaboratory comparison or roundrobin PT/ILC that doesn't utilize one of the L-A-B approved PT providers, the laboratory is required to complete and maintain an up-to-date L-A-B Form 28.14 – PT/ILC Application for Non PT Provider Schemes. This scheme must be provided to L-A-B for review and approval.*

3.3 The QA manager reviews nonconformance memoranda (NCM) that are generated within the TestAmerica LIMS (TALS). If reoccurring NCMs are noted for a method or procedure the QA manager will discuss this with the analyst, technical director and/or lab director to attempt to find an effective corrective action and prevent future NCMs.

3.4 A TestAmerica designee or the QA manager is responsible for conducting internal audits on technical operations throughout each laboratory department on an annual basis. The items addressed are covered in the corporate internal audit work instruction and workbook, CA-Q-WI-011. The audits are done using the checklists provided in the workbook. The QA manager typically prints out the checklist for the necessary section (i.e. if a metal analyst is being audited then the appropriate metal analysis checklist will be used) and asks questions from the checklist of the personnel. Not all items need to be asked.

3.5 All audits that are done under the DoD and NELAC are discussed with the Corporate QA Director and any requested information is made available

3.6 The QA manager has full access to the laboratory and can review items not discussed in this SOP if it is deemed appropriate (i.e. logbooks, data, observe a procedure).

4.0 REFERENCES / CROSS-REFERENCES

4.1 Department of Defense Quality Systems Manual for Environmental Laboratories, prepared by DoD Environmental Quality Workgroup, Final Version 4.1, April 22, 2009.

4.2 NELAC Standards, Chapter 1-6, June 5, 2003. EPA 600/R-04/003.

5.0 ATTACHMENTS

Attachment 01 – Annual PT Schedule
Attachment 02 - List of Method/Analytes Not Associated with a PT Study

6.0 REVISION HISTORY

Revision 9, dated 26 March 2010
- Updated Section 3.2 for the handling of PT samples.

Revision 8, dated 20 May 2009
- Updated Section 3.1 to reflect new metrics report requirements.

Revision 7, dated 19 April 2008
- Integration for TestAmerica and STL operations.
- Updated categories to correspond to the new version of the monthly QA report.

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ATTACHMENT 01

Proficiency Testing Audit Schedule*

First Quarter	Full WP Study Partial WS Study with Inorganics and EDB/DBCP Only Alaska UST Study Aqueous NELAP UST
Second Quarter	Full RCRA, TCLP, Full EHP & VPH and Soil NELAP UST
Third Quarter	Full WP Study Partial WS Study with Inorganics and EDB/DBCP Only Aqueous NELAP UST
Fourth Quarter	Full RCRA, TCLP, Full EHP & VPH and Soil NELAP UST

*Subject to change

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ATTACHMENT 02

List of Method/Analytes Not Associated with a PT Study *

Semivolatiles - 8270	Semivolatiles - 8270	Metals
1,4-Dioxane	1,3,5-Trinitrobenzene	6020 Gold
Acetophenone	0,0,0-Triethyl phosphorothioate	6020 Lithium
2-Acetylaminofluorene		6020 Uranium
4-Aminobiphenyl		
Aramite	Semivolatiles – 8081A/8082/8151A	Conventionals
Chlorobenzilate	Perthane	4500-CN I Cyanide, weak acid dissociable
Diallate	Bromoxynil	2520 Salinity
Dimethylaminoazobenzene	Congeners	
3,3'-Dimethylbenzidine		
a,a-Dimethylphenethylamine		
Dimethoate		
7,12-Dimethylbenz(a)anthracene		
1,3-Dinitrobenzene	Volatiles - 8260	Waste Characterization
Diphenylamaine	Chloroprene	1312/6000/7000/8000 SPLP
Ethyl methacrylate	3-Choropropene	
Ethyl methanesulfonate	Ethanol	
Famphur	Ethyl acetate	
Hexachlorophene	Ethyl methacrylate	
Hexachloropropene	Iodomethane	
Isodrin	Isobutyl alcohol	
Isosafrole	Methyl methacrylate	
Kepone	Methacrylonitrile	
Methapyrilene	Methcyclopentane	
3-Methylcholanthrene	2-Methylpentane	
Methyl methanesulfonate	3-Methylpentane	
1,4-Naphthoquinone	Propionitrile	
1-Naphthylamine	tert-butyl alcohol	
2-Naphthylamine	trans-1,4-dichloro-2-butene	
N-Nitrosodibutylamine	1,1,2-1,2,2-Trifluoroethane	
N-Nitrosomethylethylamine		
N-Nitrosomorpholine		
N-Nitrosopyrrolidine		
N-Nitrosopiperidine		
5-Nitro-o-toluidine		
4-Nitroquinoline-1-oxide		
Pentachloroethane		
Pentachloronitrobenzene		
Phenacetin		
1,4-Phenylenediamine		
2-Picoline		
Safrole		
Thionazin		
1,3,5-Trichlorobenzene		**Subject to change*

Title: QA Review of Data Reports

Approvals (Signature/Date):

SIGNATURES ON FILE

Dave Wunderlich Date	Kathy Kreps Date
Quality Assurance Manager	Laboratory Director

This SOP was previously identified as SOP No. 0606.7.

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1.0 PURPOSE

This Standard Operating Procedure (SOP) describes the procedures used for reviewing the quality assurance elements of the data reports produced by the laboratory.

2.0 SAFETY

3.1 There are no specific safety hazards associated with this SOP.

3.2 During the course of performing this procedure it may be necessary to go into laboratory areas to consult with appropriate staff members, therefore employees performing this procedure must be familiar with the Laboratory Health & Safety Plan, and take appropriate precautions and wear appropriate attire and safety glasses.

3.0 DEFINITIONS

The quality control terms used in this procedure are consistent with SW-846 terminology. Definitions are provided in the glossary of the TestAmerica Tacoma Quality Assurance Manual (QAM).

4.0 PROCEDURE

4.1 The Chain-of-Custody (COC) and any client contacts are reviewed and compared to the pricing tab in login to ensure the analyses and methods correspond to the client's request. A client contact form should be included in the permanent file for any deviations from the COC request. The date received, client name, and sample identification(s) and matrices are compared to the COC and client contact(s) for accuracy.

4.2 The data package is reviewed to ensure that the required analyses are present with the correct methods employed.

4.3 The data is reviewed and the following sample-specific and QA-specific criteria are evaluated:

4.3.1 Project Initiation

4.3.1.1 Non-routine technical/QC specifications (Quality Assurance Project Plans / Sampling Analysis Plans).

4.3.1.1.1 Check that these requirements were reviewed and approved by appropriate personnel within the laboratory and that any discrepancies between the project requirements and the laboratory's ability to meet those requirements have been resolved in writing.

4.3.1.2 Verify that sample receipt and associated COC are properly documented.

4.3.1.3 Instances of compromised sample receipt have been noted and that there is documentation of client contact required in resolving issues of compromised sample receipt or discrepancies.

4.3.1.4 Verify that samples were logged in according to the instructions on the chain of custody.

4.3.1.5 Verify that project specific requirements were communicated to the laboratory analysts.

4.3.2 Technical Review

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4.3.2.1 Verify that samples were analyzed within holding time. Client should be contacted for instructions and appropriate corrective action initiated and documented if holding time not met.

4.3.2.2 Verify acceptability of QC samples (MB, BS, MS/MSD/MD) run. The appropriate frequency and control limits were met. Were any approvals or corrective actions documented if control limits not met and client informed of any significant non-conformance?

4.3.2.3 Sample analysis

4.3.2.3.1 Target analytes reported accurately and within calibration range.

4.3.2.3.2 All manual integrations indicated with a data flag in the raw data and authorized with the signature/initials and date by the primary analyst.

4.3.2.3.3 Samples were run at appropriate dilutions and reporting limits are adjusted for any dilution and sample preparation.

4.3.2.3.4 If multiple dilutions or analyses are reported, do the results of these agree?

4.3.2.3.5 Reporting units clearly identified and appropriate to the sample matrix.

4.3.2.3.6 Results are reported to the correct number of significant figures.

4.3.2.3.7 Are data flags properly applied?

4.3.2.3.8 Check to see if results of associated parameters (i.e., dissolved metals vs. total metals, BOD/COD, etc.) make sense.

4.3.2.3.9 Project specific requirements were followed.

4.3.3 Completeness Review/Reporting

4.3.3.1 Project reported within the quoted Turnaround Time. If not, was the client contacted to apprise them of the delay?

4.3.3.2 The project job has been final reviewed by a PM or an appropriate PM representative.

4.3.3.3 The appropriate deliverables were included in the project report.

4.3.3.4 A project narrative was written to include all significant non-conformances.

4.3.3.5 The appropriate EDD was reported (if required).

4.4 The data deliverables are reviewed for compliance with the established drinking water, Tier I through Tier V, Army Corps of Engineers, Navy, or client specific deliverable requirements.

4.5 *A minimum of 10% of all DOD packages are reviewed for technical completeness and accuracy by the quality assurance manager or designee. Twice a month, the QA manager or designee will use the following procedure to queue every tenth DOD package for review:*

4.5.1 *Locate the DOD Package Review folder and identify the last DOD package reviewed as indicated on the Reviewed list.*

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4.5.2 *In TALS, under Customer Service Management, select Management Reports and then Invoice Reports.*

4.5.3 *Select an appropriate date range that begins on the Invoice Date of the last DOD package reviewed (4.5.1) and extends to the current day.*

4.5.4 *In this table, use the filter on Project Category to isolate records for Federal DOD.*

4.5.5 *While on this filtered table, use a right-mouse click and select PDF Reports and Global Invoice Summary. Determine if at least ten DOD jobs have been completed since the last package reviewed. If so, proceed to step 4.5.6. If not, re-evaluate in two weeks. In either case, print the summary and save it in the DOD Package Review folder.*

4.5.6 *Counting from the last package reviewed, determine if the tenth job listed in the Global Invoice Summary required a Level IV deliverable. If so, review that package using a checklist like the example provided in Attachment 1. If not, evaluate the deliverable requirements for the next job and so on in the list until one is identified that required a Level IV deliverable. Review that package using a checklist like the example provided in Attachment 1.*

4.5.7 *After the review is complete, add the job number to the Reviewed list.*

This review is part of the QA program and does not need to be completed before the data package is issued to the client.

5.0 RESPONSIBILITIES

6.0 REFERENCES / CROSS-REFERENCES

Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, 3rd Edition, Chapter One, Section 2.7.4.2

7.0 ATTACHMENTS

Attachment 1: QA Report Review Checklist

8.0 REVISION HISTORY

Revision 9, dated 04 January 2010
- Added DOD QSM grey box 44 review requirements and procedures in section 4.5

Revision 8, dated 19 April 2008
- Integration for TestAmerica and STL operations.

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Attachment 1. QA Report Review Checklist

TestAmerica Job Number:_____ Date:_____

Auditor:_____

Project Initiation	Y/N/NA	Comments
Are there non-routine technical/QC specifications (QAPPs/SAPs) associated with the project?		
If Yes, were project specific requirements reviewed and approved by appropriate personnel within the laboratory?		
If Yes, were any discrepancies between the project requirements and the laboratory's ability to meet those requirements resolved in writing?		
Was sample receipt and associated chain of custody properly documented?		
Were all instances of compromised sample receipt noted?		
Is there documentation of client contact required to resolve issues of compromised sample receipt or discrepancies?		
Were the samples logged in according to the instructions on the chain of custody?		
Were project specific requirements communicated to the laboratory analysts in a clear, systematic manner?		

Technical Review	Y/N/NA	Comments
Were the samples analyzed within holding time?		
If not, was the client contacted for instructions and appropriate corrective action initiated and documented?		
Were QC samples (Method Blank, LCS, MS/MSD/MD) run at the appropriate frequency?		
Were laboratory QC samples within control limits?		
If not, was appropriate action taken (either documented approval or corrective action)?		
Were all non-conformances documented?		
Was the client contacted to inform them of **significant** non-conformances in a timely manner?		
Are target analytes reported accurately and within calibration range?		
Are manual integrations indicated with a data flag in the raw data and authorized with the signature/initials and date by the primary analyst?		
Spot check manual integrations.		
Were samples run at appropriate dilutions?		
If multiple dilutions or analyses are reported, do the results of these agree?		
Are the reporting limits adjusted for dilutions and sample preparation?		
Are reporting units clearly identified and appropriate to the sample matrix?		
Are results reported to the correct number of significant figures?		
Were data flags properly applied?		
Do the results of associated parameters (i.e. dissolved metals vs. total metals, BOD/COD, etc.) make sense?		
Were all project specific requirements followed?		

Completeness Review/Reporting	Y/N/NA	Comments
Was the project reported within the quoted Turnaround Time?		
If not, was the client contacted to appraise them of the delay?		
Was the project report paginated?		
Was the project report authorized by an appropriate signatory?		
Were the appropriate deliverables included in the project report?		
Was a project narrative written to include all significant non-conformances?		
Is there documentation that an appropriate EDD was reported (if required)?		

Any other Comments/Issues Noted:

Title: Total Organic Carbon in Solids
[Method Nos. SW 9060, 9060A, SM 5310B, PSEP-TOC]

Approvals (Signature/Date):

SIGNITURES ON FILE

Anthony Ocana Date Wet Chemistry Department Manager	Stan Palmquist Date Health & Safety Manager
Dave Wunderlich Date Quality Assurance Manager	Kathy Kreps Date Laboratory Director

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1.0 Scope and Application

1.1 This SOP describes the procedure for analysis of organic carbon in solid matrices.

1.2 The reporting limit (RL) is 2000 mg/kg.

1.3 On occasion clients may request modifications to this SOP. These modifications are handled following the procedures outlined in Section 13.3.1 in the Quality Assurance Manual.

2.0 Summary of Method

Liquid or prepared solid samples are introduced into the carbonaceous analyzer. The organic carbon is measured by conversion to carbon dioxide after the inorganic component has been removed by the addition of phosphoric acid. An infrared detector then directly measures the carbon dioxide formed; total organic carbon is calculated as the difference between the total carbon result and the total inorganic carbon result.

3.0 Definitions

Total Organic Carbon (TOC): The carbon measured as a result of combustion of the sample after the removal of inorganic carbon.

4.0 Interferences

4.1 This procedure is applicable to samples that can be thoroughly homogenized into a fine powder.

4.2 Oily samples will cause erratic results. This is minimized by homogenization of the sample.

4.3 Hydrochloric acid must not be used with this system.

5.0 Safety

Employees must abide by the policies and procedures in the Corporate Safety Manual and this document.

This procedure may involve hazardous material, operations and equipment. This SOP does not purport to address all of the safety problems associated with its use. It is the responsibility of the user of the method to follow appropriate safety, waste disposal and health practices under the assumption that all samples and reagents are potentially hazardous. Safety glasses, gloves, lab coats and closed-toe, nonabsorbent shoes are a minimum.

5.1 Specific Safety Concerns or Requirements

The furnace and combustion cups are very hot and can cause severe burns if touched.

5.2 Primary Materials Used

The following is a list of the materials used in this method, which have a serious or significant hazard rating. **Note: This list does not include all materials used in the method. The table contains a summary of the primary hazards listed in the MSDS for each of the materials listed in the table.** A complete list of materials used in the method can be found in the reagents and materials section. Employees must review the information in the MSDS for each material before using it for the first time or when there are major changes to the MSDS.

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Material (1)	Hazards	Exposure Limit (2)	Signs and symptoms of exposure
Phosphoric Acid, 85%	Corrosive	1 mg/m^3-TWA; 3 mg/m^3-STEL	Phosphoric acid causes burns by all exposure routes. May cause irreversible eye injury. Contact with liquid is corrosive and causes server burns and ulceration.
1 – Always add acid to water to prevent violent reactions. 2 – Exposure limit refers to the OSHA regulatory exposure limit.			

6.0 Equipment and Supplies

6.1 Instrumentation

- OI Analytical TOC Analyzer Model 1020A
- OI Analytical Solids Module

6.2 Supplies

- Analytical balance, ± 0.0001 g accuracy
- Combustion cups
- Syringes, 25 uL, 100 uL, and 1000 uL
- Volumetric flask, 100 mL
- Mortar and pestle

7.0 Reagents and Standards

7.1 *Document reagent/standards and reagent/standard preparation in TALS using the reagent module as described in TA-QA-0619.*

7.2 ASTM Type II reagent water.

7.3 Phosphoric, 5%. Add 5.9 ml of 85% H_3PO_4 to 100 mL of Type II water.

7.4 Sucrose standard, 30% Carbon.

7.4.1 Dissolve 71.25 g sucrose in 100 mL of Type II water.

7.5 Certified Reference Material (CRM) TOC QC standard, from ERA or equivalent.

7.6 Second Source Standards

7.6.1 Prepared 30% sucrose standard from OI or equivalent.

7.6.2 Solids: NIST traceable solid standard, Buffalo River Sediment may be used for solid batches.

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7.7 *Managers/supervisors or a designee are expected to check their areas on a monthly basis for expired standards and dispose of them according to TA-EHS-0036*.

8.0 Sample Collection, Preservation, Shipment and Storage

Listed below are the holding time and the reference that include preservation requirements.

Matrix	Sample Container	Min. Sample Size	Preservation	Holding Time	Reference
Soils	Glass	3 grams	Cool 0-6°C	28 Days; Sediments may be frozen for up to 6 months.	N/A

9.0 Quality Control

9.1 The minimum quality controls (QC), acceptance criteria, and corrective actions are described in this section. When processing samples in the laboratory, use the LIMS special instructions to determine specific QC requirements that apply.

9.1.1 The laboratory's standard QC requirements, the process of establishing control limits, and the use of control charts are described more completely in SOP TA-QA-0620, Quality Control Program.

9.1.2 Project-specific requirements can override the requirements presented in this section when there is a written agreement between the laboratory and the client, and the source of those requirements should be described in the project documents. Project-specific requirements are communicated to the analyst via special instructions in the LIMS.

9.1.3 Any QC result that fails to meet control criteria must be documented in a Nonconformance Memo (NCM). The NCM is approved by the supervisor and then automatically sent to the laboratory Project Manager by e-mail so that the client can be notified as appropriate. The QA group also receives NCMs by e-mail for tracking and trending purposes. The NCM process is described in more detail in SOP TA-QA-0610. This is in addition to the corrective actions described in the following sections.

9.2 Batch Definition

A batch is a group of no greater than 10 samples excluding QC samples (Method Blank, LCS, and MS), which are processed similarly, with respect to the procedure. All samples within the batch must be treated with the same lots of reagents and the same processes.

9.3 Method Blank (MB)

One method blank (MB) must be processed with each batch. The method blank consists of a solid blank matrix containing all reagents specific to the method that is carried through the entire analytical procedure, including preparation and analysis. The method blank is used to identify any system and process interferences or contamination of the analytical system that may lead to the reporting of elevated analyte concentrations or false positive data.

Acceptance Criteria: The method blank should not contain any analyte of interest at or above the reporting limit.

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Corrective Action: If the analyte level in the method blank exceeds the reporting limit for the analytes of interest in the sample, all associated samples are re-prepared and reanalyzed. If this is not possible due to limited sample quantity or other considerations, the corresponding sample data must be taken in consultation with the client and must be addressed in the project narrative.

If there is no analyte greater than the RL in the samples associated with an unacceptable method blank, the data may be reported with qualifiers. Such action must be taken in consultation with the client and must be addressed in the project narrative.

If all samples associated with a blank greater than the RL are greater than 10 times the blank value, the samples may be reported with an NCM to qualify the high blank value.

9.4 Laboratory Control Sample (LCS)

One LCS must be processed with each batch. The LCS is used to monitor the accuracy of the analytical process. On-going monitoring of the LCS results provides evidence that the laboratory is performing the method within acceptable accuracy and precision guidelines.

The LCS for TOC in soils is performed by analyzing a 0.05 g aliquot of an ERA CRM (see Section 7.4).

Acceptance Criteria: The LCS recovery must fall within the control limits certified by the vendor. The control limits are maintained in the LIMS.

Corrective Action: If any analyte is outside established control limits, the system is out of control, and corrective action must occur. Corrective action will be re-preparation and reanalysis of the batch unless the client agrees that other corrective action is acceptable.

9.5 Matrix Spike (MS) Samples

One MS must be processed for each batch. A matrix spike (MS) is a field sample to which known concentrations of target analytes have been added. Some client specific data quality objectives (DQOs) may require the use of sample duplicates in place of or in addition to an MS. The MS results are used to determine the effect of a matrix on the accuracy of the analytical process. Due to the potential variability of the matrix of each sample, these results may have immediate bearing only on the specific sample spiked.

The MS is prepared by placing 0.05 g of the soil sample to be spiked into a quartz combustion cup and adding 50 µL of sucrose (2% carbon). These are mixed and combusted as a sample with the weight of the soil (0.05g) used as the sample weight in the sample table.

Acceptance Criteria: The recovery of the analyte in the MS must fall within ±20% of the true value.

Corrective Action: If the analyte recovery falls outside the acceptance range, the recovery of that analyte must be in control for the LCS. If the recovery of the LCS is outside limits, corrective action must be taken. Corrective action will include re-preparation and reanalysis of the batch.

If an MS is not possible due to limited sample volume then a laboratory control sample duplicate (LCSD) should be analyzed.

9.6 Duplicate Sample Analysis

A duplicate pair is required with each analytical batch and must be within 50% RPD. Note that the control limits only apply to samples with results greater than 5 times the RL. The process of establishing control limits is described in more detail in the QC SOP TA-QA-0620.

Corrective Action: If the RPD is greater than 50% the sample should be reanalyzed if within holding time and sufficient sample is remaining.

Note: Samples analyzed under the PSEP protocol require one sample per batch of 20 to be analyzed in triplicate.

Note: Samples analyzed for the USACE require analysis in quadruplicate.

9.7 **Instrument QC**

9.8 Calibration Acceptance Summary

The instrument calibration is verified each day prior to sample and method blank analysis; a single combustion of the appropriate standard must yield results within 20% of the true value in order to proceed.

9.9 Initial Calibration Verification (ICV)

The ICV standard is analyzed immediately following the ICAL. The ICV is a second-source sucrose standard with a true value of 30% carbon. The analyte recovery must fall within the 80-120% range. If it is outside the acceptance limits, check the equipment and standards, correct any problems, and then recalibrate.

9.10 Continuing Calibration Verification (CCV)

The calibration is checked at the beginning of an analytical sequence (ICV), after every ten samples (CCV), and at the end of the sequence (CCV) by measuring a CCV standard.

The CCV is sucrose with a true value of 2% carbon.

The CCV recovery must be within the 80-120% range. If it is outside the acceptance limits, check the equipment and standards, correct any problems, recalibrate, and rerun all samples analyzed since the last successful CCV.

9.11 Initial and Continuing Calibration Blank (ICB and CCB)

System cleanliness is checked at the beginning of an analytical sequence, after every ten samples (CCB), and at the end of the sequence (CCB) by analyzing a blank.

The CCB for the automated method is a solid sample matrix.

Results must be less than the reporting limit. If the blank result is greater than the reporting limit, check for carry-over from high level samples, clean the system, recalibrate, and rerun all samples analyzed since the last successful CCB.

9.12 *Any extra QC that is analyzed in batch or sequence must be evaluated using the same criteria as the corresponding QA above.*

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10.0 Procedure

10.1 Sample Preparation

10.1.1 *Check the Balance Logbook to determine if the daily calibration check was completed. If the balance requires a check, verify the calibration as detailed in TA-QA-0014.*

10.1.2 Dry the sample to constant weight at 70°F ± 2°F.

10.1.3 Using a mortar and pestle, grind the sample to a very fine powder.

10.1.4 Tare a clean combustion cup approximately half full of quartz wool and weigh a representative aliquot of the prepared sample (typically 45-55 mg) into it.

10.1.5 Determine the weight to the nearest 0.1 mg and record in the TOC logbook.

10.1.6 Slowly add approximately 100-uL of 5% H_3PO_4 to remove inorganic carbon (continue adding acid until there is no further effervescence) from the sample.

10.2 Calibration

10.2.1 An initial calibration is performed annually, or as needed, based on instrument performance and maintenance.

10.2.2 Calibrate the instrument at five levels including a blank and standard concentrations of 0.5 mg/L, 1.0 mg/L, 2.0 mg/L, and 5.0 mg/L. Calibration is performed by placing sucrose on a quartz wool pad in a combustion cup

10.2.3 Construct a calibration curve using least-squares linear regression.

Acceptance Criteria:	The absolute value of the correlation coefficient (r) must be 0.995 or greater.
Corrective Action:	If the correlation coefficient is less than the acceptance limit, recheck instrument conditions and calibration standards. Samples cannot be analyzed until the initial calibration is successful.

10.3 Sample Analysis

10.3.1 The components of the TOC system must be started in the proper order or they will not function correctly. First turn on the OI 1020A, then the OI Solids Module (the OI Solids Module will load the firmware from the internal floppy drive in the OI 1020A, so make sure the OI Solids Module disc is inserted in the drive before turning on either instrument). After the OI Solids Module has loaded the firmware, the OI 1020A will beep three times and the WinTOC Solids software may then be started. Allow the instrument to warm up until the furnace temperature is 900 degrees F and the baseline has stabilized.

10.3.2 To create a new sequence, click on the “Setup” drop down menu, and then on the “WinTOC Output” submenu. On the WinTOC Output screen, change the Subdirectory and Run log fields to the current date and click “OK” to return to the main screen. Click on the “Databases” drop down menu, and then the “Sequences” submenu. On the Sequences screen, enter the sample name, the number of reps, the approximate mass of the sample and method to be used for analysis in the appropriate fields for every sample. Once the sequence has been completed, save it under the current date and click “OK” to return to the main screen. Click “Start” to begin analysis.

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Note: All QC samples are run with one replicate and all other samples with two replicates unless otherwise specified (see notes in Section 9.6).

10.3.3 Place the first prepared sample on the sampling rod and when prompted enter the actual sample weight in mg. The OI Solids Module will cool the furnace to 250° F and initiate the first burn to complete the removal of inorganic carbon from the sample. It is possible to lose POC at this step, but the loss is considered to be minimal. After thirty seconds, the sample is dropped out of the furnace and the furnace temperature is raised to 900°F. Once the temperature has stabilized, the OI Solids Module will initiate the final burn and complete the analysis. Remove the combustion cup from the sampling rod and cool in the sample rack and proceed with the next sample when prompted by the software.

10.3.4 Unless in response to specific project requirements, all instrument and batch QC is run with one replicate, all analytical samples with two replicates. For the QC sample, the sample duplicate and triplicate are substituted for the two replicates.

Note: The instrument measures mg C and reports in %C. Always evaluate whether or not a sample falls within the calibration range based on the mg C (0.5-5 mg C), not the %C.

10.4 Standards and samples are measured in the following sequence:

ICV
CCB
CCV
MB
LCS
QC sample
QC duplicate
QC triplicate
QC ms
4 samples
CCB
CCV
10 samples
CCB
CCV

11.0 Calculations / Data Reduction

11.1 Accuracy

ICV / CCV, LCS % Recovery = $\frac{\text{observed concentration}}{\text{known concentration}} \times 100$

MS % Recovery = $\frac{\text{(spiked sample) - (unspiked sample)}}{\text{spiked concentration}} \times 100$

11.2 Precision (RPD)

Matrix Duplicate (MD) = $\frac{|\text{orig. sample value - dup. sample value}|}{[(\text{orig. sample value + dup. sample value})/2]} \times 100$

11.3 **Concentration** = mg/kg = Instrument reading (in %C) * 10,000

12.0 Method Performance

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12.1 Method Detection Limit Study (MDL)

The method detection limit (MDL) is the lowest concentration that can be detected for a given analytical method and sample matrix with 99% confidence that the analyte is present. The MDL is determined according to the laboratory's MDL procedure (see SOP TA-QA-0602). MDLs reflect a calculated (statistical) value determined under ideal laboratory conditions in a clean matrix, and may not be achievable in all environmental matrices. The laboratory maintains MDL studies for analyses performed; these are verified at least annually unless method requirements require a greater frequency.

12.2 Demonstration of Capabilities

Analyst initial and continuing Demonstrations of Capability (DOC) are performed before any client samples are analyzed and are updated annually. See SOP TA-QA-0617 for details.

12.3 Training Requirements

See SOP TA-QA-0608 for detailed training requirements.

13.0 Pollution Control

It is TestAmerica's policy to evaluate each method and look for opportunities to minimize waste generated (i.e., examine recycling options, ordering chemicals based on quantity needed, preparation of reagents based on anticipated usage and reagent stability).

14.0 Waste Management

Waste management practices are conducted consistent with all applicable rules and regulations. Excess reagents, samples and method process wastes are disposed of in an accepted manner. Waste description rules and land disposal restrictions are followed. Waste disposal procedures are incorporated by reference to Waste Disposal SOP TA-EHS-0036.

14.1 Waste Streams Produced by the Method

14.1.1 There are no waste streams produced when this method is carried out.

15.0 References / Cross-References

15.1 Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition and all promulgated updates, U.S. Environmental Protection Agency, Office of Solid Waste and Emergency Response, Method 9060.

15.2 Puget Sound Estuary Protocols, Conventional Sediment Variables, Total Organic Carbon, March 1986.

15.3 Standard Methods for the Examination of Water and Wastewater, 20th Edition; Clesceri, L.S.; Greenberg, A.E.; Eaton, A.D.; Editors; American Public Health Association, American Water Works Association, and Water Environment Federation, Method 5310B, 1998.

16.0 Method Modifications:

Item	Method	Modification
1	PSEP CSV TOC	Phosphoric acid is used to remove carbonates (Puget Sound Estuary Protocol calls for hydrochloric acid); TestAmerica Tacoma uses H_3PO_4 due to instrument incompatibility.
2	9060/9060A	Method 9060 requires analysis in quadruplicate. TestAmerica Tacoma performs the analysis in duplicate. For samples analyzed under PSEP, one sample per batch is analyzed in triplicate.

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17.0 Attachments

Attachment 1: Sample Prep Log Sheet

18.0 Changes from last version

- Revision 12, dated 12 November, 2009
  - Added documentation of standards/reagents and standard/reagent preparation Section 7.1
  - Added removal of expired standards Section 7.7.
  - Added criteria for additional QC, Section 9.12.
  - Added daily balance check to Section 10.1.
  - Integration for TestAmerica Bothell and TestAmerica Tacoma operations.

- Revision 11, dated 26 May 2009
  - Added units to the spike volume for the LCS in Section 9.5.

- Revision 10, dated 13 May 2008
  - Integration for TestAmerica and STL operations.

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Attachment 1.
Sample Prep Log Sheet

Sample Prep Log Sheet - 2/26/2004

Total Organic Carbon Analysis by USEPA Method 9060

QCBatch ID	TOC1142		
Sample Matrix	solid		
TOC MS Spike No.	toc17-12-6	Weighed By/Date	
		Extracted By/Date	
Extraction Date	2/24/2004		
		Spike Witness Signature/Date	

QC Sample Type	QC Identifier	Sample Weight (g)	MS/BS spike amt (ul)
Method Blank	TOC1142	0.0150	
Duplicate	none		
Duplicate-2	none		
Matrix Spike	119473s1	0.0132	300
Matrix Spike Duplicate	119473d1	0.0132	300
Matrix Spike-2	none		
Matrix Spike Duplicate-2	none		

Sample	Client Sample ID	Sample Weight (g)
119473-1		0.0117
119473-2		0.0132
119473-3		0.0137

ATTACHMENT 5

Field Laboratory
Standard Operating Procedures

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AK102	Alaska Method determination of DRO
AK103	Alaska Method determination RRO
ASE	accelerated solvent extractor
CVS	Calibration Verification Standard
DCS	diesel calibration standard
DE	Diatomaceous Earth
DRO	diesel range organics
FID	flame-ionization detector
GC	gas chromatographic or gas chromatograph
ICAL	initial calibration
LCS	laboratory control sample
LFB	laboratory-fortified blank
MDL	method detection limit
mg/kg	milligrams per kilogram
mg/L	milligram per liter
mL	microliter
MSDS	Material Safety Data Sheet
NOM	naturally occurring materials
OTP	ortho-terphenyl
PQLS	practical quantitation limits
psi	pounds per square inch
QC	quality control
RCS	residual calibration standard
RRO	residual range organics (motor oil range)
RSD	relative standard deviation
RTW	retention time window
SOP	Standard Operation Procedure
VOA	volatile organic analysis

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1.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the procedures for determining the concentration of diesel range organics and residual range organics (DRO/RRO) in soil using methodology developed by the Alaska Department of Environmental Conservation (ADEC), and described in the *Underground Storage Tank Procedures Manual* (ADEC, 2002).

1.1 OBJECTIVES

The objectives in the use of this method are to accurately determine the concentrations of diesel and residual range organics in soil.

1.1.1 Scope of Method

These methods are designed to measure the concentration of DRO and RRO in soil. DRO is determined by method AK102, and RRO is determined by method AK103. The diesel range corresponds to an n-Alkane range from the beginning of C_{10} to the beginning of C_{25}, and a boiling point range of approximately 170 degrees Celsius (°C) to 400 °C. An n-Alkane is a chemical compound that consists of only hydrogen and carbon, linked in a single bond in a straight chain. The residual range corresponds to an n-alkane range from the beginning of C_{25} to the end of $C_{36,}$ and a boiling range of 400 °C to 500 °C. Both methods are performed sequentially on a single sample extract, and a single analytical run on a gas chromatograph. The methods differ in the range of quantitation, based on the elution of n-alkanes on the gas chromatographic (GC) column.

1.1.2 Practical Quantitation Limits

The practical quantitation limits (PQLs) for these methods have been adjusted to reflect site-specific cleanup levels. The PQLs for DRO and RRO have been elevated to approximately 500 milligrams per kilogram (mg/kg).

1.1.3 Dynamic Range

The dynamic range for method AK 102 is 500 milligrams per liter (mg/L) to 25,000 mg/L. The dynamic range for method AK 103 is 500 mg/L to 25,000 mg/L. The dynamic ranges reflect the concentration of target analytes in the sample extract. Dilutions may be performed as necessary to put the chromatographic envelope (sample extract concentration) within the linear range of the method. The determination of soil concentrations is based on the sample weight and the percent moisture in the sample (Sections 9.12.1 and 9.12.2).

2.0 METHOD SUMMARY

2.1 METHOD PROCEDURE

This method provides GC conditions for the detection of semivolatile petroleum products, such as diesel and motor oil. Other non-petroleum compounds with similar characteristics and boiling points may also be detected with this method.

Samples are extracted from approximately 20 grams of soil using methylene chloride as the solvent. A surrogate mixture of known concentration is spiked into all field and quality control (QC) samples to evaluate the efficiency of the extraction process. An aliquot (2 micro liters [µL]) of the extract is injected into a gas chromatograph equipped with a capillary column and a flame ionization detector (FID). The GC is temperature programmed to facilitate separation of organic compounds.

2.1.1 DRO Range

Quantitation of DRO is performed by comparing the total chromatographic area between and including the peak start of C_{10} to the peak start of C_{25}, including both resolved and unresolved compounds, based on the FID response compared to a diesel calibration standard. Integration is performed using forced baseline-baseline integration.

2.1.2 RRO Range

Quantitation of RRO is performed by comparing the total chromatographic area between and including the peak start of C_{25} to the peak end of C_{36}, including both resolved and unresolved components. Integration is performed using forced baseline-baseline integration.

2.2 METHOD DEVELOPMENT

This method was developed by the ADEC and is based, in part, on a modification of the American Petroleum Institute consensus “Method for the Determination of Diesel Range Organics,” Revision 2, 2/5/92, supplemented with information gathered by the State of Alaska, Department of Environmental Conservation, State Chemistry Laboratory, with support from the Storage Tank Program. It is also based in part on EPA Methods 8000 and 8100, SW – 846, *Test Methods for Evaluating Solid Waste, Physical/Chemical Methods* [1], adopted by reference in Title 18 Alaska Administrative Code, Chapter 78.090(i) [18 AAC

78.090(i)], Method OA-2 [2] and work by the EPA Total Petroleum Hydrocarbons Method Committee [3], and the State of Oregon, "Total Petroleum Hydrocarbon Methods" QAR 340-122-350, dated December 11, 1990.

3.0 DEFINITIONS

3.1 DIESEL RANGE ORGANICS (DRO)

All chromatographic peaks for DRO, both resolved and unresolved, eluting between the peak start of n-decane (C_{10}) and the peak start of n-pentacosane (C_{25}). Quantitation is based on direct comparison of the area within this range to the total area over the same (C_{10} - C_{25}) range of the calibration standard, as determined by FID response using forced baseline-baseline integration. Surrogate peak areas shall be determined by valley to valley integration.

3.2 RESIDUAL RANGE ORGANICS (RRO)

All chromatographic peaks for RRO, both resolved and unresolved, eluting between the peak start of n-pentacosane (C_{25}) and the peak end of n-hextriacontane (C_{36}). Quantitation is based on direct comparison of the area within this range to the total area over the same (C_{25} – C_{36}) range of the calibration standard, as determined by FID response using forced baseline-baseline integration. Surrogate peak areas shall be determined by valley-to-valley integration.

3.3 DIESEL CALIBRATION STANDARD (DCS)

The DCS is Commercial #2 diesel fuel or equivalent hydrocarbon mixture, in which greater than 95% of the hydrocarbon mass elutes within the diesel change and is diluted to appropriate concentrations in methylene chloride. The DCS serves as a calibration standard for DRO. The DCS standard will be injected without any other standards present to demonstrate the 95% elution criteria is met, based on the area of integration.

3.4 RESIDUALS CALIBRATION STANDARD (RCS)

RCS is an equal blend of 30 weight and 40 weight motor oils (1:1), diluted to appropriate concentrations in methylene chloride. The RCS serves as a calibration standard for RRO. The RCS standard will be injected without any other standards present to demonstrate the elution range of the RCS.

3.5 COMBINED CALIBRATION STANDARD

A stock standard mixture of DCS and RCS components is used for the initial and continuing calibration standards. Multiple concentrations of the combined calibration standards are used

for the initial calibration. The standard concentrations vary from the PQL of 500 mg/L to 25,000 mg/L, which is the upper dynamic range of the calibrations. A 10,000 mg/L standard is used as the continuing calibration standard.

3.6 CONTINUING CALIBRATION STANDARD (CCS)

The continuing calibration standard is a mid-range working standard diluted from the stock standard solution and is used to verify that the analytical system is responding in a manner comparable to the time of initial calibration. The continuing calibration standard is analyzed at the beginning of an analytical sequence, and after every 20 samples to ensure that reported sample concentrations are accurate, as determined by the calibration.

3.7 CALIBRATION VERIFICATION STANDARD (CVS)

The CVS is a QC standard, but with diesel from a source other than that used to prepare the DCS, (i.e., a second source). It is used by the laboratory to verify the accuracy of calibration and source materials. Greater than 95 % of the hydrocarbon mass must elute within the diesel range, as described in Section 3.1.

3.8 SURROGATE MIXTURES

Ortho-terphenyl is used as the DRO surrogate and n-triacontane d^{62} is used as the RRO surrogate. The surrogate mixture contains equal concentrations of the surrogates, and it is spiked into all extracted samples before the extraction begins.

3.9 RETENTION TIME WINDOW (RTW) STANDARD

The RTW is a mixture of the normal (n-) alkanes, including n-decane, n-pentacosane, and n-hexatriacontane (C_{10}, C_{25} and C_{36}), which are analyzed once every 24-hour day or with each analytical batch of samples. This standard defines the integration windows for methods AK102 and AK103.

3.10 STANDARD SOIL

Baked Ottawa sand is used in QC samples (method blank and laboratory-fortified blank) to represent the soil matrix. Quality control samples are extracted and analyzed using the same procedures as field samples.

3.11 METHOD BLANK

The method blank (also known as a procedural blank), demonstrates that the apparatus and reagents used to verify that the handling, extraction, and analysis of field samples is valid and that the reported concentrations in field samples were not biased due to contamination introduced in the extraction and analysis process.

3.12 INSTRUMENT BLANK

An instrument blank demonstrates that the instrument is free from contamination. The instrument blank is not extracted, and consists of methylene chloride solvent used in the extraction process.

3.13 SOLVENT BLANK

A solvent blank demonstrates that the solvent (in this case methylene chloride) used in the method is free from contamination. It may also serve as an instrument blank.

3.14 LABORATORY-FORTIFIED BLANK (LFB)

An LFB is a method blank sample spiked with diluted commercial #2 diesel fuel and motor oil which is the same as that used to make the Combined Calibration Standard (see Section 7.5 of this method). There are 2 laboratory-fortified blanks extracted with every extraction batch. The spike recoveries are used to evaluate method control for accuracy and precision (see Table 1 of this method in Section 11.2). The laboratory-fortified blank is synonymous with a laboratory control sample (LCS).

3.15 METHOD DETECTION LIMIT (MDL)

The MDL is the minimum concentration of a compound that can be measured and reported with 99% confidence that the value is greater than zero, determined from analysis of a sample in a given matrix containing the analyte(s). The MDL is determined prior to the analysis of any samples.

3.16 PRACTICAL QUANTITATION LIMIT (PQL)

The PQL is defined as the concentration in the sample extract that can be accurately determined and has a reproducible result. The PQL is generally between 2 and 5 times the MDL.

4.0 INTERFERENCES

4.1 NON-TARGET ANALYTES

Other organic compounds, including, but not limited to, animal and vegetable oil and grease, chlorinated hydrocarbons, phenols, phthalate esters, and biogenic compounds, are measurable under the conditions of this method.

4.2 BIOGENIC INTERFERENCE

Some site conditions contain non-petroleum compounds from naturally occurring materials (NOMs), such as plants. Many of these compounds found in natural settings also occur at varying concentrations in crude oil and refined petroleum products. When NOM is present in a DRO or RRO sample, there is no practical method to distinguish NOMs from petrogenic sources. This interference is termed biogenic interference. Silica gel may be used to remove some of the polar compounds and reduce the magnitude of quantitative interference to varying degrees. Sample chromatograms of refined products usually have a distinct characteristic hump, or bell shape. Chromatograms from NOM samples do not exhibit the bell shape and typically have a ramped look that extends from the middle diesel range past the residual range. The analysts experience will be used for the interpretation of chromatograms when the presence of NOM is suspected. Silica gel may be employed to lessen the magnitude of interference.

4.3 GLASSWARE CLEANING

Method interferences are reduced by washing all glassware with hot soapy water, followed by a rinse with tap water and methylene chloride At least one blank must be analyzed with each extraction batch to demonstrate that the laboratory samples are free from method interferences.

4.4 REAGENT QUALITY

High purity reagents must be used to minimize interference problems. All reagents are screened for contamination before being introduced to field and QC samples.

4.5 SAMPLE CARRYOVER

Contamination by carryover can occur whenever high-level and low-level samples are sequentially analyzed. Whenever an unusually concentrated sample is encountered, the successive analysis will be evaluated for possible carryover.

4.6 WATER

Water may be unintentionally extracted along with the target analytes during the extraction process, particularly when samples are wet. Water interferes with the proper concentration of the extract, and also interferes with the analysis. The water must be removed using steps outlined in Section 9.2.1.5.

5.0 SAFETY ISSUES

5.1 CHEMICAL EXPOSURE

The toxicity or carcinogenicity of each reagent in this method has not been precisely defined. However, each chemical compound should be treated as a potential health hazard. Exposure to these chemicals must be reduced to the lowest possible level by whatever means available, including personal protective equipment (PPE) and using fume hoods. A reference file of Material Safety Data Sheets will be maintained on site, and made available to all personnel involved in chemical analysis.

5.2 HEARING PROTECTION

Hearing protection will be used when performing sonication.

5.3 SAMPLE DRYING

The ADEC requires that moisture determinations must accompany all soils data (reported in mg/dry kg) in order to determine the results in the original soil condition. Because of the potential for high petroleum compound concentrations in the soil, all drying should be done under a functioning hood or with proper ventilation of the oven exhaust.

(Intentionally blank)

6.0 APPARATUS AND MATERIALS

6.1 GLASSWARE

- 4-oz amber glass wide-mouth jars with Teflon®-lined screw caps
- 400 mL beakers
- Turbo-Vap tubes
- Two mL glass vials with Teflon-lined cap (autosampler vials)
- Disposable pipettes: Pasteur and volumetric
- Graduated cylinders: 250-mL
- Glass funnels
- Volumetric flasks: 10-mL, 25-mL, 50-mL, 250-mL, and 1000-mL
- Micro syringes 1-µL, 5-µL, 10-µL, 25-µL, 100-µL, and 500-µL.

6.2 ANALYTICAL BALANCE

An analytical balance capable of accurately weighing to 0.0001 grams will be used for preparing standards. A top-loading balance capable of weighing to the nearest 0.01 grams will be used for sample preparation and percent moisture determination.

6.3 SONICATION

6.3.1 Ultrasonic Cell Disrupter (Sonicator)

A dual horn-type sonicator equipped with a titanium tip (Misonix, Inc., Model 2020 (475 watt)) with pulsing capability and a No. 200, ½-inch tapped disrupter horn is used to perform extraction method 3550B.

6.3.2 Sonabox

The sonicator will be operated in a sonabox to decrease sound. Hearing protection will also be worn by lab personnel during sonication steps to prevent hearing loss.

6.4 SOLVENT CONCENTRATOR

A solvent evaporator (TurboVap®) with a nitrogen gas source will be used to concentrate sample extracts to their final volume.

6.5 MISCELLANEOUS APPARATUS

- Stainless steel spatula.
- Weigh boats
- Glass wool

6.6 GAS CHROMATOGRAPH (GC)

A GC is an analytical system that measures concentrations of analytes introduced with an autosampler and syringes into an injection port. The components in the sample extract separate inside of a 30-meter analytical column before their response is measured on an FID. A data system capable of measuring peak areas using a forced baseline-baseline projection is required. The data system is capable of storing and processing chromatographic data.

6.6.1 Columns

Columns are Restek DB-5 30 M x 0.53 mm 1.0 micron film thickness or equivalent.

6.6.1.1 Optional Columns

Other columns may be used as long as they are capable of achieving the necessary resolution. The column must resolve C_{10} from the solvent front in a mid-range DCS or CVS.

7.0 REAGENTS AND STANDARDS

7.1 REAGENT WATER

Reagent water is free of organics, target analytes, and interfering substances.

7.2 METHYLENE CHLORIDE

Methylene chloride – reagent grade or equivalent. At a minimum, the solvent must be shown to be free of DRO, as demonstrated by the analysis of a solvent blank.

7.3 SODIUM SULFATE

Sodium sulfate – (ACS grade) granular, anhydrous. Sodium sulfate is used to remove water from samples in extraction method 3550B. Water interferes with the extraction and concentration of sample extracts. Sodium sulfate is purified by heating it in a shallow tray at 400 °C for 4 hours in a muffle furnace. Incomplete cleaning of sodium sulfate can result in DRO contamination of samples. Refer to Section 4.0 for other interferences

Note: Sodium sulfate should not be used with samples that will be extracted with the ASE.

7.4 DIATOMACEOUS EARTH

Diatomaceous Earth (DE) is used to dry samples for extraction method 3545. DE is purified by heating it in a shallow tray at 400 °C for 4 hours in a muffle furnace. Incomplete cleaning of DE can result in DRO contamination of samples.

7.5 STOCK STANDARD SOLUTIONS

Stock Standard Solutions for AK102 and AK103 analyses are prepared in methylene chloride. Standard preparation will follow the procedures as described in Section 9.1. All standards prepared by the laboratory must be stored at less than 6 °C, and protected from light. The meniscus is marked and observed to ensure stock standard integrity. Standards must be replaced within 6 months of preparation. Prepared standards purchased from commercial suppliers may be kept indefinitely, and under the conditions, specified by the manufacturer if different than described in this paragraph. Stock standards often come in flame-sealed glass ampoules, and with proper storage are good for one year from receipt.

7.5.1 Surrogates

A Surrogate Control Standard is a working standard of 1 µg/mL each of OTP and hexatriacontane-d^{62} in methylene chloride is used as a working standard solution. A calculated volume of concentrated stock solution may be combined with initial and continuing calibration standards to verify that surrogate recoveries and chromatographic separation are adequate for the determination of extraction recovery efficiencies.

7.5.2 Diesel and Residual Range Calibration Standards

Diesel #2 is used to prepare stock calibration standards in methylene chloride. No fewer than 5 concentrations of this DCS are used for instrument calibration. Other than one standard concentration near the PQL, the expected range of concentrations found in project samples should define the working range of the GC.

7.5.2.1 Continuing Calibration Standard

A mid-range dilution of the diesel range and residual range blends serve as the Continuing Calibration Standard. The concentration is 10,000 mg/L.

7.5.3 Retention Time Window Standard

A Retention Time Window (RTW) Standard is a stock solution containing at a minimum, n-alkanes C_{10}, C_{25} and C_{36}, at a concentration of at least 2 µg/mL. This blend of alkanes is used to establish the RTW, which is used to define the integration ranges for DRO and RRO.

7.5.4 Stock Calibration Verification Standard (CVS)

The CVS is prepared from a second source of commercial Diesel #2 other than that used to prepare the DCS, as described in Section 7.5.2 of this method. A working solution is made at a recommended concentration of 5000 µg/mL in methylene chloride, which is near the mid-point of the calibration range.

8.0 SAMPLE COLLECTION, PRESERVATION, CONTAINERS, AND HOLDING TIMES

8.1 SAMPLE COLLECTION

Soils for field analyses may be collected in labeled Ziploc® bags or 4-oz amber glass jars with Teflon-lined lid. A separate Sampling and Analysis Plan and Field Standard Operating Procedures fully address the procedures used to collect field samples. Samples must be collected using clean sampling equipment, and new clean nitrile gloves. Sample gloves should be changed prior to the beginning of any collection activities and between samples.

8.2 SAMPLE PRESERVATION

All samples will be immediately placed in a gel iced cooler after collection, and stored at 4 ± 2 °C until extraction.

8.3 HOLDING TIMES

Sample extraction must be performed within 14 days [1]. All analyses of extracts must take place within 40 days.

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9.0 PROCEDURE

9.1 STANDARDS PREPARATION

9.1.1 Initial and Continuing Calibration Standards and Surrogates

DRO calibration standards are prepared from neat #2 Diesel. RRO standards are prepared from equal portions of 30-weight and 40-weight motor oil. Neat standards are weighed on a 4-place analytical balance. Approximately 2.5 grams of #2 Diesel and 2.5 grams of the mixed motor oils are added to a 100-mL volumetric flask. Methylene chloride is added to the volumetric flask to a final volume of 100 mL, generating a combined stock standard solution at a concentration of 25,000 mg/L. Other initial and continuing calibration standards are prepared from this stock standard solution.

Initial and continuing calibration standards are prepared by diluting the stock standard solution in volumetric flasks on a volume:volume basis. Initial calibration standards are prepared at concentrations of 500, 2500, 5000, and 10,000 mg/L. The stock standard solution is used for the 25,000 mg/L solution, which is the upper dynamic range of the calibrations.

The 10,000 mg/L solution is used at the continuing calibration standard.

Ortho-terphenyl and n-triacontane-d62 are added to the stock calibration standard at 10 mg/L from a vendor-prepared solution (Ultra Scientific). Subsequent dilutions of the stock standard will result in surrogate concentrations of 0.2, 1, 2, and 4 mg/L.

9.2 ACCELERATED SOLVENT EXTRACTION

Method 3545A (ASE) is used for soil samples and the extraction solvent is methylene chloride.

9.2.1 Soil Preparation – Accelerated Solvent Extraction

The following sections outline procedures used to prepare sample extracts for analysis.

9.2.1.1 Remove Excessive Water

Decant any water layer that may accompany the solid layer in the sample. Note the apparent condition of the sample (presence of foreign materials, variable particle size, presence of oil sheen, multiple phases, etc., on the bench sheet).

9.2.1.2 Sample Weighing

Weigh approximately20 grams of the original sample in a tared weighing dish or extraction beaker on a 2-place balance. Add an equal weight of DE, and stir the mixture well with a clean stainless steel or Teflon spatula. The sample should have a grainy texture after mixing. If the sample clumps, add more DE until a grainy texture is achieved, and note the addition. (Do this for all samples and standards.)

9.2.1.3 Sample Transfer and Spiking

Place the soil-DE mixtures into the ASE 33-mL extraction tubes, and add surrogate to both field and QC samples. Prepare the method blank and LFBs in a similar fashion to field samples. Add a known amount of spiking solution to the duplicate LFBs. These QC samples should contain 20 grams of Ottawa sand and an equal amount of DE.

9.3 SONICATION EXTRACTION

9.3.1.1 Remove Excessive Water

Decant any water layer that may accompany the solid layer in the sample. Note the apparent condition of the sample (presence of foreign materials, variable particle size, presence of oil sheen, multiple phases, etc) on the bench sheet.

9.3.1.2 Sample Weighing

Weigh approximately 20 grams of the original sample in a tared weighing dish, or extraction beaker on a 2-place balance. Add an equal weight of DE or sodium sulfate, and stir the mixture well with a clean stainless steel spatula or spoon. The sample should have a grainy texture after mixing. If the sample clumps, add more DE or sodium sulfate until a grainy texture is achieved and note the addition. (Do this for all samples and standards.)

9.3.1.3 Sample Transfer and Spiking

Place the dried soil mixture into a 250-mL beaker and add surrogate to both field and QC samples. Prepare the method blank and LFBs in a similar fashion to field samples. Add a known amount of spiking solution to the duplicate LFBs. These QC samples should contain 20 grams of Ottawa sand.

9.3.1.4 Sonication

Add approximately 50 mL of methylene chloride to the sample after surrogate has been added. Place the beaker under the sonicator and sonicate for 90 seconds. Transfer the solvent extract to a Turbo-Vap tube through a lined glass filter funnel filled with sodium sulfate. Repeat sonication twice more by adding 50 mL of solvent each time.

9.4 SAMPLE CONCENTRATION

Samples must be concentrated to a measurable final volume of 10 mL, using a TurboVap solvent concentrator. TurboVap tubes are placed in the TurboVap, and solvents are evaporated under a gentle nitrogen stream in a heated water bath. Samples must not go dry, or the extraction process will need to be repeated with fresh soil.

9.5 MOISTURE DETERMINATION FOR SOLIDS

9.5.1 Moisture Determination Procedure

To determine percentage of moisture, pre-weigh an aluminum drying pan and record the weight to the nearest 0.01 grams. Tare the balance to zero with the aluminum pan on the balance and add 9 to 11 grams of the sample to the drying pan. Record the weight to the nearest 0.01 gram. Exclude any large rocks while making sure the moisture determination sample is representative (similar) to the extraction portion of the sample. Dry the sample a minimum of 4 hours or overnight in an oven at 105 °C. Allow the sample and pan to cool to room temperature before weighing. Place the sample and weighing pan on the balance and record the weight to the nearest 0.01 gram.

9.5.2 Percent Moisture Calculation for Soils

Subtract the aluminum boat weight from the dry weight and divide the result by the wet weight. Multiply the result by 100% to determine the percent dry weight. The wet weight is equal to 1.0 minus the dry weight, expressed as a decimal. The macro formula is:
% Moisture = [(A-C)/(A-B)] x 100. The % Solid = 1-% moisture.

Where:

A = weight of boat + wet sample

B = weight of boat

C = weight of boat + dry sample

Note: Make sure drying oven is placed under a hood or has proper exhaust ventilation. Heavily contaminated soils will produce strong organic vapors.

9.5.3 Dry Weight Calculation for Extracted Soil

mg/dry kg soil = (100-% moisture)/100)) x wet weight of sample

Note: Excel spreadsheets with formulas will be used to determine the percent moisture, dry weight of samples, and soil sample concentrations.

9.6 SAMPLE EXTRACT DILUTION TECHNIQUE

Measure 1.0 mL of sample into a 10-mL volumetric flask. Dilute sample to 10-mL with methylene chloride. Transfer to a labeled vial with a Teflon-lined lid. Note the dilution on the vial. Mark meniscus and store at <4 °C.

9.7 GAS CHROMATOGRAPHY

9.7.1 Method Conditions

Set helium column pressure to 20 pounds per square inch (psi). Set oven temperature to 40 °C for 2 minutes, then ramp at a rate of 15 °C/minute to 320 °C, and hold for 12 minutes (run time = 30.6 minutes). Set FID to 320 °C and injector to 280 °C. Method conditions may be modified to achieve proper separation of analytes. The instrument must be calibrated after any method conditions have changed.

9.7.2 Method Performance Criteria

GC run conditions and columns must be chosen to meet the following criteria:

- Resolution of the methylene chloride solvent front from C_{10}.
- The column must be capable of separating typical diesel and residual components from the surrogates. There may be potential problems with separating the resolution of n-C_{19} from OTP and n-C_{21} at varying relative concentrations.

9.8 CALIBRATION

9.8.1 Initial Calibration

To calibrate the GC, set up as in Section 9.7 of this method. A minimum of five concentrations of DCS must be used for the calibration. The lowest initial calibration standard concentration will establish the PQL for the method, and the highest concentration standard defines the upper quantitation limit. Samples exceeding the upper calibration limit must be diluted and reanalyzed.

9.8.2 Initial Calibration Curve Verification

The calibration curve must be confirmed using the CVS. This standard independently verifies the accuracy of the calibration. The concentration of the CVS should be within the expected concentration range of the samples to be analyzed. A relative standard deviation (RSD) of less than 20% of true value is the acceptance criteria for the CVS.

9.8.3 Continuing Calibration Standards (CCS)

The working calibration curve must be verified on each working day (24 hours) by the injection of a continuing calibration standard (see Section 3.6 of this method) at a concentration near the mid-point of the calibration curve (10,000 mg/L). The continuing calibration standard is a diluted aliquot of the same standard used to initially calibrate the instrument. An initial calibration standard near the mid-point of the curve may be used for the continuing calibration standard, and it is recommended. If the response for the continuing calibration standard varies from the predicted response by more than 25%, check the instrument for leaking septa, dirty injection liners and gas leaks. Recheck the calibration, if it is not within limits, a new calibration curve must be prepared. The instrument should be checked and cleaned prior to establishing a new 5-point calibration.

9.8.4 Calibration Curve Linearity

Acceptable criteria for the initial calibration are dependent on the type of curve fit applied to the initial calibration. Acceptance criteria for the most used types of calibration curves are listed below.

- A linear regression curve fit must have an R^2 of 0.995 or better,
- A quadratic fit must have an R^2 of 0.995 or better,
- Average of response factors, the average percent relative standard deviation (%RSD) is less than 20% over the working range.
- Other curve fits may be employed as long as they meet acceptance criteria outlined in EPA method 8000B [2].

9.9 ESTABLISHING RTWS

9.9.1 RTW Definition

The RTW for individual peaks is defined as the average RT plus or minus three times the standard deviation of the absolute retention times for each component. The RTWs for this method are defined in Section 3.9. RTWs are crucial to the identification of target compounds. RTWs are established to compensate for minor shifts in absolute retention times as a result of sampling loadings and normal chromatographic variability.

9.9.2 Chromatographic Separation Definition

Chromatographic processes achieve separation by passing a mobile phase over a stationary phase. Constituents in a mixture are separated because they partition differently between the mobile and stationary phases, and thus have different retention times. Compounds that strongly interact with the stationary phase elute slowly (i.e., long RTs), while compounds that remain in the mobile phase with little interaction with the stationary phase elute quickly (short RTWs).

Before establishing RTWs, be certain that the GC system is within optimum operating conditions (Section 6.7). Make three injections of the RTW Standard (Section 7.5.3) and surrogates (Section 7.5.1) throughout the course of a 72-hour period. Serial injections over less than a 72-hour period result in RTWs that are too tight.

9.9.3 Calculation of RTWs

1. Record the retention times for decane, pentacosane, and hexatriacontane using an RTW standard (Section 7.5.3) and the surrogates (Section 7.5.5.) from at least 3 injections over a minimum 72-hour period.
2. Calculate the mean and standard deviation of the three absolute retention times for the RTW standards and surrogates.
3. In those cases where the standard deviation for a particular analyte is zero, the laboratory will use ±0.05 minute as the default standard.
4. The width of the RTW for each analyte, surrogate, and major constituent is multi-component analytes is defined as ± 3 times the standard deviation of the mean absolute RT established during the 72-hour period. If the default standard deviation in Step 3 is used, the width of the window will be 0.05 minutes.

9.9.4 Reestablishing RTWs

The laboratory must calculate RTWs for each standard on each GC column, and whenever a new GC column is installed or instrument conditions change. RTWs must be verified regularly and updated no less frequently than once a year.

9.10 GAS CHROMATOGRAPH ANALYSIS

9.10.1 Injection Volume

Samples are analyzed by GC/FID. Injection volumes are 2 µL, using the conditions established in Section 9.7 of this method.

9.10.2 Analytical Batch Window

If initial calibration (Section 9.8.1) has been successfully performed, verify the calibration by analysis of a mid-point continuing calibration standard prior to and immediately after any samples are analyzed. An analytical batch is defined as the analysis of standards, field samples, and QC samples analyzed sequentially until all samples are analyzed, or those samples analyzed within 24 hours.

9.10.3 Continuing Calibration Acceptance Criteria

Calculate the percent difference of the response from the known continuing calibration standard concentration and the established response factor in mg/L. If the reported continuing

calibration standard has a reported concentration difference greater than 25% from the known concentration, corrective action must be taken.

9.10.4 Instrument Blank Criteria

The instrument blank is essential for determining if analytical conditions are suitable for the proper analysis of samples. An unextracted solvent blank (methylene chloride) is analyzed each day to determine the area generated from normal baseline noise under the conditions prevailing in the 24-hour period. This area is generated by projecting a horizontal baseline between the retention times observed for the peak start of C_{10} and the peak start of C_{25}. This blank is integrated over the DRO area in the same manner as for the field samples, and is reported as the solvent blank. Baseline subtractions of instrument blanks is not allowed.

9.10.5 Carryover Blanks

Blanks may be run after samples suspected of being highly concentrated to prevent carryover. If the blank analysis shows contamination above the PQL, maintenance must be performed to remove the source of the carryover before any samples can be analyzed. New injector liners may be installed, or the column may be trimmed or baked out to remove the chromatographic contamination. Subsequent blanks must be analyzed until the system is shown to retain contaminant at concentrations less than the one-half the PQL.

9.10.6 Calibration Exceedances

If the DRO concentration exceeds the linear range of the method (as defined by the range of the calibration curve) in the final extract, corrective action must be taken. The sample should be diluted and the response of the major peaks should be kept in the upper half of the linear range of the calibration curve.

9.11 CHROMATOGRAPHIC INTERPRETATION

The analyst may perform a qualitative interpretation of sample chromatograms in order to determine if the sample result is attributed to natural (anthropogenic) or petroleum (petrogenic) sources. Chromatograms from known types of petroleum products may be used to compare the fuel patterns to those found in samples. Field notes and sample examination may also be used to identify potential origins of analytes in the chromatograms.

9.12 CALCULATIONS

9.12.1 Soil Concentration Calculation

External Sample Calculation:

Soil samples:

$$Cs = \frac{Cex * (Vt) * D}{(Ws)}$$

Where:

*****	=	times
Cs	=	Concentration of DRO or RRO in mg/kg in soil (dry weight)
Cex	=	Concentration in final extract
Vt	=	Volume of final extract in mL
D	=	Dilution factor, if dilution was performed on the sample prior to analysis. If no dilution was made, then D = 1, dimensionless
Ws	=	Dry weight of sample extracted in grams

9.12.2 Data Reduction Software

A software program from Agilent (Chemstation-Enviroquant) will be used to determine the concentration of the sample extract relative to Sections 9.12 of this method, based on the instrument calibration.

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10.0 QUALITY CONTROL

10.1 CURVE VERIFICATION STANDARD (CVS)

- The CVS is not extracted.
- The CVS is analyzed once after the initial calibration standards to verify calibration curve.
- The CVS recovery limit is 75-125% of true value.

10.2 CONTINUING CALIBRATION SAMPLES

- The continuing calibration standard is not extracted.
- The continuing calibration standard is analyzed at the start and end of an analytical batch, and for every 20 samples in that batch.
- The continuing calibration standard recovery requirement is 75-125% of true value.

10.3 BLANKS

- The instrument blank is analyzed prior to any samples and after calibration standards to demonstrate that the system is free from contamination.
- The method blank must be extracted and analyzed with each extraction batch.
- If additional cleanup steps are performed on field samples, the same steps must be applied to the method blank.
- **Acceptance Criteria**: Results for the method blank must be less than or equal to the reporting limit concentration.
- BLANK SUBTRACTION IS NOT ALLOWED. Blanks are reported by value.
- Other blanks may be analyzed as necessary following the recommendations of Chapter 2, Section 9 of the *UST Procedures Manual*.

10.4 LABORATORY FORTIFIED BLANKS (LFB)

- LFB is extracted using the same method procedure as the associated samples.
- Two LFBs are analyzed with each extraction batch.
- Acceptance Criteria: The LFB recovery requirement for AK102-DRO is 75-125% of true value. The LFB recovery requirement for AK103-RRO is 60-120%. The acceptance criterion is 20% RPD for both methods.
- If additional cleanup steps are performed on field samples, the same steps must be applied to the LFB samples.
- If any LFB recovery fails to meet method criteria, appropriate corrective action must be taken. See Section 10.6 Corrective Actions.

10.5 SURROGATES

10.5.1 Surrogate Concentration

The surrogate should be spiked at a level to produce a recommended extract concentration of 1.66 µg/mL.

10.5.2 Surrogate Acceptance Criteria

Surrogate recoveries must be 60-120% for LCS (continuing calibration standard, CVS, method blank, LFB), and 50-150 % for field samples (all other samples).

10.5.3 Surrogate Recovery Failure-Corrective Action

If any surrogate recovery fails to meet method criteria, corrective action must be taken if there is no reasonable explanation for the failed recovery. Some soil types such at peat and tundra often bias recoveries low. See Section 10.6 Corrective Actions.

10.5.4 Sample Qualifiers (Flags)

If field samples show poor surrogate recovery that is not attributable to laboratory error, DRO results must be flagged.

10.6 CORRECTIVE ACTIONS

The actions listed below are recommended and may not apply to a particular failure.

- If the CVS fails to meet acceptance criteria, recheck all calculations used to prepare the standards. If the CVS fails again, prepare new ICAL and CVS standards from neat standards.
- If the instrument fails to meet continuing calibration criteria, all samples analyzed since the last acceptable continuing calibration standard must be reanalyzed.
- If method blank acceptance criteria are not met, identify and correct the source of contamination and re-prepare and reanalyze the associated samples.
- If the LFB(s) acceptance limits are not met, reanalyze the LFB to confirm the original result is reliable. If the results are still outside control limits, the associated samples must be re-extracted and reanalyzed. If the LFB is above the upper control limit, and the associated samples are all below the PQL, the deviation should be described in a non-conformance memo.

- If surrogate recoveries are outside the established limits, verify calculations, dilutions, and standard solutions. Also, verify that instrument performance is acceptable. High recoveries may be due to co-eluting matrix interference, and the chromatogram should be examined for evidence of this. Low recoveries may be due to adsorption by the sample matrix (clay, peat, or organic material in the sample). Recalculate the results and/or reanalyze the extract if the checks reveal a problem. If the surrogate recovery is outside of established limits due to well-documented matrix effects, the results must be flagged.

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11.0 METHOD PERFORMANCE

11.1 METHOD DETECTION LIMIT

The MDL for soil is calculated according to Title 40 Code of Federal Regulations, Part 136 (40 CFR136), Appendix B (1994). The MDL is estimated to be 60 mg/kg (external standard calibration, Ottawa sand) for DRO and 89 mg/kg for RRO. MDL studies will be performed and MDLs will be updated prior to any sample analyses.

11.2 METHOD ACCEPTANCE CRITERIA FOR AK102

The method acceptance criteria for laboratory control and field samples analyzed by Method AK102 are presented in Table 1.

Table 1 Method AK102 Acceptance Criteria for Quality Control

	Control Limits	
Soils (mg/kg)	**% Recovery**	**Relative % Difference**
Laboratory-Fortified Blanks	75-125	20
Continuing Calibration	75-125	
Calibration Verification	75-125	
Surrogate Recovery:		
Laboratory Fortified Blanks**	60-120	
Field Sample	50-150	

Notes:

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% = percent

mg/kg = milligrams per kilogram

11.3 METHOD ACCEPTANCE CRITERIA FOR AK103

The method acceptance criteria for laboratory control and field samples analyzed by Method AK103 are presented in Table 2.

Table 2 Method AK103 Acceptance Criteria for Quality Control

	Control Limits	
Soils (mg/kg)	**% Recovery**	**Relative % Difference**
Laboratory Fortified Blanks	60-120	20
Continuing Calibration	75-125	
Calibration Verification	75-125	
Surrogate Recovery:		
Laboratory Fortified Blanks**	60-120	
Field Sample	50-150	

**Laboratory Fortified Blank is any laboratory prepared sample used for quality control, except for calibration standards. Field criteria from voluntary contribution of method performance information from approved laboratories, and method performance at SCL.

% = percent

mg/kg = milligrams per kilogram

12.0 REFERENCES

Alaska Department of Environmental Conservation (2002), *Underground Storage Tank Procedures Manual*. 18 AAC 75 (Appendix D).

U.S. Environmental Protection Agency. *SW 846-Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, Solid Waste Method 8000B, Determinative Chromatographic Separations*. Revision 2, 1996. Washington, D.C.

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ACRONYMS AND ABBREVIATIONS

µg/L	micrograms per liter
ANSI	American National Standards Institute
ECD	electron capture detectors
EPA	U.S. Environmental Protection Agency
GC	gas chromatograph (or gas chromatogram)
LCS	laboratory control sample
LFB	laboratory-fortified blank
MDL	method detection limit
mg/kg	milligrams per kilogram
mL	milliliter
MSDS	Material Safety Data Sheet
NOM	natural organic matter
PCBs	polychlorinated biphenyls
PE	performance evaluation
PIDs	photoionization detectors
PPE	personal protective equipment
ppm	parts per million
QC	quality control
RF	response factor
RSD	relative standard deviation
SOP	Standard Operating Procedure
TCMX	tetrachlorometaxylene
TSDF	treatment storage disposal facility
VOA	volatile organic analysis

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1.0 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the procedures for determining the concentration of polychlorinated biphenyls (PCBs) as Aroclors® using the methodology developed by U.S. Environmental Protection Agency (EPA) Region 1 and described in the *Standard Operating Procedure PCB Field Testing for Soil and Sediment Samples* (EPA 2002).

1.1 PURPOSE OF METHOD

This method may be used to determine the concentrations of PCBs as Aroclors in extracts from soil and solids using open-tubular, capillary columns with electron capture detectors (ECD). The Aroclors listed below have been determined by this method, using a single-column analysis system. This method also may be applied to other matrices, such as oils and wipe samples, if appropriate sample extraction procedures are employed.

Table 1 Aroclor® Classes

Aroclor Class	CAS Registry No.[a]
Aroclor 1016	12674-11-2
Aroclor 1221	11104-28-2
Aroclor 1232	11141-16-5
Aroclor 1242	53469-21-9
Aroclor 1248	12672-29-6
Aroclor 1254	11097-69-1
Aroclor 1260	11096-82-5

Notes:
[a]Chemical Abstract Service Registry No.

1.2 AROCLOR QUANTITATION

The seven classes of Aroclors listed in Table 1 are those that are commonly specified in EPA regulations. The quantitation of PCBs as Aroclors is appropriate for meeting standard State and EPA cleanup criteria.

1.3 AROCLOR IDENTIFICATION

Compound identification based on single-column analysis is appropriate when Aroclor patterns of known standards (fingerprints) can be compared to a sample chromatogram. Certified standards of the differing Aroclors are used to produce chromatograms, which can be compared to sample chromatograms to identify the Aroclor mixture so it can be properly quantitated. Software which incorporates chromatogram overlay tools or other means may also be used to compare chromatograms of unknown mixtures against standards. The overlay tool is especially useful in determining if weathering of the Aroclor has occurred.

1.4 AROCLOR MIXTURES

Aroclors are multi-component mixtures. When samples contain more than one Aroclor, a higher level of analytical expertise is required to attain acceptable levels of qualitative and quantitative analysis. The same is true of Aroclors that have been subjected to environmental degradation ("weathering") or degradation by treatment technologies. Such weathered multi-component mixtures may have significant differences in peak patterns compared to those of Aroclor standards.

2.0 SUMMARY OF METHOD

2.1 EXTRACTION

Approximately 10 grams of soil (wet weight) is weighed in a tared sample boat on a 2-place, top-loading balance for extraction and analysis. The sample weight is recorded on a spreadsheet. Approximately 10 grams of the same sample is weighed in a tared aluminum drying pan for percent moisture determination. The extraction sample is allowed to air dry before being placed in a VOA vial. Once dried, the sample is transferred to a 40 milliliter (mL) volatile organic analysis (VOA) vial then 1 mL of 2 milligrams per liter (mg/L) of surrogate is added to the sample using a gas-tight syringe. Twenty mL of a 1:1 hexane acetone mixture is then added to the VOA vial and sealed with a Teflon® cap. The contents of the vial are agitated for 1 minute using a vortex mixer or vigorous shaking by hand. Four mL of deionized water is added to the vial to facilitate the separation of hexane from acetone in the vial. The vial contents are briefly vortexed or hand mixed and allowed to settle. Separation and settling may be assisted by placing the vial in a centrifuge and spinning the vial(s) for 30 seconds. The hexane and all analytes of interest are contained in the top-floating layer in the vial. If the sample extract shows signs of petroleum contamination, sulfuric acid cleanup may be performed to remove interferents. Approximately 3 mL of the hexane layer is transferred to two 2mL crimp top vials. The sample extract is now ready for analysis.

2.2 ALTERNATE EXTRACTION METHODS

Solid samples may be extracted with hexane-acetone (1:1) using Method 3545A (2007a) (pressurized fluid extraction) or Method 3550C (2007b) (ultrasonic extraction), or other appropriate technique or solvents. Extraction methods are presented in Section 10.1.

2.3 EXTRACT CLEANUP

Extracts for PCB analysis may be subjected to a sulfuric acid cleanup (Method 3665) designed specifically for these analytes. This cleanup technique will remove (destroy) many single component organochlorine or organophosphorus pesticides, as well as petroleum. Therefore, this method is not applicable to the analysis of organochlorinated compounds, such as pesticides.

2.4 SAMPLE INJECTION

After cleanup, the extract is analyzed by injecting a 2-microliter (µL) aliquot into a gas chromatograph (GC), equipped with a wide-bore fused-silica capillary column and an electron capture detector (ECD).

2.5 SAMPLE QUANTITATION

Sample quantitation involves two distinct steps. First the Aroclor chromatographic pattern has to be qualitatively identified against a known standard (fingerprinting). Second, the five major quantitative peaks must be integrated using consistent integration technique in order to properly quantitate the concentration of Aroclor in the extract. Each peak is quantified separately, and the determined concentrations of each of the 5 peaks are added to determine to total PCB concentration in the extract. The soil concentration is calculated using the soil dry weight, final volume of the extract (hexane layer), and any dilutions performed on the final extract. Sample results are reported in milligrams per kilogram (mg/kg) on a dry weight basis.

3.0 DEFINITIONS

The following sections provide definitions that may be relevant to this procedure, but may not include all terms used in this method.

3.1 POLYCHLORINATED BIPHENYLS (PCBS)

PCBs are a class of chlorinated organic compounds with 1 to 10 chlorine atoms attached to the biphenyl rings. There are 209 possible compounds (congeners) of PCBs. Each congener contains varying levels of chlorine ions attached to the carbon atoms of 2 conjoined phenyl rings. The manufacturing of the PCBs produced 7 main classes of PCBs, known as Aroclors. The 7 main classes of Aroclors are listed in Table 1 in Section 1.1.

3.2 INTEGRATION

Integration is the determination of the area of a peak or peaks in a chromatogram. Integration determines the base or bottom of the peak, and it separates the integrated peak from other peaks. Software generally performs the integration automatically; however, the analyst may be required to manually integrate the peak. The peak integration must be consistent with the integration performed on the initial and continuing calibration standards. Proper integration is required for accurate quantitation.

3.2.1 Quantitation

Quantitation is the determination of standard and sample concentrations based on the instrument response to known standard concentrations. Quantitation is based on the ratio of response (area) to concentration, and the ratio is known as the calibration or response factor.

3.2.2 Extraction

Extraction is the transfer of analytes from the matrix (soil) into solvent (extract) for the determination of analyte concentrations in the matrix.

3.2.3 Elution

Elution is the transmittal of separated analytes from the GC column to the detector.

3.2.4 Combined Calibration Standard

A stock standard mixture of Aroclor 1016 and Aroclor 1260 is diluted in hexane to produce the initial and continuing calibration standards. Multiple concentration standards are used for the initial calibration and the standard concentrations vary from the practical quantitation limit (PQL) of 0.1 to 10 mg/L, which is the upper dynamic range of the initial calibration. A 1.0 mg/L standard is used as the continuing calibration standard.

3.2.5 Continuing Calibration Standard (CCS)

A mid-range working standard diluted from the Stock Standard Solution, used to verify that the analytical system is responding in a manner comparable to that at the time of initial calibration. The continuing calibration standard is analyzed at the beginning of an analytical sequence, and at minimum, after every 20 samples to ensure that reported sample concentrations are accurate as determined by the initial calibration.

3.2.6 Calibration Verification Standard (CVS)

The CVS is a quality control (QC) standard, prepared as outlined in Section 8.6 of this method, but with an Aroclor mixture from a source other than that used to prepare the Initial Calibration, i.e., a second source from a different vendor. It is used by the laboratory to verify the accuracy of calibration and standards. Acceptance criteria are +/- 20% of the initial calibration response factor.

3.2.7 Surrogate Mixture

Tetrachlorometaxylene (TCMX) and decachlorobiphenyl are used as the surrogates for this method. The surrogate mixture contains equal concentrations of the surrogates, and it is spiked into all extracted samples before the extraction begins. The surrogate mixture is also included in the initial calibration standard as varying concentrations. Decachlorobiphenyl is the primary surrogate used to evaluate the extraction efficiency. Tetrachlorometaxylene is the secondary surrogate standard and may be used to evaluate the extraction efficiency when decachlorobiphenyl is subject to interference, as described in Section 4.2.

3.2.8 Standard Soil

Baked Ottawa sand is used in QC samples (method blank and laboratory-fortified blanks) to represent the soil matrix. Quality control samples are extracted and analyzed using the same procedures as field samples.

3.2.9 Method Blank

Method blank, also known as a preparation blank, demonstrates that the apparatus and reagents used to verify that the handling, extraction, and analysis of field samples are valid, and that the reported concentrations in field samples were not biased due to contamination introduced in the extraction and analysis process.

3.2.10 Instrument Blank

Instrument blank demonstrates that the instrument is free from contamination. The instrument blank is not extracted and consists of hexane.

3.2.11 Solvent Blank

A solvent blank demonstrates that the solvent (in this case hexane) used in the method is free from contamination. It may also serve as an instrument blank.

3.2.12 Laboratory-Fortified Blank (LFB)

A method blank sample consisting of Ottawa sand is spiked with a known quantity of prepared standard that is the same as that used to make the Initial and Continuing Calibration Standards (see Section 3.2.4 and 3.2.5 of this method). Two LFBs are extracted with every extraction batch. The spike recoveries are used to evaluate method control for accuracy and precision (see Table 1 in Section 1.1 of this method). The LFB is synonymous with a laboratory control sample (LCS).

3.2.13 Method Detection Limit (MDL)

The MDL is the minimal concentration of a compound that can be measured and reported with 99% confidence that the value is greater than zero, determined from analysis of a sample in a given matrix containing the analyte(s). (See, Appendix B, for the method of determining MDL). The method detection limit is determined prior to the analysis of any field samples.

3.2.14 Practical Quantitation Limit (PQL)

The PQL is defined as the concentration in the sample extract that can be accurately determined, and has a reproducible result. The PQL is generally between 2 and 5 times the MDL.

3.2.15 Extraction Batch

An extraction batch is a set of field and QC samples extracted using the same consistent procedure throughout the batch. A sample batch consists of an extraction blank, two LFBs, and up to 20 field samples extracted in less than a 24 hour period.

4.0 INTERFERENCES

4.1 SOLVENTS, REAGENTS, GLASSWARE

Solvents, reagents, glassware, and other sample-processing hardware may yield artifacts and/or interferences to sample analysis. All of these materials must be demonstrated to be free from interferences under the conditions of the analysis by analyzing method blanks. Specific selection of reagents and solvents may be necessary. Refer to each method to be used for specific guidance on QC procedures, and to Section 6.4.1 for general guidance on the cleaning of glassware.

4.2 DECACHLOROBIPHENYL

Decachlorobiphenyl is used as a surrogate, but it may also be present as an analyte of interest when the PCB analyte is Aroclor 1268. Aroclor 1268 is not a major class of PCBs, and it was rarely used in practice. In this instance, dechlorobiphenyl is a target analyte, but the chromatographic result should not be used to determine surrogate recovery nor for quantitation of the Aroclor. Instead, TCMX should be used to measure recovery efficiency as a surrogate, and another major chromatographic peak should be used to quantitate the Aroclor against known calibration standards.

4.3 INTERFERENCES FROM PHTHALATES

Interferences by phthalate esters introduced during sample preparation can pose a major problem in PCB determinations. Interferences from phthalate esters can best be minimized by avoiding contact with any plastic materials and checking all solvents and reagents for phthalate contamination.

Common flexible plastics contain varying amounts of phthalate esters, which are easily extracted or leached from such materials during laboratory operations.

Exhaustive cleanup of solvents, reagents, and glassware may be required to eliminate background phthalate ester contamination.

These materials can be removed prior to analysis using EPA Method 3665 (sulfuric acid cleanup).

Cross-contamination of clean glassware can routinely occur when plastics are handled during extraction steps, especially when solvent-wetted surfaces are handled. Glassware must be scrupulously cleaned.

4.4 SULFUR (S_8)

Sulfur (S_8) is readily extracted from soil samples and may cause chromatographic interferences in the determination of PCBs. Sulfur contamination should be expected with sediment samples. Sulfur can be removed through the use of EPA Method 3665.

4.5 PETROLEUM

Petroleum may be extracted from samples as a non-target analyte. Petroleum interferes with the quantitation of PCBs when it co-elutes with the PCBs. Petroleum can be removed from samples following a sulfuric acid cleanup (EPA Method 3665) of the extract.

4.6 OTHER INTERFERENCES

Interferences extracted from the samples will vary considerably from matrix to matrix and sample to sample. While general cleanup techniques are referenced or provided as part of this method, unique samples may require additional cleanup approaches to achieve desired degrees of discrimination and quantitation. Sources of interference in this method can be grouped into three broad categories, as follows:

- Contaminated solvents, reagents, or sample processing hardware.
- Contaminated GC carrier gas, parts, column surfaces, or detector surfaces.
- Compounds extracted from the sample matrix to which the detector will respond, such as single-component chlorinated pesticides, including the DDT analogs (DDT, DDE, and DDD) may cause interference of some of the Aroclor peaks.

5.0 SAFETY

This method does not address all safety issues associated with its use. The laboratory is responsible for maintaining a safe work environment, and a current awareness file of OSHA regulations regarding the safe handling of the chemicals listed in this method. A reference file of Material Safety Data Sheets (MSDSs) will be maintained and will be available to all personnel involved in these analyses.

5.1 SAFETY REQUIREMENTS

5.1.1 Personal Protective Equipment (PPE)

Eye protection that satisfies ANSI Z87.1 specifications (splash-proof and shatter-proof eye protection), laboratory coat, and nitrile gloves must be worn while handling samples, standards, solvents, and reagents. Disposable gloves that have been removed are discarded as nonhazardous waste. Non-disposable gloves must be cleaned immediately.

5.1.2 High Temperature Surfaces

The GC contains zones that have elevated temperatures. The analyst needs to be aware of the locations in those zones, and must cool them to room temperature prior to working on them. Solid reagents, such as silica gel, Ottawa Sand, and diatomaceous earth, are baked in a muffle furnace at high temperatures (450°C). Care must be taken when placing solid reagents in the muffle furnace and removing them after heating. It is required that commercial-grade oven mitts and tongs are used for the muffle furnace. The soil-drying oven is used to remove water from soil samples in order to determine the percent moisture in samples. Oven mitts must be used when placing or removing samples from the oven.

5.1.3 Electrical Hazards

There are areas of high voltage in the GC. Depending on the work to be performed, either turn off the power to the instrument, or unplug the GC from the power source. It should be noted that the back of the GC has capacitors that store energy even if the GC is unplugged. Avoid contacting the capacitor. If working in the capacitor area, it is required that the analyst wears a grounding strap.

5.1.4 Radiation

The ECD contains radioactive nickel (^{63}Ni) that requires leak testing every six months. The detector can be maintained without risk to the operator as long as the source is left in its sealed vessel. Do not open up the source, it is in violation of licensing agreements with Agilent Technologies and the Nuclear Regulatory Commission. If a source leak is suspected, do not use the detector. Perform a wipe test to evaluate the potential leak and contact Agilent immediately for further instructions. A leaking source cannot be transported by air, unless it is in a container made specifically for shipping radioactive items. Proper documentation and manifesting is required. A non-leaking detector can be flown on aircraft as hazardous material in excepted quantities. The contained radiation of a single detector is 15 millicuries.

5.1.5 Solvent Handling

Solvents used for sample extraction may be flammable and/or hazardous. Personnel must minimize their exposure to solvent fumes and avoid contact with skin or clothing. Refer to each MSDS to properly identify hazards associated with each type of solvent. Eye protection is required when handling solvents. Solvents must be handled under a fume hood whenever they are transferred. Residual solvent may remain in soil after extraction, and the soil must be stored under a fume hood or in a proper container after extraction. Signs of solvent exposure include dizziness, coughing, lightheadedness, and headaches. Over exposure to hexane may cause irritation to the skin and eyes. Hexane and acetone are flammable and must be handled with care under a fume hood. Sulfuric acid is a corrosive material, and will produce chemical burns when exposed to the skin. Sulfuric acid must be handled under a fume hood. Sulfuric acid vapors are an irritant and may cause problems with the respiratory tract and mucous membranes. Organic vapor monitors (PIDs) and/or chemical badges may be worn to ensure exposure levels are minimized.

5.1.6 Target Analytes

Some target analytes have been tentatively classified as known or suspected human or mammalian carcinogens. Standard materials and stock standard solutions of these compounds and field samples should be handled with suitable protection to the skin, eyes, etc.

6.0 EQUIPMENT AND SUPPLIES

Glassware, reagents, supplies, equipment, and settings other than those listed in this procedure may be employed provided that method performance is appropriate and not impacted by the use of items not listed in this method.

6.1 GAS CHROMATOGRAPH

An analytical system complete with GC suitable for split-splitless injection and all necessary accessories, including auto-injectors, syringes, analytical columns, gases, ECDs, and a data system.

6.2 GC COLUMNS

The single-column approach will be utilized and involves a single analysis to determine if PCBs are present. The chromatographic pattern will confirm the identity of the compound. The single-column approach may employ narrow-bore (0.25 or 0.32-mm ID) or wide-bore (0.53-mm ID) columns. The GC may employ dual columns mounted in a single GC, but with each column connected to a separate injector and a separate detector.

The columns listed in this section may be used at the discretion of the analyst performing the method. The listing of these columns in this method is not intended to exclude the use of other columns that are available.

- 30-m DB-5 30-m x 0.53-mm ID fused-silica capillary column chemically bonded with SE-54 (DB-5, SPB-5, RTx-5, or equivalent), 1.0-µm film thickness.
- 30-m DB-608 30-m x 0.53-mm ID fused-silica capillary column chemically bonded with 35 percent phenyl methylpolysiloxane (DB-608, SPB-608, RTx-35, or equivalent), 0.5-µm or 0.83-µm film thickness.
- 30-m DB-1701 30-m x 0.53-mm ID fused-silica capillary column chemically bonded with 14% cyanopropylmethylpolysiloxane (DB-1701, or equivalent), 1.0-µm film thickness.

6.3 ANALYTICAL BALANCES

- An analytical balance capable of weighing to 0.0001 gram balance is used for the preparation of standards.
- A 2-place, top-loading balance capable of weighing to 0.01 gram is used for the determination of sample weights for extraction and percent moisture determinations.

- Calibration weights will accompany the balances, and the balance calibration and accuracy are checked daily prior to sample or standard weighing.

6.4 GLASSWARE

- 4-oz amber glass wide-mouth jars with Teflon-lined screw caps
- 40-mL VOA vials with Teflon-lined screw caps are used as extraction vessels
- Two mL glass vials with Teflon-lined crimp caps (autosampler vials)
- Transfer pipettes
- Graded pipettes are pipettes with volumes etched on the glass of such quality to accurately measure the volume contained in the pipette
- Glass Beakers: 250-mL
- Glass funnels
- 10-mL, 25-mL, and 50-mL volumetric glass used for the preparation of standards.

6.4.1 Glassware Cleaning

Clean all glassware as soon as possible after use by rinsing with the last solvent used. This should be followed by detergent washing (Alconox®) with hot water, and rinsed with tap water and/or organic-free reagent water. Glassware should be covered with aluminum foil and stored in a clean environment between uses.

6.5 EXTRACTION EQUIPMENT

- Vortex Shaker
- Heat Systems Model W400 Ultrasonic Extractor with ½” horn or Misonix XL 2020 with dual horn.
- Thermo CL2 centrifuge or a Whirlybird® hand-crank centrifuge.

6.6 OTHER EQUIPMENT

- GOW-MAC® Model 21-250 helium leak detector. The leak detector is used to verify system integrity by checking all fittings and orifices for leaks that could affect system performance.
- Glass wool

7.0 REAGENTS AND STANDARDS

Reagent-grade or pesticide-grade chemicals are used in all preparations and extractions. Other grades may be used, provided the reagent is of sufficiently high purity to permit its use without lessening the accuracy of the determination. Reagents should be stored in glass to prevent the leaching of contaminants from plastic containers.

NIST-certified standards will be used for the identification and quantitation of target analytes.

7.1 SOLVENTS

Solvents used in the extraction and cleanup procedures include *n*-hexane, acetone, sulfuric acid, and water. All solvents must be exchanged to *n*-hexane prior to analysis. All solvents are pesticide grade in quality or equivalent, and each lot of solvent must be determined to be free of phthalates. A manufacturer's certificate of analysis is sufficient determination, unless factors or interferences indicate otherwise.

Hexane is used for the preparation of all standards, surrogates and spiking solutions. All solvent lots must be reagent- or pesticide-grade in quality, or equivalent, and should be determined to be free of phthalates.

7.2 ORGANIC-FREE REAGENT WATER

All references to water in this method refer to organic-free reagent water

7.3 STANDARD SOLUTIONS

The following sections describe the preparation of stock, intermediate, and working standards for the compounds of interest. This discussion is provided as an example, and other approaches and concentrations of the target compounds may be used, as appropriate for the intended application. See EPA Method SW8000B for additional information on the preparation of calibration standards.

7.4 STOCK STANDARD SOLUTIONS

Stock standard solutions (1,000 µg/mL) of certified PCB standards in acetone are purchased from vendors such as Restek or AccuStandard. Certificates of analysis are maintained and

stored on site in order to ensure the accuracy of prepared standards. Lot numbers and each standard preparation are recorded in the Standards Log Book.

NOTE: Standard solutions (stock, composite, calibration, and surrogate) are stored at less than 6°C in Teflon-sealed glass containers in the dark once they are removed from flame-sealed vials. When a lot of standards are prepared, aliquots of that lot are stored in individual small vials. All stock and working standard solutions must be replaced after six months, or sooner if routine QC checks indicate a problem.

7.5 CALIBRATION STANDARDS FOR AROCLORS

7.5.1 Initial Calibration Standard Mixtures

A standard containing a mixture of Aroclor 1016 and Aroclor 1260 will include many of the peaks represented in the other five Aroclor mixtures. As a result, a multi-point initial calibration employing a mixture of Aroclors 1016 and 1260 are used to demonstrate the linearity of the detector response without the necessity of performing multi-point initial calibrations for each of the seven Aroclors. In addition, such a mixture can be used as a standard to demonstrate that a sample does not contain peaks that represent any one of the Aroclors. This standard can also be used to determine the concentrations of either Aroclor 1016 or Aroclor 1260, should they be present in a sample. If other Aroclors are identified, a five-point calibration with passing ICV is required.

A minimum of five calibration standards containing equal concentrations of both Aroclor 1016 and Aroclor 1260 are prepared by diluting a stock standard with hexane. The concentrations should correspond to the expected range of concentrations found in real samples, and must be within the linear range of the detector. Initial calibration standards are prepared in volumetric glassware at concentrations of 0.1, 0.5, 1.0, 10 and 20 mg/L from a 1000 mg/L stock standard solution. Other concentrations may be used as long as they demonstrate response and linearity consistent with other standards, and are within the linear dynamic range of the detector.

7.5.2 Single PCB Standards

Single standards of each of the other five Aroclors listed in Table 1 are required to aid the analyst in pattern recognition. Assuming that the Aroclor 1016/1260 standards described in Section 7.5.1 have been used to demonstrate the linearity of the detector, these single standards of the remaining five Aroclors listed in Table 1 also may be used to determine the calibration factor for each Aroclor when a linear calibration model is chosen. A standard for each of the other Aroclors is prepared at a concentration of 1.0 mg/L. The concentrations should generally correspond to the mid-point of the linear range of the detector, but lower concentrations may be employed at the discretion of the analyst based on project requirements.

7.5.3 Surrogate Standards

The extraction efficiency of the method is monitored using surrogates. Surrogate standards (TCMX and decachlorobiphenyl) are added to all samples, method blanks, laboratory-fortified blanks, and calibration standards.

7.5.4 Other Standards

Other standards (e.g., other Aroclors) and other calibration approaches (e.g., non-linear calibration for individual Aroclors) may be employed to meet project needs. When the nature of the PCB contamination is already known, standards of those particular Aroclors will be used to prepare initial and continuing calibration standards.

(Intentionally blank)

8.0 QUALITY CONTROL

The QC acceptance criteria for various aspects of this method are described in this section. Quality control limits are outlined in Table 2 and described in detail in the following sections.

Table 2 Quality Control Criteria

QC Item	Frequency	Acceptance Criteria	Corrective Action(s)
Initial Calibration	Before analysis of samples	<20% RPD or a linear regression correlation coefficient (r^2) value greater than 0.995	Check standard integrity and perform additional initial calibrations as necessary.
Continuing Calibration	Before introduction of samples, after every 20 samples, and at the end of an analytical batch	<20% RPD of the known standard concentration	Inject another standard, clean the injector port. Perform initial calibration.
Instrument Blank	Before introduction of samples, after every 20 samples, and at the end of an analytical batch	Reported concentrations less than ½ the practical quantitation limit	Repeat blank injection, clean injection port, and replace septa and liner.
Extraction Blank	One extraction blank is extracted and analyzed with each extraction batch.	Reported concentrations less than ½ the practical quantitation limit	Repeat blank injection, clean injection port, and replace septa and liner. If the blank concentration is less than 10 times the lowest concentration of any field samples, data must be qualified (flagged) or the entire sample batch must be re-extracted.
Laboratory-Fortified Blank (LFB)	Two LFBs are extracted and analyzed with each extraction batch.	Control limits are 60 to 130% of known spiked concentrations. The RPD between 2 LFBs from the same extraction batch must not exceed20%.	Repeat injection, if re-injection fails to meet acceptance criteria, all samples in the extraction batch must be re-extracted.

Table 2 Quality Control Criteria (continued)

QC Item	Frequency	Acceptance Criteria	Corrective Action(s)
Surrogates	Surrogates are included in all continuing calibration standards, method blanks, LFBs and field samples.	continuing calibration standard acceptance criteria are +/- 20% RPD of the known concentration. Method blanks and LFB acceptance criteria are 40-140% for TCMX and 60-130% for DCB.	Determine the cause of the failure. Failure to meet recovery criteria in method blanks and LFBs indicate that extraction or analysis problems exist. Failure of surrogate recoveries in field samples may indicate matrix interference if recoveries are acceptable in extraction blanks and LFBs.

Notes:
CCS = continuing calibration standard
QC = quality control
RPD = relative percent difference
RSD = relative standard deviation

8.1 SAMPLE COLLECTION

The collection of analytical field samples is described in the Sample Analysis Plan, which is a separate document. The Sample Analysis Plan translates project objectives and specifications into procedures used in the collection of samples. Samples must be collected using clean sampling equipment, and new clean nitrile gloves must be worn. Sample gloves should be changed prior to the beginning of any collection activities and between samples.

8.2 INITIAL CALIBRATION

The initial calibration is performed by analyzing standards at known variable concentrations over the expected concentration range of samples, or within the linear dynamic range of the detector. The area (response) of quantitative peaks is determined, and then the area is divided by the known concentration to develop individual response factors. The response factors may be incorporated into a calibration function, such as an average response factor or a linear regression. An average response factor incorporates the individual response factors into an average of the response factors. The average response must have a relative standard deviation (RSD) of less than 20% to be acceptable. A linear regression calibration curve uses the least squares method to produce a straight line that does not pass through the origin, when the regression calibration technique is used. The linear regression must have a correlation coefficient (r^2) greater than 0.995 to be acceptable. The software (Agilent ChemStation and

Enviroquant) performs the calculations necessary to determine the average RSD and correlation coefficient (r^2).

8.3 CONTINUING CALIBRATION

A continuing calibration standard is analyzed as a calibration check, after each group of 20 samples in the analysis sequence. Thus, injections of method blank and LFB extracts and other non-standards are counted in the total. Solvent blanks, injected as a check on cross-contamination, are also not counted in the total. The response factors for the continuing calibration must be within ±20 percent of the initial calibration to meet acceptance criteria. When the continuing calibration is outside of acceptance criteria, the laboratory will stop analyses and take corrective action.

8.4 LABORATORY FORTIFIED BLANK (LFB)

The LFB concentration of PCBs as Aroclor 1260 is spiked at sufficient volume to have the concentration at 1.0 mg/L in the blank sample. Other concentrations may be used, as appropriate for the intended application. The LFB is also known as the LCS. Two LFBs are extracted with each extraction batch.

8.5 METHOD BLANK

Initially, before processing any samples, the analyst should demonstrate that all parts of the equipment in contact with the sample and reagents are interference-free. This is accomplished through the analysis of a method blank. As a continuing check, each time samples are extracted, cleaned up, and analyzed, and when there is a change in reagents, a method blank is prepared and analyzed for the compounds of interest as a safeguard against chronic laboratory contamination. If a peak is observed within the RTW of any analyte that would prevent the determination of that analyte, identify the source and eliminate it, before processing the samples, if possible. The blanks should be carried through all stages of sample preparation and analysis. When new reagents or chemicals are received, the laboratory must monitor the preparation and/or analysis blanks associated with samples for any signs of contamination. A single method blank is extracted with each extraction batch.

8.6 SAMPLE QUALITY CONTROL FOR PREPARATION AND ANALYSIS

The laboratory must also have procedures for documenting the effect of the matrix on method performance (precision, accuracy, method sensitivity). This includes the analysis of QC samples, including a method blank and LFBs in each analytical batch and the addition of surrogates to each field sample QC sample when surrogates are used. Any method blanks, matrix spike samples, or replicate samples, should be subjected to the same analytical procedures (Section 11.0) as those used on actual samples.

8.7 SURROGATE RECOVERIES

The laboratory will evaluate surrogate recovery data from individual samples versus the surrogate control limits listed in Table 2.

8.8 INITIAL DEMONSTRATION OF PROFICIENCY (PERFORMANCE EVALUATION [PE] SAMPLE)

Each analyst must demonstrate initial proficiency with each sample preparation and determinative method combination it utilizes, by generating data of acceptable accuracy and precision for target analytes in a clean matrix. The laboratory must also repeat the demonstration of proficiency whenever new staff members are trained, or significant changes in instrumentation are made. PE samples are provided by manufacturers at concentrations unknown to the laboratory or analyst. Once the PE sample concentration is determined, the results are sent back to the manufacturer for confirmation. If the confirmation is within the manufacturer's criteria, a certificate of performance is issued by the manufacturer. If the confirmation result is outside of acceptance criteria, the cause(s) must be corrected before a new PE sample is requested. The analysis and determination of each PE sample, whether in or out of acceptance criteria, must be documented and maintained by the laboratory.

9.0 METHOD PROCEDURES

The following procedures have been demonstrated to be applicable for soil screening by the Office of Environmental Measurement and Evaluation (EPA Region 1). The method is also described in *Standard Operating Procedures for PCB Field Testing For Soil and Sediment Samples* (EPA, 2002).

9.1 SAMPLE EXTRACTION

Soil Samples are extracted by weighing approximately 10 grams (wet weight) of sample in a weigh boat. The sample is allowed to air dry for up to 12 hours to evaporate excess soil moisture.. The weighed sample is transferred to a 40-mL VOA vial, then surrogates are introduced to the sample. Twenty (20) mL of 1:1 hexane-acetone solvent is added to the sample and agitated with a vortex mixer for 90 seconds. 4 mL of organic-free water is added to separate the hexane from the acetone and the sample is again agitated on the vortex shaker for 30 seconds. The extraction vial is then centrifuged for 30 seconds or more to facilitate the separation of the hexane from the soil and acetone-water layer. The hexane layer is the top layer, and it is removed and transferred with a disposable Pasteur pipette to two 2 mL autosampler vials for analysis.

EPA Method 3550B, ultrasonic extraction, may be used to handle large sample loads, difficult matrices, or, in the event of mechanical breakdown, poor recoveries. A sample batch will only be extracted using one method.

The use of hexane-acetone solvents generally reduces the amount of interferences, and improves signal-to-noise ratio.

9.1.1 Extract Cleanup

Cleanup procedures may not be necessary for a relatively clean sample matrix, but most extracts from environmental and waste samples may require additional preparation to remove interferences before analysis. A modified Method 3665A will be used for PCB sample cleanup when sample extracts exhibit likely non-target interference due to the presence of POL or natural organic matter (NOM). The hexane layer is removed from the top of the sample extract after water has been added to facilitate the separation of the hexane and

acetone. Target analytes preferentially partition into the hexane layer. The hexane layer is removed and transferred to a clean 40-mL VOA vial using transfer pipettes. Five mL of 1:1 sulfuric-acid-water is then applied to sample extract, mixed on a vortex shaker, and allowed to settle before injection on the GC.

9.1.2 Method Applicability to Other Matrices

The extraction techniques for solids may be applicable to wipe samples and other sample matrices not addressed in Section 10.1. The analysis of oil samples may need special sample preparation procedures that are not described here.

9.1.3 Demonstration of Extraction Method Proficiency and Detection Limits

Reference materials, field-contaminated samples, and spiked samples will be used to verify the applicability of the selected extraction techniques. Samples will be spiked with the compounds of interest and surrogates in order to determine the percent recovery and the limit of detection for each extraction method.

A combination of Aroclor 1016 and Aroclor 1260 will be spiked at concentrations at or below the PQL to determine the detection limit. The PQL has been empirically determined to be 0.1 mg/kg in soil samples.

9.2 GC CONDITIONS

9.2.1 Single-Column Analysis

This capillary GC/ECD method allows the analyst the option of using 0.25-mm or 0.32-mm ID capillary columns (narrow-bore), or 0.53-mm ID capillary columns (wide-bore). Due to the likely presence of non-target interference, 0.53-mm ID columns will be used for this analysis. The GC is configured with dual injectors, dual columns, and dual detectors for simultaneous analysis of two independent samples.

9.2.2 GC Temperature Programs and Flow Rates

Table 3 lists the GC operating conditions for the analysis of PCBs as Aroclors for single-column analysis, using wide-bore capillary columns. The GC conditions in these tables are the GC temperature program and flow rates necessary to separate the analytes of interest.

Once established, the same operating conditions must be used for the analysis of samples and standards. Retention times and calibrations will be verified on a daily basis at the beginning of each analytical sequence and retention times will be verified by monitoring subsequent continuing calibration standards.

Note: Once established, the same operating conditions must be used for both calibrations and sample analyses**.**

Table 3 Instrument Conditions

Parameter	Settings
Injector Port Temperature	240°C
Detector Temperature	325°C
Temperature Program	100°C for 1 minute 10°C/min to 280°C 20°C /min to 300°C
Columns 1 and 2	30 m x 0.53 mm ID, 0.5 µm coating
Injection Volume	2 µL
Carrier Gas	Helium at 10 mL per minute.
Make-up Gas	5% Methane in Argon (P5) at 2.5 mL per minute

Notes:

°C	=	degrees Celsius	ID	=	identification
µL	=	micrograms per liter	mL	=	milliliter
µm	=	micrometers	mm	=	millimeter

9.3 INSTRUMENT CALIBRATION

9.3.1 Initial Calibration

Prepare calibration standards using the procedures in Section 7.5. PCBs will be determined and quantitated as Aroclors using an external standard calibration.

Note: Because of the sensitivity of the electron capture detector, always clean the injection port and column prior to performing the initial calibration.

To establish the calibration factor, estimate the linear range starting at the PQL, which is the lowest concentration that can be accurately quantitated using the established GC analysis conditions. The upper dynamic range of the calibration is dependent on the detector and

operating conditions. Upper calibration standards should demonstrate adequate sensitivity as evaluated using the response factor (RF) for each individual standard. The RF is equal to: RF=Peak Area in the Standard/Total Mass of the Standard Injected (in nanograms).

The initial calibration consists of two parts, described below.

9.3.1.1 Establishment of Linear Dynamic Range

As noted in Section 7.5, a standard containing a mixture of Aroclor 1016 and Aroclor 1260 will include many of the peaks represented in the other five Aroclor mixtures. Thus, such a standard may be used to demonstrate the linearity of the detector and to demonstrate that a sample does not contain peaks that represent any one of the Aroclors. This standard can also be used to determine the concentrations of either Aroclor 1016 or Aroclor 1260, should they be present in a sample. Therefore, an initial multi-point calibration is performed using the mixture of Aroclors 1016 and 1260.

9.3.2 Selection of Quantitative Peaks

Sample and standard concentrations will be determined using 5 quantitation peaks for each Aroclor. The peaks must be characteristic of the Aroclor in question. Selected quantitation peaks should be at least 25% of the height of the largest Aroclor peak. The 5 quantitative peaks are selected at the discretion of the analyst, and should demonstrate adequate separation from non-quantitative peaks. When practical, the quantitative peaks should have slopes returning to baseline and not co-elute or shoulder with other peaks. For each Aroclor, the set of quantitation 5 peaks should include at least one peak that is unique to that Aroclor. If the analyst is using the Aroclor 1016/1260 mixture, none of the individual congeners should be found in both of these Aroclors.

Inject 2 µL of each calibration standard and record the peak area and retention time of each characteristic Aroclor peak to be used for quantitation. Whether using automated or manual integration technique, the peak baseline must be integrated in the same manner as the initial and continuing calibration standards, in order to accurately determine analyte quantities in the sample extract. When five peaks are used for determining sample concentrations, each peak will be assigned a concentration at $1/5^{th}$ the total concentration in the standard. The

concentration in the sample extract is determined by totaling the concentrations of the five peaks. When field sample peaks do not demonstrate the same characteristics as the standards due to interferences, a peak may be excluded from the quantitation at the discretion of the analyst. The concentration is determined by totaling the concentration of the other four peaks and multiplying the sum by 1.25 in order to normalize the sample concentration. Exclusion of quantitated peaks should only be performed by an experienced analyst after confirmation that the Aroclor has been properly identified, and that no other classes of Aroclors are present in the sample. (See Section 4.0 for description of interferences).

9.3.2.1 Calibration Factors

For a five-point calibration, ten sets of calibration factors will be generated for each standard of the Aroclor 1016/1260 mixture, with each set consisting of the calibration factors for each of the five (or more) peaks chosen for this mixture. For example, there will be at least 50 separate calibration factors in the multi-point calibration.

9.3.2.2 Establishing the Calibration Function

If a linear calibration model is used, the response factors or calibration factors from the initial calibration are used to evaluate the linearity of the initial calibration. This involves the calculation of the mean response or calibration factor, the standard deviation, and the RSD for each Aroclor peak. When the Aroclor 1016/1260 mixture is used to demonstrate the detector response, the linear calibration models must be applied to the other five Aroclors for which only single standards are analyzed. If multi-point calibration is performed for other Aroclors (such as Aroclor 1254), use the same criteria to evaluate calibration factors from those standards to evaluate linearity. An RSD of less than or equal to 20% is considered an acceptable demonstration of linearity.

Refer to EPA Method 8000B for the specifics of the evaluation of the linearity of the calibration and guidance on performing non-linear calibrations. In general, non-linear calibrations will also consider each characteristic Aroclor peak separately.

9.3.2.3 Qualitative Identification of Other Aroclors

Standards of the other five Aroclors are necessary for pattern recognition. When employing the traditional model of a linear calibration, these standards are also used to determine a single-point calibration factor for each Aroclor, assuming that the Aroclor 1016/1260 mixture in Section 7.5.1 has been used to describe the detector response. The standards for these five Aroclors should be analyzed before the analysis of any samples, and may be analyzed before or after the analysis of the five 1016/1260 standards in Section 7.5.2. These Aroclors must be reinjected if the GC operating conditions are modified, or new columns are installed. If new columns are installed with the same characteristics as the one that is replaced, and no other operating conditions have changed, the analyst may use discretion in determining if the 5 Aroclor standards need to be reinjected. Criteria for the determination include similar retention times and chromatographic patterns nearly identical to those previously established for the qualitative determination of the classes of Aroclor standards.

9.3.2.4 Initial Calibration of Other Aroclor Classes

In situations where other Aroclors of interest are present at a site, the analyst may employ a multi-point initial calibration of the Aroclors of interest (e.g., five standards of Aroclor 1254 if this Aroclor is of concern and linear calibration is employed) and not use the 1016/1260 calibration mixture.

9.4 RETENTION TIME WINDOWS

Absolute retention times are generally used for compound identification. When absolute retention times are used, RTWs are crucial to the identification of target compounds, and should be established by one of the approaches described in EPA Method 8000B.

Retention time windows are established to compensate for minor shifts in absolute retention times as a result of sample loadings and normal chromatographic variability. The width of the RTW should be carefully established to minimize the occurrence of both false positive and false negative results. Tight RTWs may result in false negatives and/or may cause unnecessary reanalysis of samples when surrogates or spiked compounds are erroneously not identified. Overly wide RTWs may result in false positive results that cannot be confirmed upon further analysis. Analysts should reference EPA Method 8000B for the details of

establishing RTWs. Other approaches to compound identification may be employed, provided that the analyst can demonstrate and document that the approaches are appropriate for the intended application. A sum of the area of all peaks (congeners) in any class of Aroclors in not recommended due to the relative inaccuracy of the integration.

When conducting Aroclor analysis, it is important to determine that common single-component pesticides, such as DDT, DDD, and DDE, do not elute at the same retention times as the target congeners. There may be substantial DDT interference with the last major Aroclor 1254 peak in some soil and sediment samples.

9.5 GAS CHROMATOGRAPHIC ANALYSIS OF SAMPLE EXTRACTS

9.5.1 Operating Conditions for Field Samples

The same GC operating conditions used for the initial calibration must be employed for the analysis of all samples and continuing calibration standards.

9.5.2 Continuing Calibration Verification

Verify calibration at least once each 12-hour shift or every 20 samples, by injecting calibration verification standards prior to conducting any sample analyses. A calibration standard must also be injected at intervals of not less than once every 20 samples and at the end of the analysis sequence. For Aroclor analyses, the calibration verification standard will be a mixture of Aroclor 1016 and Aroclor 1260. The calibration verification process does not *require* analysis of the other Aroclor standards used for pattern recognition unless that Aroclor is present in a field sample.

9.5.2.1 <u>Continuing Calibration Verification Criteria</u>

The calibration factor for each analyte calculated from the CVS should not exceed a difference of more than ±20 percent when compared to the mean calibration factor from the initial calibration curve. If a calibration approach other than the RSD method has been employed for the initial calibration (e.g., a linear model not through the origin, a non-linear calibration model, etc.), consult Method 8000B for the specifics of calibration verification. % Difference = ((known concentration of standard-standard analytical result/ known concentration) * 100. RF × 100

9.5.2.2 Continuing Calibration Verification Failure

If the calibration does not meet the ±20% limit on the basis of each compound, check the instrument operating conditions, and if necessary, restore them to the original settings, and inject another aliquot of the calibration verification standard. If the response for the analyte is still not within ±20%, then a new initial calibration must be prepared. See Section 8.0 for a discussion on the effects of a failing calibration verification standard on sample results.

9.5.3 Qualitative Identification of Aroclors

Qualitative identifications of target analytes are made by examination of the sample chromatograms and comparison of target analytes to known standards injected on the GC under the same analytical conditions.

9.5.4 Quantitative Determination of Aroclor Concentrations

Quantitative results are determined for each identified analyte using the procedures described in Section 9.3 for the external calibration procedure (Method 8000B). If the responses in the sample chromatogram exceed the calibration range of the system, dilute the extract and reanalyze.

9.5.5 Sample Bracketing with Continuing Calibration Standards

Each sample analysis employing external standard calibration must be bracketed with an acceptable initial calibration, calibration verification standard(s) after every 20 field samples, or calibration standards interspersed within the samples. The results from these bracketing standards must meet the calibration verification criteria in Section 9.3. Multi-level standards are used in the initial calibration to ensure that detector response remains stable for all analytes over the calibration range.

When a calibration verification standard fails to meet the QC criteria, all samples that were injected after the last standard that met the QC criteria must be evaluated to prevent misquantitation and possible false negative results, and reinjection of the sample extracts is required. More frequent analyses of standards will minimize the number of sample extracts that would have to be reinjected if the QC limits are violated for the standard analysis. However, if the standard analyzed after a group of samples exhibits a response for an analyte

that is above the acceptance limit, i.e., >20% of true value, and the analyte was not detected in the specific samples analyzed during the analytical shift, then the extracts for those samples do not need to be reanalyzed, because the verification standard has demonstrated that the analyte would have been detected if it were present. In contrast, if an analyte above the QC limits was detected in a sample extract, then reinjection is necessary to ensure accurate quantitation. If an analyte was not detected in the sample and the standard response is more than 20% below the initial calibration response, then reinjection is necessary. The purpose of this reinjection is to ensure that the analyte could be detected, if present, despite the change in the detector response, e.g., to protect against a false negative result.

Sample injections may continue for as long as the CVS and other standards interspersed with the samples meet instrument QC requirements. It is *recommended* that standards be analyzed after every 10 samples (*required* after every 20 samples and at the end of a set per EPA Method 8082) to minimize the number of samples that must be re-injected when the standards fail the QC limits. The sequence ends when the set of samples has been injected, after 24 hours of continuous injections, or when qualitative or quantitative QC criteria are exceeded.

9.5.6 Retention Time Stability

Use the calibration standards analyzed during the sequence to evaluate retention time stability. If any of the standards fall outside their daily RTWs, the system is out of control. Determine the cause of the problem and correct it. Likely causes of retention time shifts are loss of system integrity due to a leaking gas system. Check regulator pressures at the cylinders and flow controls on the GC. If they are the same as the conditions used to initially determine the RTWs, replace the injector septa and/or check for leaks in the system with a helium leak detector.

9.5.7 Analytical Interferences

If compound identification or quantitation is precluded due to interferences (e.g., broad, rounded peaks or ill-defined baselines are present), corrective action is warranted. Cleanup of the extract, column trimming, or replacement of the capillary column or detector may be necessary. The analyst may begin by rerunning the sample on another column to determine if

the problem results from analytical hardware or the sample matrix. Refer to Section 9.1.1 for sample cleanup procedures.

9.6 QUALITATIVE IDENTIFICATION

The identification of PCBs as Aroclors using this method with an electron capture detector is based on agreement between the retention times of peaks in the sample chromatogram with the RTWs established through the analysis of standards of the target analytes. See Section 9.4 for information on the establishment of retention time windows. Tentative identification of an Aroclor occurs when peaks from a sample extract fall within the established RTWs for a particular Aroclor.

The results of a single column/single injection analysis may be confirmed, if necessary, on a second, dissimilar, GC column. In order to be used for confirmation, RTWs must have been established for the second GC column. In addition, the analyst must demonstrate the sensitivity of the second-column analysis. This demonstration must include the analysis of a standard of the target analyte at a concentration at least as low as the concentration estimated from the primary analysis. That standard may be the individual Aroclor or the Aroclor 1016/1260 mixture.

When samples are analyzed from a source known to contain specific Aroclors, the results from a single-column analysis may be confirmed on the basis of a clearly recognizable Aroclor pattern. This approach should not be attempted for samples that appear to contain mixtures of Aroclors. In order to employ this approach, the analyst must document:

- The peaks that were evaluated when comparing the sample chromatogram and the Aroclor standard.
- The absence of major peaks representing any other Aroclor.
- The source-specific information indicating that Aroclors are anticipated in the sample (e.g., historical data, generator knowledge, etc.).

Note: This information should either be provided to the data user or maintained by the laboratory.

9.6.1 Confirmation

Tentative identification of an analyte occurs when a peak from a sample extract falls within the daily RTW established by injection of a known standard. An experienced analyst must perform the confirmation.

9.7 QUANTITATION OF PCBS AS AROCLORS

The quantitation of PCB residues as Aroclors is accomplished by comparison of the sample chromatogram to that of the most similar Aroclor standard. A choice must be made as to which Aroclor is most similar to that of the residue and whether that standard is truly representative of the PCBs in the sample.

Use the individual Aroclor standards (not the 1016/1260 mixtures) to determine the pattern of peaks on Aroclors 1221, 1232, 1242, 1248, and 1254. The patterns for Aroclors 1016 and 1260 will be evident in the mixed calibration standards.

Once the Aroclor pattern has been identified, compare the response's 5 major peaks in the single-point calibration standard for that Aroclor with the peaks observed in the sample extract. The amount of Aroclor is calculated using the individual calibration factor for each of the 5 characteristic peaks chosen in Section 9.3 and the calibration model (linear or non-linear) established from the multi-point calibration of the 1016/1260 mixture. Non-linear calibration may result in different models for each selected peak, i.e. more than one type of calibration may be used for fitting the differing peaks but only one type of calibration per peak. A concentration is determined using each of the characteristic peaks and the individual calibration factor calculated for that peak in Section 9.2. Then, these 5 concentrations are totaled to determine the concentration of that Aroclor.

Weathering of PCBs in the environment and changes resulting from chemical or natural weathering processes, may alter the PCBs to the point that the pattern of a specific Aroclor is no longer recognizable.

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10.0 GC MAINTENANCE

The analytical system must be inspected and maintained on a daily basis to ensure accurate and determinative identification and quantitation of analytical samples.

10.1 METAL INJECTOR BODY

Turn off the oven, cool the detectors and injectors to room temperature, and remove the analytical columns once the oven has cooled. Remove the glass injection port insert. Inspect the injection port and remove any noticeable foreign material.

Place a beaker beneath the injector port inside the oven. Using a wash bottle, rinse the entire inside of the injector port with acetone and then hexane while catching the rinseate in the beaker.

Deactivated glass injection port liners should be replaced after every 3 days, or as indicated by instrument conditions. Replace the injector liner, reassemble the injector, replace the injector septa, and re-install the columns. Test all fittings with a leak detector to ensure a gas-tight system.

10.2 COLUMN RINSING

Rinse the column with several column volumes of an appropriate solvent. Both polar and nonpolar solvents are recommended. Depending on the nature of the sample residues expected, the first rinse might be water, followed by methanol and acetone. Fill the column with the appropriate solvent and allow it to stand flooded overnight to allow materials within the stationary phase to migrate into the solvent. Afterwards, flush the column with fresh hexane, drain the column, and dry it at room temperature with a stream of ultrapure nitrogen or helium.

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11.0 DATA ANALYSIS AND CALCULATIONS

The determination of sample concentrations is essential to project goals and quality assurance objectives. Whenever possible, spreadsheets with inserted formulas will be utilized to perform routine calculations, including determination of percent solids, sample extract concentrations, and sample concentrations. Sample extract concentrations are determined with Agilent Chemstation/Enviroquant software.

11.1 DETERMINATION OF PERCENT SOLIDS

The determination of the percent solids is performed using a spreadsheet with the following procedures and calculations:

1. Zero the 2 place balance.
2. Weigh the empty aluminum pan and record the weight.
3. Tare the balance with the aluminum pan on the balance.
4. Add approximately 10 grams of sample that is representative of the sample. Be sure to remove any rocks or twigs that may be present. Record the weight.
5. Place the panned sample in the drying oven, which is set at 104°C, for a minimum of 4 hours or until the sample is dry.
6. Remove the dry weight sample and allow to cool to room temperature.
7. Record the weight of the dried sample and pan.
8. Calculate the percent (%) solids.

Note: % Solids= (dry weight + pan weight)-pan weight)/ wet weight)*100

11.2 DETERMINATION OF SAMPLE CONCENTRATIONS

The concentration in the sample extract is calculated with the data system in Enviroquant and is based on the current calibration. The analyst must ensure that the data system is using the current calibration factors to calculate the concentration of analytes in the extract. The calculation for determining the soil sample concentration is performed on an Excel spreadsheet using the following formula.

Soil concentration= (Concentration of the sample extract (µg/L)/1000 µg/g) X (Volume of the sample extract (10mL of hexane)/dry weight of sample (g)) X dilution factor (1 or more). The result will be in µg/g, which equates to mg/kg (ppm).

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12.0 METHOD PERFORMANCE

Performance data and related information are provided in EPA SW-846 Solid Waste Methods only as examples and guidance. The data do not represent required performance goals for users of the methods. Instead, performance criteria should be developed on a project-specific basis, and the laboratory should establish in-house QC performance criteria for the application of this method. These performance data are not intended to be and must not be used as absolute QC acceptance criteria for purposes of laboratory accreditation.

The accuracy and precision obtainable with this method depend on the sample matrix, sample preparation technique, optional cleanup techniques, and calibration procedures used.

12.1 METHOD DETECTION LIMIT STUDY (MDL)

An MDL study is performed for with the same Aroclor mixture using in the ICAL and spiking solutions, but at a lower concentration. At minimum, the MDL spike should be at or below the PQL. The MDL samples go through the same extraction procedure as field and QC samples. Ten samples are extracted in the same batch along with a method blank. Sample concentrations are quantified and the standard deviation is calculated for all of the MDL samples. The standard deviation is then multiplied by the student T value to determine the MDL.

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13.0 POLLUTION PREVENTION

Pollution prevention encompasses any technique that reduces or eliminates the quantity and/or toxicity of waste at the point of generation. Numerous opportunities for pollution prevention exist in laboratory operations. The EPA has established a preferred hierarchy of environmental management techniques that places pollution prevention as the management option of first choice. Whenever feasible, laboratory personnel should use pollution prevention techniques to address their waste generation. When wastes cannot be feasibly reduced at the source, the Agency recommends recycling as the next best option.

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14.0 WASTE MANAGEMENT

Laboratory waste management practices will be conducted consistently with all applicable federal, state and local rules and regulations. The laboratory will use best practices to protect the air, water, and land, by minimizing and controlling all releases from hoods and bench operations, complying with all permits and regulations, and by complying with all solid and hazardous waste regulations, particularly the hazardous waste identification rules and land disposal restrictions. For further information on waste management, consult the *Waste Management Plan*, located inside the Bristol Work Plan, which is a separate document. Waste streams will be segregated and stored in categories, such as chlorinated and non-chlorinated solvents, acids and solid waste. Used solvents and acids will be stored in labeled bung top drums. Extracted and unextracted soil and solid reagents, such as sodium sulfate or diatomaceous earth, will be incorporated into the contaminated soil waste stream, which will be disposed of at the appropriate permitted treatment storage disposal facility (TSDF).

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15.0 REFERENCES

U.S. Environmental Protection Agency (EPA), 2007a. EPA Method 3545A Pressurized Fluid Extraction, Revision 1 and all promulgated updates. EPA Office of Solid Waste. February 2007.

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EPA, 2002. Standard Operating Procedure for Polychlorinated Biphenyls (PCBs) Field Testing for Soil and Sediment Samples. The Office of Environmental Measurement and Evaluation. EPA Region New England. 2002.

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APPENDIX E

Spill Prevention, Control, and Countermeasures Plan

ENGINEER'S CERTIFICATION

I hereby certify that I or my agent has personally examined this facility and attest that this Spill Prevention, Control, and Countermeasures (SPCC) Plan has been prepared in accordance with good engineering practices, including consideration of applicable industry standards, and with the requirements of the SPCC Rule (40 CFR Part 112). I further attest that this plan establishes procedures for testing and inspections, and that this plan is adequate for this facility.

This certification will expire if there is a change in the facility design, construction, operation, or maintenance that could materially affect the potential for discharge of oil into or upon navigable waters or adjoining shorelines. Recertification of this plan is not required for non-technical changes to the plan, such as changes to names and phone numbers.

Kyle L. Petersen, P.E.
Registration No.: Alaska CE-11250

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REVIEW PAGE

In accordance with Title 40 Code of Federal Regulations (CFR) 112.5(b), a review and evaluation of this Spill Prevention, Control, and Countermeasures (SPCC) Plan is conducted at least once every five years if the temporary fuel storage area is still in use. As a result of this review and evaluation, Bristol Environmental & Engineering Services Corporation (Bristol) will amend the SPCC Plan within six months of the review to include more effective prevention and control technology if: (1) such technology will significantly reduce the likelihood of a spill event from the facility, and (2) such technology has been field-proven at the time of review. Any technical amendment to the SPCC Plan shall be certified by a Professional Engineer within six months after a change in the facility design, construction, operation, or maintenance occurs that materially affects the facility's potential for the discharge of oil into or upon the navigable waters of the United States or adjoining shorelines. A Certification of the Applicability of the Substantial Harm Criteria Checklist is included as Attachment 1.

Review	Signature

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MANAGEMENT APPROVAL

Bristol is committed to the prevention of discharges of oil to navigable waters and the environment, and maintains the highest standards for spill prevention, control, and countermeasures through regular review, updating, and implementation of this Spill Prevention, Control, and Countermeasures Plan for the temporary fuel storage area constructed to support Bristol's Hazardous, Toxic, Radioactive Waste (HTRW) Remedial Actions at Northeast Cape, St. Lawrence Island, Alaska.

Molly Welker
Bristol Project Manager

Signature: Molly W

Date: 8/3/11

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ACRONYMS AND ABBREVIATIONS

ADEC	Alaska Department of Environmental Conservation
Bristol	Bristol Environmental Remediation Services, LLC
CFR	Code of Federal Regulations
EPA	U.S. Environmental Protection Agency
HTRW	Hazardous, Toxic, and Radioactive Waste
ISO	International Standards Organization
MOC	Main Operations Complex
PPE	personal protective equipment
SPCC	Spill Prevention, Control, and Countermeasures
TDC	Transportation and Disposal Coordinator

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1.0 FACILITY OWNER AND OPERATOR

1.1 FACILITY OWNER ADDRESS AND TELEPHONE

Bristol Engineering Services Corporation (Bristol)
111 West 16th Avenue, Third Floor
Anchorage, Alaska 99501
Contact: Molly Welker
Business Phone: 907-563-0013
Cell Phone: 907-244-7784
Home Phone: 907-522-1805

1.2 LAND OWNER ADDRESS AND TELEPHONE

Sivuqaq Incorporated – Village Native Corporation
P.O. Box 101
Gambell, Alaska 99742
Phone: 907-985-5826
Fax: 907-985-5426
E-mail: sivuqaq@gci.net

Kukulget Incorporated – Village Native Corporation
PO Box 150
Savoonga, Alaska 99769
Phone: 907-984-6613

1.3 DESIGNATED PERSON RESPONSIBLE FOR SPILL PREVENTION

Chuck Croley, Bristol Site Superintendent
Bristol Engineering Services Corporation (Bristol)
111 West 16th Avenue, Third Floor
Anchorage, Alaska 99501
Business Phone: 907-563-0013
Cell Phone: 907-242-7402

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2.0 FACILITY AND EMERGENCY CONTACTS

NAME/AGENCY	PHONE
GOVERNMENT REPORTING	
National Response Center	1-800-424-8802
Alaska Department of Environmental Conservation (ADEC) Fairbanks Office	907-451-2121
ADEC – After Hours	1-800-478-9300
U.S. Coast Guard	907-581-3466 907-391-2733 (24 Hr.)
SPILL RESPONSE ORGANIZATIONS	
Alaska Chadux Corporation	907-348-2365 (24 Hr)
SPILL PREVENTION MANAGER	
Chuck Croley – Bristol Site Superintendent/Spill Prevention Manager	1-206-973-0239 907-242-7402 (Cell)
PROJECT MANAGER	
Molly Welker, Bristol Project Manager	907-563-0013 (Office) 907-244-7784 (Cell) 907-522-1805 (Home)
Carey Cossaboom, USACE Project Manager	907-753-2689 (Office)
EMERGENCY CONTACTS	
Base Camp (Also for Medical Emergencies)	1-206-973-0239
Alaska State Troopers (Anchorage)	907-269-5511
Alaska State Troopers (Nome)	907-443-2441
Norton Sound Health Corporation Medevac	907-443-3311
Providence Hospital (Anchorage)	907-562-2211
Alaska Regional Hospital (Anchorage)	907-264-1222
Alaska Native Medical Center (Anchorage)	907-563-2662
Alaska Native Medical Center (Emergency)	907-729-1729

Notes:
Bristol = Bristol Environmental Remediation Services, LLC
USACE = U.S. Army Corps of Engineers, Alaska District

Reporting requirements will follow Alaska Department of Environmental Conservation (ADEC) spill reporting guidelines (see Section 8.6). The National Response Center (single-

source contact for all federal agencies) should be notified first, followed by the ADEC. In an emergency, or if a spill has entered or threatens to approach water, the U.S. Coast Guard should be notified immediately. The U.S. Environmental Protection Agency (EPA) notification is required for a single spill discharged to navigable water that is greater than 1,000 gallons, or two spills discharged to navigable water within any 12-month period that are greater than 42 gallons each. Alaska Chadux Corporation can be contacted for spill response and cleanup operations.

3.0 FACILITY LOCATION AND SETTING

3.1 FUEL FACILITY LOCATION

The temporary fuel facility is located on the Northeast Cape on St. Lawrence Island (Figure 1). The site is located at 63 degrees 20 minutes north latitude, by 168 degrees 59 minutes west longitude, in Township 25 South, Range 54 West, Kateel River Meridian. The temporary fuel storage facilities will be used to support the U.S. Army Corps of Engineers, Alaska District, project for HTRW Remedial Actions. The fuel facility will be used for heavy equipment personnel support vehicles/equipment and construction camp generators.

3.2 SITE HISTORY

Refer to the 2011 Work Plan, Section 2.5.4 (Bristol, 2011), for site history details.

In June 2011, Bristol will mobilize eight 5,500-gallon International Standards Organization (ISO) tanks containing diesel and two 5,500-gallon ISO tanks containing unleaded gasoline (filled to 4,500 gallons each). The ISO tanks will be unloaded from the barge at St. Lawrence Island, loaded on a trailer, and then trucked to the temporary fuel storage facility.

At the completion of the project, the ISO tanks will be loaded on a flatbed truck with a crane or a forklift, returned to the beach, and loaded aboard the barge for demobilization to Anchorage, Alaska. The completion of the project will occur at the end of the summer (approximately September 2011).

3.3 DRAINAGE PATHWAY AND DISTANCE TO NAVIGABLE WATERS

The main temporary fuel storage facility is about 8,000 feet southwest of Kitnagak Bay on a gravel pad immediately southeast of the Former Main Operations Complex (MOC) Area (Figure 2). The topography slopes gently northeast from the main fuel storage location to Kitnagak Bay. The Suqitughneq River is located approximately 2,000 feet from the temporary facility. A distinct drainage pathway to the Suqitughneq River exists approximately 750 feet northwest of the area of the main temporary fuel storage facility. Figure 3 shows the drainages in the vicinity of the temporary fuel storage facility. The Certification of the Applicability of the Substantial Harm Criteria Checklist is included as Attachment 1.

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4.0 FACILITY DESCRIPTION

4.1 FUEL FACILITY LAYOUT

4.1.1 General Description

The layout for the main temporary fuel storage facility is shown on Figure 4. The main temporary fuel storage facility will be constructed on a gravel pad immediately southeast of the former MOC Area.

4.1.2 Fuel Storage

The nine 5,500-gallon ISO tanks at the temporary fuel storage facility will have a maximum fuel storage capacity of 44,000 gallons (maximum stored capacity will be no greater than 36,000 gallons). The ISO tanks are single-walled, stainless-steel material with a shell thickness of 0.24 inches.

Eight ISO tanks will store diesel fuel and two will store gasoline. Table 1 identifies the fuel tanks and assigns a tank identification number for the purpose of Spill Prevention Control and Countermeasures (SPCC).

Table 1 Fuel Storage Tanks

Tank ID	Tank Capacity (Gallons)	Contents	Maximum Quantity Stored Per Tank (Gallons)	Maximum Quantity Stored (Gallons)	Tank Description
1 through 8	5,500 (ea)	Diesel No. 2	4,500 (82% Capacity)	36,000 (82% Capacity)	Single-walled, ISO tanks with stainless-steel spill boxes on top fittings
9	5,500 (ea)	Unleaded Gasoline	4,500 (82% Capacity)	9,000 82% Capacity)	Single-walled, ISO tanks with stainless-steel spill boxes on top fittings

Notes:
% = percent ID = identification
ea = each ISO = International Standards Organization

4.1.3 Containment

At the main temporary fuel storage facility, the ISO tanks will be placed in a common secondary containment area. This containment area will be constructed on a laydown area

immediately southeast of the MOC Area. Figure 4 shows a cross section and dimensions of the containment berm and ISO tanks.

Granular fill from the borrow pit will be transported to the location and spread to level and expand the area. Because the fill is somewhat angular and sharp, a minimum one-fourth inch-thick geotextile will be laid over the rock and then covered with Typar® liner, and finally a 20-mil Hypalon™ liner as the impervious containment surface. Berms will be created with soil transported from the borrow pit. The Hypalon® liner will be laid over the berms and secured with sand bags.

The minimum inside length of the containment berm will be 45 feet, and the minimum inside width will be 45 feet. The berm will be built to a height of 2 feet. The maximum expected rain event for one day is estimated to be 2.36 inches. Using these dimensions, the one-day maximum storm precipitation volume was calculated to be 3,000 gallons. The capacity of the containment area using these dimensions and accounting for displacement from the tanks and fueling flat will be approximately 13,000 gallons.

4.1.4 Fuel Delivery to St. Lawrence Island

Each 5,500-gallon ISO tank will be fueled in Anchorage, Alaska, before the tanks are loaded and mobilized to St. Lawrence Island. At St. Lawrence Island, the ISO tanks will be offloaded onto a flatbed truck and transported to the main temporary fuel storage area at the construction camp. At the main temporary fuel storage locations, the ISO tanks will be placed within the bermed secondary containment area. No refueling or transfer of contents between ISO tanks will take place on the island.

4.2 OPERATING PROCEDURES

Fuel from the main temporary fuel storage location will be transferred into the 900-gallon-capacity oiler truck. Fuel will be transferred to the oiler truck by a 3-inch pump and hose equipped with dry-break connectors and Camlock fittings. The truck will be parked inside the containment berm on a 20-foot-long by 8-foot-wide flat bed truck. The ISO tanks will not be connected to one another using a manifold system. The oiler truck will be used to transport

and dispense fuel to the camp generators, and to individual pieces of equipment Bristol will operate on the island.

Diesel and unleaded gasoline will be dispensed to equipment storage tanks and to individual vehicles using a conventional 1-inch-diameter hose and fuel nozzle. An electrically-powered fuel transfer pump will be placed inside the containment berm. For vehicles, spill pans will be placed beneath the fill port during refueling.

The following procedures will be adhered to during all fueling operations to or from the fuel tanks:

- Parking brakes are on. The vehicle is blocked. The engine is off unless required to operate the fuel transfer pump;
- The delivery hose and all valves and piping are checked for visible leaks, cracks, or damage;
- A check is made to ensure that valves are in the proper position;
- A drip pan is placed underneath nozzle connections and under hose connections, if required;
- Fuel levels of the target tank are checked to determine how much product the fuel tank can take. The target amount is not to exceed 90 percent of the tank capacity;
- During the transfer, flow is restricted to a reduced rate until it is certain that the product is flowing correctly. Once the pump is running, the operator must remain ready for emergency shut-downs until all fluid is transferred. The transfer rate is again reduced when the 90 percent level is approached. All personnel must be notified when the transfer operation is nearing completion;
- Once fueling is complete, valving is closed so that fuel can no longer be transferred from the tank. Any fuel remaining in the piping or transfer hose is be collected and returned to the appropriate tank;
- All valves on the truck are closed. The hose, valves, and surrounding ground are checked for leaks; and
- If leaks are found, absorbent pads are used to capture any fuel prior to unblocking the tires and leaving the area.

4.3 FACILITY INSPECTION AND MAINTENANCE

4.3.1 Facility Inspection

A formal fuel facility inspection is to be performed every week and logged on the form provided as Attachment 2, Fuel Facility Inspection Checklist. All inspections must be signed

by the Inspector, reviewed and initialed by the designated person, and filed in the SPCC files. These records will be kept for a minimum of three years. Staff familiar with fuel facility operations will perform regular walkthroughs of the facility.

If any spills are found during the inspections, ADEC spill identification and notification procedures must be followed (Attachments 3 and 4). Areas of inspection are listed below:

- General Housekeeping. It is essential that the facility be kept clean and free of unnecessary items. Only items directly related to the operation of the facility and the storage of fuels should be in the containment areas. Personnel will perform formal monthly and informal regular checks of the facility for cleanliness and make corrections immediately. Any serious problems will be recorded and filed.
- Safety Equipment. A check will be made to ensure the availability of all fire extinguishers, safety signs, and other safety equipment. Any discrepancies will be recorded and corrected immediately.
- Signs. A check will be made to ensure that all required signs are in place. The following signs are required:
  - Tank signs – tank content indicated on the tanks;
  - Hazard placards;
  - Tank identification numbers;
  - "No Smoking" signs in storage, secondary containment, and fuel dispensing areas;
  - ADEC Discharge Notification and Reporting Placard (Attachment 3); and
  - Signs warning drivers of tank proximity.
- Security. A check will be made for any notable security issues. Security concerns will be addressed as soon as possible.
- Tanks. A check will be made for chipped or worn paint, drip marks and leaks, discoloration of tanks, corrosion, and cracks. Particular attention will be made for "weeping" or "wet" staining on the tank near the ground, which may signify internal leaking.
- Tank Supports and Foundations. These will be checked to see if the tanks are stable and level to ensure the foundations and supports are not weakening. Particular attention will be focused on cracks and gaps between the tank and foundation.
- Pumps and Hoses. Pumps, valves, and connections will be checked for leaks and drips. All spills will be immediately cleaned up and maintenance will be scheduled as required. All hoses will be inspected for cracks, leaks, or other signs of weakening and replaced as soon as possible. A check will be made to ensure that hoses are kept on hose reels or in a protected manner when not in use.

4.3.2 Spill Response Equipment Inventory and Inspection

All spill response equipment will be inspected once a week and after any event during which any of the equipment is used. This inspection will entail a complete inventory and an operational check of emergency response and support equipment (such as pumps). All deficiencies will be corrected as soon as possible, any new equipment added to the list, and the updated list filed in the SPCC files.

4.4 TRAINING

4.4.1 Initial SPCC Training

Any person who is to operate fuel storage and delivery equipment will receive training when initially hired, or when assigned duties that involve fuel handling or storage. Initial training will include operation, maintenance, and SPCC functions. As a minimum, all personnel must read the SPCC Plan and document that they have read and understood it. Training will be documented on the form provided in Attachment 5, Spill Response Team Training, Drill, and Exercise Log. This record will be maintained in the SPCC files, for at least three years.

4.4.2 Spill and Safety Briefings

Spill and safety briefings will be provided to all new personnel upon employment and regularly to all available personnel who operate and/or maintain fuel and/or equipment. The briefings will include any changes or problems with the equipment or facility, any new procedures, or any other information that could help prevent accidents and spills. The subjects covered at the briefing and attendance will be documented on the form provided in Attachment 6, Record of Attendance for Spill Response and Safety Meetings. In lieu of a meeting, a written briefing may be issued. The form contained in Attachment 6 will be attached to the written briefing. Personnel will be required to sign the form once they read and understand what it says. The signed forms will be maintained in the SPCC records.

4.5 FUEL FACILITY RECORD KEEPING

Records of all activities pertaining to the fuel facility will be maintained on file by Bristol in the SPCC documents for this project, for a period of at least three years. These records include, but are not limited to:

- Copies of Inspections;
- Operator Inspections;
- Government Inspections;
- Maintenance Records;
- Records of Major Maintenance and Construction;
- Pressure Testing of Tanks;
- Visual Integrity Inspections;
- Fuel Inventory Records;
- Training Documents;
- Training Records;
- Exercise and Safety Briefing Logs;
- Equipment Operating Procedures;
- Training Manuals;
- Oil Spill Records;
- Notification Reports;
- After-action Reports;
- SPCC Plan; and
- SPCC Correspondence.

5.0 SPILL HISTORY

The main temporary fuel storage facility is newly constructed and provides support necessary for Bristol's 2011 site activities. No spills have occurred at this location from operation of the temporary facility. The facility will be inspected regularly by personnel. An inspection will be made for indications of spilled fuel (including stains, odors, and stressed vegetation).

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6.0 POTENTIAL SPILLS AND CONTROL MEASURES

Table 2 presents potential spill predictions, volumes, and rates for this project.

Table 2 Potential Spill Predictions, Volumes, and Rates

Source	Type of Failure	Tank Volume (Gallons)	Maximum Spill Volume (Gallons)	Direction of Flow	Containment	Ratio (Cont. /Vol.)
ISO Tank	Rupture, leakage	5,500	5,000	Into surrounding soil	Secondary containment with impermeable liner	1,200% (main); >110% (auxiliary)
Oiler Truck Loading	Rupture, piping failure, valve failure	900	810	Into surrounding soil	By boom and absorbent pads	100% if boom is placed in time
Transfer Hose/ Pump	Pipe/hose rupture	9	8 (estimated maximum)	Into surrounding soil	By boom and absorbent pads	100% if boom is placed in time

Notes:
% = percent ISO = International Standards Organization
Cont. = containment Vol. = volume

6.1 TANK FAILURE

A puncture or rupture of tanks is unlikely because of the berm surrounding the tanks. If a valve is broken by violent contact, the complete drainage of any tank is possible. Valves are unlikely to break from freezing because this is a seasonal camp.

A complete spill from a tank would be contained within the containment berm. Fuel spilled outside the tank, within the containment berm, could be pumped into tanker trucks, or into 55-gallon drums. Recovered fuel would be stored in 55-gallon drums or other containers until they are properly disposed of.

During mobilization and demobilization efforts, it will be necessary to move the tanks using heavy equipment between the barge landing area and the fuel storage containment area. The possibility for a spill exists if the tank is punctured or a valve is broken due to the mishandling

of containers. Spills occurring during transportation of the tanks would likely be released to the environment.

Initial recovery could be performed with heavy equipment, shovels, absorbent pads, drums and other containers, and a portable pump, if needed. A spill traveling towards the river would require the placement of boom to contain the flow. Long-term treatment and storage of contaminated soil would be required.

6.2 BROKEN HOSE CONNECTION

6.2.1 Transfers From Fuel Truck

Generators and vehicles will be filled by the fuel truck hose. The maximum capacity of the truck pump is estimated at approximately 900 gallons. Spill containment (spill buckets) will be provided for hose connections. If a hose connection or the pumping system were to break during fueling operations, the spill would likely be spilled onto the surrounding soil. The spill would likely be noticed immediately, and the operator would most likely stop pump operations within one minute. The estimated maximum amount of spilled fuel from such an event would not be more than 200 gallons. Some of, or the majority of, such a spill would likely be cleaned up before it could affect navigable waters. Absorbent pads, pumps, boom, and other means would be used to recover the fuel. Contaminated water, soil, or fuel could be pumped into 55-gallon drums for future disposal.

The chance of a hose break is considered to be low. If a hose is ruptured during fueling operations, the amount of fuel spilled will depend on how fast the operator shuts off the pump. In most cases, the operator will shut off the pump immediately. An estimated 200 gallons of fuel could be spilled in this scenario. However, the exact location of a hose break cannot be known until the break occurs, so it must be assumed that any spill could travel to the shoreline. Absorbent pads, boom, emergency soil berms, portable fuel pumps, and other manual methods may be required to stop the flow and recover the fuel. Some long-term treatment of the soil would be expected.

6.3 OVERSPILLS

An overspill of the generators or vehicles while fueling is possible if the tanks and/or fuel truck are not carefully monitored during fueling operations. Flow control for the generator tank is achieved through constant monitoring of the tank level. Because none of the tanks have automatic shut-off capabilities, an overspill during fueling is possible, even when closely monitored. In the event of an overspill, the operator will stop pumping immediately. Absorbent pads, pumps, and oil/water separators would normally be used to recover this fuel. Soil berms, boom, and other means of containment and recovery would be required in the event that fuel overflows from the primary containment. In this case, immediate spill response would be needed to ensure that fuel does not enter the river.

Fuel levels will be carefully monitored at all times during fuel transfers. Poor monitoring could result in a severe spill. An emphasis should be placed on the need for continual training, awareness, and education.

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7.0 EVALUATION OF COUNTERMEASURES

This section evaluates compliance of the temporary fuel storage tanks with spill prevention regulatory requirements. Paragraph titles reflect specific areas of concern outlined in Title 40, Code of Federal Regulations, Part 112 (40 CFR 112) and other related documents. Each area of concern is rated as SATISFACTORY, NOT APPLICABLE, or UNKNOWN. The rating in this case was derived from observations of prevailing conditions collected from data collected during previous temporary fuel storage operations. Any limitations are so noted and discussed in the body of this SPCC Plan. Operational and design issues may exist at the site that were not identified during the site visits.

7.1 INSPECTIONS, TESTS, AND RECORDS, 40 CFR 112.7(E)

(SATISFACTORY) Under the requirements of this SPCC Plan, employees inspect the fuel facility regularly during their normal work functions, and weekly during the fuel facility inspection. The inspections are logged using the Fuel Facility Inspection Checklist provided as Attachment 2. The completed forms will be signed by the fuel systems manager and kept on file for three years.

7.2 PERSONNEL, TRAINING, AND DISCHARGE PREVENTION PROCEDURES [40 CFR 112.7(F)]

7.2.1 Personnel Instructions [40 CFR 112.7(f)(1)]

7.2.1.1 Annual Training

(SATISFACTORY) Because the fuel storage facilities are temporary, new workers involved with fuel handling will attend an initial training session that will meet the requirements of the annual training.

7.2.1.2 Annual Exercises

(SATISFACTORY) Because the fuel storage facilities are temporary, annual exercise requirements will be met by accomplishing an initial “tabletop” spill scenario on site, at the beginning of the project. All employees that operate fuel facility equipment will attend the “tabletop” exercise in operations and spill prevention. Training, exercise, and inventory procedures will be established under this SPCC Plan and all associated records maintained in

the SPCC Records. A reporting placard is included with this SPCC Plan, and should be prominently displayed at the fuel facility. A Spill Response Team Training, Drill, and Exercise Log is provided as Attachment 5.

7.2.1.3 Weekly Spill Response and Safety Meetings

(SATISFACTORY) Each week, employees will be provided a spill response and safety briefing. This briefing will be in a verbal or written format, such as applicable current news articles, and will be tailored to this fuel facility. The briefing will be documented on the Record of Attendance for Spill Response and Safety Meetings attendance record, provided as Attachment 6, and will be maintained in the project file.

7.2.2 Designated Person Accountable for Spill Prevention, 40 CFR 112.7(f)(2)

(SATISFACTORY) The Site Superintendent is Mr. Chuck Croley. He is assigned as the Spill Prevention Manager, and is the designated person accountable for spill prevention at the fuel facility.

7.2.3 Spill Prevention Briefings, 40 CFR 112.7(f)(3)

(SATISFACTORY) Spill prevention briefings will be given monthly. Sign-in sheets (Attachment 6) will be maintained with the other SPCC records, and kept on file for three years in the SPCC records.

7.3 SITE SECURITY, 40 CFR 112.7(G)

7.3.1 Fencing, 40 CFR 112.7(g)(1)

(NOT APPLICABLE) The fuel storage facility is located at a remote site that will be occupied only by contractors and agency representatives. The nearest village, Savoonga, is located approximately 60 miles west of the project site. The remote nature of the site will provide adequate security for the fuel facility.

7.3.2 Flow Valves Locked, 40 CFR 112.7(g)(2)

(SATISFACTORY) When construction operations are completed, all valves on all ISO tanks will be locked. Individual ISO tank openings will be secured with wire tag seals, unless being used.

7.3.3 Starter Controls Locked, 40 CFR 112.7(g)(3)

(SATISFACTORY) Fuel will be transferred by electric- or gasoline-powered transfer pumps that will be connected and operated only when fuel transfer is taking place.

7.3.4 Loading/Unloading Connections Securely Capped, 40 CFR 112.7(g)(4)

(SATISFACTORY) There are no pipeline loading/unloading connections. Individual ISO tank openings will be secured with wire tag seals, unless being used.

7.3.5 Lighting Adequate to Detect Spills, 40 CFR 112.7(g)(5)

(SATISFACTORY) Fuel transfer and weekly fuel facility inspections will take place during daylight hours only. Daylight will be prevalent given the seasonal operation (summer), and northern latitude of the site.

7.3.6 Facility Loading/ Unloading Rack, 40 CFR 112.7(h)

(NOT APPLICABLE) The facility does not have a loading rack.

7.4 BRITTLE FRACTURE, 40 CFR 112.7(I)

(NOT APPLICABLE) There are no field-constructed tanks at the facility.

7.5 DRAINAGE CONTROL, 40 CFR 112.8(B)

7.5.1 Drainage from Diked Storage Areas, 40 CFR 112.8(b)(1)

(SATISFACTORY) Water that accumulates in the containment dike of the temporary fuel storage facility will be pumped directly onto the ground if there is no evidence of petroleum sheen. If petroleum sheen is evident, the water will be treated with a water-scrubbing system before discharge to the ground. Water treatment, if necessary, will employ the use of a water-scrubbing system utilizing absorbent materials for the removal of petroleum hydrocarbons from water.

7.5.2 Valves Used on Diked Storage Areas, 40 CFR 112.8(b)(2)

(NOT APPLICABLE) There are no valves on the diked storage area.

7.5.3 Facility Drainage Systems and Equipment, 40 CFR 112.8 (b)(3), (4), and (5)

(NOT APPLICABLE) There are no drainage systems at the diked containment area. No treatment units or slop tanks for contaminated water treatment will exist at the main temporary fuel storage facility.

7.6 BULK STORAGE CONTAINERS/SECONDARY CONTAINMENT, 40 CFR 112.8(C).

7.6.1 Tank Compatibility with Its Contents, 40 CFR 112.8(c)(1)

(SATISFACTORY) All ISO tanks are constructed of stainless steel, welded in accordance with American Petroleum Institute standards, and are compatible with the contents they hold.

7.6.2 Diked Area Construction and Containment Volume for Storage Tanks, 40 CFR 112.8(c)(2)

(SATISFACTORY) The main temporary fuel storage facility will have bermed and lined secondary containment capable of containing a minimum capacity of the largest tank volume, plus anticipated storm water.

7.6.3 Drainage of Uncontaminated Rainwater, 40 CFR 112.8(c)(3)

(SATISFACTORY) Rainwater that accumulates in the containment dike of the temporary fuel storage facility will be pumped directly onto the ground if there is no evidence of petroleum sheen. If petroleum sheen is evident, the water will be treated before being discharged to the ground.

7.6.4 Corrosion Protection of Buried Metallic Storage Tanks, 40 CFR 112.8(c)(4)

(NOT APPLICABLE) There are no buried metallic storage tanks.

7.6.5 Corrosion Protection of Partially Buried Metallic Tanks, 40 CFR 112.8(c)(5)

(NOT APPLICABLE) There are no partially buried metallic tanks.

7.6.6 Aboveground Tank Periodic Integrity Testing, 40 CFR 112.8(c)(6)

(SATISFACTORY) Because the tanks are shop-built containers with a capacity of 5,500 gallons each, equivalent integrity testing is provided in the form of visual inspections for the

storage tanks, and barriers are provided between the tanks and the ground (diked containment area).

7.6.7 Control of Leakage Through Internal Heating Coils, 40 CFR 112.8(c)(7)

(NOT APPLICABLE) None of the tanks at the facility have internal heating coils.

7.6.8 Tank Installation Fail-safe Engineered, 40 CFR 112.8(c)(8)

(SATISFACTORY) Tanks are located within a diked containment. A complete tank failure is unlikely. Any spills would be contained within the dike.

7.6.9 Disposal Facilities for Effluent Discharge, 40 CFR 112.8(c)(9)

(NOT APPLICABLE) The fuel facility is not equipped with an effluent discharge system.

7.6.10 Visible Leak Corrections, 40 CFR 112.8(c)(10)

(SATISFACTORY) Visible leaks are reported to the Site Superintendent and fixed immediately. Spilled fuel is cleaned up immediately with absorbent pads or other applicable spill response equipment. Soiled pads and other similar spill control equipment would be kept in an overpack drum until they can be removed from the island or burned in an approved manner.

7.6.11 Portable Oil Storage Tanks, 40 CFR 112.8(c)(11)

(SATISFACTORY) All portable tanks at the temporary fuel storage facility will be in secondary containment structures with sufficient freeboard to contain the capacity of the largest tank in the dike, and expected maximum rainfall.

7.7 FACILITY TRANSFER OPERATIONS, 40 CFR 112.8(D)

7.7.1 Buried Piping Installation Protection and Examination, 40 CFR 112.8(d)(1)

(NOT APPLICABLE) No buried piping installations are present.

7.7.2 Not-in-service and Standby Service Terminal Connections, 40 CFR 112.8(d)(2)

(NOT APPLICABLE) There are no not-in-service or standby service terminal connections at this facility.

7.7.3 Pipe Supports Design, 40 CFR 112.8(d)(3)

(NOT APPLICABLE) The facility does not have a piping system.

7.7.4 Aboveground Valve and Pipeline Examination, 40 CFR 112.8(d)(4)

(SATISFACTORY) Aboveground valves will be examined during the weekly inspections. These inspections will be documented using the Fuel Facility Inspection Checklist (Attachment 2) and will be kept in the Site Superintendent's spill response files for at least three years. Bristol personnel will also observe valves periodically during each workday and will be instructed to report any problems to the Site Superintendent. There are no aboveground pipelines.

7.7.5 Protection from Vehicles, 40 CFR 112.8(d)(5)

(SATISFACTORY) The ISO tanks will be kept inside a bermed containment area, with a distance of 11 feet between the outside berm and the tanks. Speed limits in the vicinity of the ISO tanks will be 10 miles per hour, and will be discussed at safety meetings and posted.

7.8 SPILL CONTROL EQUIPMENT

(SATISFACTORY) Sufficient spill equipment is available to contain a catastrophic spill of one of the 5,500-gallon ISO tanks inside the lined and bermed facilities. Sufficient spill equipment is also available to contain a spill associated with fuel transfer from the main temporary fuel storage facility to the oiler truck. Table 3 presents spill control equipment at Bristol's project site.

Table 3 Spill Control Equipment

Amount	Material	Location	Inspection Remarks
3	55-gallon overpack drums	Various	New and complete
1	95-gallon overpack drum	Various	New and complete
20	3-inch by 12-foot SOCs™	Various	New and complete
12	3-inch by 4-foot SOCs	Various	New and complete
32	18-inch by 18-inch absorbent pillows	Various	New and complete
2,200	18-inch by 18-inch absorbent pads	Various	New and complete
800	12-inch by 12-inch absorbent wipes	Various	New and complete
25	Disposal bags	Various	New and complete
2	Rolls of 3-foot by 120-foot absorbent pad	Various	New and complete
1	750 feet of containment boom	Various	New and complete

Field first aid-kits and fire extinguishers will be available in all field vehicles. A fuel transfer pump, personal protective equipment (PPE), and 55-gallon drums will be available for spill cleanups. Heavy equipment, shovels, and other miscellaneous tools will also be available.

(Intentionally blank)

8.0 SPILLS

This section addresses procedures designed to prevent spills, and provides contingency measures for mitigation of any spills that occur during the performance of this project. The procedures discussed in this section cover control of detected spills.

8.1 GENERAL PROVISIONS

All employees will be properly trained and supervised in protocols for hazardous waste operations and emergency spill response. Proper equipment, procedures, and safeguards will be used when handling waste materials. To minimize the frequency of spills, personnel will be instructed during daily safety briefings on the proper methods for transferring and handling hazardous materials.

8.2 LIKELY SPILL SCENARIOS

Activities that could result in a spill include fueling activities associated with equipment use. A release of hazardous materials to the land could occur during equipment fueling, or transfer operations, such as from hose rupture or overfilling.

8.3 SPILL RESPONSE EQUIPMENT

To minimize the impact of spilled material by quick response, Bristol will maintain emergency spill response kits on site. Each kit will contain absorbent materials (oil sorbent pads and booms) and PPE (safety glasses or goggles, chemical-resistant gloves, Tyvek® suits, and booties, etc.). Personnel on site will be familiar with the contents and use of the kits. In addition, each vehicle on site will carry oil-sorbent pads.

Spill response materials will also be maintained at the fueling station and inside vehicles. These materials include universal and oil-only sorbent materials, and PPE. The vehicles will have spill kits containing oil-sorbent pads and an “SPC Attack Pac™”. The SPC Attack Pac contains materials to absorb up to 7 gallons of liquid spills. Personnel working at the fueling station will be familiar with the type of hazardous materials stored there, and will be instructed in the appropriate spill response procedures.

8.4 SPILL RESPONSE PROCEDURES

Bristol will contain any spill and stop all work in areas of release if there is any reason to believe the spill represents a safety concern. The following procedures will apply in the event of a spill:

- Protect project personnel and notify the Site Superintendent.
- Identify contaminant spilled, source of release, volume of release, and any associated contaminated media (such as soil).
- Take necessary personal precautions, isolate or segregate contaminated material from human contact (using temporary berms, absorbents, and shut-off valves, as necessary).
- Take immediate measures, using properly protected personnel, to control the discharge at its source and contain the release.
- Keep combustibles and ignition sources away from spilled materials.
- Take additional actions and request outside assistance, as required.

These procedures for response to spills and releases will be reviewed weekly as part of the health and safety meetings. The following sections further outline typical spill resources Bristol will employ in the event of the release of a contaminant to land.

8.4.1 Release to Water

- Contain and absorb using absorbent booms, roll absorbent, or other appropriate mechanisms.
- Eliminate and contain the spill source.
- Place absorbent between the spill source and its most direct pathway(s) to surface water access, as close to the source as possible.
- Locate and establish spill absorbent downgradient where product may collect.
- Place absorbent in other downgradient areas likely to collect spilled product.
- Change collected absorbent as necessary and store in U.S. Department of Transportation-approved containers.

8.5 SPILL REPORTING PROCEDURES

In the event of a spill, Bristol will provide all emergency measures necessary, including notifying appropriate personnel and containing the spill. The Transportation and Disposal Coordinator (TDC) will serve as Bristol's on-site representative for spill and release reporting.

The TDC will receive training for these procedures and be familiar with all aspects of implementation. The following chain of communication will be used in case of a spill:

- Site personnel will first contact Bristol's Site Superintendent.
- Bristol's Site Superintendent will contact the appropriate agencies.
- All spills will be reported using the Oil Discharge Notification Form (Attachment 4).

8.6 NOTIFICATIONS

Upon discovery of a spill, the appropriate parties listed below will be notified. Use the Oil Discharge Notification Form (Attachment 4) to document all releases. Immediate notifications should not be delayed by lack of any information required on the Oil Discharge Notification Form. The ADEC notification and reporting requirements is provided as Attachment 3.

8.6.1 Discharge to Water

For any discharge to water, immediately notify (verbally):

- National Response Center (1-800-424-8802);
- U.S. Coast Guard (1-907-391-2733);
- ADEC, Fairbanks District Office (907) 451-2121;
- EPA (if single spill greater than 1,000 gallons, or two spills discharged to navigable water within any 12-month period that are greater than 42 gallons each).

8.6.2 Discharge to Land

- For any discharges to land of greater than 55 gallons, immediately notify (verbally).
  - National Response Center (1-800-424-8802);
  - U.S. Coast Guard (1-907-391-2733);
  - ADEC, Fairbanks District Office (907) 451-2121;
  - EPA (if single spill greater than 1,000 gallons, or two spills discharged to navigable water within any 12-month period that are greater than 42 gallons each).
- Discharge to Land (less than 55 gallons):
  - Within 48 hours (written): ADEC, Fairbanks District Office (fax 907-451-2188) – releases exceeding 10 gallons, but less than 55 gallons, outside of secondary containment;

- Monthly (written): ADEC Fairbanks District Office (fax: 907-451-2188) – less than 10 gallons. Interim reports will be submitted when the total of separate releases of less than 10 gallons accumulates to exceed 10 gallons.

8.7 CONTAINMENT PROCEDURES

- Establish an exclusion zone to control access to the site. Smoking and open flames are banned within the exclusion zone.
- Prevent release of additional product by using the following procedures, as appropriate:
  - Close valves.
  - Set upright the container releasing the product.
  - Plug punctures with wooden pegs, sticks, rags, or absorbent pads.
  - Move the container into a lined containment area.
- Contain the released product by using the following procedures, as appropriate:
  - Construct earthen berms downgradient of the product.
  - Apply granular sorbent or absorbent pads and booms.
  - Collect free product with barrel pumps, buckets, skimmers, or other physical means.
- Clean up the spill by using the following procedures:
  - Recover free product.
  - Excavate affected soils and place in containment cells.
  - Gather contaminated spill response materials and place in sealable drums for disposal.
- Provide follow-up notification to appropriate parties listed in Section 8.6.

9.0 REFERENCE

Bristol Environmental Remediation Services, LLC. 2010 (March). *Northeast Cape HTRW Remedial Actions Work Plan*.

(Intentionally blank)

FIGURES

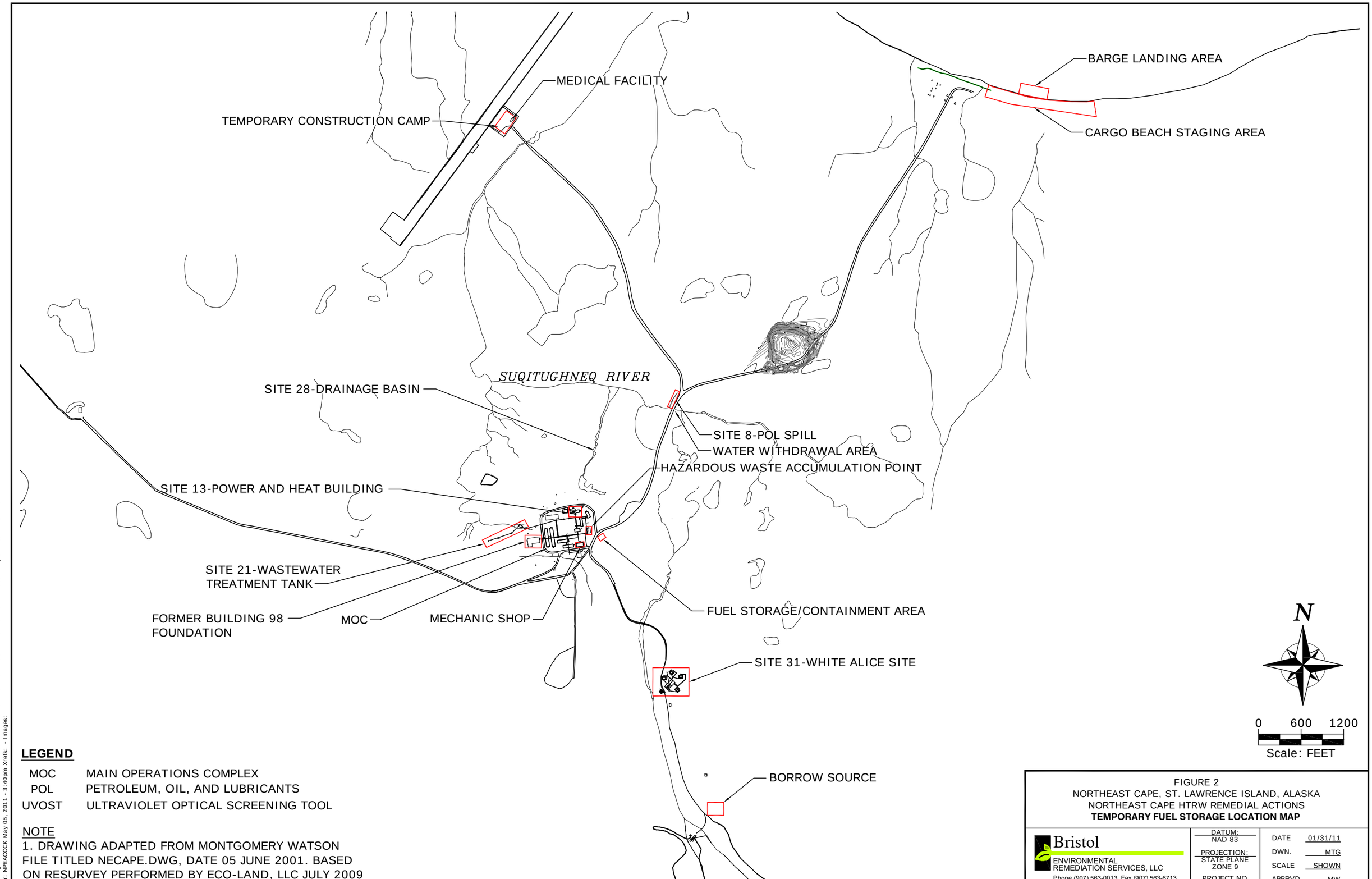
Drawing: O:\JOBS\410026 NE CAPE HTRW\ACAD-ENVIRO\FIGURES-MAR10\DWG\410026-FIG1-MAR10.DWG - Layout: 410026-FIG1-MAR10
User: MGARCIA Mar 10, 2010 - 4:05pm Xrefs: - Images: NECAPE.JPG

Source: USGS National Atlas Sheet Number 42-43

FIGURE 1
NORTHEAST CAPE, ST. LAWRENCE ISLAND, ALASKA
NORTHEAST CAPE HTRW REMEDIAL ACTIONS
VICINITY MAP

Bristol
ENVIRONMENTAL REMEDIATION SERVICES, LLC
Phone (907) 563-0013 Fax (907) 563-6713

DATUM:	NA
PROJECTION:	NA
PROJECT NO.	410026
DATE	03/08/10
DWN.	MTG
SCALE	SHOWN
APPRVD.	MW



LEGEND

MOC	MAIN OPERATIONS COMPLEX
POL	PETROLEUM, OIL, AND LUBRICANTS
UVOST	ULTRAVIOLET OPTICAL SCREENING TOOL

NOTE

1. DRAWING ADAPTED FROM MONTGOMERY WATSON FILE TITLED NECAPE.DWG, DATE 05 JUNE 2001. BASED ON RESURVEY PERFORMED BY ECO-LAND, LLC JULY 2009

FIGURE 2
NORTHEAST CAPE, ST. LAWRENCE ISLAND, ALASKA
NORTHEAST CAPE HTRW REMEDIAL ACTIONS
TEMPORARY FUEL STORAGE LOCATION MAP

Bristol
ENVIRONMENTAL REMEDIATION SERVICES, LLC
Phone (907) 563-0013 Fax (907) 563-6713

DATUM:	NAD 83
PROJECTION:	STATE PLANE ZONE 9
PROJECT NO.	34110008
DATE	01/31/11
DWN.	MTG
SCALE	SHOWN
APPRVD.	MW

Drawing: O:\JOBS\34110008 2011 NE CAPE\ACAD-ENVIRO\FIGURES-MAR11\34110008-FIG2-APR11.DWG - Layout: 34110008-FIG2-APR11
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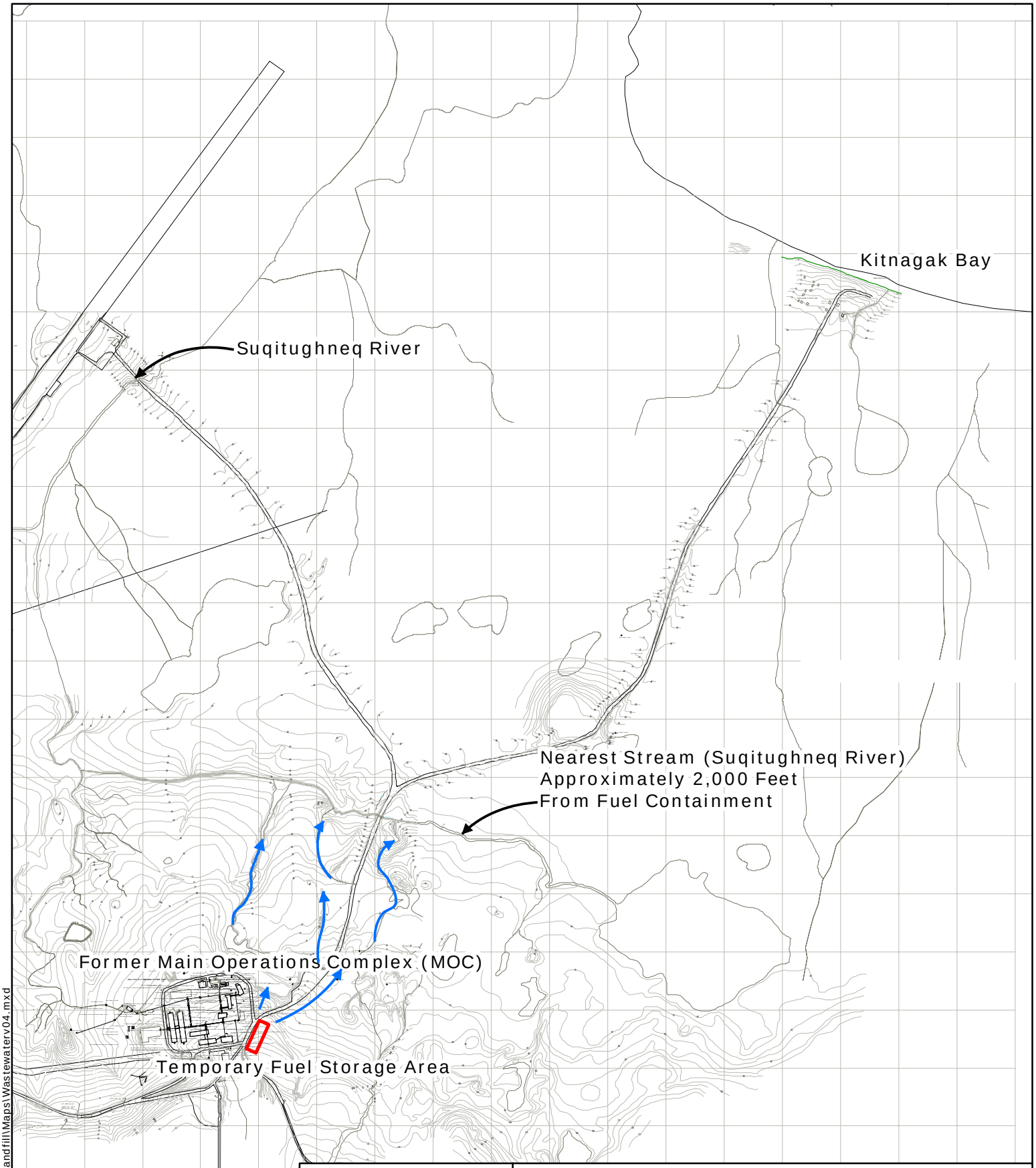


N
W E
S

Note: Not to Scale.
Blue lines indicate
surface water flow.

Figure 3
Northeast Cape, St. Lawrence Island, Alaska
Rivers and Drainage in Vicinity of
Fuel Storage Area

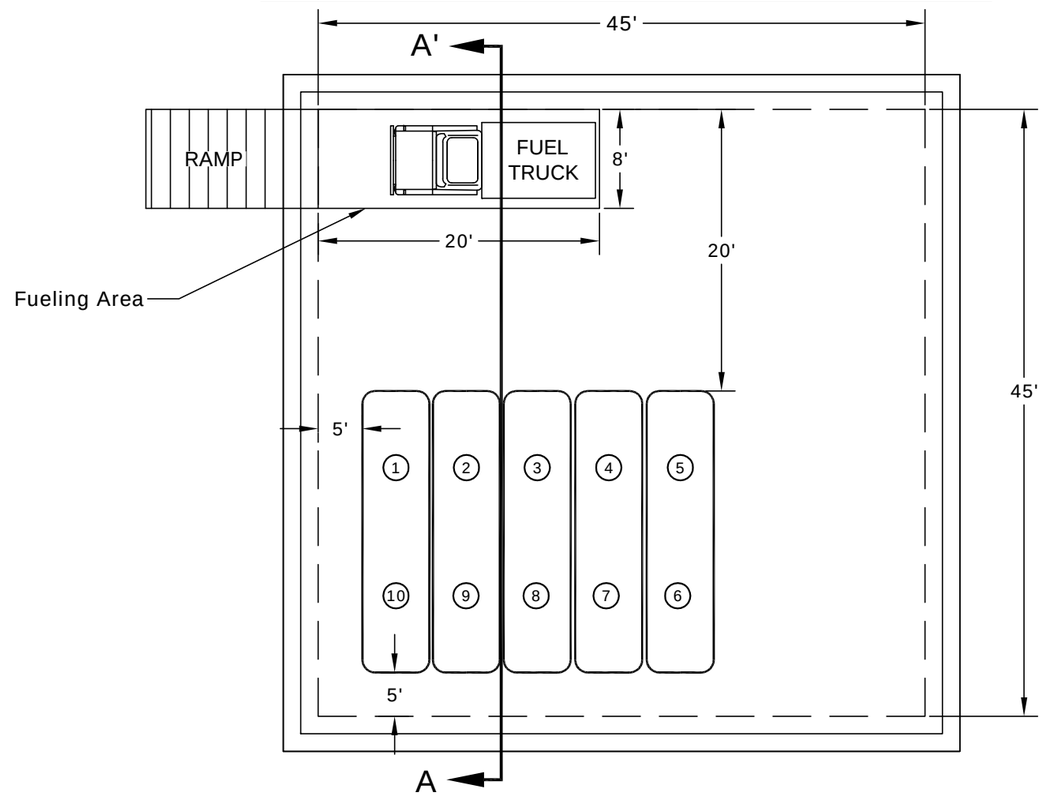
Bristol
ENVIRONMENTAL
REMEDIATION SERVICES, LLC
Phone (907)563-0013 Fax (907)563-6713
Project No. 49028

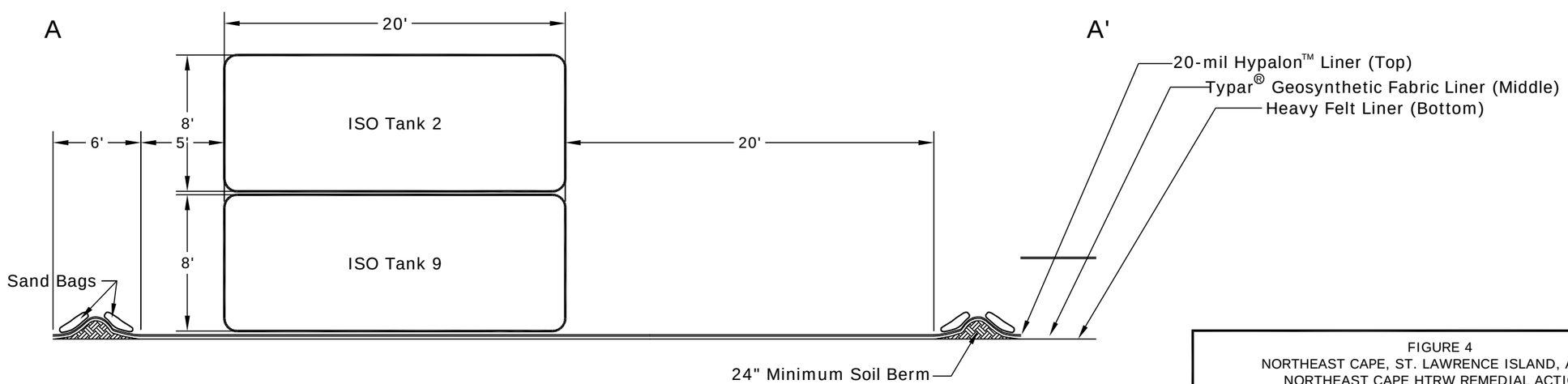
DATUM:	DATE 03-04-10	SHEET
N/A	DWN. BERS-RJ	1
PROJECTION:	SCALE NTS	of
N/A	APPRVD. BERS-MW	1

File: G:\Jobs\49028_NE_Cape_Landfill\Maps\Wastewaterv04.mxd

Main Temporary Fuel Storage Area

TANK #	CAPACITY (GALLONS)	CONTENTS
1	5,500	DIESEL
2	5,500	DIESEL
3	5,500	DIESEL
4	5,500	DIESEL
5	5,500	DIESEL
6	5,500	DIESEL
7	5,500	DIESEL
8	5,500	DIESEL
9	5,500	GASOLINE
10	5,500	GASOLINE





Typical Fuel Storage Area Cross Section A-A'

FIGURE 4
NORTHEAST CAPE, ST. LAWRENCE ISLAND, ALASKA
NORTHEAST CAPE HTRW REMEDIAL ACTIONS
TEMPORARY FUEL STORAGE AREA DETAIL

Bristol
ENVIRONMENTAL REMEDIATION SERVICES, LLC
Phone (907) 563-0013 Fax (907) 563-6713

DATUM:	NA
PROJECTION:	NA
PROJECT NO.	34110008
DATE	01/31/11
DWN.	MTG
SCALE	SHOWN
APPRVD.	MW

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ATTACHMENT 1

Certification of the Applicability of the Substantial Harm Criteria Checklist

CERTIFICATION OF THE APPLICABILITY OF THE SUBSTANTIAL HARM CRITERIA CHECKLIST

Does the facility transfer oil over water to or from vessels and does the facility have a total oil storage capacity greater than or equal to 42,000 gallons?

Yes ☐ No ☐

Does the facility have a total oil storage capacity greater than or equal to 1 million gallons and, within any storage area, does the facility lack secondary containment that is sufficiently large to contain the capacity of the largest aboveground oil storage tank, plus sufficient freeboard to allow for precipitation?

Yes ☐ No ☐

Does the facility have a total oil storage capacity greater than or equal to 1 million gallons, and is the facility located such that a discharge from the facility could cause injury to fish and wildlife and sensitive environments?

Yes ☐ No ☐

Does the facility have a total oil storage capacity greater than or equal to1 million gallons, and is the facility located such that a discharge from the facility would shut down a public drinking water intake?

Yes ☐ No ☐

Does the facility have a total oil storage capacity greater than or equal to 1 million gallons, and has the facility experienced a reportable oil spill in an amount greater than or equal to 10,000 gallons within the last 5 years?

Yes ☐ No ☐

ATTACHMENT 2

Fuel Facility Inspection Checklist

FUEL FACILITY INSPECTION CHECKLIST

ITEM	TANK # OR LOCATION	DATE	INSPECTORS SIGNATURE

FUEL TANK INSPECTION CHECKLIST (Continued)			
ITEM	**TANK # OR LOCATION**	**DATE**	**INSPECTORS SIGNATURE**

Tanks

Drip marks and leaks
Discoloration of tanks
Corrosion
Leaks
Cracks

Tank Support Foundation

Settling
Cracks
Gaps between tank & foundation
Gaps, breaks between liner & wall

Piping

Drip marks and leaks
Discoloration of soil under TF piping
Corrosion
Seepage from valves & seals
Bowing of pipe

Fuel Pumps

Pumps are operational
Drip marks and leaks
Discoloration of soil under pumps
Corrosion
Seepage from valves & seals
Fire Extinguisher is available and operational
Appropriate locks are in place

Secondary Containment Area (if applicable)

Water in containment area
Debris
Wall erosion
Floor settling
Puddles containing spilled or leaked material
Discoloration of soil/sand inside the containment area
Hardened areas of soil/sand inside the containment area
Vegetation starting to grow inside containment area

Fuel Trucks

Both trucks are operational
Pump equipment is operational
Hoses are in good order
Drip marks and leaks in truck parking area
Corrosion
Seepage from valves and seals
Extinguishers are on trucks and operational
Safety equipment is on trucks
Spill equipment is on trucks

Other

Electricity and Security lighting are operational
Security locks are properly placed
Appropriate Operational, Safety, and Emergency Action checklists are available

ATTACHMENT 3

ADEC Discharge Notification and Reporting Requirements Placard

REPORT ALL

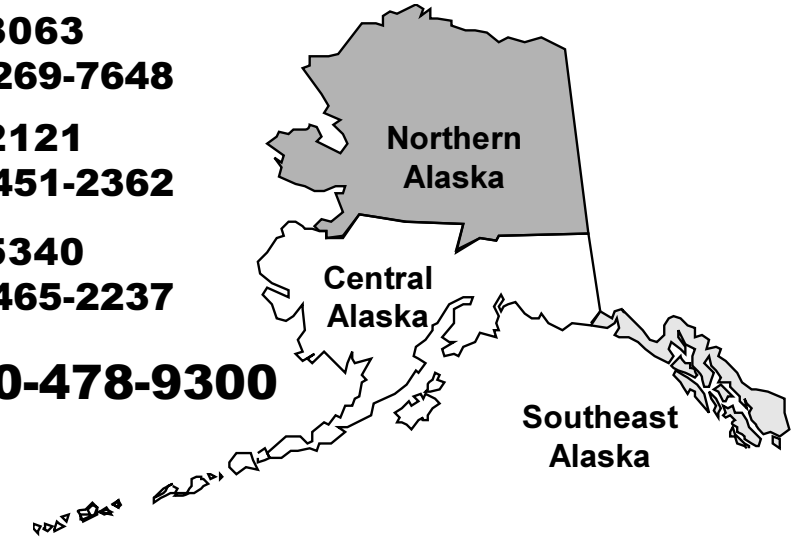
OIL AND HAZARDOUS SUBSTANCE SPILLS

ALASKA LAW REQUIRES REPORTING OF ALL SPILLS

During normal business hours

contact the nearest DEC Area Response Team office:

Central Area Response Team:	**Anchorage**	**269-3063** **fax: 269-7648**
Northern Area Response Team:	**Fairbanks**	**451-2121** **fax: 451-2362**
Southeast Area Response Team:	**Juneau**	**465-5340** **fax: 465-2237**



Outside normal business hours, call: 1-800-478-9300

Alaska Department of Environmental Conservation
Division of Spill Prevention and Response

rev. 4/2002

Alaska Department of Environmental Conservation

Discharge Notification and Reporting Requirements

AS 46.03.755 and 18 AAC 75 Article 3

Notification of a discharge must be made to the **nearest** Area Response Team during working hours:

Anchorage:	**269-3063** **269-7648 (FAX)**	**Fairbanks:**	**451-2121** **451-2362 (FAX)**	**Juneau:**	**465-5340** **465-2237 (FAX)**

OR

to the 24-Hour Emergency Reporting Number during non-working hours: **1-800-478-9300**

Notification Requirements

Hazardous Substance Discharges

Any release of a hazardous substance must be reported as soon as the person has knowledge of the discharge.

Oil Discharges

■ TO WATER

- Any release of oil to water must be reported as soon as the person has knowledge of the discharge.

■ TO LAND

- Any release of oil in ***excess of 55 gallons*** must be reported as soon as the person has knowledge of the discharge.
- Any release of oil in ***excess of 10 gallons but less than 55 gallons*** must be reported within 48 hours after the person has knowledge of the discharge.
- A person in charge of a facility or operation shall maintain, and provide to the Department on a monthly basis, a written record of any discharge of oil ***from 1 to 10 gallons***.

■ TO IMPERMEABLE SECONDARY CONTAINMENT AREAS

- Any release of oil ***in excess of 55 gallons*** must be reported within 48 hours after the person has knowledge of the discharge.

Special Requirements for Regulated Underground Storage Tank (UST) Facilities*

If your **release detection system** indicates a possible discharge, or if you notice **unusual operating conditions** that might indicate a release, you must notify the Storage Tank Program at the nearest DEC Office **within 7 days**:

Anchorage:	(907) 269-7504	Fairbanks:	(907) 451-2360
Juneau:	(907) 465-5200	Soldotna:	(907) 262-5210

*Regulated UST facilities are defined at 18 AAC 78.005 and do not include heating oil tanks.

ATTACHMENT 4

Oil Discharge Notification Form

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION

OIL & HAZARDOUS SUBSTANCES SPILL NOTIFICATION

ADEC SPILL #	**ADEC FILE #**	**ADEC LC**
PERSON REPORTING	**PHONE NUMBER**	**REPORTED HOW?** Troopers phone fax

DATE/ TIME OF SPILL	**DATE/TIME DISCOVERED**	**DATE/TIME REPORTED**

LOCATION/ADDRESS	**LAT.**	****SUBSTANCE TYPE** A) CR EHS HS NC PW UNK B) CR EHS HS NC PW UNK	****PRODUCT** **A)** **B)**
	LONG.		

QUANTITY SPILLED ☐ gallons ☐ pounds	**QUANTITY CONTAINED** ☐ gallons ☐ pounds	**QUANTITY RECOVERED** ☐ gallons ☐ pounds	**QUANTITY DISPOSED** ☐ gallons ☐ pounds

POTENTIAL RESPONSIBLE PARTY C-Plan Holder? YES ☐ NO ☐	****FACILITY TYPE**

****SOURCE OF SPILL**	☐ 400 GT Vessel?
****CAUSE OF SPILL (List Primary Cause first)**	☐ Accident ☐ Human Factors ☐ Structural/Mechanical ☐ Other

****CLEANUP ACTIONS**

****DISPOSAL METHODS AND LOCATION**

RESOURCES AFFECTED/THREATENED (Water sources, wildlife, wells. etc.)	**AIR** ☐	**LAND** ☐	**MARINE** ☐	**FRESH** ☐	**SURF. AREA AFFECTED**	**SURF. TYPE**

COMMENTS:

DEC USE ONLY

SPILL NAME, IF ANY	**NAMES OF DEC STAFF RESPONDING**	**C-PLAN MGR NOTIFIED** YES ☐ NO ☐ _____

DEC RESPONSE ☐ phone follow-up ☐ field visit ☐ took report	**CASELOAD CODE** ☐ First and Final ☐ Open/No LC ☐ LC assigned	**CLEANUP CLOSURE ACTION** ☐ NFA ☐ Monitoring ☐ Transferred to CS or STP

STATUS OF CASE (circle) OPEN CLOSED DATE CASE CLOSED _____

COMMENTS:

REPORT PREPARED BY	**DATE**

revised April 19, 2002

ALASKA DEPARTMENT OF ENVIRONMENTAL CONSERVATION

OIL & HAZARDOUS SUBSTANCES SPILL NOTIFICATION

**** Please see reference sheet when completing these columns.**

****Substance Type**
CR = Crude Oil
EHS = Extremely Hazardous Substance
HS = Hazardous Substance
NC = Non Crude Oil
PW = Process Water
UNK = Unknown

****Product**
See cheat sheet for questions on product

****Source**
Include both the "Facility Type" and the "Source" from cheat sheet

****Cause**
Include Category and Cause

****Cleanup Actions**
See cheat sheet for choices

****Disposal Methods and Location**
See cheat sheet for choices

State of Alaska
DEPARTMENT OF ENVIRONMENTAL CONSERVATION

OIL & HAZARDOUS MATERIALS INCIDENT FINAL REPORT

The following written report is required by State regulations 18 AAC 75.300(e), following departmental notification of a discharge of oil and hazardous materials. The report is due within 15 days after the cleanup is completed, or if no cleanup occurs, within 15 days after the discharge. Forward the report to the nearest DEC office of the department. The report must contain, as applicable:

1. Date and time of the discharge:

2. Location of the discharge:

3. Name of the site, facility or operation:

4. Name, mailing address, and telephone number of:

A. Person or persons causing or responsible for the discharge:

B. Owner and operator of the site, facility or operation:

5. Type and amount of each oil or hazardous substance discharged:

6. Cause of the discharge:

7. Description of any environmental damage caused by the discharge or containment, to the extent the damage can be identified:

8. Description of cleanup actions taken:

9. Estimated amount of:

(A) oil or hazardous substance cleaned up:

(B) oily or hazardous waste generated:

10. Date, location, and method of ultimate disposal of the oil, hazardous substance and any contaminated materials, including cleanup materials:

11. Description of actions being taken to prevent recurrence of the discharge:

12. Other information the department requires to fully assess the cause and impact of the discharge (receipts for disposal if available):

Signature	**Printed name**
Date	**Title**

MAIL OR FAX TO the Closest A.D.E.C. Office below

Anchorage
Phone: 269-3063
Fax: 269-7648
555 Cordova Street
Anchorage, AK 99501

Fairbanks
Phone: 451-2121
Fax: 451-2362
610 University Ave.
Fairbanks, AK 99709-3643

Juneau
Phone: 465-5340
Fax: 465-2237
410 Willoughby Ave., Suite 309
Juneau, AK 99801-1795

DEC USE ONLY	
ADEC Project Manager:	ADEC Spill #:

OIL DISCHARGE NOTIFICATION FORM

STATE NOTIFICATION

When a spill occurs, the following information should be reported according to the Alaska Department of Environmental Conservation (ADEC).

Anchorage: 269-7500 **Fairbanks: 451-2121** **Juneau: 465-5340**

Or the 24-Hour Emergency Reporting Number during non-working hours: ***1-800-478-9300***

FEDERAL NOTIFICATION

National Response Center: 1-800-424-8802
Note: It is not necessary to wait for all information before calling The National Response Center.

COLLECT AS MUCH OF THE FOLLOWING INFORMATION AS YOU CAN:

	A. REPORTING PARTY	**B. RESPONSIBLE PARTY (if different)**
NAME	_____	_____
PHONE	_____	_____
COMPANY	_____	_____
POSITION	_____	_____
ADDRESS	_____	_____
	_____	_____

C. ORGANIZATION TYPE

PRIVATE		**PUBLIC UTILITY**	**GOVERNMENT**	
Citizen	_____	_____	Local	_____
Business	_____		State	_____
			Federal	_____

Were Materials Discharged? YES _____ NO _____
Calling for Responsible Party? YES _____ NO _____

D. INCIDENT DESCRIPTION

Source and/or Cause _____
Start of Spill Date/Time _____
Discharged Material _____
Discharge Quantity & Unit _____
Quantity in Water _____
Discharge Location _____
Nearest City and Distance From it _____
Storage Tank Container Type Aboveground _____ Underground ____ Unknown ____

OIL DISCHARGE NOTIFICATION FORM (Continued)

Page 2

E. FACILITY CAPACITY

Tank Capacity _____ Other Tanks Potentially Affected _____

F. GEOGRAPHIC OR PHYSICAL LOCATION

Latitude deg min N, Longitude deg min W

_____

G. RESPONSE ACTION

Actions Taken to Correct or Mitigate Discharge:

_____

_____

_____

H. IMPACT

Number of Injuries _____ Number of Fatalities _____

Were there Evacuations? YES ☐ NO ☐ UNK ☐ Number _____

Was There any Damage? YES ☐ NO ☐ UNK ☐ Dollars _____

I. DISPERSANTS

Were appropriate procedures or approvals used or obtained prior to any dispersant use, if applicable?

YES ☐ NO ☐

J. ADDITIONAL INFORMATION

Any Other Information

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____

K. CALLER NOTIFICATIONS

AGENCY	DATE	TIME	CONTACT NAME
U.S. Coast Guard			
EPA			
ADEC			

ATTACHMENT 5

Spill Response Team Training, Drill, and Exercise Log

TRAINING, DRILL, AND EXERCISE LOG			
X = COMPLETED	B = BASIC	R = REFRESHER	T = ON THE JOB TRAINING
Name	**Annual SPCC Training**	**Fuel Truck Operator Training**	**Other**

ATTACHMENT 6

Record of Attendance for
Spill Response and Safety Meetings

RECORD OF ATTENDANCE FOR SPILL RESPONSE AND SAFETY MEETINGS

Spill Response Meeting ___ Date _____

Safety Meeting ___ Date _____

Record	Required Action	Implementation
ATTENDEES:	**SIGNATURE**	**COMMENTS**

APPENDIX F

Permits and Quarry Agreement

STATE OF ALASKA

SARAH PALIN, GOVERNOR

1300 COLLEGE RD.
FAIRBANKS, AK 99701
PHONE: (907) 459-7289
FAX: (907) 459-7303

DEPARTMENT OF FISH AND GAME

DIVISION OF HABITAT

FISH HABITAT PERMIT
FH09-III-OI03

ISSUED: April 22, 2009
EXPIRES: December 31, 2014

Ms. Molly Welker
Bristol Environmental and Engineering Services Corporation
111 W. 16th Ave., Third Floor
Anchorage, AK 99501-5109

Dear Ms. Welker:

RE: Bridge Repair, Northeast Cape White Alice Site Removal Action (St. Lawrence Island); T25S, R54W, Suqitughneq River; SID AK0203-17AA

Pursuant to AS 16.05.841, the Alaska Department of Fish and Game (ADF&G), Division of Habitat, has reviewed your proposal to place riprap or conduct maintenance activities in the Suqitughneq River (on St. Lawrence Island) to protect the bridge abutments. ADF&G received your request via email on April 17, 2009. Your original request was received on March 19, 2002 with a more detailed description received via email on April 3, 2002. The original activity was permitted under Fish Habitat Permit FG02-III-0072 which expired December 31,2005.

Your original proposed project entailed placing approximately 15 cubic yards of riprap at the base of the abutments of the bridge crossing the Suqitughneq River each work season (two work seasons are anticipated). An excavator, operating from the deck of the bridge, will place the riprap. The current proposed work will included any necessary repairs but will not exceed the original footprint and scope of work.

The Suqitughneq River supports anadromous Dolly Varden (and possibly whitefish) and resident fish (e.g., Alaska blackfish) in the area of your proposed activity. Based upon our review of your plans, your proposed project should not obstruct the efficient passage and movement of fish.

In accordance with AS 16.05.841, project approval IS hereby given subject to the following stipulations:

(1) Banks shall not be altered or disturbed in any way. If stream banks are inadvertently disturbed, they shall be immediately stabilized to prevent erosion.

(2) "End-dumping" riprap is prohibited. Riprap shall be strategically placed to prevent excess rock in the streambed.

The permittee is responsible for the actions of contractors, agents, or other persons who perform work to accomplish the approved plan. For any activity that significantly deviates from the approved plan, the permittee shall notify the ADF&G and obtain written approval in the form of a permit amendment before beginning the activity. Any action taken by the permittee, or an agent of the permittee, that increases the project's overall scope or that negates, alters, or minimizes the intent or effectiveness of any stipulation contained in this permit will be deemed a significant deviation from the approved plan. The final determination as to the significance of any deviation and the need for a permit amendment is the responsibility of the ADF&G. Therefore, it is recommended that the ADF&G be consulted immediately when a deviation from the approved plan is being considered.

This letter constitutes a permit issued under the authority of AS 16.05.841. This permit must be retained on site during construction. Please be advised that this approval does not relieve you of the responsibility of securing other permits, state, federal or local.

This permit provides reasonable notice from the commissioner that failure to meet its terms and conditions constitutes violation of AS 16.05.861; no separate notice under AS 16.05.861 is required before citation for violation of AS 16.05.841 can occur.

In addition to the penalties provided by law, this permit may be terminated or revoked for failure to comply with its provisions or failure to comply with applicable statutes and regulations. The department reserves the right to require mitigation measures to correct disruption to fish and game created by the project and which were a direct result of the failure to comply with this permit or any applicable law.

The recipient of this permit (permittee) shall indemnify, save harmless, and defend the department, its agents and its employees from any and all claims, actions or liabilities for injuries or damages sustained by any person or property arising directly or indirectly from permitted activities or the permittee's performance under this permit. However, this provision has no effect, if, and only if, the, sole proximate cause of the injury is the department's negligence.

Sincerely,

Denby S. Lloyd, Commissioner

BY: Robert F. "Mac" McLean, Regional Supervisor
Habitat Division
Alaska Department of Fish and Game

cc: Chris Milles, ADNR, Fairbanks
Ann Rappoport, USFWS, Anchorage
Jeanne Hanson, NMFS, Anchorage

RFM:mac

STATE OF ALASKA

SARAH PALIN, GOVERNOR

1300 COLLEGE RD.
FAIRBANKS, AK 99701
PHONE: (907) 459-7289
FAX: (907) 459-7303

DEPARTMENT OF FISH AND GAME

DIVISION OF HABITAT

FISH HABITAT PERMIT
FH09-III-OI02

ISSUED: April 22, 2009
EXPIRES: December 31, 2014

Ms. Molly Welker
Bristol Environmental and Engineering Services Corporation
111 W. 16th Ave., Third Floor
Anchorage, AK 99501-5109

Dear Ms. Welker:

RE: Equipment Stream Crossing, Northeast Cape White Alice Site Removal Action (St. Lawrence Island), T25S, R54W, Quangeghsaq River; SID AK 0203-17AA

Pursuant to AS 16.05.841, the Alaska Department of Fish and Game (ADF&G), Division of Habitat, has reviewed your proposal to make multiple crossings at multiple sites (four) across the Quangeghsaq River with amphibious all-terrain vehicles. Timbers or poles may need to be placed in and adjacent to the stream to create better crossing sites that prevent ATVs from getting stuck and reduce damage to vegetation. Access is needed to cut down and remove hundreds of poles from abandoned utility lines. ADF&G originally received a description of the proposed project on March 19, 2002 and a more detailed description via email on April 3, 2002. That activity was permitted under Fish Habitat Permit FG02-III-0073 which expired December 31, 2005. Additional access may be needed to conduct maintenance activities.

The Quangeghsaq River supports anadromous Dolly Varden (and possibly whitefish) and resident fish (e.g., Alaska blackfish) in the area of your proposed activity. Based upon our review of your plans, your proposed project may obstruct the efficient passage and movement of fish.

In accordance with AS 16.05.841, project approval IS hereby gIven subject to the following stipulations:

(1) Equipment crossings shall be made from bank to bank in a direction substantially perpendicular to the direction of stream flow.

Equipment crossings shall be made only at locations with gradually sloping banks. There shall be no crossings at locations with sheer or cut banks.

Banks shall not be altered or disturbed in any way to facilitate crossings. If stream banks are inadvertently disturbed, they shall be immediately stabilized to prevent erosion.

(2) If timber/poles are placed in and adjacent to the stream to create a crossing site, they must be placed in such a way that free passage of fish is assured. In addition, all material shall be completely removed from the streambed and banks at the end of each work season. If needed, the streambed shall be recontoured to assure that "trenches" are not left that will trap fish at low-water levels.

(3) Vehicle crossings shall be limited to only what is necessary to accomplish work.

(4) No damming or diversions are permitted.

The permittee is responsible for the actions of contractors, agents, or other persons who perform work to accomplish the approved plan. For any activity that significantly deviates from the approved plan, the permittee shall notify the ADF&G and obtain written approval in the form of a permit amendment before beginning the activity. Any action taken by the permittee, or an agent of the permittee, that increases the project's overall scope or that negates, alters, or minimizes the intent or effectiveness of any stipulation contained in this permit will be deemed a significant deviation from the approved plan. The final determination as to the significance of any deviation and the need for a permit amendment is the responsibility of the ADF&G. Therefore, it is recommended that the ADF&G be consulted immediately when a deviation from the approved plan is being considered.

This letter constitutes a permit issued under the authority of AS 16.05.841. This permit must be retained on site during construction. Please be advised that this approval does not relieve you of the responsibility of securing other permits, state, federal or local.

This permit provides reasonable notice from the commissioner that failure to meet its terms and conditions constitutes violation of AS 16.05.861; no separate notice under AS 16.05.861 is required before citation for violation of AS 16.05.841 can occur.

In addition to the penalties provided by law, this permit may be terminated or revoked for failure to comply with its provisions or failure to comply with applicable statutes and regulations. The department reserves the right to require mitigation measures to correct disruption to fish and game created by the project and which were a direct result of the failure to comply with this permit or any applicable law.

The recipient of this permit (permittee) shall indemnify, save harmless, and defend the department, its agents and its employees from any and all claims, actions or liabilities for

injuries or damages sustained by any person or property arising directly or indirectly from permitted activities or the permittee's performance under this permit. However, this provision has no effect, if, and only if, the sole proximate cause of the injury is the department's negligence.

Sincerely,

Denby S. Lloyd, Commissioner

BY: Robert F. "Mac" McLean, Regional Supervisor
Habitat Division

cc: Chris Milles, ADNR, Fairbanks
Ann Rappoport, USFWS, Anchorage
Jeanne Hanson, NMFS, Anchorage

RFM:mac

Welker, Molly

Subject: FW: NE Cape

From: Leinberger, Dianna L (DNR) [mailto:dianna.leinberger@alaska.gov]
Sent: Thursday, April 21, 2011 1:31 PM
To: Luetters, Susan
Subject: RE: NE Cape

Susan,

The letter is still valid. I'll note in the file that clean up is still ongoing.

-Dianna

Dianna Leinberger
Department of Natural Resources
Division of Mining, Land & Water
Northern Region Lands Section - Permits & Easements
907-451-3014

From: Luetters, Susan [mailto:sluetters@bristol-companies.com]
Sent: Thursday, April 21, 2011 12:41 PM
To: Leinberger, Dianna L (DNR)
Subject: FW: NE Cape

Trying this one more time.

Susan Luetters
Senior Environmental Scientist
Phone : (907) 563-0013

From: Luetters, Susan
Sent: Thursday, April 21, 2011 12:33 PM
To: 'dainna.leinberger@alaska.gov'
Cc: Welker, Molly; Floyd, Christopher B POA
Subject: FW: NE Cape

Hi Dianna,

It is that time of year again . . . As per below we are ramping up for the 2011 season out at NE Cape conditions surrounding the request are the same as 2009 and 2010. Are we good to go?

Susan Luetters
Senior Environmental Scientist
Phone : (907) 563-0013

From: Luetters, Susan
Sent: Tuesday, February 23, 2010 1:19 PM
To: 'dianna.leinberger@alaska.gov'
Subject: FW: NE Cape

From: Luetters, Susan
Sent: Tuesday, February 23, 2010 10:11 AM

To:
Cc: Welker, Molly; Floyd, Christopher B POA
Subject: NE Cape

Hi Dianna,

As per the attached, Bristol Environmental Remediation Services will be going back to Northeast Cape at the request of the USACE to continue the environmental remediation of the Formerly Used Defense Site. Included in this transmission is your 2009 "Letter of Entry for State tidelands within Kitnagak Bay, Saint Lawrence Island" For the purpose of accessing NE Cape for a Formerly Used Defense Site Cleanup and a Native American Lands Environmental Mitigation Program Project.

The conditions that surrounded the issuance of this Letter of Entry will not be changing for the 2010 season; therefore, do we need to re-request this authorization for the 2010 season or will the 2009 letter extend to cover this season since there is no expiration date on the authorization?

Thank you for your attention to this matter and we look forward to your response.

Sincerely,

Susan Luetters
Senior Environmental Scientist
Bristol Environmental & Engineering Services Corporation
111 W. 16th Avenue, Third Floor
Anchorage, AK 99501-5109
Phone : (907) 563-0013
Direct : (907) 743-9316
FAX : (907) 563-6713
sluetters@bristol-companies.com
http://www.bristol-companies.com/

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STATE OF ALASKA

SARAH PALIN, GOVERNOR

1300 COLLEGE RD.
FAIRBANKS, AK 99701
PHONE: (907) 459-7289
FAX: (907) 459-7303

DEPARTMENT OF FISH AND GAME

DIVISION OF HABITAT

FISH HABITAT PERMIT
FH09-III-0103
Amendment #1

ISSUED: April 22, 2009
AMENDMENT #1 ISSUED: June 5, 2009
EXPIRES: December 31, 2014

Ms. Molly Welker
Bristol Environmental and Engineering Services Corporation
111 W. 16th Ave., Third Floor
Anchorage, AK 99501-5109

Dear Ms. Welker:

RE: Bridge Repair, Northeast Cape White Alice Site Removal Action (St. Lawrence Island); T25S, R54W, Suqitughneq River; SID AK0203-17AA

Pursuant to AS 16.05.841, the Alaska Department of Fish and Game (ADF&G), Division of Habitat, has reviewed Ms. Susan Luetters' email request, dated June 4, 2009, to amend Fish Habitat Permit FH09-III-0103 to authorize withdrawal of up to 3,000 gallons per day of water from the Suqitughneg River (180,000 gallons per season). Water will be withdrawn with a 4-inch diameter pump at a rate of 35 gpm. Proposed season of use is July 15, 2009 to September 15, 2009.

In accordance with AS 16.05.841, Fish Habitat Permit FH09-III-0103 is hereby amended subject to the following stipulation:

(1) In fish bearing waters, pump intakes or stream diversions shall be designed to prevent intake, impingement, or entrapment of fish. Each water intake structure shall be centered in a screened enclosure. The effective screen opening may not exceed ¼ inch. To reduce fish impingement on the screened surfaces, water velocity at the screen/water interface may not exceed 0.5 feet per second when the pump is operating.

NOTE: Due the small water withdrawal rate, the simplest manner to achieve compliance with this stipulation is to perforate the lower third of a 5-gallon plastic bucket with a large

number of ¼-inch holes, place some large rock in the bucket to keep it submerged, and then place the intake hose (presumably with a small rock chuck) in the bucket.

All other terms and conditions of FH09-III-0103 remain in effect.

Sincerely,

Denby S. Lloyd, Commissioner

BY: Robert F. "Mac" McLean, Regional Supervisor
Habitat Division
Alaska Department of Fish and Game

cc: Chris Milles, ADNR, Fairbanks
Ann Rappoport, USFWS, Anchorage
Jeanne Hanson, NMFS, Anchorage

RFM:mac

DEPARTMENT OF THE ARMY
RIGHT-OF-ENTRY FOR
ENVIRONMENTAL ASSESSMENT AND RESPONSE

SAINT LAWRENCE ISLAND, ALASKA
(Project, Installation or Activity)

NO. DACA85- 8-08-0134
(Property Identification Number)

The undersigned, hereinafter called the "**Owner**", in consideration of the mutual benefits of the work described below, hereby grants to the **UNITED STATES OF AMERICA**, hereinafter called the "Government", a right-of-entry upon the following terms and conditions:

1. The Owner hereby grants to the Government an irrevocable right to enter in, on, over and across the land described herein, for a period not to exceed five (5) years, **beginning June 1, 2008**, and terminating upon the earlier completion of remediation or the filling of a notice of termination in the local land records by the representative of the United States in charge of the Saint Lawrence Island remediation project, for use by the United States, its representatives, agents, contractors, and assigns, as a work area for environmental investigation and response; including the right to store, move, and remove equipment and supplies; erect and remove temporary structures on the land; investigate and collect samples; excavate and remove ordnance and explosive waste, pollutants, hazardous substances, contaminated soils, containerized waste, and replace with uncontaminated soil; excavate and remove all storage tanks (above, at and below ground level), contents and appurtenant piping; demolish and dispose of former military structures and debris; construct, operate, maintain, alter, repair and remove groundwater monitoring wells, groundwater purification and injection systems, appurtenances thereto and other devices for the monitoring and treatment of contamination in soil, air and water; and perform any other such work which may be necessary and incident to the Government's use for the environmental investigation and response on said lands; subject to existing easements for public roads and highways, public utilities, railroads and pipelines; reserving, however, to the landowner(s), their heirs, executors, administrators, successors and assigns, all such right, title, interest and privilege as may be used and enjoyed without interfering with or abridging the rights and right-of-entry hereby acquired.

2. The Owner also grants the right to enter and exit over and across any other lands of the Owner as necessary to use the described lands for the purposes listed above.

3. All tools, equipment, and other property taken upon or placed upon the land by the Government shall remain the property of the Government and may be removed by the Government at any time within a reasonable period after the expiration of this permit or right-of-entry.

4. Upon expiration or termination of this right-of-entry, the Government shall assure restoration of the ground contour and replace any pavement or other cover which was removed or damaged for this work, establish a groundcover of grass on areas not otherwise covered and reconnect any operating utility lines which were required to be disconnected or otherwise disrupted.

5. If any action of the Government's employees or agents in the exercise of this right-of-entry results in damage to the real property, the Government will, in its sole discretion, either repair such damage or make an appropriate settlement with the Owner. In no event shall such repair or settlement exceed the fair market value of the fee title to the real property at the time immediately preceding such damage. The Government's liability under this clause is subject to the availability of appropriations for such payment, and nothing contained in this agreement may be considered as implying that Congress will at a later date appropriate funds sufficient to meet any deficiencies. The provisions of this clause are without prejudice to any rights the Owner may have to make a claim under applicable laws for any damages other than those provided for herein.

6. The land affected by this right-of-entry is located in the State of Alaska, and is described as follows:

All surface and subsurface rights on Saint Lawrence Island, Alaska, within Township 20 South, Range 67 West, Kateel River Meridian and; Township 25 South, Range 54 West, Kateel River Meridian

WITNESS MY HAND AND SEAL this 17 day of June 2008.

SAVOONGA AK 99769 JUN 17 2008 USPS

KUKULGET, INCORPORATED
Perry Pungowiyi, President

Perry Pungowiyi
Authorized Signature

P.O. Box 160
Address

(907) 984-6184
Telephone Number

UNITED STATES OF AMERICA

Veronica A. Hiriams
Chief, Real Estate Division
US Army Engineer District, AK
P.O. Box 898
Anchorage, Alaska 99506-0898

SAINT LAWRENCE ISLAND, ALASKA
(Project, Installation or Activity)

NO. DACA85-8-08-0134
(Property Identification Number)

SIVUQAQ, INCORPORATED
~~Bruce Boolowon, President~~ Merle Apassingok, Acting Chairman

Authorized Signature

P.O. Box 101 Gambell, AK. 99742
Address

(907) 985-5826
Telephone Number

MATERIAL SUPPLY AND
QUARRY OPERATING AGREEMENT

Kukulget Inc., whose address is P.O. Box 160 Savoonga, Alaska 99769, and Sivuqaq Inc., whose address is P.O. Box 101 Gambell, Alaska 99742, Alaska Native Corporations created pursuant to the Alaska Native Claims Settlement Act, herein referred to as "Owners," and Bristol Environmental Remediation Services LLC, whose address is 111 W. 16th Avenue, Third Floor, Anchorage, Alaska 99501, herein referred to as "Contractor" agree to the extraction of material and the operation of the quarry and such other rights as are designated in this contract, subject to the following provisions:

1. DESCRIPTION - LOCATION, MATERIAL, AND PRICE:

1.1. Quarry Description. The material source area covered by this agreement is the borrow site south of the Main Operations Complex at Northeast Cape, St. Lawrence Island, Alaska shown on the attached figure.

1.2. Royalty. The royalty price for all types of material removed from the Quarry during the Term of this Agreement is:

Material Type	Unit Price
All Material	$10.00 (per cubic yard)

Quantities to be determined by truck count.

2. EXCLUSIVE RIGHTS AND DUTIES:

Owner hereby grants to Contractor and Contractor accepts from Owner, the exclusive right to manage and operate the Quarry for the Term of this Agreement (defined in ¶3). Management and operation of the Quarry shall include, without limitation, the following:

A. The exclusive right to manage the extraction and removal of Materials from the Quarry;

B. The exclusive right, to secure access to the Quarry to avoid an attractive nuisance and deter unauthorized extraction of Materials therefrom, up to and including, fencing the perimeter and/or access to the Quarry;

C. The duty to perform all reclamation identified in the Letter of Intent (section 5).

3. TERM:

The term of this Agreement ("term") shall commence on July 1, 2011 and expire on December 31, 2011.

4. PAYMENTS AND DEPOSITS:

Within 30 days after the cessation of work for winter, or completion or termination, Contractor in any year in which the Contractor extracts or transports material from the Quarry, Contractor shall pay payments as described in Paragraph 1.2.

5. LETTER OF INTENT/ANNUAL RECLAMATION STATEMENT:

By July 1, 2011 and prior to commencing any operations in any Quarry subject to this Agreement, the Contractor shall file a "Letter of Intent" (Letter) with the State of Alaska Department of Natural Resources, Division of Land (Division of Land) as required by State law. The contractor shall also file an "Annual Reclamation Statement" (Statement) with the Division of Land as required by State law. The Statement shall be filed before December 31 of any calendar year during which Quarry operations were carried out under this Agreement. The Contractor shall provide copies of the Letter and the Statement(s) to the Owners.

6. RECLAMATION PLAN:

Contractor shall comply with the requirements of the Letter (section 5) regarding reclamation. The Contractor shall document reclamation activities per the Statement (section 5).

7. CONFLICT WITH CONTRACT.

In the event that any provision of this Material Supply Contract and Quarry Operating Agreement shall conflict with Contractor's Contract W911KB-06-D-0007 with the Corp of Engineers for the Northeast Cape HTRW Remedial Actions, St. Lawrence Island, Alaska, contract W911KB-06-D-0007 shall control and this Agreement shall be considered amended to bring it into conformity with W911KB-06-D-0007.

8. INSPECTION OF QUARRY:

Prior to commencing any operations at the Quarry, authorized representatives of Contractor and Owners may inspect the Quarry to determine whether and to what extent prior mining operations have resulted in visual environmental contamination that requires remediation. Contractor shall have no obligation to perform remediation of contamination discovered at this inspection; provided, however, that from the date of such inspection Contractor shall be liable for all hazardous materials deposited at the Quarry as a result of Contractor's operations during the term hereof, or any extension . Failure by the parties to do so shall not affect the enforceability of this Agreement, provided Contractor prepares and transmits its environmental findings to Owners, at its address set forth in ¶17, below in writing, before beginning Operations.

9. BOOKS AND RECORDS OF ACCOUNT:

Contractor shall maintain accurate and complete records, log books and books of account documenting: (a) the volume of gravel extracted from the Quarry seasonally and submitted to Owners; (b) the amounts due and payable by Contractor and; the amounts actually paid by Contractor to Owners pursuant to this Agreement.

Materials from the Quarry shall be measured by truckloads. Each truck load will contain between 18.75 and 25 cubic yards depending on the truck type (e.g., 30 or 40 ton rock truck). Truck count and truck type shall be performed and recorded by the operator loading haul units at the quarry site. The operator will provide the truck count to the Contractor's Site Superintendent or his designee on a daily basis. The Site Superintendent will provide a summary of the truck count to Owner within five business days of receiving a request from the Owner.

10. OPERATING REQUIREMENTS:

10.1. Standards of Operations. Contractor shall excavate and remove Material from the Quarry in compliance with all laws, regulations, ordinances, orders and its contract with the Corps W911KB-06-D-0007. Contractor shall conduct and maintain its Operations in a commercially reasonable, workman like and clean manner, and shall take all necessary precautions to prevent or suppress fires and to prevent erosion, contamination or destruction of the land and adjacent wetlands and waters. The Contractor agrees to carry out its quarry operations only in areas previously disturbed by others at the Quarry site.

10.2. Supervision. Contractor shall maintain adequate supervision at all times when Operations are in progress to ensure compliance with the provisions of this contract and all applicable federal, state, and local laws and regulations.

10.3. Agents. The provisions of this Contract apply with equal force upon any agent, employee, or contractor designated by Contractor to perform any of the Operations under this contract. Contractor is liable for the noncompliance caused by any such agent, employee, or contractor.

10.4. Grave Sites or Archaeological Sites. No grave or archaeological site shall be in any way disturbed, removed, or damaged. Upon encountering any grave or archaeological site, Contractor shall immediately cease work in the area of the site and shall immediately notify Owners.

11. COMPLIANCE WITH APPLICABLE LAWS:

Contractor shall comply with all local, State and federal laws, statutes, ordinances, rules, regulations, decrees, injunctions, orders and codes applicable to the operation or management of the Quarry, including without limitation, mining reclamation, mining safety and health (i.e., "MSHA") and occupational safety and health (i.e., "OSHA"). These laws and regulations are, by this reference, made a part of this Contract.

12. REQUIRED PERMITS:

Contractor shall obtain and maintain, at its expense and throughout the Term, all licenses, permits, approvals, consents and certificates from local, state and federal authorities which may be necessary or appropriate for its management and operation of the Quarry.

13. ASSIGNMENT:

This contract may be assigned or transferred pursuant to 30 days advance notice to Owners.

14. PERMITS:

Any permits necessary for Operations under this Contract must be obtained by Contractor before commencing those Operations.

15. WARRANTIES:

This sale is made without any warranties, express or implied, as to quantity, quality, merchantability, profitability, or fitness for a particular use of the Material to be extracted from the Quarry under contract. Contractor specifically waives any claims that may arise resulting from the use of the Material.

16. NOTICES:

All notices and other documents required or authorized under this Contract must be in writing and are deemed delivered upon receipt provided that the same are sent certified mail, postage paid, to the party to which the same is mailed the following address or such other address as such party may by written notice provide:

To the Owner: Kukulget Inc.
P. O. Box 160
Savoonga, AK 99769

Sivuqaq Inc.
P.O. Box 101
Gambell, AK 99742

with a copy to Fortier & Mikko, P.C. 101 W. Benson Blvd., Suite 304, Anchorage, AK 99503.

To the Contractor:
Bristol Environmental Remediation Services, LLC
Attn: Molly Welker
111 W. 16th. Avenue, Third Floor
Anchorage, Alaska 99501

17. INTEGRATION AND MODIFICATION:

This Contract, including all laws and documents that by reference are incorporated in it or made a part of it, contains the entire agreement between the parties. This Contract may not be modified or amended except by a document signed by both parties to this contract. Any amendment or modification which is not in writing, signed by both parties, is null and void and of no legal effect.

18. SEVERABILITY OF CLAUSES OF CONTRACT:

If any provision of this Contract is adjudged to be invalid, that judgment does not affect the validity of any other provision of this Contract, nor does it constitute any cause or action in favor of either party as against the other.

19. CONSTRUCTION:

Words in the singular number include the plural, and words in the plural number include the singular.

20. HEADINGS:

The headings of the numbered paragraphs in this Contract shall not be considered in construing any provisions of this Contract.

21. "EXTRACTED," "EXTRACTION":

In this Contract, use of the terms "Extracted" and "Extraction" encompasses the severance or removal, as well as extraction, by Contractor of any Material covered by this Contract.

22. WAIVERS:

No agent, representative, or employee of Owners has authority to waive any provision of this Contract unless expressly authorized to do so in writing by the Presidents of Kukulget Inc. and Sivuqaq Inc.

23. GOVERNING LAW:

This Contract shall be governed by and construed in accordance with Alaska law. Venue and jurisdiction shall lie exclusively in the Superior Court for the State of Alaska, Third Judicial District, at Anchorage, Alaska.

24. EFFECTIVE DATE:

This Contract shall be effective the 1st day of July 2011.

25. BY SIGNING THIS CONTRACT, Owner, and Contractor, agrees to be bound by its provisions as set out above.

CONTRACTOR:

Bristol Environmental Remediation Services, LLC

By: _____

Its: Project Manager

OWNER:

Kukulget Inc.

Morris Toolie Jr.

By: _____

Its: President

Sivuqaq Inc.

By: _____

Its: President

STATE OF ALASKA

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF AGRICULTURE

Sean Parnell, GOVERNOR

CENTRAL OFFICE
1800 GLENN HIGHWAY, SUITE 12
PALMER, ALASKA 99645-6736
PHONE: (907) 745-7200
FAX: (907) 745-7112

NORTHERN REGION OFFICE
1648 S. CUSHMAN ST., # 201
FAIRBANKS, ALASKA 99701-6206
PHONE: (907) 328-1950
FAX: (907) 328-1951

PLANT MATERIALS CENTER
5310 S. BODENBURG SPUR
PALMER, ALASKA 99645-9706
PHONE: (907) 745-4469
FAX: (907) 746-1568

August 16, 2010

Carey Cossaboom
Project Manager
U.S. Army Corps of Engineers

Carey,

After visiting the NE Cape cleanup site I believe a maintenance fertilization program may be real valuable in order to meet the 70% cover requirement for the sites. The process is starting but the plants could use some help. An application of fertilizer (20-20-10) at 500 pounds per acre would help the process along. I believe this will give the plants the boost they need.

Species composition of the seeded areas does correspond with the applied seed mix of 70% Tufted hairgrass and 30% Red fescue, although not at that density. The seeded perennial grasses are performing relatively well and there is no indication of extreme stress. The brown color and yellowing of the grasses at some sites is probably due to fertilizer deficiency and would benefit from an additional application. Some sites are heavily compacted and may require breakup in order for grasses to become established. This is especially true where the three tanks were removed.

Sporadic vegetation cover at one site is likely the result of using hand-held broadcast seeders to apply the seed mix. It looks like a lot of the area was simply missed. If available, a broadcast seeder mounted on the back of an ATV vehicle will provide more uniform coverage of the seed mixture. One good way to prevent misses while seeding and fertilizing areas with employees not familiar with broadcast applications is to set the spreader at half the rate. Apply the product in one direction, and then repeat the application perpendicular to the first application. Skips and void are often prevented using the two step application method. I recommend reseeding this site with 70% Tufted hairgrass and 30% Red fescue at a rate of 1 pound per 1,000 square feet. Follow with 20-20-10 fertilizer at a rate of 500 pounds per acre. The fertilizer should be applied concurrent with or prior to seeding to avoid unnecessary disturbance. Seeding will need to be completed prior to August 1.

The appearance of native species other than those planted, resulted from natural reinvasion from the surrounding community. These species will continue to colonize the site over time providing additional ground cover. Non-seeded grass species that have been identified include: Deschampsia caespitosa (Hairgrass), Festuca rubra (Red

fescue), Arctagrostis latifolia (Polargrass), Trisetum Spicatum (Spike trisetum), Hierochloe odorata (Sweetgrass), Poa Alpina (Alpine bluegrass), and Calamagrostis nutkaensis (Nootka reedgrass). These species appear to be performing well and will add a natural appearance to the project.

If I can be of further assistance please do not hesitate to give me a call.

Sincerely,
Phil Czapla
Alaska Plant Materials Center
907-745-8747
phil.czapla@alaska.gov

Carey Cossaboom
Project Manager
U.S. Army Corps of Engineers
August 16, 2010
Page 3

This site will require a mechanical implement, such as ripper to fracture the soil.

I recommend reseeding this site with 70% Tufted hairgrass and 30% Red fescue. Fertilize with 20-20-10 at 500 pounds per acre. Yellowing of the grasses is probably due to fertilizer deficiency.

Carey Cossaboom
Project Manager
U.S Army Corps of Engineers
August 16, 2010
Page 4

STATE OF ALASKA

DEPT. OF ENVIRONMENTAL CONSERVATION

DIVISION OF WATER

WASTEWATER DISCHARGE AUTHORIZATION PROGRAM

SEAN PARNELL, GOVERNOR

555 Cordova
Anchorage, Alaska 99501-2617
PHONE: (907) 269-6285
FAX: (907) 334-2415
http://www.dec.state.ak.us

Thank you for using the DEC Water Online Application System. In order to sign your electronic Notice of Intent (eNOI) application, you the NOI Certifier must sign and submit this Signature NOI. The ADEC needs to verify your signature in order to update the status of your eNOI to a signed status.

Please sign on the appropriate line in the Certification Information Section (Section VII) of this Signature NOI and mail, fax, or email to:

Attn: Storm Water Program
Division of Water
Alaska Department of Environmental Conservation
555 Cordova Street
Anchorage, AK 99501
Fax Number: (907) 269-3487
Phone Number: (907) 269-8117
Email Address: DEC.Water.OPAHelp@alaska.gov

If you have any questions regarding this signature page or other questions concerning the eNOI System, please call ADEC at: (907) 269-8117.

Thank you for using the ADEC eNOI system.

For Agency Use
Permit # AKR10DL58

Notice of Intent (NOI) for Storm Water Discharges Associated with Construction Activity Under an APDES Construction General Permit

Submission of this Notice of Intent (NOI) constitutes notice that the party identified in Section I of this form requests authorization to discharge pursuant to the APDES Construction General Permit (CGP). Submission of this NOI also constitutes notice that the party identified in Section I of this form meets the eligibility requirements of the CGP for the project identified in Section II of this form. Permit coverage is required prior to commencement of construction activity until you are eligible to terminate coverage as detailed in the CGP. To obtain authorization, you must submit a complete and accurate NOI form. Refer to the instructions at the end of this form.

I. Operator Information

Organization: Bristol Environmental Remediation Services, LLC

Contact Person: Charles Croley

Mailing Address:

Street (PO Box): 111 W. 16th Avenue, Third Floor

City: Anchorage State: AK Zip: 99501

Phone: 907-563-0013 Fax(optional):

Email:

II. Billing Contact Information

Organization: Bristol Environmental Remediation Services, LLC

Contact Person: Molly Welker

Mailing Address:

[ ] Check if same as Operator Information.

Street (PO Box): 111 W. 16th Avenue, Third Floor

City: Anchorage State: AK Zip: 99501

Phone: 907-563-0013 Fax(optional):

Email:

III. Project/Site Information

Project/Site Name: Northeast Cape HTRW Remedial Actions

Project Street/Location: Main Operations Complex, Site 13, Site 31 NE Cape

City: Savoonga, Northeast Cape, St. Lawrence Is. State: AK Zip: 99769

Borough or similar government subdivision: Nome

Latitude: 63.312 Longitude: -168.957

Determined By: ☐ GPS ☐ USGS topographic map ☑ Other: Google Maps

If you used a USGS topographic map, what was the scale?

Estimated Project Start Date: 6/26/2011 Estimated Project Completion Date: 9/15/2011

Estimated Area to be Disturbed (to the nearest quarter acre): 0.85

For Agency Use
Permit # AKR10DL58

IV. SWPPP (Storm Water Pollution Prevention Plan)			
Has the SWPPP been prepared in advance of filing this NOI?	☑ Yes	☐ No	
Location of SWPPP for Viewing:	☐ Address in Section I	☑ Address in Section III	☐ Other
If other:	SWPPP Street:		
	City:	State: AK	Zip:
	SWPPP Contact Information (if different than that in Section I):		
	Name: Charles Croley		
	Phone: 907-563-0013	Fax(optional):	
	Email:		

V. Discharge Information		
Identify the name(s) of waterbodies to which you discharge: NA		
Is this discharge consistent with the assumptions and requirements of applicable EPA approved or established TMDL(s)?	☑ Yes	☐ No

VI. Endangered Species Protection					
Under which criterion of Part 1.3.3.6 of the permit have you satisfied your ESA eligibility obligations?					
☑ A	☐ B	☐ C	☐ D	☐ E	☐ F
If you select criterion F, provide permit tracking number of operator under which you are certifying eligibility:					

VII. Certification Information

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Printed Name: Steve Johnson Title: CEO

Signature: Date: 5/6/11 Email: sjohnson@bristol-companies.com

NOI Preparer (Complete if NOI was prepared by someone other than the certifier)

Prepared By: Derek Tannahill

Organization: Bristol Engineering Services Corp.

Phone: 907-563-0013 Email:

STATE OF ALASKA

SEAN PARNELL, GOVERNOR

1300 COLLEGE RD.
FAIRBANKS, AK 99701
PHONE: (907) 459-7289
FAX: (907) 459-7303

DEPARTMENT OF FISH AND GAME

DIVISION OF HABITAT

FISH HABITAT PERMIT
FH11-III-0190

ISSUED: June 29, 2011
EXPIRES: December 31, 2011

Bristol Environmental Remediation Services
Attn.: Molly Welker
111 West 16th Avenue, 3rd Floor
Anchorage, AK 99501

Dear Ms. Welker:

RE: Water Withdrawal; Northeast Cape Remedial Actions; Section 15, T25S, R54W, KRM; St. Lawrence B-0 Quad; Suqitughneg River (AWC #333-99-10250).

Pursuant to AS 16.05.871, the Alaska Department of Fish and Game (ADF&G), Division of Habitat, has reviewed your proposal to withdraw up to 35 gpm (3,000 gpd) over a two month period using a 4 inch diameter pump from the Suqitughneg River. Water will be used in support of ongoing environmental remedial cleanup activities at the former Northeast Cape site.

Anadromous Fish Act

The Suqitughneg River has been specified as being important for the migration, spawning, or rearing of anadromous fishes in accordance with AS 16.05.871(a). Anadromous Dolly Varden are documented in the river at the subject location.

In accordance with AS 16.05.871(d), project approval is hereby given subject to your proposed scope of work and the following stipulation:

1. Pump intakes shall be designed to prevent intake, impingement, or entrapment of fish. Each intake structure shall be enclosed in a screened enclosure. The effective screen opening may not exceed ¼ inch. To reduce fish impingement on the screened surface,

water velocity at the screen/water interface may not exceed 0.5 feet per second when the pump is operating.

You are responsible for the actions of contractors, agents, or other persons who perform work to accomplish the approved plan. For any activity that significantly deviates from the approved plan, you shall notify the Division of Habitat and obtain written approval in the form of a permit amendment before beginning the activity. Any action that increases the project's overall scope or that negates, alters, or minimizes the intent or effectiveness of any stipulation contained in this permit will be deemed a significant deviation from the approved plan. The final determination as to the significance of any deviation and the need for a permit amendment is the responsibility of the Division of Habitat. Therefore, it is recommended that the Division of Habitat be consulted immediately when a deviation from the approved plan is being considered.

For the purpose of inspecting or monitoring compliance with any condition of this permit, you shall give an authorized representative of the state free and unrestricted access, at safe and reasonable times, to the permit site. You shall furnish whatever assistance and information as the authorized representative reasonably requires for monitoring and inspection purposes.

This letter constitutes a permit issued under the authority of AS 16.05.871 and must be retained on site during the permitted activity. Please be advised that this approval does not relieve you of the responsibility of securing other permits, state, federal or local.

In addition to the penalties provided by law, this permit may be terminated or revoked for failure to comply with its provisions or failure to comply with applicable statutes and regulations. The ADF&G reserves the right to require mitigation measures to correct disruption to fish and game created by the project and which were a direct result of the failure to comply with this permit or any applicable law.

You shall indemnify, save harmless, and defend the ADF&G, its agents and its employees from any and all claims, actions or liabilities for injuries or damages sustained by any person or property arising directly or indirectly from permitted activities or your performance under this permit. However, this provision has no effect if, and only if, the sole proximate cause of the injury is the ADF&G's negligence.

Please be advised that this determination applies only to activities regulated by the Division of Habitat; other departments and agencies also may have jurisdiction under their respective authorities. This determination does not relieve you of the responsibility for securing other permits, state, federal, or local. You are still required to comply with all other applicable laws.

This permit decision may be appealed in accordance with the provisions of AS 44.62.330--44.62.630.

Any questions or concerns about this permit may be directed to me at (907) 459-7281 or emailed to mac.mclean@alaska.gov.

Sincerely,

Cora Campbell, Commissioner

BY: Robert F. "Mac" McLean, Regional Supervisor
Division of Habitat

ecc: Chris Milles, ANDR, Fairbanks
Merry Johnson, ADNR, Anchorage
Jewel Bennett, USFWS, Fairbanks
NOAA Fisheries, Anchorage
Brendan Scanlon, ADF&G, Fairbanks
Jim Menard, ADF&G, Nome
Al Ott, ADF&G, Fairbanks

RFM/mac

STATE OF ALASKA

SEAN PARNELL, GOVERNOR

DEPARTMENT OF NATURAL RESOURCES

DIVISION OF MINING, LAND & WATER
Water Resources Section

550 WEST 7TH AVENUE, SUITE 1020
ANCHORAGE, ALASKA 99501-3562
PHONE: (907) 269-8600
FAX: (907) 269-8904

July 13, 2011

Bristol Environmental Remediation Services
Attn: Molly Welker
111 W. 16th Avenue, Third Floor
Anchorage, AK 99501

Subject: Temporary Water Use Authorization, TWUP A2011-81

Dear Ms. Welker:

The Water Resources Section completed the review of the Application for Temporary Use of Water from Bristol Environmental Remediation Services. Enclosed is the Temporary Water Use Authorization TWUP A2011-81, **with an expiration date of December 31, 2011,** for uses associated with the ongoing environmental remedial cleanup activities at the former Northeast Cape site.

Please note all of the conditions on the permit, especially conditions one (1), five (5) and thirteen (13) through nineteen (19).

If changes to this project are proposed during its operation, please contact this office immediately to determine if further review is necessary. If you have any questions or concerns, I may be contacted at (907) 269-8588. Thank you for your cooperation with the Water Resources Section.

Sincerely,

Merry Johnson

Merry Johnson
Natural Resource Specialist III

Enclosures: Temporary Water Use Authorization – TWUP A2011-81

Cc. Susan Luetters, Bristol Environmental & Engineering Services Corporation
(via email: sluetters@bristol-companies.com)

ALASKA DEPARTMENT OF NATURAL RESOURCES
Division of Mining, Land, and Water
Water Resources Section
550 West 7th Avenue, Suite 1020, Anchorage, AK 99501-3562

TEMPORARY WATER USE AUTHORIZATION
TWUP A2011-81

Pursuant to AS 46.15, as amended and the rules and regulations promulgated thereunder, permission is hereby granted to Bristol Environmental Remediation Services, 111 W. 16th Avenue, Third Floor, Anchorage, Alaska 99501, and its contractors, **to withdraw up to 3,000 gallons of water per day (subject to a maximum of 180,000 gallons of water)** from July15 through December 31, 2011 from the below-described source of water. The water will be used for camp water supply and dust suppression associated with the ongoing environmental remedial cleanup activities at the former Northeast Cape site, on Saint Lawrence Island, Alaska.

SOURCES OF WATER:

Suqitughneg River within NW¼ Section 15, Township 25 South, Range 54 West, Kateel River Meridian.

STRUCTURES TO BE CONSTRUCTED AND USED:

Screened water intake structure, four-inch pump with 35-gpm output, hose and/or pipe, tanker truck and other water removal and distribution equipment.

Changes in the natural state of water are to be made as stated herein and for the purposes indicated.

During the effective period of this authorization, the permittee shall comply with the following conditions:

CONDITIONS:

1. **This authorization does not authorize the permittee to enter upon any lands until proper rights-of-way, easements, or permission documents from the appropriate landowner have been obtained.**

2. Comply with all applicable laws, and any rules and/or regulations issued thereunder.

3. Except for claims or losses arising from negligence of the State, defend and indemnify the State against and hold it harmless from any and all claims, demands, suits, loss, liability and expense for injury to or death of persons and damages to or loss of property arising out of or connected with the exercise of the privileges covered by this authorization.

4. Notify the Water Resources Section upon change of address.

5. **The permittee shall obtain and comply with other permits/approvals (state, federal, or local) that may be required prior to beginning water withdrawal pursuant to this authorization.**

6. Follow acceptable engineering standards in exercising the privilege granted herein.

7. Failure to respond to a request for additional information during the term of the authorization may result in the termination of this authorization.

8. The permittee shall allow an authorized representative of the Water Resources Section to inspect, at reasonable times, any facilities, equipment, practices, or operators regulated or required under this authorization.

9. The permittee is responsible for the actions of contractors, agents, or other persons who perform work to accomplish the approved project, and shall ensure that workers are familiar with the requirements of this authorization. For any activity that significantly deviates from the approved project during its siting, construction, or operation, the permittee is required to contact the Water Resources Section and obtain approval before beginning the activity.

10. The Water Resources Section may modify this authorization to include different limitations, expand monitoring requirements, evaluate impacts, or require restoration at the site.

11. Pursuant to 11 AAC 93.220 (f), this authorization may be suspended by the Department of Natural Resources to protect the water rights of other persons or the public interest.

12. Any false statements or representations, in any application, record, report, plan, or other document filed or required to be maintained under this authorization, may result in the termination of this authorization.

13. **Any water intake structure in fish bearing waters, including a screened enclosure, well-point, sump, or infiltration gallery, must be designed, operated, and maintained to prevent fish entrapment, entrainment, or injury, unless specifically exempted by the Alaska Department of Fish and Game, Habitat Division.**

14. **To avoid entrainment, impingement, or injury to fish, a properly sized and screened structure must surround the water intake. The screen mesh shall not exceed 1/4 inches and the water velocity at the screen surface shall not exceed 0.5 feet per second.**

15. **The intake screen will be inspected for damage (torn screen, crushed screen, screen separated from intake ends, etc.) before and after each use. Any damage observed must be repaired prior to use of the structure. The structure must always conform to the original design specifications while in use.**

16. **Permittee must employ pumping operations in such a way as to prevent any petroleum products or other hazardous substances from contaminating surface or ground water. Pumps will not be fueled or serviced within 100 feet of a pond, lake, stream, or river unless the pumps are situated within a catch basin designed to contain any spills.**

17. **Water trucks will not be fueled or serviced within 100 feet of a pond, lake, stream or river. In case of accidental spills, absorbent pads shall be readily available at the water collection point. All spills must be reported to the Alaska Department of Environmental Conservation and the Alaska Department of Natural Resources.**

18. **Permittee shall control any runoff so that it does not introduce any pollutants, including sediment, into any surface water body, including the Suqitughneg River and adjacent wetlands.**

19. **The streambed and stream banks of the Suqitughneg River shall not be excavated, altered, or disturbed in any manner to facilitate the water withdrawal.**

This Temporary Water Use Authorization is issued pursuant to 11 AAC 93.220. No water right or priority is established by a temporary water use authorization issued pursuant to 11 AAC 93.220. Water so used is subject to appropriation by others (11 AAC 93.210(b)).

Pursuant to 11 AAC 93.210 (b), authorized temporary water use is subject to amendment, modification, or revocation by the Department of Natural Resources if the Department of Natural Resources determines that amendment, modification, or revocation is necessary to supply water to lawful appropriators of record or to protect the public interest.

This authorization shall expire on December 31, 2011.

Date issued: July 13, 2011

Approved: Kristina Pleti

Title: Natural Resource Manager

APPENDIX G

Certificates and Training

ERIC BARNHILL

Environmental Scientist

Years Experience

Total: 10; Bristol: 4

Areas of Expertise

Biology

Fisheries Research

Research Development

Remedial Investigation Sampling

Groundwater Sampling

Training and Certifications

HAZWOPER 40-hour Training

CPR and First Aid for Adults

Certified Erosion and Sediment Control Lead

Wetland Training Institute Wetland Delineation Certification Program

Defensive Driving Training

Education

B.S., Biology, Eastern Washington University, 1999

Mr. Barnhill has used his environmental science capabilities for contaminated site projects since 2007. Project types include site assessments and groundwater monitoring investigations. Mr. Barnhill has an extensive background in fisheries science, including both the research and the development sides of numerous fisheries projects. Additionally, he has been responsible for developing contracts and research plans for fisheries research. His end goal has been support of continued sustainability of Alaska's fisheries resource and the areas in which they inhabit. Among his many attributes, he has proficient skills in public speaking.

Project Experience

- **Environmental Scientist, Choggiung Limited Spill, Choggiung Limited, Dillingham, Alaska (10/2010).** Sampling responsibilities included excavating soil from beneath an above ground storage tank with a fuel leak; and taking several samples from the excavation to determine possible closure. The project consisted of direction of soil excavation and collection of analytical samples.
- **Environmental Scientist, Northeast Cape HTRW, USACE, St. Lawrence, Island, Alaska (07/2010 - 09/2010).** Sampling responsibilities included coordinating sampling efforts for several sites within the project area, soil sampling and water sampling and packing/shipping of sampling. The project consisted of a landfill cap and removal of POL and PCB contaminated soil.
- **Environmental Scientist, Soil Sampling, FAA, Selawik, Alaska (09/2009).** Responsibilities included taking samples in frozen soil, packing and shipping of samples, and swing tying. The project consisted of collecting confirmation samples of soil from underneath an aboveground storage tank (AST) where an overfill of two gallons of diesel fuel occurred years earlier.

- **Field Environmental Scientist, Data Collection Project, Fairbanks Environmental Services, Fort Wainwright Operating Unit 3, Alaska (04/2009).** Responsibilities included collecting well information and taking groundwater parameters for DRO, GRO, VOC, EDB, PAH, iron (II), lead, and sulfate analysis using low-flow groundwater sampling techniques.
- **Environmental Scientist, Well Inventory Project, U, Fort Richardson, Alaska (05/2009 - 09/2009).** Responsibilities included researching information on well locations, physically finding wells using Trimble GPS unit, and taking well field parameters, including well casing size, depth of well, depth to water and taking GPS positions for inclusion in a GIS database. The project consisted of a team of environmental scientists locating wells on the Fort Richardson Post, and noting metrics such as well damage, water level, casing type, etc. for inclusion in a military wells database.
- **Lead Environmental Sampler, Northeast Cape In-Situ Chemical Oxidation (ISCO) Study and Intrusive Drum Removal/Landfill Cap, USACE, Alaska District (07 - 09/2009).** Sampling responsibilities included coordinating sampling efforts for several sites within the project area, soil sampling, water sampling, petroleum, oil and lubricant (POL) sampling and packing/shipping of sampling. Tasks included report writing and gathering field supplies. This project consisted of excavation of an historic landfill with removal of drums of oil, transformers and other contaminated items; also a in-situ study to determine if chemical oxidation was a viable method for remediation of a petroleum contaminated area.
- **Environmental Scientist, Former Skelly Site Assessment, EPA 1004, Winnebago, Nebraska (10/2008).** Tasks included writing the Site Health and Safety Plan, installing soil borings, monitoring wells and collecting soil and groundwater samples. The project consisted of conducting a site assessment at a potential LUST site on the Winnebago Reservation in Nebraska, following NDEQ guidelines for a Tier 1 Site Assessment.
- **Environmental Scientist, Choggiung East Creek Hatchery Post Treatment Sampling and Assessment Report, Choggiung Limited, Dillingham, Alaska (10/2008).** Duties included developing sampling grid, soil sampling, collecting field-screening headspace samples, using a photoionization detector (PID), and packing and shipping of samples. Wrote a report summarizing field activities, presenting analytical data, and providing recommendations for future site remediation. Project consisted of soil sampling for assessment of a land farm being used to remediate petroleum contaminated soil.
- **Environmental Scientist, Private Residence Heating Fuel Investigation, Dillingham, Alaska (10/2008).** Developed a sampling protocol and performed soil sampling of an excavation at a private residence in Dillingham, Alaska. Duties included developing sampling grid, soil sampling, and packing and shipping of samples.
- **Environmental Scientist, Project Support for Elmendorf Treatability Study, Parsons Infrastructure & Technology Group Inc., Elmendorf Air Force Base, Alaska (06/2008).** Provided assistance for installation of bladder pump and set up of micro purge system for groundwater sampling from monitoring wells. Calibrated YSI brand water quality meter and logging system for groundwater monitoring. Performed seep sampling using a peristaltic pump. Assisted in labeling, packing and shipping of samples.

- **Environmental Scientist, Cape Yakataga Landfill Removal Project, Phase III, FAA, Cape Yakataga, Alaska (04/2008 - 06/2008).** Collection of waste characterization and confirmation soil samples for the decommissioning of a landfill and Biocell. Manifested barge shipments of contaminated soil to a disposal facility.
- **Environmental Scientist, Annette Island Phase I Environmental Due Diligence Audit (EDDA), Federal Aviation Administration, Annette Island, Alaska (04/2008).** Project responsibilities included conducting site visits to check for environmental contamination, interviews, database searches, and preparation of report and figures. Project consisted of site assessment of a former FAA site.
- **Environmental Scientist, BERS, Private Housing Development Project, Totem Trailer Park, Anchorage Alaska (04/2008).** Performed on-site assistance for well placement for groundwater contamination study. Project consisted of well installation in a residential mobile home park to assess soil and groundwater contamination.
- **Environmental Scientist, Wetland Delineation, Alaska Natural Gas Development Authority (ANGDA), Various Locations, Alaska (06/2008 - 09/2008).** Performed wetland delineation on sections of an approximately 470-mile proposed natural gas pipeline corridor. The effort was initiated by ANGDA to prepare primary requirements for a U.S. Army Corps of Engineers (USACE) National Environmental Policy Act (NEPA) ecological evaluation. Duties included traversing through developed and undeveloped Alaska wilderness, navigation and data entry using ArcPad software on several models of Trimble GPS units, making determinations of whether areas along the route were wetlands or uplands, participating in all aspects of wetland delineation, including digging pits, identifying soil types using Munsell soil charts, and identifying local plant types. Training included wildlife health and safety, wildlife interaction, rare plant Identification, wetland procedures, and using Geographical Information Systems to prepare a Wetland Delineation Report, which included: Wetland and Waterways Report, Preliminary Project Description, Support Data (Field forms, JD Forms, Photographs) and Mapping.
- **Environmental Scientist, BCS, Beaufort Sea Project, USACE, Alaska District, North Slope, Alaska (09/2007).** Performed remedial investigation sampling at Kogru, Collinson Point, and Nuvagapak DEW Line sites. Assisted in following work plan, sampling soil, sediment and surface water samples, sample packing, and shipping. Project consisted of soil sampling of former DEW line sites.

Professional Experience

- **Staff Biologist, Bering Sea Fishermen's Association, Anchorage, Alaska (2003 - 03/2007).** Developed fisheries research project in rural western Alaska and interior Alaska. Aided in the facilitation of these fisheries projects, as well as provided on-site guidance and hands-on research. Developed and maintained strong relationships with State fish and game entities. Developed contracts and research plans for fisheries research. Conducted data collection and storage. Acted as support staff of the Arctic-Yukon-Kuskokwim Sustainable Salmon Initiative. Planned data sharing symposiums and meetings. Provided oversight for many aspects of several fisheries projects. Maintained frequent contact with state, federal,

and non-governmental employees for field projects. Performed grant writing and contract development. Responsible for maintaining ongoing compliance with grant criteria. Participated in watershed council meetings, resource advisory committees, Alaska Board of Fisheries Meetings, North Pacific Fisheries Management Council meetings, and various other fisheries-related meetings. Assisted Executive Director and Program Director with fisheries issues as they arose. Performed operations in remote areas, including field camp setup and maintenance, weir installation, and project preparation, setup, and maintenance. Traveled extensively to projects across the state of Alaska.

- **Fisheries Technician II, Alaska Department of Fish and Game (2001 - 2003).** Worked on the Yukon River, Kuskokwim River, and several other Western Alaska and Interior Alaska rivers, as well as Bristol Bay. Traveled to and lived in remote areas and performed camp setup. Performed radio tagging salmonids. Used gill netting as a capture method. Performed scale taking, scale reading, tissue sampling, and otolith extraction on herring. Performed Age-Sex-Length (ASL) sampling. Performed river navigation and utilized Global Positioning System. Maintained fish wheels as a means of data collection and used data loggers. Identified salmon and resident species.
- **Lab Aide, Eastern Washington University, Cheney, Washington (1998 - 1999).** Collected walleye ASL information. Read walleye scales. Assisted in separating out juvenile preserved fish by species. Performed backpack and boat electrofishing and collected samples from an electrofishing boat. Assisted in collecting individual and population statistics.

ALEX BASKOUS, M.D., M.P.H.
OCCUPATIONAL MEDICINE
BOARD CERTIFIED IN OCCUPATIONAL MEDICINE
BY THE AMERICAN BOARD OF PREVENTAVIE MEDICINE
2841 DEBARR ROAD – SUITE 24

TELEPHONE: (907) 279-4953
FAX: (907) 334-9667
EMAIL: DRALEXBASKOUS@GMAIL.COM

PHYSICIAN'S WRITTEN OPINION

PURSUANT TO 29 CFR 1910.120(f) MEDICAL SURVEILLANCE:

NAME Eric Barnhill SS#

DATE OF EXAM 04-27-11

✓ A. NO MEDICAL CONDITIONS WERE DETECTED WHICH WOULD PLACE THE EMPLOYEE AT INCREASED RISK OF IMPAIRMENT OF THE EMPLOYEE'S HEALTH FROM WORK IN HAZARDOUS WASTE OPERATIONS OR EMERGENCY RESPONSE, OR RESPIRATOR USE.

THE FOLLOWING MEDICAL CONDITIONS ARE OCCUPATIONALLY PERTINENET:

_____

_____

_____

✓ B. NO LIMITATIONS UPON THE EMPLOYEE'S ASSIGNED WORK.

THE FOLLOWING LIMITATIONS ARE RECOMMENDED:

_____

_____

✓ C. THE EMPLOYEE HAS BEEN INFROMED BY ME OF THE RESULTS OF THE EXAMINATIONS.

DATE: 04-27-11

_____, M.D., M.P.H.

ALEXANDER BASKOUS, M.D., M.P.H.
2841 DEBARR ROAD, SUITE 24
ANCHORAGE, AK 99508

OSHA Occupational Safety and Health Administration

35-600698938

This card acknowledges that the recipient has successfully completed a 30-hour Occupational Safety and Health Training Course in

Construction Safety and Health

Eric Barnhill

(Trainer name – print or type)

4/24/11

(Course end date)

CERTIFICATE OF ACHIEVEMENT

This certifies that

Eric Barnhill

has successfully completed

Alaska Certified Erosion & Sediment Control Lead (AK-CESCL) Storm Water Training Program

Continuing Education Credits Earned:
12 Continuing Competency Credits Residential Endorsement Holders
Course approved by Alaska State Home Builders Association
16 Professional Development Hours for Architects, Engineers and Landscape Architects

AGC of Alaska
8005 Schoon Street

Alex Zimmerman , Instructor	**February 2, 2011** Course Date	**Anchorage, Alaska** Location
Juanita Kardell, CEF Training	**February 2, 2011** Certification Date	**February 1, 2014** Expiration Date

Eric Barnhill

Has successfully completed the training for
Alaska Certified Erosion & Sediment Control Lead

ID # AGC-11-0066 Expires February 01, 2014

Juanita Kardell

Juanita Kardell, CEF Training

U.S. ARMY CORPS OF ENGINEERS

PROFESSIONAL DEVELOPMENT SUPPORT CENTER
HUNTSVILLE, ALABAMA

CERTIFICATE

This is to certify that

Eric Barnhill

has completed the Corps of Engineers Training Course

CONSTRUCTION QUALITY MANAGEMENT FOR CONTRACTORS

Given at AGC (Location) By Alaska District (Instructional District) 04/07/2011 (Date)

Dale Berry
Facilitator

THIS CERTIFICATE EXPIRES FIVE YEARS FROM DATE OF ISSUE

Chief, USACE Professional Development Support Center

Bristol

INDUSTRIES

Eric Barnhill

Has completed 8 hours of annual refresher training as required by

29 CFR 1910.120

Hazardous Waste Operations & Emergency Response

March 4, 2009

Clark Roberts, CIH, CHMM

Instructor

Successful Completion Card

Basic TRAINING PROGRAMS

Eric Barnhill
Name

3/11/10 — Issued
3/11/12 — Expires

This certifies that the individual named above has successfully demonstrated the knowledge and skill objectives for:

☒ **BasicPlus CPR, AED, and First Aid** for Adults
☐ **Basic CPR and First Aid** for Adults

Card not valid if more than one box is checked.

MEDIC First Aid INTERNATIONAL

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Training Center Phone No. 563-0013

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ENVIRONMENTAL
MANAGEMENT
INCORPORATED

Certificate of Training

T - 21703 - 4930
Certificate Number

This is to certify that

Eric Barnhill

has satisfactorily completed 12 hours

of

Hazardous Materials Transportation - 12 Hours (DOT)

In compliance with 49 CFR 172.700-704 (3 Year Expiration)

Class Start Date: 2/15/2010 *Class End Date: 2/16/2010*

Steven Schuler	*2/16/2010*	*2/16/2013*	*Stuart M. Jacques*
	Exam Date	*Cert. Exp. Date*	*Director*

Environmental Management Inc. 206 E. Fireweed Lane Suite 201, Anchorage Alaska 99503 907-272-8852

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LITHO. IN U.S.A.

ENVIRONMENTAL
MANAGEMENT
INCORPORATED

Certificate of Training

T - 21704 - 4930
Certificate Number

This is to certify that

Eric Barnhill

has satisfactorily completed 12 hours

of

Hazardous Materials Transportation - 12 Hours (IATA)

Section 1.5 of IATA Dangerous Goods Regulations (2 Year Expiration)

Class Start Date: 2/16/2010 *Class End Date: 2/17/2010*

Steven Schuler	2/17/2010	2/17/2012	Stuart M. Jacques
	Exam Date	*Cert. Exp. Date*	*Director*

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LITHO. IN U.S.A.

CHARLES "CHUCK" CROLEY

Site Superintendent / Site Safety & Health Officer

Years Experience

Total: >35; Bristol: 6

Areas of Expertise

Quality Control

Site Superintendent

Safety and Health Management

Fuel Storage Tank (FST) Installation and Removal

Well Drilling and Sampling

Mobilization and Demobilization to Remote Sites

Training and Certifications

Certified UST Worker, State of AK No. 172 (Installation/Retrofitting and Decommissioning)

Certified Safety Instructor-ATV Safety Institute-ID No. 120099

U.S. EPA/ AHERA-Asbestos Abatement Worker - AK No. 5249

30-Hour OSHA Construction Safety and Health

40-hour EPA/AHERA Asbestos Supervisor/Worker / plus 8-hour Refresher

40-hour HAZWOPER / 8-hour Supervisor / 8-hour Refresher

8-hour Entry to Confined Spaces

24-hour Excavation, Trenching, and Soil Mechanics

USACE Construction Quality Management for Contractors

Hazardous Materials Transportation (DOT/IATA)

Certified Erosion & Sediment Control Lead

Education

Laramie High School, Laramie, Wyoming, 1963

Mr. Croley has worked on remote site projects throughout Alaska for over 35 years. From 1968 to 1979, he worked for a variety of construction and drilling contractors that conducted soils investigation and mining exploration work. The soils investigations included work for geotechnical studies for the Trans-Alaska oil pipeline. Projects in mining fields included mineral exploration and hydrological studies for dam foundations. Mr. Croley is an experienced Site Superintendent, Health and Safety Officer, and Contractor Quality Control Systems Manager (CQCSM) for projects encompassing construction, aboveground and belowground fuel tank installations and removals, monitoring well drilling, sampling for a variety of media, reserve pit closures, demolition projects, and oil field investigations.

Professional Experience

- **Site Supervisor/SSHO, N.E. Cape Debris Removal, Landfill Cap, and Soil Removal, USACE, Alaska District, St. Lawrence Island, Alaska (05/2010 – 10/2010; $7.8M).** Directed mobilization / demobilization activities for a 40-man camp and all related equipment, supplies, and personnel to conduct debris removal from a landfill and construct a legal landfill cap; locate and remove in excess of 800 tons of PCB-contaminated soil; locate, remove, screen, and ship off-site 2500 tons of POL contaminated soil; conduct water and soil studies; set up a portable chemical analysis laboratory; and conduct debris removal activities from tundra / wetlands. Responsible for the supervision and safety of staff. Conducted three separate tours of the project for visiting dignitaries, ranging from one to 26 participants.
- **Site Supervisor/SSHO, FUDS, Tierra Amarilla Air Force Station, USACE, Albuquerque District, Tierra Amarilla, New Mexico (04/2010; $223K).** Directed a subcontractor for the excavation, removal, and shipment offsite of 360 tons of debris and the demolishment of physical hazards, such as open manways and a deteriorating sewage system with several large septic tanks.

Bristol

- **Site Supervisor/SSHO, N.E. Cape In-situ Chemical Oxidation (ISCO) and Intrusive Drum Removal/Landfill Cap, USACE, Alaska District, St. Lawrence Island, Alaska, (05/2009 – 10/2009; $6.2M).** Directed the mobilization of a 30-man-camp and related heavy construction materials and equipment, via barge and landing craft, from Anchorage, Alaska to St. Lawrence Island, Alaska, which is located roughly 130 miles offshore west of the western coast of Alaska. Responsible for the supervision and safety of all Professional staff, equipment operators, laborers, surveyors, subcontractor personnel, and camp staff. The project included an In-situ Chemical Oxidation study on a subsurface hydrocarbon plume in arctic terrain and conditions. The project also included an intrusive removal of old drums containing waste oil that had been placed in a landfill, where the oil was recovered and the drums cleaned and reburied as inert debris in the landfill. The project included mining, hauling, and placing 28,000 cubic yards of cap material for the landfill and then re-vegetation of the landfill cap area. At the end of the project, all waste material, equipment, and camp were loaded on barges and demobilized.
- **Site Supervisor/SSHO, Clean and Inspect Diesel Fuel Tanks, FAA, Biorka Island and Level Island, Alaska (2008; $93K).** Supervised cleaning and inspection of diesel tanks and other activities. The scope of work included preparing planning documents and reports; mobilizing and demobilizing to and from Biorka Island; cleaning and inspecting five 20,000-gallon ASTs on Biorka Island; inspecting the secondary containment of the 20,000-gallon tanks; mobilizing and demobilizing to and from Level Island; and cleaning and inspecting two 10,000-gallon ASTs on Level Island.
- **Site Supervisor/SSHO, Phase II and Phase III, Landfill Remedial Action, FAA, Cape Yakataga, Alaska (Summers of 2007 and 2008; total project for two years: $14.3M).** Supervised remedial action activities for Bristol Construction, LLC on FAA project. Phase II and Phase III. Project included the excavation, containerization, and transportation of dioxin affected soil from an old landfill. During Phase II soil was placed in 8’ X 20’ containers, trucked 40 miles and then loaded on Landing Craft and barges for transportation to the disposal site in Oregon. Phase III of the project involved loading the soil into 9 cubic yard supersacks, trucking the 40 miles and loading the supersacks onto Landing Craft and barges for transportation to the final disposal site in Oregon. Both phase of the project involved waste characterization and confirmation sampling for chemical analysis. Monitoring wells were installed for monitoring. Final site restoration included the establishment of a borrow source, hauling the backfill 8 miles, regarding the site, site restoration that included grass seeding, tree planting, and stream bank restoration to ADEC guidelines.
- **Site Supervisor/SSHO, Kodiak Air Traffic Control Tower (ATCT) AST Upgrades, FAA, Kodiak, Alaska (2007; $98K).** Supervised the removal of a 2,000-gallon AST and replaced with a newly designed 1,000-gallon AST. Installation included new fuel piping. Outside piping was secondarily contained and interior piping upgraded to include new fuel filtration and valve system. A new VeederRoot monitor and inventory control system was installed.

- **Site Supervisor/SSHO, Cold Bay AST Upgrades, FAA, Alaska (2007; $93K).** Supervised AST upgrade activities for Bristol Construction Services, LLC. Site activities included the removal of an old 500 gallon, single wall AST and associated piping with a newly designed 500 gallon double walled AST and new associated piping and the installation of a VeederRoot monitoring and inventory control system.
- **Site Supervisor/SSH, Biorka Island Groundwater Investigation, FAA, Alaska (2006; $99K).** Supervised the emergency removal of a 1000 gallon AST, the survey of a previously removed pipeline, the location of 5 historical POL release areas and the soil sampling of these areas for contaminants, and the air monitoring and sampling of a area underneath an occupied building to determine the presence of any contaminants.
- **Site Supervisor/SSHO, ATCT UST Upgrades, FAA, Anchorage, Alaska (2006; $45K).** Supervised UST upgrade activities for Bristol Construction that involved with the reconditioning of manway protective coating and pulling all of the fuel and return lines and replacing with new lines and valves. The project also called for the installation of new piping that would allow a newly installed emergency generator to use the UST as a primary fuel source.
- **Site Superintendent/SSHO and Equipment Operator, Airport Tower Installation, FAA, Adak, Alaska (2005; $500K).** Directed a project that involved the upgrades of navigation aids at a Critical Navigation Site without the disruption of services. The scope of work included resealing two radomes by re-caulking and re-bolting (in excess of six thousand bolts and gaskets), demolition of two remote communication air/ground (RCAG) antennas and construction of two new RCAG antennas inside the radomes; the installation and burial of electrical and communications cables in over 300 lineal feet of trenches; the installation of two uninterruptible power supply systems (UPS); the construction of three new antennas (C-3, Glideslope, and Localizer); the repair of the main power supply box; and the installation of a new LCD lighting system on the NDB towers. The project also included installation of a new monitoring system, new piping, and the repair of an aboveground storage tank (AST) that furnishes fuel to the site emergency generator.
- **CQCSM, N.E. Cape Debris and Tram Demolition, U.S. Army Corps of Engineers (USACE), Alaska District, St. Lawrence Island, Alaska (2005; $5.2M).** Set up the Project Quality Control and Site Safety Management System at the start of the fieldwork. Conducted all beginning of field project orientations and Preparatory inspections. Conducted five safety classes for all-terrain vehicles per EM 385-1-1.
- **CQCSM/Alternate SSHO, Landfill Project, CH2M Hill Constructors, Inc. (CCI), U.S. Air Force, Shemya, Alaska (2005; $2.1M).** Project involved capping an old landfill and constructing a new landfill with an adjoining asbestos cell. The project involved the excavation, placement, and grading of 112,000 cubic yards of three different soils types for the designed capping of the old landfill and excavation of 80,000 cubic yards in the construction of the new landfill and asbestos cell.

Professional Experience

- **Harding Lawson Associates, Anchorage, Alaska (01/1979 – 10/2004).**
  - Site Superintendent/ SSHO, and CQCSM for the Bureau of Land Management, and Equipment Operator for R & R Lodge Fuel Spill Cleanup, Alaska Range (2004; $100K). This project entailed excavation and sampling activities for a fuel spill from a fuel bladder and containment area at a remote hunting lodge in the Alaska Range. The project included the excavation of 55 cubic yards of fuel-contaminated soil over bedrock, alongside a short (1,600-foot) active airstrip, to a depth of 9 feet. Excavation was accomplished with small equipment. Five cubic yards of soil were removed from the site by small aircraft (Cessna 206) and 50 cubic yards were stockpiled on a liner for land-farming activities.
  - Contract Site Supervisor, Closure Activities at an Inactive Reserve Pit, Chevron/Texaco, West Kavik, Alaska’s North Slope (2004; $750K). The first phase consisted of mobilization, construction, and demobilization of a remote site camp with Rolligons. The camp included power generation, freshwater treatment, grey water treatment, and cooking facilities, as well as living accommodations for 20 persons. The second phase consisted of mobilization and demobilization of equipment capable of mining approximately 8,500 cubic yards of gravel from an old airstrip and placing the gravel on top of an inactive reserve pit. Acted as SSHO while he was on site.
  - Site Superintendent/SSHO, Restoration at Red Devil Mine, BLM, Alaska (2003; $450K). Project consisted of demolition activities, a site investigation, and a historical site sampling activity for restoration at Red Devil Mine, a remote Alaska site where all equipment and personnel were mobilized by aircraft. The project included the demolition of six ASTs ranging from 200- to 350-barrel tanks and an ore hopper and ore-crushing facility. Project included the on-site burial of materials from demolition activities (including metal, wood, and concrete). Demolition activities took place in supplied air because of the presence of lead and mercury contaminants. A site investigation was conducted using a probe-pounding rig. A successful Historical Site Investigation was conducted for an ore house that had been destroyed more than 50 years prior and the site had been built over. The investigation was conducted using present-day air photos, old maps and field books, and a backhoe.
  - Contract Field Operations Manager, Closure Activities at Inactive Reserve Pits, Glenn Springs Holdings, Inc., a subsidiary of Occidental Petroleum, North Slope, Alaska (2002-2003; $1.25M). This project involved closure activities at three inactive reserve pits sites on the North Slope, Alaska. The first phase was the planning and mobilization of drilling equipment mounted on Rolligons to complete a subsurface investigation, and estimate drilling wastes and volumes of clean drill pad gravel. The second phase included the route selection and building and maintenance of eight miles of ice roads over tundra and river bottoms. The second phase also included the excavation and transport of 9,500 cubic yards of drilling wastes to the grind-and-inject facility at Prudhoe Bay from the reserve pit, and the hauling and placement of clean gravel, via Rolligon, at a third reserve pit. The work involved coordination among three oil companies and their contractors.

- CQCSM/Alternate SSHO, Demolition and Site Restoration, USACE, Alaska District (2001-2003; $5M). Managed demolition and site restoration of the Tok Fuel Terminal, Alaska. Site tasks included researching historical photographs; asbestos, polychlorinated biphenyls (PCBs), and lead-based paint (LBP) sampling; conducting a landfill investigation; construction of a solid waste landfill that included an asbestos cell; the removal and packaging of hazardous wastes; the removal of petroleum, oils, and lubricants (POL)-contaminated soil; site-wide abatement and disposal of asbestos and LBP; demolition and burial of 23 buildings; demolition and burial of four 1,000-gallon FSTs, one 1,000-barrel water storage tank, and one 5,000-barrel FST; and demolition and removal of one 1,000-barrel FST, two 5,000-barrel FSTs, nine 30,000-barrel FSTs, and 30,000 lineal feet of tank-farm-related fuel and fire retardant pipelines.
- CQCSM/Alternate SSHO, School Demolition Project, USACE, Alaska District, Eielson Air Force Base (2001; $1.2M). Managed the demolition of the Ben Eielson Taylor Elementary School, Eielson AFB, and the construction of an Olympic-sized soccer field, a softball field, bleachers and fencing of the entire sports complex. Complicated demolition and disposal activities were involved, including security concerns with off-site disposal of debris, asbestos removal prior to demolition, and suspected mercury releases. Construction included leveling and placement of several types of soils, installation of an underground water hydrant system, concrete, asphalt, grass seeding, and fencing activities. Supervised quality control for contractor and subcontractor activities.
- CQCSM/Alternate SSHO, Demolition of Long-Range Radar Station, USACE, Alaska District, Fort Yukon, Alaska (1999-2002; $5M). Managed multifaceted demolition of a long-range radar station. Directed removal and long-term storage of more than 650 cubic yards of POL-contaminated soils. Supervised asbestos removal and asbestos storage of materials from 13 buildings, four radar towers, and utility facilities; demolition of two 60-foot by 60-foot and two 120-foot by 120-foot radar towers; demolition and debris removal of 12 buildings; decommissioning and demolition of 26 ASTs; construction of a solid waste landfill; placement of various types of demolition debris in the landfill, including use of an asbestos cell; and capping of the landfill to State of Alaska criteria. Conducted soils exploration program and water sampling; constructed new fuel storage and monitoring system. Installed biovent system.
- CQCSM/SSHO, FST Upgrades, USACE, Alaska District/FAA, Various Locations, Alaska (1998). Responsibilities included on-site construction management and health and safety, developing reporting documents, and assisting in planning and submittal of documents Managed FST upgrades at Port Heiden, Wrangell, Metlakatla, Sand Point, and Dillingham, Alaska. Project entailed removal of seven regulated underground storage tanks (USTs) and one AST, and installation of five ASTs for prime fuel sources at remote navigation aid sites. Fuel systems included lead detection, inventory control, and remote site monitoring systems.
- CQCSM/SSHO, Tank Removal and Soil Remediation, USACE. Alaska District, Galena Air Force Station (AFS), Alaska (1997). Responsibilities included on-site construction management and assisting with completing planning and reporting documents, managing submittals, performing network analysis, and submitting pay requests. Managed cleaning of three bulk fuel ASTs; decommissioning of three USTs; and construction, operation, and maintenance of a 5,100-cubic-yard bioremediation cell. The project included demolition, asbestos abatement and waste management.

- CQCSM/SSHO, UST Removal at the Galena AF Power Plant, USACE, Alaska District, Galena, Alaska (1996-1997). Responsibilities included on-site construction management, site safety, and assisting with completing planning and reporting documents, managing submittals, performing network analysis, and submitting pay requests. The project included removal of two 12,000-gallon and two 25,000-gallon fuel USTs and five 55- to 1,000-gallon USTs that contained fuel and oil/water separator waste; removal and stockpiling of 700 cubic yards of contaminated soil; installation of two 30,000-gallon ASTs at a remote site off the road system.
- Contract Site Superintendent, Reserve Pit Closeout, Exxon Mobil, Flaxam Island, Alaska (2000-2001; $7.5M). Provided construction and safety oversight and permit compliance for closeout of two inactive reserve pits on Alaska’s North Slope. Winter 2001 activities included drilling a new 2,500-foot disposal well for grinding and injecting reserve pit wastes; excavation of two inactive reserve pits and two flare pits; confirmation sampling and on-site laboratory analyses; slurrying and injecting cuttings; and reviewing and verifying quantities and pay items. Winter 2002 activities included construction of a 68-mile offshore ice road on the Arctic Ocean; excavation of contaminated soil from reserve pits, and the excavation and hauling of 20,000 cubic yards of drilling wastes to the Prudhoe Bay grind and injection facility. Project considerations included sensitive wildlife habitats, construction in arctic conditions, and North Slope safety requirements. Job range: $7.5 million.
- Contract Site Quality Control Manager, Quality Assurance Monitoring, Alaska Department of Natural Resources, Joint Pipeline Office (JPO) for the Northstar Development Project, Point McIntyre/Point Storkerson, North Slope, Alaska ($3M). Provided in-field quality assurance monitoring during construction of two 10-inch pipelines running from Seal Island, offshore, to Point McIntyre, onshore, and then onshore and terminating at BP’s Gathering Center 1. The offshore underwater pipeline portion was approximately 6 miles long and depths to 50 feet.
- Site Superintendent, Cleanup at Fuel Site, Exxon Company, USA, Flaxman Island, Alaska Cleanup project at a former fuel storage area at the Alaska State A-1 drill site on remote Flaxman Island in the Beaufort Sea. The project involved the use of a field laboratory to field screen and segregate 1,000 cubic yards of soil during the winter. The excavated contaminated soil was then transported, via Roligon, back to the Prudhoe Bay area for treatment.
- Site Superintendent, Inactive Reserve Pit Investigations, for Exxon Company, USA, Flaxman Island, Alaska. The project consisted of winter investigations of two inactive reserve pits at Alaska State A-1 and G-2 drill sites on Flaxman Island, Alaska, a remote Island in the Beaufort Sea. The investigations included relocation of the reserve pits, soil drilling with a drill rig transported via Roligon, excavation of trenches (in permafrost materials) for drill mud sampling and investigating the use of liners.
- Contract Site Quality Control Manager, Quality Assurance Monitoring, Alaska Department of Natural Resources, JPO for the Alpine Development Project, Colville River, North Slope, Alaska. Provided in-field quality assurance monitoring during horizontal directional drilling and installation of four pipelines beneath the Colville River. The crossing was approximately 4,100 feet long.

- Construction Manager/SSHO, Development of Soil Gas Recovery System, USACE, Alaska District, Fort Wainwright, Alaska. Provided construction management of an experimental soil gas recovery system that included the installation of two horizontally drilled wells, a 1,000-foot-long air-injection well, and a 750-foot-long vapor-extraction well. The experimental system included the installation of a variety of monitoring wells and nuclear density probe wells, as well as the compressor plant for the air injection. Also implemented site safety plan.
- Construction Superintendent/SSHO, FST Improvements, FAA, McGrath, Alaska.
- Supervised project to decommission eight FSTs and install seven FSTs. Also responsible for site safety.
- Construction Superintendent/SSHO, FST Improvements, FAA, Bethel, Alaska. Supervised the decommissioning of 14 FSTs and installation of 9 FSTs. Also responsible for site safety.
- Construction Superintendent/SSHO, UST Decommissioning, FAA, Cordova, Alaska. Supervised the decommissioning of 19 FSTs and installation of nine FSTs. Responsible for site safety.
- Construction Superintendent/SSHO, UST Decommissioning, Municipality of Anchorage, Alaska. Directed field operations for decommissioning of three USTs at a power-generating facility.
- Construction Superintendent/SSHO, FST Replacement, FAA, Statewide Alaska (1990-1998). Directed field operations for the FAA for Alaska (statewide) FST replacement project to decommission USTs and ASTs, construct new fuel systems, and clean up fuel-affected soil. Responsible for site safety. Completed projects at four Anchorage and 16 rural locations, involving 190 USTs and ASTs, 122 decommissionings, 79 installations, and 11 upgrades.
- Senior Technician, Hunters Point Annex Restoration, USACE, San Francisco, California. Logged borings, field-screened soil samples for radiation, installed and sampled monitoring wells, located drill borings for future projects, and mapped dump sites suspected of containing radiation-affected waste.
- Drilling Superintendent/Senior Technician, Groundwater Investigations, FAA, Bettles, Alaska. Performed groundwater investigations. Supervised drilling and environmental soil and water sampling program to trace the limits of a contaminant plume. Responsible for site safety.
- Drilling Superintendent/Senior Technician, Reserve Pit Monitoring, Confidential Client, Kenai, Alaska. Supervised a reserve pit monitoring project over a two-year period. Supervised field operations including drilling, environmental soil sampling, and groundwater testing for possible groundwater contamination.
- Drilling Superintendent, Milne Point Gravel Study, for Conoco, Inc., North Slope, Alaska. Directed a drilling and soil sampling program for gravel mine site exploration.

- Drilling Superintendent, Drilling and Soil Sampling Program at the Point McIntyre Development, ARCO Alaska, Inc., North Slope, Alaska. Supervised a drilling and soil sampling program for a foundation study for a drill pad design and pipeline construction. Installed a ground temperature monitoring system. Drilling activities included onshore and over-ice operations.
- Drilling Superintendent, Field Investigation, Sohio Petroleum Company, Beaufort Sea, Alaska. Supervised field investigation for the Endicott Geotechnical Investigation, which involved drilling onshore and offshore soil borings, and performing in-situ testing to establish design criteria for the development of Endicott oil field facilities. Coordinated field crews, maintained all equipment, and troubleshot drilling problems.
- Superintendent/Senior Technician, U5-A Slab Investigation, ARCO Alaska, Inc., North Slope, Alaska. Supervised drilling for an environmental soil sampling and geotechnical drilling program inside a warehouse in a permafrost area. The purpose of the project was to investigate a foundation failure and related chemical release.
- Drilling Superintendent, Support for FST Decommissioning, USACE, Alaska District, Various Sites throughout Alaska. Served as drilling superintendent for FST decommissionings and installations, soil and water investigations and studies, and remedial action and construction projects.
- Senior Technician, Remedial Investigation, USACE, Sacramento District, at Fort Ord, California. Performed remedial investigation for the installation and sampling of monitoring wells, and collection of inventory and control samples.
- Senior Technician, Heavy Metal Sampling, ARCO Alaska, Inc, Prudhoe Bay, Alaska . Developed a system to sample for heavy metals in high-pressure natural gas at Prudhoe Bay, Alaska.
- Senior Technician, Soil Sampling, Exxon Company, U.S.A, Seward and Valdez, Alaska. Conducted environmental soil sampling programs on and around contaminated soil stockpiles
- Senior Technician, Soil Sampling, Confidential Client, Beluga, Alaska. Conducted environmental soil sampling programs on a soil bioremediation project near Beluga, Alaska. The sampling took place at several remote gravel pads in southcentral Alaska. Directed the initial construction of two bioremediation cells.
- Senior Technician Tatitlek Soil Remediation Project, Exxon Company U.S.A., So
- Senior Technician, Sampling and Monitoring System, Chevron U.S.A., Inc. Directed drilling operations for sampling the core of a man-made ice island and constructing a monitoring system in the Beaufort Sea, Alaska. Conducted over-ice sampling for future ice or gravel island drilling locations.
- Senior Technician, Groundwater Investigation, State of Alaska, Minto, Alaska. Responsible for overseeing groundwater investigation and permanent abandonment of a freshwater production well.
- Senior Technician, Seismic Monitoring System Development, ARCO Alaska, Inc. Directed drilling operations and recovery of seismic equipment, and construction of a seismic monitoring system for a production well test (UGNU tiltmeters) on the North Slope, Alaska.
- Senior Technician, Reserve Pit Closeout, ARCO Alaska, Inc., and Conoco, Inc, North

Slope, Alaska. Directed drilling and environmental soil sampling for reserve pit closeout permit requirements on the North Slope of Alaska, using hollow-stem auger and coring systems. Installed permanent ground temperature monitoring systems. Collected and field tested surface-water samples to monitor closeout permit compliance.

- Senior Technician, Drilling and Sampling Programs, Exxon Company, U.S.A, Alaska. Conducted drilling and sampling programs at a remote arctic exploration site (Point Thomson Units 1 and 4, North Slope, Alaska) during summer and winter. Directed bioremediation activities at the same site, including mobilization and demobilization of workers, equipment, camp facilities, and bioremediation work, using marine and overland transportation.
- Senior Technician, UST Removal at the Alaska Aviation Heritage Museum, Municipality of Anchorage, Alaska. Responsible for overseeing the removal of three USTs in a shallow groundwater area.
- Senior Technician, Site Investigation, Confidential Client, Anchorage, Alaska. Performed service station site investigation and directed drilling operations for soil testing around buried facilities and utilities.
- Senior Technician, Support Causeway, Municipality of Anchorage, Alaska. Drilled five offshore borings and performed cone penetrometer tests for a causeway linking Anchorage and Fire Island.
- Senior Technician, Third Avenue Shelter Project, Municipality of Anchorage, Alaska. Drilled three borings in an earthquake slide area in which cone penetrometer testing was conducted to a depth of 120 feet.

♦ **Senior Technician, Municipality of Anchorage Projects, Alaska.** Participated in the following area projects:

- Peters Creek Watershed Improvement District (W.I.D.)
- Nancy Local Improvement District 174 and W.I.D.
- Chester Creek Oil and Gas Separators
- West 42nd Avenue
- West High Culvert
- 56th Street Walls
- Girdwood Anchorage Telephone Utility Site
- 39th and 40th Streets, Anchorage Telephone Utility Site
- Southeast Interceptor Project
- Bear Valley Anchorage Telephone Utility Site
- Chugiak Fire Station
- Hiland Drive Slope Stabilization
- Diamond Trunk Storm Drainage Study

- Senior Field Technician/Drilling Superintendent, Geotechnical Investigation, ARCO Alaska, Inc. Performed geotechnical investigation for Prudhoe Bay Unit reserve pits on the North Slope of Alaska. Work consisted of drilling and logging test borings via 3-inch frozen cores. Project objective was to measure the depth of chemical contamination beneath the reserve pit. Collected soil samples for chemical analyses.
- Senior Field Technician/Drilling Superintendent, Groundwater Investigation, Union Oil Company of California. Performed groundwater investigation on the Kenai Peninsula, Alaska. Drilled borings and sampling soil and groundwater for geochemical analyses to evaluate impacts on groundwater resources and potential contaminant transfer.
- Senior Field Technician/Drilling Superintendent, Site Investigation, Butler Aviation, Anchorage, Alaska. Performed site background investigation. Drilled borings and sampled soil and groundwater for geochemical laboratory analyses.
- Senior Field Technician/Drilling Superintendent, Sampling Program, ARCO Alaska, Inc. Performed work on an environmental project on the North Slope of Alaska, to explore possible effects of dispersion and biological accumulation of chemical contaminants in tundra. Duties included sampling surface water, soil, and vegetation at 250 sampling points for geochemical analyses. Assisted in field measurements of pH, electrical conductivity, and dissolved oxygen content of water.
- Senior Field Technician/Drilling Superintendent, Groundwater Investigation, ARCO Alaska, Inc. Performed an investigation to examine the potential for reserve pit water to seep through gravel containment berms on the North Slope, Alaska. Assisted in installing and monitoring instrumentation to identify groundwater characteristics in saturated and unsaturated zones, and to profile ground temperatures. Collected groundwater, soil, reserve pit water, and drilling reserve samples for geochemical analyses.
- Senior Field Technician/Drilling Superintendent, Multiphase Groundwater Investigation, Confidential client, Alaska. Performed multiphase investigation of impacts of plant discharges on groundwater in a multi-aquifer system for the Bernice Lake Power Plant in Alaska. During the initial phase, performed geochemical sampling of groundwater to evaluate potential problems. In Phase II, assisted in installing and monitoring groundwater and ground temperature instrumentation.
- Senior Field Technician/Drilling Superintendent, Soil and Groundwater Investigations, Tesoro Alaska Petroleum, Alaska. Performed soil and groundwater contamination investigation for an underground hydrocarbon spill at an industrial facility. Participated in drilling test borings and sampling soil and groundwater.
- Senior Field Technician/Drilling Superintendent, Preliminary Site Investigation, Pacific Gas and Electric’s Hinkley Compressor Station in Hinkley, California. Performed preliminary site appraisal and participated in collecting groundwater samples from approximately 100 wells including domestic, agricultural, public water supply, and industrial wells in an investigation of chromium-contaminated groundwater.
- Senior Field Technician/Drilling Superintendent, Geotechnical Investigation, ARCO Alaska, Inc. Performed geotechnical investigation project, sampled soil, performed resistivity testing, and installed thermistors as part of freeze-thaw studies to redesign a flare pit on the North Slope, Alaska.

- Senior Field Technician/Drilling Superintendent, Boring and Sampling Program, America North, Inc./Alaska Gold Nome, Alaska. Drilled borings for the Steadman Field Site Investigation, and sampled soil contaminated with mercury and arsenic in Nome, Alaska. Project included investigating a waste disposal area.
    - Other related project experience includes the following:
        - Duck Island Development Area, Beaufort Sea, Alaska
        - Port of Nome Over-Ice Investigation, Nome, Alaska
        - Soil Boring Programs, Trans-Alaska Pipeline Route
        - Mukluk Island Site, Beaufort Sea, Alaska
        - Offshore Drilling, Beaufort Sea, Alaska
        - Drilling of Five Island Sites, Beaufort Sea, Alaska
        - Wharf and Docking Facilities, Afognak Island, Alaska
        - Rotary Drilling and Wireline Coring, Remote Island in Indian Ocean
        - Alpine Permafrost Institute, Pikes Peak, Colorado

♦ **Driller, Senior Technician, Drill Superintendent, Construction Superintendent, and Field Operations Manager, MACTEC Engineering and Consulting Inc., and its predecessors (Harding ESE and Harding Lawson Associates) (1979 to 10/2004).** Performed the role of CQCSM and alternate SSHO on many USACE Projects throughout Alaska. Description of duties in the various positions are as follows:

- As senior technician, responsibilities included installing monitoring wells; sampling water and soil; handling oil and hazardous substances; performing field measurements on water samples; installing soil-gas wells; and installing thermistors, manometers, and piezometers. Conducted freeze-thaw studies, cone penetrometer tests, permafrost investigations, and percolation tests.
- As general drilling superintendent, operated and maintained drilling equipment, supervised drill crews, and was responsible for site safety. Experienced with permafrost drilling, refrigerated coring, mineral exploration, dam foundation drilling and testing, over-water and over-ice operations, and helicopter drilling.
- As construction superintendent, mobilized and demobilized construction crews and materials to various remote Alaska sites via air, land, and water transportation. Provided oversight for removal and storage of contaminated soil, decommissioning of USTs and ASTs, and installation of new FSTs and distribution systems, and was responsible for site safety.

Additional Training and Certifications

Certified in UST Installation/Retrofitting, International Code Council
No. 1057168-U1

Certified in UST Decommissioning, International Code Council-No. 1057168-U2

Certified in the Use of Nuclear Testing Equipment – Alaska No. 16619

40-hour Hazardous Waste Operations and Emergency Response (HAZWOPER),
plus 8-hour Supervisor and 8-hour Refresher, Bristol Industries

CPR and First Aid for Adults, MEDIC FIRST AID® International

24-hour Construction Project Administration

Hydrogen Sulfide Safety Training

Radiation Protection Training

10-hour Construction Safety

Defensive Driving Training

ALEX BASKOUS, M.D., M.P.H.
OCCUPATIONAL MEDICINE
BOARD CERTIFIED IN OCCUPATIONAL MEDICINE
BY THE AMERICAN BOARD OF PREVENTAVIE MEDICINE
2841 DEBARR ROAD – SUITE 24

TELEPHONE: (907) 279-4953
FAX: (907) 334-9667
EMAIL: DRALEXBASKOUS@GMAIL.COM

PHYSICIAN'S WRITTEN OPINION

NAME Charles Croley SS#_____

DATE OF EXAM 3/30/11

✓ A. NO MEDICAL CONDITIONS WERE DETECTED WHICH WOULD PLACE THE EMPLOYEE AT INCREASED RISK OF IMPAIRMENT OF THE EMPLOYEE'S HEALTH FROM WORK IN HAZARDOUS WASTE OPERATIONS OR EMERGENCY RESPONSE, OR RESPIRATOR USE.

____ B. THE FOLLOWING MEDICAL CONDITIONS ARE OCCUPATIONALLY PERTINENET

_____

_____

_____

✓ C. NO LIMITATIONS UPON THE EMPLOYEE'S ASSIGNED WORK.

____ D. THE FOLLOWING LIMITATIONS ARE RECOMMENDED

_____

_____

✓ E. THE EMPLOYEE HAS BEEN INFROMED BY ME OF THE RESULTS OF THE EXAMINATIONS.

DATE: 3/30/11

_____, M.D., M.P.H.

ALEXANDER BASKOUS, M.D., M.P.H.
2841 DEBARR ROAD, SUITE 24
ANCHORAGE, AK 99508

HLA

HARDING LAWSON ASSOCIATES

CERTIFICATE OF QUALIFICATION

This certifies that

Charles L. Croley

has completed 8 hours

SUPERVISORY HAZARDOUS MATERIALS/WASTE HEALTH AND SAFETY TRAINING

in accordance with the requirements of
29 CFR PART 1910.120

HLA AUTHORIZED INSTRUCTOR

Chris Corpuz — June 13, 1988

Chris Corpuz — **Date**

Title Industrial Hygiene and Safety Specialist

MINING AND PETROLEUM TRAINING SERVICE

№ 18299

The University of Alaska Anchorage

CERTIFICATE

This is to certify that

CHARLES L. CROLEY

has satisfactorily completed

8 Hours

in

ENTRY TO CONFINED SPACES

INSTRUCTOR	DATE	DIRECTOR
Robert G. Strother	October 4, 1993	

MINING AND PETROLEUM TRAINING SERVICE

№ 14148

The University of Alaska Anchorage

CERTIFICATE

This is to certify that

CHARLES L. CROLEY

has satisfactorily completed

24 Hours

in

EXCAVATION, TRENCHING, AND SOIL MECHANICS

George Bradberry
INSTRUCTOR

February 20, 1992
DATE

DIRECTOR

CERTIFICATE OF ACHIEVEMENT

This certifies that

Chuck Croley

has successfully completed

Alaska Certified Erosion & Sediment Control Lead (AK-CESCL) Storm Water Training Program

Continuing Education Credits Earned:
16 Continuing Competency Credits Residential Endorsement Holders
Course approved by Alaska State Home Builders Association
16 Professional Development Hours for Architects, Engineers and Landscape Architects
AGC of Alaska
Construction Education Foundation
8005 Schoon Street
Anchorage, Alaska 99518

Michael D. Travis	March 26 & 27, 2009	Anchorage, Alaska
Instructor	Course Date	Location
Robert Cress	March 27, 2009	March 26, 2012
Robert Cress, AGC Training Director	Certification Date	Expiration Date

ATV Safety Institute®

A Division of the Specialty Vehicle Institute of America

Certificate of Completion

This certificate confirms that

Chuck Croley

has successfully completed an

ATV Instructor Preparation Course

Jane Bash
Chief Instructor

March 20, 2005
Date

This program complies with the instructional guidelines recommended by the ATV Safety Institute

ENVIRONMENTAL
MANAGEMENT
INCORPORATED

Certificate of Training

T - 20537 - 3236
Certificate Number

This is to certify that

Charles L. Croley

has satisfactorily completed 16 hours

of

Hazardous Materials Transportation - (DOT/IATA)

In compliance with 49 CFR 172.700-704 (3 Year Expiration)

Class Start Date: 2/13/2008 *Class End Date: 2/14/2008*

Karl Aughe	*2/14/2008*	*2/14/2011*	*Stuart M. Jacques*
	Exam Date	*Cert. Exp. Date*	*Director*

Environmental Management Inc. 206 E. Fireweed Lane Suite 201, Anchorage Alaska 99503 907-272-8852

U.S. ARMY CORPS OF ENGINEERS

PROFESSIONAL DEVELOPMENT SUPPORT CENTER
HUNTSVILLE, ALABAMA

CERTIFICATE

This is to certify that

Charles Croley

has completed the Corps of Engineers Training Course

CONSTRUCTION QUALITY MANAGEMENT FOR CONTRACTORS

Given at AGC of Alaska (Location) By Anchorage (Instructional District) February 9, 2007 (Date)

Ronald Rodin Facilitator

Chief, USACE Professional Development Support Center

THIS CERTIFICATE EXPIRES FIVE YEARS FROM DATE OF ISSUE

Bristol

ALLIANCE OF COMPANIES

Chuck Croley

Has completed 8 hours of annual refresher training as required by

29 CFR 1910.120

Hazardous Waste Operations & Emergency Response

March 25, 2011

Maxey Riggs.
Instructor

ENVIRONMENTAL
MANAGEMENT
INCORPORATED

Certificate of Training

T - 22370 - 3236
Certificate Number

This is to certify that

Charles L. Croley

has satisfactorily completed 8 hours

of

Hazardous Materials Transportation Refresher DOT

In compliance with 49 CFR 172.700-704 (3 Year Expiration)

Class Start Date: 1/20/2011 *Class End Date: 1/20/2011*

Steven Schuler	*1/20/2011*	*1/20/2014*	*Stuart M. Jacques*
	Exam Date	*Cert. Exp. Date*	*Director*

Environmental Management Inc. 206 E. Fireweed Lane Suite 201, Anchorage Alaska 99503 907-272-8852

© GOES 746

LITHO. IN U.S.A.

ENVIRONMENTAL
MANAGEMENT
INCORPORATED

Certificate of Training

T - 22371 - 3236
Certificate Number

This is to certify that

Charles L. Croley

has satisfactorily completed 8 hours

of

Hazardous Materials Transportation Refresher IATA

Section 1.5 of IATA Dangerous Goods Regulations (2 Year Expiration)

Class Start Date: 1/20/2011 *Class End Date: 1/20/2011*

Steven Schuler	*1/20/2011*	*1/20/2013*	*Stuart M. Jacques*
	Exam Date	*Cert. Exp. Date*	*Director*

Environmental Management Inc. 206 E. Fireweed Lane Suite 201, Anchorage Alaska 99503 907-272-8852

© GOES 746

LITHO. IN U.S.A.

Successful Completion Card

Basic TRAINING PROGRAMS

Chuck Croley
Name

3/11/10 — Issued
3/11/12 — Expires

This certifies that the individual named above has successfully demonstrated the knowledge and skill objectives for:

☒ BasicPlus CPR, AED, and First Aid for Adults
☐ Basic CPR and First Aid for Adults

Card not valid if more than one box is checked.

MEDIC First Aid INTERNATIONAL

Instructor Maxey Riggs

Registry Number 37530

Training Center Phone No. 563-0013

Training Center ID

MEDIC FIRST AID® BasicPlus follows ILCOR, AHA, and ASTM recommendations and guidelines for CPR, first aid, and emergency care. Additional source authority information can be found in your *Student Guide* and at medicfirstaid.com.

Continued proficiency as a MEDIC FIRST AID Provider requires frequent retraining. This card expires as documented on the front of the card or within 24 months of issue.

© 2009 MEDIC FIRST AID International, Inc. medicfirstaid.com

Bristol

INDUSTRIES, LLC

Chuck Croley

Has completed 8 hours of annual refresher training as required by

29 CFR 1910.120

Hazardous Waste Operations & Emergency Response

February 22, 2010

Clark Roberts, CIH, CHMM

Instructor

TYLER ELLINGBOE

Project Manager / Senior Waste Specialist

Years Experience

Total: 16; Bristol 2.5

Areas of Expertise

Project Management

Hazardous/Nonhazardous Waste Materials Management

Regulatory Compliance

Logistics

Sampling

Training and Certifications

40-Hour Hazardous Waste Operation & Emergency Response (HAZWOPER)

HAZWOPER Refresher

HAZWOPER Site Worker and Supervisor Training

RCRA Hazardous Waste Regulations/Land Disposal Restrictions

Hazardous Materials Transportation (49CFR 172.700-704) / IATA

HAZCAT® Chemical Identification System Training

Physical Sampling for Hazardous Materials and Contaminants Training

Toxic Substances Control Act Training (TSCA)

Education

M.S., Engineering and Science Management – Science Option, University of Alaska Anchorage, Alaska, 2007

B.S., Biological Sciences-Fish and Wildlife Management Option, Montana State University, Bozeman, Montana, 1994

Mr. Ellingboe's education and specialized training have allowed him to develop skills in project management, chemical identification and characterization, and logistics over the previous 16 years. He has served as project manager for clients ranging from small privately-owned businesses to larger corporations, and from municipal and borough household waste programs to federal projects and contracts. His knowledge of the WAC, OSHA, RCRA, CERCLA, DOT, IATA, and TSCA regulations have been crucial to timely job completion while maintaining regulatory compliance. Mr. Ellingboe is a State of Alaska Qualified Sampler, and has extensive experience in sampling, identification, consolidation, labeling, lab-packing, packaging, profiling, manifesting, and transporting of hazardous / nonhazardous waste materials. Supervision and direction of project staff and the handling of personnel and equipment scheduling have also been his primary responsibilities. He has been accountable for regulatory and contract compliance, waste tracking, and reporting requirements. His various projects have led to a wide range of experiences in both local and remote, arctic areas and conditions.

Project Experience

- **Project Manager/Senior Waste Specialist for Class V Underground Injection Control (UIC) Closure – Building 722, U.S. USACE, Alaska District at Fort Richardson, Alaska (06/2010 – 12/2010; $273K).** Prepared planning and final reporting documents. Performed the excavation and removal of a 1940s era septic tank and cesspool. Conducted soil sampling for site characterization, confirmation, and wastestream disposal. Performance evaluation sampling was a required part of the project. Excavated, transported, and removed approximately 170 tons of petroleum hydrocarbon impacted soil. Prepared all required waste stream profiling and manifesting paperwork and coordinated all subcontractors.

Bristol

- **Senior Waste Specialist for Removal of Polychlorinated Biphenyl (PCB)-containing Transformers at a Formerly Used Defense Site (FUDS), USACE, Albuquerque District, Deming, New Mexico (04/2010 – 11/2010; $640K).** Project was at the former Deming Army Airfield. Oversaw the preparation of all waste material profiling and manifesting paperwork required for proper disposal. Supervised the subcontractor and the removal, packaging, transportation, and disposal of PCB waste from the site to the disposal/recycling facility.
- **Senior Waste Specialist, NE Cape In Situ Chemical Oxidation (Phase I ISCO) and Intrusive Drum Removal/Landfill Cap Project, USACE, Alaska District, Northeast Cape of St. Lawrence Island, Alaska (04/2009 – 12/2010; $13.8M).** Supported the preparation of waste management planning documents. Responsible for proper characterization, containerization, and profiling of waste streams for disposal. This project also required the preparation of non-hazardous and uniform hazardous waste manifests and Canadian transit notices and movement documents.
- **Project Manager, Native American Lands Environmental Mitigation Program (NALEMP) Site Investigation and Removal Action, Native Village of Savoonga (NVS), Native Village of Northeast Cape, St. Lawrence Island, Alaska (01/2009 – 08/2010; $62K).** Prepared the planning documents, conducted a reconnaissance of all the sites, performed a hazardous materials building survey, and collected samples from areas of concern. Prepared the Reconnaissance Report and helped the NVS plan the next phase of work. Project site was the Native Village of Northeast Cape "Fish Camp" located at the Northeast Cape of St. Lawrence Island, Alaska. The NALEMP was developed by the Department of Defense (DoD) to address environmental issues from past DoD activities on Indian lands. The NVS obtained funding under the NALEMP Program from the USACE to identify and mitigate military impacts to Native land. Bristol subcontracted to the NVS to assist them in conducting the first phase of the Site Investigation/Removal Action at several areas of concern and supported the tribe with the preparation of Fiscal Year 2010 Facilitated Cooperative Agreement documents between the tribe and the USACE.
- **Project Manager, Leaking Underground Storage Tank Investigations and Remediation, EPA, Region 8, Several States (09/2008 – Present; $1.2M).** This is a three-year contract with EPA to investigate and remediate leaking underground storage tank sites on Indian Lands in Colorado, Montana, North and South Dakota, Utah, and Wyoming. Supervised the performance of site assessments / characterizations and/or remedial actions 12 sites on 5 reservations. Projects have included installing soil borings and groundwater monitoring wells, collecting analytical samples, evaluating and upgrading existing remediation systems, and designing and installing remediation systems. Removal actions including soil excavation and removal and groundwater monitoring well pumping and removal have also occurred. Responsible for contracts, budgets and invoices, monthly progress reports to the EPA, and oversight of all field activities and reports.
- **Task Manager / Senior Waste Specialist for NALEMP Site Investigation and Removal Action, Gulkana, Alaska (09/2008 – 07/2009; $80K).** The NALEMP was developed by the Department of Defense (DoD) to address environmental issues from past DoD activities on Indian lands. The Village of Gulkana, Alaska, obtained funding under the NALEMP Program from the U.S. Army Corps of Engineers (USACE) to identify and mitigate military impacts to

Native land. Bristol subcontracted to the Gulkana Village Council (GVC) to assist them in conducting the first phase of a Site Investigation/Removal Action at several areas of concern. Bristol prepared the planning documents, conducted a reconnaissance of all the sites, and collected samples from areas of concern. Bristol prepared the Reconnaissance Report and is working with the GVC to plan the next phase of work.

Professional Experience

- **Contract Manager for Emerald Alaska, Inc. (02/2001 – 09/2008).** Played a vital role on the DLA/DRMO contract that Emerald holds for the military in the State of Alaska. Ensured that all contract requirements were fulfilled accurately and within specified time constraints. With support from the team, ensured that all service requests for hazardous waste management from the U.S. Army, U.S. Air Force (USAF).
  - Coast Guard and National Guard were completed correctly, according to all RCRA/DOT/TSCA regulations. Primary responsibilities included project and contract oversight, interpreting data, decision making, and preparation of all necessary paperwork to properly manage and transport all hazardous and nonhazardous wastes to final disposal facilities. Also supervised environmental specialists and other project personnel on a variety of commercial customer projects, both locally and in remote locations.
  - Transportation Manager. Served as the Transportation Manager for Emerald Alaska, Inc. (February 2001 – September 2008). Primary responsibility was to coordinate and provide all proper documentation for shipping hazardous and nonhazardous wastes from Anchorage to the Lower 48 via road, rail, air, and marine systems. Some of the documentation prepared included the following: bill of ladings, hazardous and nonhazardous waste manifests, Canadian manifests, and transit notices. Coordinated inbound and outbound loads to maximize efficiency, reduce costs, and remain compliant with transfer facility waste storage times. In 2004, managed the incident-free transportation of over 12 million pounds of hazardous and nonhazardous wastes to both intrastate and interstate destinations.
- **Philip Services Corp., Anchorage, Alaska (03/1995 – 02/2001).**
  - Environmental Specialist II for Foster Wheeler, St. Lawrence Island, Alaska (May - October 2000). Served as the on-site regulatory specialist on a remedial action and demobilization project for the USACE. Directly responsible for all regulatory compliance in regards to the following agencies: EPA, Alaska Department of Environmental Conservation (ADEC), CERCLA, and TSCA. Guided field personnel in the characterization, consolidation, sampling, and shipment off site of all hazardous and nonhazardous waste materials off site.
  - Environmental Specialist II for Linder Construction, Pedro Dome, Alaska. (May - August 1999). Directly responsible for the shipment of all TSCA-regulated wastes off site during a PCB excavation and removal project for the USACE. He prepared and submitted all related and required paperwork to Linder and the USACE representative for review and approval. Labeled, marked, and placarded all waste containers for shipment and coordinated all waste loading and off-loading activities between each waste transporter.
  - Environmental Specialist II for UIC Construction, Barrow and Kotzebue, Alaska (May - July 1999). Supervised the removal of hazardous and nonhazardous wastes from the

borough landfills. Prepared and completed all required paperwork and properly containerized, labeled, marked, and shipped all wastes off site.

- Environmental Specialist II for Phillips Alaska, Inc. / British Petroleum (BP). Prudhoe Bay and Kuparuk Oilfields, Alaska (March 1999 - February 2001). Served as the project manager for the ongoing waste management contracts with Phillips/BP. Responsible for properly containerizing, labeling, marking, and shipping of all waste materials off site. Primary responsibility was the preparation of all required paperwork to properly manage and transport all hazardous and nonhazardous wastes off site and to final disposal facilities according to all applicable laws and regulations.
- Environmental Specialist II for Bristol Environmental Services (BES), Togiak and Alaska Peninsula National Wildlife Refuges, Alaska (October 1998). Responsible for the remote waste cleanup of a radio antenna site and the cleanup of abandoned drums along the Bristol Bay coastline. Daily transportation was via helicopter. Also responsible for properly containerizing, labeling, marking, and shipping all waste materials off site.
- Environmental Specialist II for Jacobs Engineering Group, Inc. Cape Chiniak, Kodiak, Alaska (September 1998). Conducted environmental sampling of soil stockpiles and excavations at an interim remedial action project at Little Navy Annex and Cape Chiniak Tracking Station. Also responsible for the proper characterization, labeling, loading, placarding, and manifesting of hazardous waste shipments off site.
- Environmental Specialist II for BES/Nugget Joint Venture, King Salmon, Alaska (June - July 1998). Worked on a remedial action cleanup at Rapids Camp for the USAF. Various duties included the proper containerizing, labeling, marking, and shipping of all waste materials off site. Conducted environmental sampling of a soil excavation, abandoned drums, and soil at various other sites. Held accountable for maintaining records and reporting all findings to the JV, the USAF representatives, and the ADEC.
- Environmental Laborer for Linder Construction, Adak Naval Station, Alaska (February - April 1998). Worked as a laborer on a tank cleaning and fuel pipeline pigging project. Participated in the cleaning and purging of six large-volume fuel tanks and a 10-inch gasoline fuel line.
- Environmental Specialist II for BES/Nugget JV, King Salmon, Alaska (July - October 1997). Conducted sampling of unknown hazardous waste drums that had been excavated from a barrel dumpsite at a remedial action cleanup at the local USAF base. Conducted air, liquid, and soil sampling using various field-screening techniques and equipment. Photoionization detectors (PIDs), immunoassay test kits, and the HAZCAT® Chemical Identification System were employed. Directed a crew of laborers in the maintenance of the drum accumulation pad. Responsible for maintaining records and for reporting all findings to the JV, the USAF representatives, and the ADEC.
- Environmental Specialist II for Oil Spill Consultants, National Park Service, Alaska. (July - October 1997). Responsible for the cleanup and disposal of hazardous and nonhazardous wastes generated from six national parks around the State of Alaska. Directly responsible for the proper identification, packaging, marking, labeling, and loading for shipment of all wastes.

- Environmental Specialist for CET, Grand Forks, North Dakota (May – June 1997). Worked on the Red River Flood Disaster Relief. Supervised the collection, handling, transportation, and disposal of household hazardous waste collected during the relief effort.
- Environmental Specialist for City of Kodiak, Dog Bay Harbor (May 1997). Active participant in the inerting and removal of a 6,000-gallon used oil underground storage tank. Assisted in the removal of the tank and the screening of the surrounding soil using qualitative methods such as visual, olfactory and PIDs. Participated in the collection of confirmation and characterization soil samples from the excavation and excavated soil stockpile.
- Site Supervisor/Project Manager for Kenai Peninsula Borough, City and Borough of Kodiak Island, and City of Juneau, Alaska (May 1997 - February 2001). Site Supervisor / Project Manager in the successful management of the household hazardous waste (HHW) contracts that Phillips held with the cities and boroughs. Site Supervisor during the completion of HHW/ Conditionally Exempt Small Quantity Generator (CESQG) collection events and industrial waste pick-ups for the three cities and boroughs. Primary responsibilities included: developing health and safety plans, project schedules, budgeting, consolidation, labpacking, and preparation of monthly and semi-annual reports.
- Facility Supervisor/Project Manager for Municipality of Anchorage, Anchorage Regional Landfill, Alaska (April 1996 - April 1997). Managed the facility crew at a year-round HHW/CESQG collection facility. Completed billing and month-end reports and acted as the liaison between the public, the Municipality of Anchorage, and Philip Services. Acted as the facility safety and spill contingency coordinator and as the regulatory compliance officer. Kept inventories of volume of wastes in storage and supplies on hand. Directly responsible for all waste shipments off site. Hired temporary employees during peak business months.
- Chemist/Environmental Specialist/Lead Technician for Municipality of Anchorage, Anchorage Regional Landfill (March 1995 - April 1996). Sampled and identified unknown hazardous materials and performed QA/QC on the various facility waste streams. Primary duties included: labpacking chemicals for shipment and disposal, record keeping, and supervision of the facility crew. Directly responsible for the accepting and checking in all waste into the facility received from the public, as well as the proper and safe consolidation of these wastes. Also held accountable for all waste shipments out of the facility and ensuring that these shipments complied with all DOT/EPA regulations. Conducted facility inspections, led safety meetings, and acted as the facility manager during the manager's absence.

- **Laboratory Technician for Northwest Technical Services, Prudhoe Bay, Alaska (Summer 1991).** Temporary employee contracted to ARCO to work in the Prudhoe Bay Oil Field. Stationed at Flow Station 2 in the post-water treatment laboratory and performed qualitative analysis on the water and oil streams throughout the plant. Conducted oil/water extraction techniques and reported his findings to plant operators and to the main lab.
- **Laboratory Technician for Northwest Technical Services. Kuparuk Oil Field, Alaska. (Summers of 1989, 1990, and 1992).** Temporary employee contracted to ARCO to work in the Kuparuk Oil Field. Stationed at the Seawater Treatment Plant. Foremost responsibility was to conduct qualitative analyses on the various water streams throughout the plant.

Tests conducted included: TSS, pH, salinity, and residual chlorine. Reported findings to the plant operators and to the field's head chemist. Also aided the plant operators with the basic operations of the plant when called upon.

- **Fish and Wildlife Technician I for State of Alaska Department of Fish and Game, Anchorage/Fairbanks, Alaska (06/1994 – S09/ 1994).** Monitored and sampled the commercial fishery on the lower Yukon River. Duties included: scale sampling, age/sex/length determinations, and heavy interaction with the local fishing population. Interpretation of data was also one of his main duties. Also worked on a remote sonar project on the upper Yukon drainage performing remote camp maintenance and the collection of biological data

Additional Training and Certifications

Confined Space Awareness

Powered Industrial Lift Truck Training

Permit Required Confined Space Training

Performance Management, Planning, and Development Training

FEMA IS-195 Basic Incident Command System Training

First Aid and CPR for Adults, MEDIC FIRST AID® International

Essentials of Communication Training

ALEX BASKOUS, M.D., M.P.H.
OCCUPATIONAL MEDICINE
BOARD CERTIFIED IN OCCUPATIONAL MEDICINE
BY THE AMERICAN BOARD OF PREVENTAVIE MEDICINE
2841 DEBARR ROAD – SUITE 24

TELEPHONE: (907) 279-4953
FAX: (907) 334-9667
EMAIL: DRALEXBASKOUS@GMAIL.COM

PHYSICIAN'S WRITTEN OPINION

PURSUANT TO 29 CFR 1910.120(f) MEDICAL SURVEILLANCE:

NAME Ellingboe, Tyler SS#_____

DATE OF EXAM 09/09/10

/ A. NO MEDICAL CONDITIONS WERE DETECTED WHICH WOULD PLACE THE EMPLOYEE AT INCREASED RISK OF IMPAIRMENT OF THE EMPLOYEE'S HEALTH FROM WORK IN HAZARDOUS WASTE OPERATIONS OR EMERGENCY RESPONSE, OR RESPIRATOR USE.

THE FOLLOWING MEDICAL CONDITIONS ARE OCCUPATIONALLY PERTINENET:

_____

_____

_____

/ B. NO LIMITATIONS UPON THE EMPLOYEE'S ASSIGNED WORK.

THE FOLLOWING LIMITATIONS ARE RECOMMENDED:

_____

_____

/ C. THE EMPLOYEE HAS BEEN INFROMED BY ME OF THE RESULTS OF THE EXAMINATIONS.

DATE 09/09/10

_____, M.D., M.P.H.

ALEXANDER BASKOUS, M.D., M.P.H.
2841 DEBARR ROAD, SUITE 24
ANCHORAGE, AK 99508

Bristol

ALLIANCE OF COMPANIES

Tyler Ellingboe

Has completed 8 hours of annual refresher training as required by

29 CFR 1910.120

Hazardous Waste Operations & Emergency Response

March 25, 2011

Maxey Riggs.
Instructor

McCoy and Associates

HAS CONFERRED UPON

Tyler Gerald Ellingboe

A CERTIFICATE OF COMPLETION FOR 3.1 CEU OR 31 HOURS OF TRAINING ON THE RCRA HAZARDOUS WASTE REGULATIONS

COURSES COMPLETED:

RCRA Fundamentals
Critical Generator Issues
Advanced RCRA Topics
RCRA Air Emissions and Land Disposal Restrictions
Remediation, Demolition, and Spills

FEBRUARY 7, 8, 9, 10 & 11, 2011; PHOENIX, ARIZONA

Instructor

Instructor

McCOY

Certificate of Attendance

This is to certify that

Tyler Gerald Ellingboe

attended and successfully completed the

HazCat® Chemical Identification System

HazCat Course Days One, Two and Three

Anchorage, AK February 11-13, 1997

Michael Kotowski
Certified Hazcat® Instructor

HAZTECH SYSTEMS, INC.™
Chemical Identification Training Seminars

Certificate of Attendance

TYLER ELLINGBOE

attended the
Hazardous Materials Transportation Workshop
conducted in Anchorage, AK
on
April 24, 2007

U.S. Department
of Transportation

Pipeline and
Hazardous Materials
Safety Administration

Director, Office of Hazardous
Materials Initiatives and Training

Emerald Alaska, Inc.
Certificate of Completion

is hereby granted to:

Tyler Ellingboe

to certify that they have completed
Hazardous Material Transportation Refresher Training
In compliance with 49 CFR 172.700 – 704

Granted: May 4, 2007

Rick Reimer

Instructor

EMERALD ALASKA INC
Emerald
SERVICES INC.
www.emeraldnw.com

Emerald Alaska, Inc.

Certificate of Completion

is hereby granted to:

Tyler Ellingboe

to certify that they have completed to satisfaction

As per 40 CFR 265.16.

EMERALD ALASKA INC

Emerald SERVICES INC.

www.emeraldnw.com

RCRA Refresher

Granted: March 31, 2008

Tyler G. Ellingboe

Instructor, Tyler Ellingboe

MARTY HANNAH

Environmental Scientist / Project Chemist

Years Experience

Total: 19; Bristol: 2

Areas of Expertise

Environmental Chemistry

Toxicology

Environmental Site Investigations

Quality Assurance/Quality Control

Site Remediation

Training and Certifications

EPA 40-hour HAZWOPER

EPA 8-hour HAZWOPER refresher, current

CPR and First Aid for Adults

DOT/IATA Dangerous Goods Shipper's Training

USAF Flight Line Training-Elmendorf AFB

BP North Slope Red Book Training for handling waste generated on the North Slope

Smith Safe Driving Course-Provided by BP Exploration A

Education

B.S., Biology, Emphasis in Toxicology, Chemistry and Emergency Medicine, Mankato State University, Mankato, Minnesota 1992

M.S., Environmental Quality Science, Emphasis on Remedial Feasibility Studies, University of Alaska Anchorage, 2005

Mr. Hannah has worked in the environmental field since 1992. He became part of the environmental remediation team in 2000. His expertise encompasses site assessment and remediation projects, site investigations, quality assurance /quality control (QA/QC) requirements, and project chemistry. He has worked on projects for federal and state agencies and is familiar with the standards and procedures for compliance with these agencies. Mr. Hannah's expertise includes management and transportation of hazardous waste materials at remote arctic project sites. He has extensive experience performing EPA analyses in environmental laboratories and managing mobile laboratories. In addition, he has served as Research Professional/Laboratory Manager for the University of Alaska, Anchorage School of Engineering, and has been responsible for all aspects of a scientific field equipment business as the sole proprietor of Hannah Instrumentation.

Project Experience

- **Field Chemist, Mercury in Soil Delineation, Nova Gold, Nome, Alaska (08 – 09/2009; $120K).** Performed environmental assessment of mercury and arsenic contamination at a former gold processing facility. Duties included creation of a work plan, sample and analysis plan, and procedures for field analysis of mercury (mobile laboratory). Performed analysis of soil samples on site to delineate the extent and concentration of mercury contamination. Directed drillers on continued sample collection based on field analytical results. Wrote project report for submittal to the ADEC.
- **Environmental Scientist, Spill Response, Iliamna Development Corporation, near the Iliamna River, Alaska (06/2009 – Present; $135K).** Provided support to client in response to a fuel spill near the Iliamna River. Coordinated client personnel in spill response-containment and determined the best methods for remediation of contaminated soil. Collected soil and surface water samples. Advised client on regulatory requirements and submittals to State agencies, as well as development of

remedial methods for reduction of contaminants in impacted soils. Designed a passive fuel collection system for winter operation at this remote site.

- **Project Chemist, former White Alice Site, US Army Corps of Engineers-Alaska District, Northeast Cape, St. Lawrence Island, Alaska (06/2009 – 12/2010; $13.8M).** Provided support to field activities at Northeast Cape for remedial pilot tests and removal of contaminants at a Formerly Used Defense Site (FUDS). Operated an on-site mobile laboratory for analysis of fuels and PCBs in soil. Coordinated the submittal of samples and evaluated laboratory data for quality and representativeness to the site. Functioned as the primary point of contact for fixed lab, project managers, and field personnel regarding procedures and submittal of samples for analyses. Responsible for laboratory reports and electronic data deliverables.
- **Environmental Scientist/Project Chemist, USACE, Omaha District, Tinker Air Force Base, Oklahoma City, Oklahoma. (10/2010 – Present).** Collected soil-gas samples and evaluated an aircraft refueling system to determine if fuels had leaked from the refueling system. Coordinated with base personnel and contractors gathering information about site conditions. Prepared documents and coordinated with vendors for the next phases of the site investigation.
- **Environmental Scientist/Remediation Specialist, Various Base-Wide Remediation Projects, USACE, Alaska District, Elmendorf Air Force Base (09/2006 – 05/2009; $1.3M).** Supported monitoring, and operation and maintenance of several remedial systems, including sites located within the active airfield and numerous other sites on the installation. Responsible for dig permits, well installation and decommissioning, soil borings, sample collection and soil gas vapor analysis, along with operation and maintenance of bioventing systems and constructed remediation wetlands.
- **Field Chemist/Environmental Scientist, POL-Contaminated Soil Remediation Project, USACE, Alaska District, Umiat, Alaska (07 – 08/2006; $1.8M).** Collected field and confirmation soil samples using multi-incremental sampling (MIS) on thermal infrared (IR)-treated soil. Developed and prepared the methods, testing, instrumentation, and environmental controls for field analysis of samples by U.S. Environmental Protection Agency (EPA) Method 1664. Coordinated the shipping of rush samples, equipment, and materials to and from this remote arctic site
- **Environmental Scientist, QA/QC Officer, Environmental Data Manager, Site Assessment and Remediation Contracts, BP Exploration (Alaska) North Slope, Alaska (04/2006 – 05/2009; $5.8M).** Provided QA and procedural input in the development and release of an extensive overhaul of BP's environmental Quality Assurance Program Plan. Reviewed laboratory data and prepared quality assurance verification reports for all related environmental projects. Designed and developed procedures for remediation systems and remote sensing at various sites throughout BP lease areas.
- **Field Scientist, Monitoring and Remedial Action, Chevron, Anchorage and Fairbanks, Alaska (09/2006 – 04/2009; $1.4M).** Performed monitoring and remedial action on former and existing Chevron gasoline stations and bulk fuel plants. Performed as Field Lead on soil, groundwater, and surface water sampling events. Supported implementation and operation of

remedial systems. Responsible for operation and maintenance of existing remedial systems. Treatment technologies included soil vapor extraction, air sparging, granular activated carbon water treatment, and free-product recovery using high-vacuum extraction.

Professional Experience

- **Project Chemist, Environmental Scientist, HM & DG Shipping Specialist, Field Equipment Manager, OASIS Environmental, Anchorage, Alaska (2006 - 2009).** Responsible for Quality Assurance Program Plans, standard field procedures, and management of laboratory data. Managed, shipped, and serviced all scientific monitoring instrumentation and support equipment for OASIS' five offices. Equipment included photoionization detectors (PIDs)/flame-ionization detectors, multi-gas meters, water quality multi-meters, pumps, and a wide variety of other field equipment.
  - Project Chemist, various projects (2006-2009). Responsible for laboratory data management, QA program plans, final review and validation of laboratory data on numerous Alaska Department of Environmental Conservation (ADEC), Federal, and private projects. Additional responsibilities included completion of ADEC laboratory data checklists, quality of analytical data reviews, flagging of tabulated data and application of matrix concentrations to various site cleanup goals.
- **Owner-Sole Proprietor, Hannah Instrumentation, Anchorage, Alaska (1998 - 2009).** Responsible for all aspects of a scientific field equipment business that leased PIDs, multi-gas meters, water quality multi-meters, pumps and other equipment used by environmental personnel performing site investigations, and monitoring and remediation services. Provided analytical equipment and chemical analysis support for mobile laboratory operations using gas chromatographs, IR spectrophotometers, and other field instrumentation for quantifying a wide variety of contaminants of concern.
- **Client Services Coordinator, North Creek Analytical (1999 – 2004), Anchorage, Alaska.** Duties included support for clients and laboratories for all aspects of environmental sampling and analyses for contaminants of concern. Performed tasks such as filling client bottle orders, receiving samples, and forwarding them to the proper laboratories within specified temperature and packing regulations. He also provided support to NCA mobile laboratories in Amchitka, Adak, Prudhoe Bay, and Livengood, Alaska.
- **Organic Chemist/GC Analyst, Semivolatiles for Columbia Analytical Services, Anchorage, Alaska (l993 – 1998).** Performed analyses of environmental samples on various matrices for contaminants of concern such as fuels, poly-chlorinated biphenyls (PCBs), pesticides and PAHs. Performed maintenance and repair of gas chromatographs and data systems. Managed waste stream and led effort to reduce the hazardous waste generation. Other duties included supporting laboratory personnel in compliance with Federal, state and municipal regulations for safety and other code compliance.

- **Organic Chemist/GC Analyst, Analytica Alaska (1992 – 1993).** Performed analyses on soils and waters for Alaska and EPA methods AK101 and EPA 8021B (GRO/BTEX).
- Research Professional-Laboratory Manager, University of Alaska Anchorage, School of Engineering (1998 – 2005). Responsible for all aspects of physical and research laboratories, including all health, safety, and environmental (HSE) policies and procedures in teaching and research laboratories. Maintained chemical inventories and instructed researchers and graduate students in proper handling of chemicals and operation of various physical and analytical systems and instrumentation. Performed numerous tasks either solely or in support of environmental remediation feasibility studies on contaminated soils and waters.
- Assistant Laboratory Manager, Applied Science and Engineering Technology (ASET) Laboratory, University of Alaska Anchorage (2002 - 2005). Utilized state-of-the-art instrumentation in support of chemistry, biology, and engineering research. Duties included selection, procurement, installation and operation of the instrumentation, as well as ancillary personal protective equipment. Prepared Standard Operating Procedures for the operation of analytical instrumentation and analysis using a wide variety of analytical methods used in the laboratory.

Publications

- Extent and Variability of Biogenic Interference in Cold Regions Soils. Journal of Cold Regions Engineering, September 1999. C.R. Woolard, D.M. White, J.L. Walworth, M.E. Hannah.

Successful Completion Card

BasicPlus CPR, AED, AND FIRST AID FOR ADULTS

Marty Hannah
Name

3/25/10 Issued

3/25/12 Expires

This certifies that the individual named above has successfully demonstrated the knowledge and skill objectives for CPR, use of an AED, and First Aid for Adults.

MEDIC First Aid INTERNATIONAL

Instructor Maxey

Registry Number 3

Training Center Phone No. ___

Training Center ID _____

MEDIC FIRST AID® BasicPlus follows ILCO
and guidelines for CPR, first aid, and em
information can be found in your *Studer*

Continued proficiency as a MEDIC FIRST
retraining. This card expires as document
24 months of issue.

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Bristol

INDUSTRIES, LLC

Marty Hannah

Has completed 8 hours of annual refresher training as required by

29 CFR 1910.120

Hazardous Waste Operations & Emergency Response

February 22, 2010

Clark Roberts, CIH, CHMM

Instructor

Bristol

INDUSTRIES, LLC

Marty Hannah

Has completed 8 hours of annual refresher training as required by

29 CFR 1910.120

Hazardous Waste Operations & Emergency Response

February 22, 2010

Clark Roberts, CIH, CHMM

Instructor

MINING AND PETROLEUM TRAINING SERVICE

701 E. Tudor, Suite 270 Anchorage, Alaska 99503 (907) 563-8098

№ 32819

The University of Alaska Anchorage

CERTIFICATE

This is to certify that

MARTIN HANNAH

has satisfactorily completed

Forty (40) Hours

in

Hazwoper

INSTRUCTOR	DATE	DIRECTOR
Wayne Engle	05/18-22/98	

ENVIRONMENTAL
MANAGEMENT
INCORPORATED

Certificate of Training

T - 20235 - 12521
Certificate Number

This is to certify that

Martin E. Hannah

has satisfactorily completed 8 hours

of

Hazardous Materials Transportation Refresher

In compliance with 49 CFR 172.700-704

Class Start Date: 6/1/2007 *Class End Date: 6/1/2007*

Karl Aughe	6/1/2007	6/1/2010	Stuart M. Jacques
	Exam Date	*Cert. Exp. Date*	*Director*

Environmental Management Inc. 206 E. Fireweed Lane Suite 201, Anchorage Alaska 99503 907-272-8852

RUSSELL C. JAMES

Environmental Scientist

Areas of Expertise

- ✓ Environmental Sampling and Monitoring
- ✓ Technical Writing
- ✓ GIS
- ✓ GPS
- ✓ Database Management
- ✓ ANCSA Land Mapping

Mr. James has 6 years of experience in demonstrating proficiency and expertise in Geographic Information Systems (GIS) and Geographic Positioning Systems (GPS). He has integrated GPS and GIS for a number of projects with government agencies and private organizations, and is adept at combining GIS/GPS with environmental sampling and geologic mapping. He is well versed in databases and skilled in the use of ArcGIS, Geomedia Professional, and Trimble® GPS equipment and software. Mr. James has performed environmental field work in Alaska, Arizona, and New Mexico. He is experienced in collecting soil, sediment, and water samples; soil boring and monitoring well installation; underground storage tank removal; conducting Phase I Site Assessments; and technical writing.

Education

B.S., Environmental Geography; Minor, Geology, Valdosta State University, Valdosta, Georgia, 2005

Project Experience

- Construction Quality Control Systems Manager (CQCSM) and Environmental Scientist for Northeast Cape In-Situ Chemical Oxidation (ISCO) Study and Intrusive Drum Removal/Landfill Cap (2009). Responsibilities include ensuring contract specifications between the U.S. Army Corps of Engineers (USACE) and Bristol; providing oversight for various activities performed in the field; and acting as liaison between Bristol and USACE. Tasks involved daily reporting to USACE, GPS, and GIS mapping services, meeting with subcontractors, reporting to the Bristol home office, environmental sampling, authoring planning documents, and writing the Removal Action Report.
- GIS Specialist and field data collection personnel for monitoring well inventories on Fort Wainwright and Fort Richardson (2009). Responsibilities include updating the current database regarding monitoring wells, maintaining open communications with the USACE's GIS point of contact, and establishing effective field data collection techniques using GPS. The project goal is to implement a more effective and accurate GIS database regarding the status and position of monitoring wells on base. Tasks included GPS field collection, and data management and integration into USACE's GIS standards.
- GIS Specialist for Alaska Natural Gas Development Authority Wetlands Delineation & Project Management project (2008). Project responsibilities included prepping data and GPS units for field crews; maintaining and organizing GPS field data; and displaying field data in GIS and map atlases, which consisted of hundreds of alignment sheets encompassing over 350 miles of potential pipeline corridor.
- Environmental Scientist for three potential Leaking Underground Storage Tank (LUST) sites in the Navajo Nation and EPA Region 9 (2008). Assisted in the supervision of subcontractors excavating Underground Storage Tanks (USTs) for removal. Six USTs were

removed from three sites. Collected field screening headspace samples using a photoionization detector (PID). Collected soil and surface water samples for analysis at fixed laboratory.

- Environmental Scientist for FAA Cape Yakataga Landfill Removal project, Phase III, Cape Yakataga, Alaska (2008). Collected waste characterization and confirmation soil samples for the decommissioning of a landfill and biocell. Monitored the installation of soil borings and monitoring wells, and conducted groundwater sampling. Authored final report summarizing field activities, presenting analytical data, and providing recommendations for future site remediation.
- Fort Richardson UST Corrective Action, Anchorage, Alaska (2007). Project responsibilities include split spoon sample collection, soil boring oversight, soil classification, and acquisition of dig permits. Collected field-screening headspace samples using a PID.
- Environmental Scientist for FAA Unalakleet Release Investigation, Unalakleet, Alaska (2007). Acquired surface and subsurface soil samples from eight sites near Unalakleet, Alaska. Collected field-screening headspace samples using a PID. Also conducted field-screening using Horiba OCMA 350 Infrared Spectrometer.
- Environmental Scientist providing project support for Elmendorf Treatability Study, Anchorage, Alaska (2007). Assisted installation of bladder pump and set up of micro purge system for groundwater sampling from monitoring wells. Calibrated YSI brand water quality meter and logging system for groundwater monitoring. Helped with construction of well injection system.
- Environmental Scientist for FAA Cape Yakataga Landfill Removal project, Phase II, Cape Yakataga, Alaska (2007). Responsible for soil sample collection; waste container data management, and packaging and shipping of soil samples. Composed interim progress report and authored work plan for 2008 field activities.
- Environmental Scientist for Hanna Dimond Project, Anchorage, Alaska. Project responsibilities include collecting water samples from aboveground tanks, and soil samples from stockpiles. Collected field-screening headspace samples using a PID.
- Environmental Scientist for 4th & Gambell Streets Project, Anchorage, Alaska. Project responsibilities included installation of soil borings, soil classification, split-spoon sample collection, oversight of monitoring well installation. Collected field-screening headspace samples using a PID.
- Environmental Scientist for Phase I Environmental Site Assessments at three sites in Anchorage, Alaska. Project responsibilities included conducting site visits and interviews, database searches, and preparation of report and figures.
- GIS Specialist for CAMPTEX Project, Bristol Bay Region, Alaska, for Bristol Bay Native Corporation (BBNC). Project responsibilities include organizing, analyzing, and maintaining GIS data; acquiring knowledge about the Alaska Native Claims Settlement Act (ANCSA), and adding/digitizing BBNC ANCSA lands into GIS using Geomedia.
- Tift County Board of Education Campus Mapping Project, Tift County, Georgia. Responsible for GPS collection of utility points, post-processing analysis of GPS in ArcGIS, and digital production of gas, water, and sewer lines. Involved in acquisition and georeferencing of 14 school floor plans. Nominated for 2006 National Association of Development Organizations (NADO) Innovation Award.

- City of Douglas Utility Mapping Project, Douglas, Georgia. Responsible for the GPS collection and post-processing of utility points contained within public rights-of-way. Points collected include street lights, manhole covers, stormwater collection inlets, fire hydrants, water meters, water valves, gas valves, and gas meters, etc. Points were collected with a Trimble GeoXT™ mounted onto a bicycle, post-processed in Pathfinder® Office, and combined into a GIS using ArcMap.
- Cook County Emergency 911 Address Mapping Project, Cook County, Georgia. Responsible for the GPS collection of every address "point-of-entry" within the limits of Cook County. Points were collected with a Trimble ProXR GPS and combined into a GIS using ArcMap 9.1.
- City of Tifton Utility and Right-of-Way Mapping Project, Tifton, Georgia. Responsible for GPS collection of utility points within public rights-of-way in the city of Tifton, Georgia. Points were collected using Trimble ProXR backpack unit and bicycle mount.
- Thomas County Sign and Bridge Inventory, Thomas County, Georgia. Responsible for the GPS collection of signs and bridges along every county maintained road in Thomas County.

Professional Experience

- Environmental Scientist for Bristol Environmental Remediation Services, LLC (2007 to present). Responsible for GIS mapping and data collection; conducting site assessments and site investigations; writing technical reports; and performing environmental sampling and monitoring, including soil borings, well installations, research, and data collection.
- GIS Specialist for Bristol Environmental & Engineering Services Corporation (BEESC) (November 2006 to July 2007). Responsibilities included data compilation, organization, and production of BBNC and BEESC GIS data.
- GIS Data Collector for South Georgia Regional Development Center (December 2003 to September 2006). Responsibilities included GPS collection of field data, analysis and presentation of data in GIS, as well as maintenance and training for Trimble GPS units and software.
- Geology Research Intern, 2004 ACRES Program, Georgia State University. Analyzed the geochemistry of metamorphic rocks in the Uchee Belt, near Columbus, Georgia. Utilized ICP-MS and XRF for chemical analyses of prepared samples. Poster presentation at the Annual GSA Meeting in Denver, Colorado. Abstract can be found at http://gsa.confex.com/gsa/2004AM/finalprogram/abstract_79798.htm.

Training and Certifications

Certified Erosion and Sediment Control Lead (CESCL)

U.S. Army Corps of Engineers, Construction Quality Management for Contractors

HAZWOPER Supervisor Training – March 4, 2009, Bristol Industries

8-Hour HAZWOPER Training

CPR and First Aid for Adults, MEDIC FIRST AID® International

40-Hour Hazardous Waste Operations and Emergency Response (HAZWOPER)

Hazardous Materials Transportation (DOT/IATA)

Defensive Driving Training

Software Capabilities

MS Office 2007, including Word, Excel, PowerPoint, and Access, gINT, GeoMedia Professional v6.1, ArcGIS v9.3, ArcPad 8, ER Mapper, GPS Pathfinder Office, Trimble TerraSync, Visual Sample Plan v5.0.

Awards

Outstanding Service Award, South Georgia RDC, 2006

Honor Graduate: Magna Cum Laude, 2005

Outstanding Student in Environmental Geography, 2005

Gertrude Odum Scholarship, 2000-2004

HOPE Scholarship, 2000-2004

ALEX BASKOUS, M.D., M.P.H.
OCCUPATIONAL MEDICINE
BOARD CERTIFIED IN OCCUPATIONAL MEDICINE
BY THE AMERICAN BOARD OF PREVENTATIVE MEDICINE
2841 DEBARR ROAD – SUITE 22
ANCHORAGE, ALASKA 99508

TELEPHONE: (907) 279-4953
FAX: (907) 278-4141
EMAIL: ABASKOUS@ALASKA.NET

PHYSICIAN'S STATEMENT
ASBESTOS EXPOSURE

NAME James Russell SS# 257-67-1562

DATE OF EXAM 9/16/09

✓ A. NO MEDICAL CONDITIONS WERE DETECTED WHICH WOULD PLACE THE EMPLOYEE AT INCREASED RISK OF IMPAIRMENT OF THE EMPLOYEE 'S HEALTH FROM WORK IN HAZARDOUS WASTE OPERATIONS OR EMERGENCY RESPONSE, OR RESPIRATOR USE.

____ B. THE FOLLOWING MEDICAL CONDITIONS ARE OCCUPATIONALLY PERTINENT

✓ C. NO LIMITATIONS UPON THE EMPLOYEE'S ASSIGNED WORK.

____ D. THE FOLLOWING LIMITATIONS ARE RECOMMENDED

✓ E. THE EMPLOYEE HAS BEEN INFORMED BY ME OF THE RESULTS OF THE EXAMINATIONS.

DATE: 9/16/09

_____, M.D., M.P.H.
ALEXANDER T. BASKOUS, M.D., M.P.H.
2841 DEBARR ROAD, SUITE 22
ANCHORAGE, ALASKA 99508

Successful Completion Card

Basic TRAINING PROGRAMS

James Russell
Name

3/11/10 Issued

3/11/12 Expires

This certifies that the individual named above has successfully demonstrated the knowledge and skill objectives for:

☒ BasicPlus CPR, AED, and First Aid for Adults

☐ Basic CPR and First Aid for Adults

Card not valid if more than one box is checked.

MEDIC First Aid INTERNATIONAL

Instructor Marcy Riggs

Registry Number 37530

Training Center Phone No. 563-0013

Training Center ID

MEDIC FIRST AID® BasicPlus follows ILCOR, AHA, and ASTM recommendations and guidelines for CPR, first aid, and emergency care. Additional source authority information can be found in your *Student Guide* and at medicfirstaid.com.

Continued proficiency as a MEDIC FIRST AID Provider requires frequent retraining. This card expires as documented on the front of the card or within 24 months of issue.

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ENVIRONMENTAL
MANAGEMENT
INCORPORATED

Certificate of Training

T - 22370 - 12792
Certificate Number

This is to certify that

Russell C. James

has satisfactorily completed 8 hours

of

Hazardous Materials Transportation Refresher DOT

In compliance with 49 CFR 172.700-704 (3 Year Expiration)

Class Start Date: 1/20/2011 *Class End Date: 1/20/2011*

Steven Schuler	*1/20/2011*	*1/20/2014*	*Stuart M. Jacques*
	Exam Date	*Cert. Exp. Date*	*Director*

Environmental Management Inc. 206 E. Fireweed Lane Suite 201, Anchorage Alaska 99503 907-272-8852

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ENVIRONMENTAL
MANAGEMENT
INCORPORATED

Certificate of Training

T - 22371 - 12792
Certificate Number

This is to certify that

Russell C. James

has satisfactorily completed 8 hours

of

Hazardous Materials Transportation Refresher IATA

Section 1.5 of IATA Dangerous Goods Regulations (2 Year Expiration)

Class Start Date: 1/20/2011 *Class End Date: 1/20/2011*

Steven Schuler	*1/20/2011*	*1/20/2013*	*Stuart M. Jacques*
	Exam Date	*Cert. Exp. Date*	*Director*

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Bristol

ALLIANCE OF COMPANIES

Russell James

Has completed 8 hours of annual refresher training as required by

29 CFR 1910.120

Hazardous Waste Operations & Emergency Response

March 25, 2011

Maxey Riggs.
Instructor

Bristol

INDUSTRIES

Russell James

Has completed 8 hours of Supervisor training as required by

29 CFR 1910.120

Hazardous Waste Operations & Emergency Response

March 6, 2008

Clark Roberts, CIH, CHMM

Instructor

ENVIRONMENTAL
MANAGEMENT
INCORPORATED

Certificate of Training

T - 20249 - 12792
Certificate Number

This is to certify that

Russell James

has satisfactorily completed 40 hours

of

Hazardous Waste Operations & Emergency Response - 40 Hours

In compliance with 29 CFR 1910.120

Class Start Date: 7/16/2007 *Class End Date: 7/20/2007*

Karl Aughe	*7/20/2007*	*7/20/2008*	*Stuart M. Jacques*
	Exam Date	*Cert. Exp. Date*	*Director*

Environmental Management Inc. 206 E. Fireweed Lane Suite 201, Anchorage Alaska 99503 907-272-8852

CERTIFICATE OF ACHIEVEMENT

This certifies that

Russell James

has successfully completed

Alaska Certified Erosion & Sediment Control Lead (AK-CESCL) Storm Water Training Program

Continuing Education Credits Earned:
16 Continuing Competency Credits Residential Endorsement Holders
Course approved by Alaska State Home Builders Association
16 Professional Development Hours for Architects, Engineers and Landscape Architects
AGC of Alaska
Construction Education Foundation
8005 Schoon Street
Anchorage, Alaska 99518

Instructor	Course Date	Location
	March 26 & 27, 2009	Anchorage, Alaska
Robert Cress, AGC Training Director	Certification Date	Expiration Date
	March 27, 2009	March 26, 2012

ENVIRONMENTAL
MANAGEMENT
INCORPORATED

Certificate of Training

T - 20537 - 12792
Certificate Number

This is to certify that

Russell C. James

has satisfactorily completed 16 hours

of

Hazardous Materials Transportation - (DOT/IATA)

In compliance with 49 CFR 172.700-704 (3 Year Expiration)

Class Start Date: 2/13/2008 *Class End Date: 2/14/2008*

Karl Aughe	*2/14/2008*	*2/14/2011*	*Stuart M. Jacques*
	Exam Date	*Cert. Exp. Date*	*Director*

Environmental Management Inc. 206 E. Fireweed Lane Suite 201, Anchorage Alaska 99503 907-272-8852

U.S. ARMY CORPS OF ENGINEERS

PROFESSIONAL DEVELOPMENT SUPPORT CENTER
HUNTSVILLE, ALABAMA

CERTIFICATE

This is to certify that

Russell James

has completed the Corps of Engineers Training Course

CONSTRUCTION QUALITY MANAGEMENT FOR CONTRACTORS

Given at AGC (Location) By Alaska District (Instructional District) 04/11/2008 (Date)

Ronald Flock, Facilitator

THIS CERTIFICATE EXPIRES FIVE YEARS FROM DATE OF ISSUE

Chief, USACE Professional Development Support Center

OSHA Occupational Safety and Health Administration

26-600640037

This card acknowledges that the recipient has successfully completed a 30-hour Occupational Safety and Health Training Course in

Construction Safety and Health

RUSSELL JAMES

(Trainer name – print or type)

2-26-2010

(Course end date)

STEVEN A. JOHNSON, P.E.

CEO/Bristol Environmental Remediation Services, LLC

Years Experience

Total: >35; Bristol: 11

Areas of Expertise

Project and Program Management

Environmental and Geotechnical Projects

Soil and Groundwater Investigation

Site Remediation

Registration

Registered Civil Engineer, State of Alaska, 1990 (CE8052)

Affiliations

Vice Chairperson, State of Alaska Board of Storage Tank Assistance

Association of Engineering Geologists

Member S.A.M.E.

Training and Certifications

40-Hour Hazardous Waste Operations and Emergency Response (HAZWOPER)

8-Hour HAZWOPER Refresher

8-Hour HAZWOPER Supervisor

Education

M.S., Engineering Geology, Purdue University, West Lafayette, Indiana, 1974

B.S., Geological Engineering, University of Alaska, Fairbanks, 1973

Mr. Johnson has provided multidisciplinary environmental and geotechnical services as an engineering geologist in Alaska for over 35 years. He has managed soil and groundwater investigations for property assessments, remedial investigations (RIs), and feasibility studies (FSs) at hazardous waste sites and for underground fuel spills. Mr. Johnson provides direction in project development, program management, quality control, scope of work assessment, and technical review. Since 1990, he has served as program manager for environmental remediation contracts totaling more than $100 million. Mr. Johnson also has been responsible for managing contracts for construction of new fuel facilities statewide worth more than $15 million.

Since 2007, Mr. Johnson has served as the Chief Executive Officer (CEO) of Bristol Environmental Remediation Services, LLC (BERS). He is responsible for conducting all of the day-to-day operations of BERS' business including all administrative, personnel, and marketing functions.

Project Experience

- **Program Manager, HTRW Immediate/Rapid Response (RR/IR) Contract, USACE, Omaha District Indefinite Delivery/Indefinite Quantity Contract, (04/2010 – 03/2013; NTE $9M).** Program Manager for this 3-year ID/IQ contract with the Omaha District for remediation of various hazardous waste sites and Facilities Sustainment, Restoration, and Modernization (SRM). The contract requires Bristol to furnish and transport all plant, labor, materials, and equipment to complete RR/IR task orders nationally including the Continental United States, Alaska, Hawaii, and the U.S. Territories. To date, Bristol has been awarded six RR task orders under the contract worth approximately $1.5 million for work in Montana, Texas, Nebraska, and Utah.

- **Program Manager, Environmental Remediation Services (ERS) Contract, USACE, Alaska District Indefinite Delivery/Indefinite Quantity Contract (04/2006 - 03/2016, NTE $180M).** Since 2006, served as Bristol's single point of contact for this 10-year IDIQ contract with the Alaska District. As Bristol's Program manager, responsible for coordinating program issues with the USACE and the overall management of the contract including cost, schedule, and technical quality. He also oversees the development and implementation of task orders under the contract including subcontract administration. To date, Bristol has been awarded several task orders under the contract totaling approximately $8 million. The following task orders have been completed or are underway on this contract:
  - Hoonah Radio Relay Station (RRS), Hoonah, Alaska – During the period 2006 to 2008 Bristol performed a site investigation and excavated, transported and disposed over 2,900 tons of PCB-contaminated soil from the Hoonah RRS site.As a result of this work, the site was conditionally closed by the ADCE and U.S. EPA.
  - Remedial Investigations (RIs) at Nuvagupak, Kogru, and Collinson Pt. – Performed RIs at three remote sites on Alaska's North Slope. Field crews used a helicopter and light aircraft to complete the field work during the summer of 2008.
  - CANOL Pipeline Decommissioning, Fort Wainwright, Alaska – In 2010 Bristol traced and surveyed approximately 24,000 linear feet (LF) of the CANOL POL pipeline at Fort Wainwright, and closed approximately 5,100 LF of the historic Canol pipeline. Work in 2011 will include additional investigative and closure activities on the CANOL line.
- **Project Manager, White Alice Tram and Debris Removal 2005, USACE, Alaska District, Northeast Cape on St. Lawrence Island, Alaska (07/2004 - 03/2006; $5.2M).** Responsible for managing all aspects of the project including scope, schedule, budget, and reporting. The removal action was performed at a remote Formerly Used Defense Site (FUDS) site located in the Bering Sea, approximately 135 air miles southwest of Nome and inaccessible by road. Bristol. prepared planning documents; made improvements to 6 miles of roads and 3 miles of trails in order to access work sites; demolished the tram line and associated line support towers and wire/cable groups; removed approximately 26 tons of debris from two debris fields on Kangukhsam Mountain; removed more than 200 metal and wooden poles and approximately 25 miles of power and communications wire and cable; sorted, processed, packaged, and transported more than 1,520 tons of demolition debris; disposed of over 370 tons of burnable wood on-island; excavated, packaged, manifested, transported, and disposed of over 160 tons of PCB-contaminated concrete; excavated, packaged, manifested, transported, and disposed of over 290 tons of PCB-contaminated soil; and manifested and transported approximately 1,500 tons of waste off-island for disposal or recycling.
- **Project Manager, Municipal Solid Waste Landfill (MSWL) Closure, CH2M Hill, Eareckson Air Station, Shemya, Alaska (2005; $2.1M).** Responsible for managing all aspects of the project including redesign, schedule, budget, construction activities, and reporting. Eareckson Air Station is located approximately 1,600 miles south-southwest of Anchorage, Alaska, on remote Shemya Island. Project objectives were to close the existing Municipal Solid Waste Landfill (MSWL) and construct a new MSWL and asbestos disposal cell, in accordance with the U.S. Air Force's Solid Waste Permit from the Alaska Department of Environmental Conservation (ADEC). Bristol's client was asked to implement plans and specifications prepared by another contractor. After the initial site visit, it was obvious that significant

redesign would be required to complete the project. Bristol supported a geotechnical investigation to relocate the borrow area, reviewed constructability, and provided consultation for the client. Significant accomplishments included: assisting in the investigation to confirm that suitable borrow material was available; participating in the redesign of the project; preparing a site-specific Work Plan, CQC Plan, and a SSHP; modifying the SSHP to include procedures for avoiding Munitions and Explosives of Concern (MEC); mobilizing/demobilizing all of the heavy equipment via barge to Shemya from Anchorage, Alaska; providing an MEC Technician III to implement and oversee MEC avoidance activities; excavating, hauling, placing and compacting a total of over 100,000 cubic yards of various borrow materials over a five-week period; and completing the project approximately four weeks ahead of schedule. Type of construction: Heavy civil

- **Project Manager, White Alice Site Removal Action 2003, USACE, Alaska District Northeast Cape on St. Lawrence Island, Alaska (2003 - 2004; $12.3M).** Responsible for managing all aspects of the project including scope, schedule, budget, and reporting. The removal action was performed at a remote FUDS for the USACE, Alaska District. The objective of the project was to remove old Cold War era buildings and structures that posed physical and chemical hazards. Bristol prepared planning documents; made improvements to roads and trails in order to access work sites; performed hazardous material removal and asbestos abatement in more than 30 buildings and other structures, followed by demolition and disposal; demolished approximately 650 feet of fuel line and 14 aboveground fuel storage tanks; demolished and disposed of approximately 60 miles of power and communication poles and wires; decontaminated, demolished, and disposed of three septic systems; and, performed asbestos abatement then demolished and disposed of over 4,000 linear feet of utilidors and piping. Packaged, manifested, transported, and disposed of approximately 6,300 tons of wastes.
- **Task Order Manager, ROTHR Facility Demolition and Environmental Closeout, U.S. Navy, Amchitka Island, Alaska (05/2001 – 09/2001; $12M).** Responsible for managing all aspects of the work including: preparing planning documents; providing logistics support; demolishing and disposing of 56 structures and 52 storage tanks; removing, identifying, packaging, transporting, and disposing of approximately 100 tons of hazardous materials and hazardous waste from the ROTHR facilities; cleaning and closing a sewage lagoon containing approximately 2,000 cubic yards of sewage sludge contaminated with polychlorinated biphenyls (PCBs); thermally treating 2,500 cubic yards of petroleum-contaminated soil on site; and preparing a closure report.
- **Task Order Manager, Focused Feasibility Study (FFS) at the South of Runway 18/36 Area, U.S. Navy, Former Naval Air Facility, Adak (2000 - 2001; $300K).** Responsible for managing all aspects of a Remedial Investigation and preparation of a Focused Feasibility Study for a site on Adak Island, Alaska. At the 5-acre affected area, soil and groundwater contamination resulted from releases from a diesel fuel pipeline constructed during World War II. The FFS presented a detailed analysis of potential remedial alternatives for free product and soil and groundwater contamination. Complete life-cycle costs were evaluated for a range of soil and groundwater remedial alternatives.

Professional Experience

- **Program Manager, Harding Lawson Associates, Anchorage, Alaska (1978 – 2000).**
  - Program Manager, Indefinite Delivery Type Remedial Action Contract, USACE, Alaska District, Various Locations throughout Alaska (1996 - 2000; $2M). Responsible for overall management, control, and administration of the contract including quality and production. Developed and coordinated joint venture cost estimate and scope of work procedures, prepared and negotiated scopes of work, managed subcontract selection, and provided expert technical consulting support. This project was conducted as a joint venture between Harding Lawson Associates and Wilder Construction Company, to provide remedial services at hazardous, toxic, and radioactive waste sites throughout Alaska. The following projects were conducted under this contract.
    - Site Investigation, Galena, Alaska. Performed a subsurface investigation, excavated 1,000 cubic yards (yd3) of hydrocarbon-contaminated soil, collected soil samples from the excavation to evaluate the extent of contamination, and transported the soil to a bioremediation pile (biopile) for treatment.
    - Bioremediation, Galena, Alaska. Designed, constructed, operated, and monitored a biopile to remediate 11,000 yd3 of previously stockpiled contaminated soil.
    - Alaska Communication System Removal Action, Northway Junction, Alaska. Removed fuel storage tanks and associated piping, chemical containers, and storage drums; sample soil, containers, and tanks for waste characterization; excavated and disposed of 350 tons of hydrocarbon contaminated soil; and transported solid and hazardous wastes for disposal.
    - Cape Romanzoff Long Range Radar Site Biopile. Constructed, operated, and maintained two biopiles to remediate approximately 3,000 yd3 of hydrocarbon-contaminated soil at two locations at the station. One biopile was on the station cantonment within 1/4 mile of the minimally attended station facilities. Contractor designed an active biopile to treat soil at this facility with an electrically powered regenerative blower to oxygenate the soil. The second, passive, biopile, approximately 4 miles from the main facilities, used wind power to ventilate the soil.
    - Wildwood Air Force Station Interim Removal Action. Planned and executed the removal of several types of wastes, hydrocarbon-contaminated soil, and abandoned structures that threatened public safety. Scope of work included excavation and thermal remediation of approximately 1,000 yd3 of hydrocarbon-contaminated soil; asbestos abatement in two abandoned buildings, abatement of lead-contaminated ash in one burned-out building, demolition of seven buildings, disposal of building debris in a regulated landfill, mitigation of other safety hazards, and backfilling of disturbed areas. Prepared a remedial action report describing cleanup activities and documenting post-cleanup site conditions. The report included a complete manifest package consisting of hazardous waste manifests, bills of lading, and certificates of recycling/disposal for all waste streams.
    - Northway Staging Area Interim Removal Action. Removed several types of wastes at the Northway Staging Area, approximately 10 square miles near the Northway, Alaska, airport, 285 air miles northeast of Anchorage. The site consists of abandoned airfield support facilities built since the start of World War II. Private

residences have been built on some of the property. Contractor was responsible for “cradle-to-grave” handling of the waste streams, including scrap metal from the recovery and cleaning of 413 fifty-five-gallon drums; one 500-gallon tank; and approximately 185 smaller containers of petroleum products, soil, water, and a white powder thought to be sodium hydroxide. The 500-gallon tank and about one hundred 55-gallon drums are in two shallow lakes; the other containers are scattered throughout the staging area. The following materials were encountered: approximately 2,000 gallons of petroleum products; approximately 3,800 gallons of asphalt from surface spills and containers; nine batteries suspected to contain nickel and cadmium; approximately 1 yd3 of asbestos; approximately 850 yd3 of asphalt-coated wood staves; and approximately 720 yd3 of asphalt-contaminated sand.

- Program Manager, RI/FS Investigation, U.S. Air Force, Eielson Air Force Base (AFB), Alaska (1989 - 1991; $2.6M). Responsible for overall management, control, and administration of the contract, including quality and production for completing an RI/FS addressing 23 hazardous waste sites at Eielson AFB under the U.S. Air Force Installation Restoration Program. Supervised development of the risk assessment procedure, the project work plans, and a community relations plan. Managed the field tasks, including soil-gas surveys, geophysical surveys, monitoring well installations, soil and water sampling, and aquifer tests.

♦ **Project Manager/Engineer, Harding Lawson Associates, Anchorage, Alaska (1978 – 2000).**

- Project Manager, Statewide Underground Storage Tank (UST) Program, Federal Aviation Administration (FAA), Alaska (1996; $200K). Developed a procedure to assess human-health risks and the threat to groundwater from fuel-affected soil. Project required developing an acceptable human-health-risk screening procedure and implementing a vadose zone model to assess leachability of various fuel constituents.
- Project Manager, Statewide Fuel Storage Tank Program, FAA, Various Locations throughout Alaska 1990 to 1998; $18M). Developed standard remedial designs for fuel-affected soil and groundwater. The remedial action alternatives were implemented on a fast-track basis through a planned, coordinated program.
- Project Engineer, Alternative Cleanup Level Development Project, FAA, Various Sites throughout Alaska (1996; $350K). Developed methodology to establish alternative cleanup levels for fuel-affected soil. Project objectives were to develop a procedure to assess human-health risks and the threat to groundwater by fuel-affected soil. Project required developing an acceptable human-health-risk screening procedure, and implementing a vadose-zone model to assess leachability of various fuel constituent.
- Project Manager, Property Transfer Assessment, Confidential Client, Anchorage, Alaska (1997; $180K). Managed the technical and financial aspects of this soil and groundwater investigation for a confidential client. Prepared a work plan/quality assurance plan and a site investigation report recommending remediation at the site. Acted as liaison between the client and the Alaska Department of Environmental Conservation.
- Project Engineer, Old Seward Highway Contaminant Survey, Alaska Department of Public Transportation and Public Facilities, Anchorage, Alaska (1995; $250K). Planned and directed subsurface investigations of five sites needed for right-of-way acquisitions. Tested soil and groundwater samples and conducted soil-gas surveys. Project Manager,

Railbed Soil Contaminant Investigation-White Pass and Yukon Route, White Pass and Yukon Railway, Skagway, Alaska (1989 - 1990; $230K). Managed a site investigation to assess the magnitude and extent of heavy metal contamination of railbed soil. attended scoping meetings between the regulatory agency and the client, prepared a work plan/quality assurance plan, conducted the field investigation, and prepared the final report. All work was completed in 3 weeks to meet deadlines.

- Project Manager, Naval Air Station Contaminant Investigation, U.S. Navy, Adak, Alaska (1988; $500K). Managed a site investigation to evaluate toxic and hazardous material contamination at 20 sites, including landfills, drum storage and disposal areas, fuel storage areas, a waste-oil pit, a pesticide disposal area, spill areas, and the fire fighting training area. Characterized the origin, nature, and extent of possible contamination in water, soil, and unknown media in drums. Field tasks included geophysical surveys, soil sampling and analysis, monitoring well installation, lysimeter installation, water sampling and analysis, and water-level surveys.
- Project Engineer, Cannery Loop Unit No. 2 Contaminant Investigation, Burr, Pease, and Kurtz, Kenai, Alaska (1985 - 1986; $350K). Assisted in a hydrogeologic and geochemical study to assess the impact of hazardous substances on groundwater resources and the potential for contaminant transfer. Project included site reconnaissance; records search; geophysical survey; and work, site safety, and quality assurance/quality control (QA/QC) plan development. Field tasks included soil probe installation, soil and water sampling and analysis, monitoring well installation, and aquifer tests.
- Project Engineer, Aleutian Air Station Detachment Site Investigation, U.S. Coast Guard, Cold Bay, Alaska (1987; $300K). Responsibilities included a literature search, geophysical surveys, subsurface investigations, laboratory testing (groundwater, soil, and soil-gas samples), and environmental studies. Investigated proposed sites for a support facility for U.S. Coast Guard search and rescue efforts. Project objectives included evaluating potential soil and water contamination from an adjacent landfill and investigating the potential encountering of landfill materials on the proposed sites.
- Project Manager, Investigation of the Poppy Lane Gravel Pit, Union Oil Company of California, Soldotna, Alaska. (1987; $280K). Managed a petroleum contaminant investigation to evaluate the vertical distribution of purgeable aromatic hydrocarbons in groundwater and locate the hydrocarbon source. Field tasks included installing monitoring wells, sampling soil and water for laboratory analysis, surveying geophysical characterizations to evaluate the extent of past waste-disposal activities at the site, and installing piezometers.
- Project Manager, Bernice Lake Power Plant Hydrogeologic Investigation, Chugach Electric Association, Nikiski, Alaska (1992; $150K). Activities included researching physical and chemical groundwater characteristics and evaluating possible sources of thermal and chemical groundwater contamination and the effects of steam blowdown discharge. In addition, provided recommendations for the location and operation of groundwater monitoring wells, and the nature and location of the plant discharges.
- Project Manager, Tundra Environmental Chemistry Study, ARCO Alaska, Inc., North Slope, Alaska (1989; $650K). Managed a contaminant investigation of the tundra surrounding reserve pits at the Kuparuk River Unit. Evaluated whether concentrations of constituents increased in different sample types to assess the distance over which increases occurred and determine whether differences in constituent concentrations could

be attributed to separate contributions from gravel placement, reserve pit seepage, and/or reserve pit dewatering. Collected more than 250 soil, water, and vegetation samples; geochemically and statistically analyzed laboratory results; and developed and implemented a QA/QC program.

- Project Manager, Moose River No. 1 Hazardous Substance Monitoring Program, ARCO Alaska, Inc., Sterling, Alaska (1989; $175K). Managed a baseline soil, groundwater, and vadose zone investigation and long-term monitoring program at a planned hazardous materials disposal site. Project objectives were to evaluate site conditions before, during, and after facility use in accordance with Alaska Solid Waste Management Regulations.
- Project Director, Remedial Action Plan, Confidential Client, Anchorage, Alaska (1991; $115K). Planned and directed the removal of waste oil-laden soil for a confidential client. Project included investigating the site to identify the limits of contamination, and recommending and implementing remedial action. Negotiated cleanup levels with the ADEC and developed a plan for QA/QC and documentation of the cleanup.
- Project Consultant, Bioremediation Pilot Study, Exxon Company, USA, Point Thomson, Alaska (1990; $300K). Project consultant for the investigation and bioremediation of hydrocarbon-bearing soil at a remote North Slope exploration pad. Planned and conducted a release investigation to establish the extent and concentration of hydrocarbons in pad gravel, and performed bench- and full-scale pilot studies to implement bioremediation at the site.
- Project Manager, Soil Remediation Project, Anchorage, Alaska. Remediated contaminated soil at a former service station site. Responsible for the in situ removal of volatile organic compounds from the vadose zone.
- Project Manager, Kenai Gas Field Contaminant Investigation, Unocal, Kenai, Alaska. Managed a hydrogeologic and geochemical study for Kenai Gas Field and Cannery Loop units to assess the impact of substances on groundwater resources and the potential for contaminant transport. Created a comprehensive water well database and a conceptual model of study area hydrogeology. Coordinated hydrogeochemical and computer modeling aspects of the study and wrote the final report.
- Project Manager, Steadman Field Site Investigation, Alaska Gold Company, Nome, Alaska. Managed multiple site investigations. Developed a remedial action plan, and identified and designed a solid waste disposal site for soil containing arsenic and mercury.
- Project Manager, Prudhoe Bay Seepage Study, ARCO Alaska, Inc., North Slope, Alaska. Managed a seepage transport study to assess the extent of reserve pit fluid migration to the tundra. Installed more than 50 monitoring wells, installed thermistors, monitored and assessed groundwater, and evaluated migration potential.
- Project Manager, Reserve Pit Hydrogeologic Study, ARCO Alaska, Inc., Kuparuk Field on the North Slope, Alaska. Managed a hydrogeologic and contaminant transport study to evaluate the potential for reserve-pit water containing hazardous chemicals to seep through containment berms. The investigation involved sampling and analyzing groundwater, soil, reserve-pit water, and drilling reserves; evaluating groundwater and containment berm characteristics; conducting dye-tracer tests to track fluid movement and measure flow velocity; and installing tensiometers.

- **Geologist/Field Manager, Geotechnical and Hydrogeological Investigations, Harding Lawson Associates, Anchorage, Alaska (1978 - 2000).**
  - Project Geologist, Reserve Pit Permitting, Conoco, Inc., North Slope, Alaska. Prepared solid waste permit applications for drill site reserve pits at the Milne Point Unit. Prepared fluid management and monitoring plans to comply with State of Alaska Solid Waste Management Regulations.
  - Field Manager, Over-Ice Drilling Investigations, Lease Sale Area 71, Major Oil Company and Members of Alaska Oil and Gas Association, Harrison Bay, Alaska. Managed field investigations for release sale studies. Planned and coordinated two concurrent operations involving a 36-person crew and two Rolligon-mounted, enclosed drilling rigs to collect more than 90 core samples to depths of 150 feet below mud line. Ice was used as the drill platform. Responsible for ice-safety reconnaissance.
  - Field Manager, Duck Island Development Project, Exxon Company, USA, in the Beaufort Sea, Alaska. Managed field operations for an onshore and offshore geotechnical investigation. Supervised a 15-person crew during the investigation for first major offshore production wells in the Beaufort Sea. Geotechnical data were used to develop preliminary foundation design criteria for offshore islands, buried pipelines, causeway, and onshore facilities.
  - Technical Manager, Geotechnical Investigation and Bathymetric Survey of a Storage Site, Glomar Beaufort Sea 1 Concrete Island Drilling Site (CID, Global Marine Drilling Company, Beaufort Sea, Alska. Managed a geotechnical investigation to define the seabed topography and subsea soil conditions at a proposed temporary set-down storage site for the CIDS. Conducted a bathymetric survey through the sea-ice canopy, prepared a map overlay showing the sounding locations and bathymetric contours, described sea bottom conditions, and provided laboratory test results on the samples obtained. Also recommended additional work required at the proposed site.
  - Field Manager, Niguanak Well Sites Geotechnical Investigation, Shell Western and Production, Inc. Beaufort Sea, Alaska. Managed the field operations of a geotechnical investigation of proposed well sites located approximately 17 nautical miles east of Barter Island, Alaska. Field tasks included bathymetric surveys of sites, cone penetrometer tests, and test boring drilling and sampling. Evaluated the geology of the proposed sites.
  - Field Manager, Knik Arm Crossing Investigation, Alaska Department of Transportation and Public Facilities, Cook Inlet, Alaska. Managed the field investigation of a marine soil drilling and sampling program for a major crossing of Knik Arm. Established boring locations and coordinated field phases of the program.
  - Field Project Manager, Sampling Investigation-Mukluk Island Site, Sohio Petroleum Company, in Beaufort Sea, Alaska. As field project manager, conducted an over-ice drilling and sampling investigation with a helicopter-support operation 20 miles offshore.
  - Field Manager, Geotechnical Investigation, Alpetco Company and Santa Fe Engineering, Valdez Harbor, Alaska. Supervised an offshore soil exploration drilling program for a docking facility.

- Engineer, Artificial Ice Island Project, Mobile Oil Company, Beaufort Sea, Alaska. Participated in designing an artificial ice island for onshore drilling program. Obtained and analyzed subsea soil-strength data and worked with the project engineer to develop design parameters.
- Field Manager, Port of Nome Over-Ice Investigation, City of Nome, Alaska. Managed the field program for a helicopter-supported, over-ice drilling operation. Drilled more than 20 borings to bedrock onshore and offshore and obtained bedrock cores.
- Field Manager, Waterflood Project, Prudhoe Bay Joint Operating Group, Prudhoe Bay, Alaska. Managed field operations for an offshore investigation of island, pipeline, and dredged channels.
- Engineer, Geotechnical Investigation, Kodiak Lumber Mills, Inc., Afognak Island, Alaska. Participated in a geotechnical investigation for wharf and docking facilities. Supervised the offshore drilling program, analyzed data, and prepared the final report.
- Field Engineer, Offshore Drilling Investigations at Four Sites, Major Oil Company, Beaufort Sea, Alaska. Managed field operations for an offshore drilling investigation conducted from a barge. Borings were drilled to 100 feet below mud line.
- Field Engineer, Well Site Geotechnical Investigation, Major Oil Company, Nation River, Alaska. Directed a geotechnical investigation to provide well site facility preliminary design data for five remote exploration drilling sites.
- Project Geologist, Geotechnical Investigatiopn-Gravel Search, UIC, North Slope, Alaska. Performed geotechnical investigation of proposed gravel mine sites to identify approximately 3 to 5 million yd3 of gravel. Summarized geologic information required for the gravel search.
- Project Engineer, Geotechnical Reconnaissance-Pruess Drive Slope Failure, Municipality of Anchorage in Eagle River, Alaska. Conducted geotechnical reconnaissance of a failed slope. Provided recommendations for preliminary remediation and slope stabilization.
- Project Manager, Geotechnical Investigation-Airport Siting, Alaska Department of Transportation and Public Facilities, Kake, Alaska. Reviewed existing aerial photographs and soil data, conducted geological reconnaissance of alternative runway sites, and provided preliminary analysis and recommendations.
- Project Manager, Geotechnical Evaluation-Airstrip Project, Alaska, Department of Transportation and Public Facilities in Circle, Alaska. Managed a geotechnical evaluation, including aerial photograph interpretation, review of existing data, and recommendations for a runway location.
- Project Supervisor, Soil Boring Programs-Trans-Alaska Pipeline Route, Alyeska Pipeline Service Company, Alaska. Supervised numerous soil boring programs to confirm that the selected construction method was compatible with soil conditions. Coordinated fieldwork and enforced proper sampling techniques for frozen and thawed soil.
- Engineer, Power Plant Foundation Design, Chugach Electric Association, Beluga, Alaska. Participated in a geotechnical investigation and the design of a foundation for a new generating facility. Supervised soil boring analyses and prepared the final report.

- Engineer, Placer Gravel Evaluation, Hope Mining Company, Resurrection Creek, Alaska. Directed geophysical and sampling programs to evaluate the character of gold-bearing placer gravel.
- Engineer, Route Selection and Design, Alyeska Pipeline Service Company on the Trans-Alaska Pipeline System, Alaska. Involved in several geotechnical studies for pipeline route selection and design. Primary work involved dynamic and static analyses of slope stability. Drilled soil borings with an 8-inch hollow-stem auger and collected soil samples in frozen and thawed ground.
- Engineer, Coal Exploration Study, Placer-Annex, Inc., on the Beluga Basin, Alaska. Performed a field survey and coordinated helicopter support for a large-scale exploratory program. Authored the engineering geology and hydrogeology sections of an environmental impact statement.
- Engineer, Tanker Dock Siting and Design, Standard Oil Company of California, Ketchikan, Alaska. Involved in a rock drilling program for tanker dock siting and design. Specified necessary laboratory tests and analyzed test data.
- Engineer, Hydroelectric Feasibility Study, Alaska Power Authority in the Bethel area, Alaska. Provided field reconnaissance support during a review of five potential hydroelectric sites on Kisaralik and Kipchuk rivers.
- Engineer, Potential Well Pad Locations, Two Major Oil Companies, Lower Yukon Delta and Yantarni Bay, Alaska. Conducted a drilling program involving helicopter transport with a portable drilling rig.
- Engineer, Bethel to Napakiak Road, Alaska Department of Transportation and Public Facilities, Bethel, Alaska. Managed a geotechnical evaluation, including library search, aerial photograph interpretation, and field analysis of the west terminus of the road.

Publications

With J.T. Brown and M. Stelljes, Methodology for Calculating Alternative Cleanup Levels of Petroleum Hydrocarbon Contaminated Soil, Joint CSCE-ASCE National Conference on Environmental Engineering, Montreal, Canada, July 12 to 14, 1993.

LYNDSEY KLEPPIN

Geologist

Years Experience

Total: 4; Bristol 4

Areas of Expertise

Environmental Sampling

Risk Assessment

Geologic Research

Borehole Geophysical Logging

Training and Certifications

Northwest Environmental Training Center Contaminant Chemistry and Monitored Natural Attenuation Workshop

40-Hour Hazardous Waste Operations and Emergency Response (HAZWOPER)

8-Hour HAZWOPER Refresher

Hazardous Materials Transportation, (DOT/IATA) 49 CFR 172.700-704 and Section 1.5 IATA Compliance

Alaska Department of Environmental Conservation 8-Hour Soil Vapor Intrusion Course

CPR and First Aid with current 4-Hour Refresher

Rigging and Slinging

Education

B.A., Geology, Carleton College, Northfield, Minnesota 2004

Ms. Kleppin began her career in 2007 and specializes in exploration geology and geophysical investigations at contaminated sites throughout Alaska. She is proficient in producing geologic maps, well diagrams, cross sections and reports. Ms. Kleppin has several years of experience in the environmental field performing surface water, groundwater, soil and sediment sampling, as well as administrative and technical support, field logistics, instrumentation, risk assessment, and technical writing.

Project Experience

- **Environmental Scientist, Northeast Cape Hazardous, Toxic, and Radioactive Waste Remediation, USACE, Alaska District, St. Lawrence Island, Alaska (06/2010 - 09/2010).** Conducted soil, groundwater and surface water sampling, directed UVOST investigation and generated boring logs for petroleum and PCB impacted sites. Interpreted and reported UVOST and laboratory analytical data to create guidance for future excavation activities. The project objective was to perform debris and soil removal actions at 10 sites across the project area; construct a landfill cap at one site; and initiate a natural attenuation monitoring program at another.
- **Environmental Scientist, Puntilla Lake Phase 2 Release Investigation, Federal Aviation Administration, Rainy Pass, Alaska (06/2010 - 10/2010).** Assisted field activities including UVOST probe advancement, soil and groundwater sampling, sample packing and shipment and monitoring well installation for characterization of a petroleum-impacted site. The project objective was to determine the extent soil and groundwater impacts resulting from petroleum releases at three former USTs.

- **Field Scientist, Native American Lands Environmental Mitigation (NALEMP) Site Assessment, Unalakleet, Alaska (05/2010 - 07/2010).** Conducted preliminary site assessment and assisted in preparation of the Strategic Project Implementation Plan (SPIP) for submittal to the USACE. NALEMP was developed by the Department of Defense (DoD) to address environmental issues from past DoD activities on Indian lands.
- **Project Scientist, Investigation and Remediation of Leaking Underground Storage Tank (LUST) Sites on Indian Lands, U.S. Environmental Protection Agency (EPA) Contract, Idaho (11/2009 - 03/2010).** Conducted Idaho Department of Environmental Quality Risk Evaluation Phase 2 for a petroleum-impacted site. Authored report presenting results of the RE-2. The project consisted of evaluating LUST-eligible sites; performing site assessments and remedial investigations; developing risk-based decision documents; conducting remediation activities; and providing other technical support to EPA as required to ensure that LUSTs located on Indian Lands no longer pose a threat to human health and the environment.
- **Field Manager, Native American Lands Environmental Mitigation (NALEMP) Site Assessment, Tetlin, Alaska (10/2009 - 02/2010).** Conducted preliminary site assessment and prepared the Strategic Project Implementation Plan (SPIP) for submittal to the USACE. NALEMP was developed by the Department of Defense (DoD) to address environmental issues from past DoD activities on Indian lands.
- **Field Manager, Monitoring Well Inventory Project, USACE, Alaska District, Fort Richardson, Alaska (07/2009 - 03/2010).** Conducted background research and field investigations of 250+ points using a Trimble GPS unit to create a comprehensive, SDSFIE compatible monitoring well database for USACE. The database included determination of active/inactive status based on sampling event records and location within active operable units or POL release sites. The project objective was to evaluate existing monitoring well databases and maps and conduct field inspections at each well location to create a database of existing wells and provide recommendations for database management and well decommissioning at Fort Richardson.
- **Environmental Scientist, Groundwater Sampling-Operating Unit 3, Fairbanks Environmental Services, Fort Wainwright, Alaska (04/2009 - 05/2009).** Collected low-flow groundwater samples for DRO, GRO, VOC, EDB, PAH, iron (II), lead, and sulfate analysis. The objective of the project was to provide field assistance for FES's USACE Alaska District contract to conduct groundwater sampling at Fort Wainwright.
- **Geologist, Investigation and Remediation of Leaking Underground Storage Tank (LUST) Sites on Indian Lands, U.S. Environmental Protection Agency (EPA) Contract, (01/2009 - 042009).** Created soil boring logs and collected analytical soil samples. Generated lithologic cross sections and well diagrams for Region 9 Navajo sites using gINT Geotechnical software and produced technical memos reporting remedial investigations; developing risk-based decision documents; conducting groundwater monitoring events. The project consisted of evaluating LUST-eligible sites; performing site remediation activities; and providing other technical support to EPA as required to ensure that LUSTs located on Indian Lands no longer pose a threat to human health and the environment.

- **Geologist, BBNC Responsible Resource Development, Bristol Bay Native Corporation Land Department, Anchorage (01/2009 - 02/2009).** Researched and prepared historical and geologic background summary of land in the vicinity of the Agulowak River. The project objective was to provide background data to assist mineral appraisal for a prospective land exchange area.
- **Field Manager, Borehole Geophysical Logging Program, Pebble Partnership, Iliamna, Alaska (02/2008 - 12/2008).** Developed site-based Standard Operating Procedure for ABI Acoustic Televiewer, 2PCA-100 Caliper, Full Wave Sonic Sonde and 4WNA Winch; revised procedures to optimize data quality and downhole tool recovery; performed maintenance and repairs on equipment; trained operators and provided regular reports to site staff; coordinated and managed downhole geophysical surveys for boreholes exceeding 6,000 feet in depth. The objective of the project was to provide geotechnical field support for exploration activities at the prospect.
- **Field Geologist, Pebble Project Support, Northern Dynasty, Iliamna, Alaska (05/2007 - 12/2008).** Conducted borehole geophysical surveys with and provided general field support for Northern Dynasty's Pebble Cu-Au-Mo prospect near Iliamna, Alaska. Additional activities included surface water and soil sampling, ground topographic surveying, corelogging, geotechnical logging, and logistical support. The objective of the project was to provide geologic field support for exploration activities at the prospect.

Professional Experience

- Weekend Programs Lead Teacher for the Pacific Science Center in Seattle, Washington (2006 to 2007). Taught interactive science lessons and assisted in curriculum development.
- Assistant to the Director for Osservatorio Geologico di Coldigioco in Italy (2005 to 2006). Provided winter logistics and maintenance for geologic observatory.
- Adjunct Chemistry Instructor for University of Alaska Anchorage (2005). Duties included laboratory instruction, creating and grading chemistry exams.
- Field Studies Instructor for 3D Education and Adventure, Isle of Wight, England (2004). Activity and field studies instructor at outdoor education camp for schoolchildren.
- Prudhoe Bay summer hire for NANA Corporation, Prudhoe Bay, Alaska (2001). Seasonal laborer at field camp facility in the Prudhoe Bay oilfield.

ALEX BASKOUS, M.D., M.P.H.
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PHYSICIAN'S WRITTEN OPINION

PURSUANT TO 29 CFR 1910.120(f) MEDICAL SURVEILLANCE:

NAME Lyndsey Kleppin SS#_____

DATE OF EXAM 04-12-11

_____ A. NO MEDICAL CONDITIONS WERE DETECTED WHICH WOULD PLACE THE EMPLOYEE AT INCREASED RISK OF IMPAIRMENT OF THE EMPLOYEE'S HEALTH FROM WORK IN HAZARDOUS WASTE OPERATIONS OR EMERGENCY RESPONSE, OR RESPIRATOR USE.

THE FOLLOWING MEDICAL CONDITIONS ARE OCCUPATIONALLY PERTINENET:

_____

_____

_____

_____ B. NO LIMITATIONS UPON THE EMPLOYEE'S ASSIGNED WORK.

THE FOLLOWING LIMITATIONS ARE RECOMMENDED:

_____

_____

_____ C. THE EMPLOYEE HAS BEEN INFROMED BY ME OF THE RESULTS OF THE EXAMINATIONS.

DATE: 04-12-11

_____, M.D., M.P.H.

ALEXANDER BASKOUS, M.D., M.P.H.
2841 DEBARR ROAD, SUITE 24
ANCHORAGE, AK 99508

Successful Completion Card

Basic TRAINING PROGRAMS

Lindsey Kleppin
Name

3/4/10 — 3/4/12
Issued — Expires

This certifies that the individual named above has successfully demonstrated the knowledge and skill objectives for:

☒ BasicPlus CPR, AED, and First Aid for Adults

☐ Basic CPR and First Aid for Adults

Card not valid if more than one box is checked.

MEDIC First Aid® INTERNATIONAL

Instructor Maxey Riggs

Registry Number 37530

Training Center Phone No. 563-0013

Training Center ID

MEDIC FIRST AID® BasicPlus follows ILCOR, AHA, and ASTM recommendations and guidelines for CPR, first aid, and emergency care. Additional source authority information can be found in your *Student Guide* and at medicfirstaid.com.

Continued proficiency as a MEDIC FIRST AID Provider requires frequent retraining. This card expires as documented on the front of the card or within 24 months of issue.

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OSHA Occupational Safety and Health Administration

35-600698939

This card acknowledges that the recipient has successfully completed a 30-hour Occupational Safety and Health Training Course in

Construction Safety and Health

Lyndsey Kleppin

(Trainer name – print or type)

4/24/11
(Course end date)

ENVIRONMENTAL
MANAGEMENT
INCORPORATED

Certificate of Training

T - 21716 - 15724
Certificate Number

This is to certify that

Lyndsey E. Kleppin

has satisfactorily completed 12 hours

of

Hazardous Materials Transportation - 12 Hours (DOT)

In compliance with 49 CFR 172.700-704 (3 Year Expiration)

Class Start Date: 3/15/2010 *Class End Date: 3/16/2010*

Steven Schuler	*3/16/2010*	*3/16/2013*	*Stuart M. Jacques*
	Exam Date	*Cert. Exp. Date*	*Director*

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Bristol

ALLIANCE OF COMPANIES

Lyndsey Kleppin

Has completed 8 hours of annual refresher training as required by

29 CFR 1910.120

Hazardous Waste Operations & Emergency Response

March 25, 2011

Maxey Riggs.
Instructor

ENVIRONMENTAL
MANAGEMENT
INCORPORATED

Certificate of Training

T - 21717 - 15724
Certificate Number

This is to certify that

Lyndsey E. Kleppin

has satisfactorily completed 12 hours

of

Hazardous Materials Transportation - 12 Hours (IATA)

Section 1.5 of IATA Dangerous Goods Regulations (2 Year Expiration)

Class Start Date: 3/16/2010 *Class End Date: 3/17/2010*

Steven Schuler	*3/17/2010*	*3/17/2012*	*Stuart M. Jacques*
	Exam Date	*Cert. Exp. Date*	*Director*

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ENVIRONMENTAL
MANAGEMENT
INCORPORATED

Certificate of Training

T - 21051 - 15724
Certificate Number

This is to certify that

Lyndsey E. Kleppin

has satisfactorily completed 40 hours

of

Hazardous Waste Operations & Emergency Response - 40 Hours

In compliance with 29 CFR 1910.120

Class Start Date: 3/2/2009 *Class End Date: 3/6/2009*

David Haggith	3/6/2009	3/6/2010	Stuart M. Jacques
David Haggith	*Exam Date*	*Cert. Exp. Date*	*Director*

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INDUSTRIES

BRISTOL COMPANIES TRAINING ROSTER

TOPIC Fit Testing / Respirator use / Local Inspection North 1/2 mask APR INSTRUCTOR Maren Riggs

DATE 6 / 25 / 09 SIGNATURE

	NAME PRINT	ID #	COMPANY	SIGNATURE
1	Lyndsey Kleppin	2594	BERS	
2	Mike Garcia	2339	BERS	
3	Patricia Braley	0655	BERS	
4	Eric Barnhill	8889	BERS	
5	Lisa Maserjian	5714	BERS	
6				
7				
8				
9				
10				
11				
12				
13				
14				
15				
16				
17				

CLARK A. ROBERTS, C.I.H., C.H.M.M.

Health and Safety Manager

Years Experience

Total: 29; Bristol: 10

Areas of Expertise

Risk Management

Regulatory Compliance Assessment

Quality Assurance Audits

Sampling & Analytical Procedures

Data Validation and Verification

Training and Certifications

OSHA 500 – Construction Trainer

AHERA Asbestos Inspector

AHERA Asbestos Management

Asbestos Abatement Designer

ATSDR Public Health Assessment & Risk Communication

Mitigation Techniques for Microbial Contamination in Indoor Environments

ISO 14001 Environmental Management Systems Auditing

HAZWOPER, 40 hour

HAZWOPER Supervisor, 8 hour

Safety and Health Management for Construction Activities

Confined Space Entry Operations

Advanced Techniques for Workplace Ergonomic Assessments

Education

M.S., Public Health, University of Illinois, Chicago, 1983

B.S., Chemistry and Biology, Heidelberg College, 1978

Mr. Roberts began his career in 1982 and has invaluable experience in developing solutions to client needs in the areas of regulatory, operational, and liability risk management. He is experienced in developing specifications for hazard abatement and managing technical and professional personnel. Mr. Roberts has developed national policies and programs for the U.S. Navy and U.S. Department of Energy (DOE) in management of occupational health issues. Mr. Roberts has performed over 500 occupational workplace investigations and reviews, including asbestos, lead and chemical exposure investigations, accident/fatality investigations, regulatory compliance assessments, remedial site investigations, and a variety of performance based evaluations. As a former compliance officer for the Occupational Safety and Health Administration (OSHA), Mr. Roberts has significant experience with determining potential exposure to health and safety hazards, setting appropriate exposure limits, recommending controls, and assessing the effectiveness of existing program efforts. Mr. Roberts is also an EPA-accredited asbestos building inspector, management planner, and abatement designer.

Project Experience

- **Project Industrial Hygienist, Alamodome Stadium Paint Removal and Facility Upgrade; Building Exterior Renovation, San Antonio, Texas (2006 – 2007; $1.6M).** Developed and implemented the site-specific health and safety, lead compliance and environmental protection plans. Developed technical approaches for removal of existing lead-containing paint on the entire building exterior, while protecting workers from lead exposures in excess of the OSHA Action Level. Paint removal operations were conducted at heights exceeding 220 feet in some areas of the stadium, necessitating use of specialty scaffolding, man lifts and crane supported work platforms. Performed oversight on all worker and environmental monitoring for lead exposure and release to the environment. Designed final clearance methods and procedures to document removal of lead-containing paint.

- **Program Health and Safety Manager, Construction of Navy Off-Crew Administration Building (OCAB), NAVFAC Engineering Command NW, Silverdale, Washington (2006 - 2007; $9M).** Performed technical review and direction for development of accident prevention plan for the entire project. Major definable features of work included demolition, excavation, concrete, electrical system installation, mechanical systems installation, steel erection, roofing, and interior finishing. Developed activity hazard analyses (AHA) for all definable features of work, including trenching/excavation, confined space entry, and heavy equipment operations.
- **Program Safety and Health Manager, White Alice Site Demolition and Removal Action, USACE, Alaska District, St. Lawrence Island, Alaska (2002 - 2010; $27M).** Responsible for the development, implementation, oversight, and enforcement of the APP and SSHP, that implements appropriate engineering controls, work practices and personal protective equipment for material handling, container loading/unloading, demolition, excavation, asbestos abatement, lead materials removal, PCB waste removal, hazardous waste sampling and characterization, construction debris cleanup and waste removal. Performed in-depth activity hazard analysis, asbestos/lead abatement oversight, verification of air monitoring and site clearance activities for 30 buildings and structures.
- **Program Manager, Remedial Actions/Long-Term Monitoring Program, U.S. Naval Facilities Engineering Command, SE, Jacksonville, Florida (2002 - 2008; $3M).** Responsible for environmental investigations, asbestos bulk sample surveys, industrial hygiene monitoring, geophysical investigations, remedial plans & designs, abatement plans, quality control, budget, and contract administration for NAVFAC SE sites in south Texas.
- **Program Safety and Health Manager, Remote over the Horizon (ROTHR) Facility Demolition and Environmental Closeout, U.S. Navy EFA-NW, Amchitka Island, Alaska (2001-2002; $15M).** Developed and implemented APP and SSHP for demolition removal and closure of all on-island facilities. Demolition included over 20 buildings, ASTs up to 1 million gallons, and 2 miles of utilidors. Safely demobilized 2,000 tons of equipment, salvaged materials, and hazardous materials and waste from the site. Provided safety oversight for an on-island work force of 45 persons, and successfully completed over 40,500 direct labor hours without any lost-time accidents, injuries, or illnesses.

Professional Experience

- **Director of Services, McCrone Environmental Services (1988 - 1992).** Managed the western region staff of 12 science professionals to meet client needs in the areas of environmental consulting, industrial hygiene surveillance, and regulatory compliance. Established analytical services and developed the quality assurance/control program for accreditation from the National Institute of Standards & Technology (NIST) and the National Voluntary Laboratory Accreditation Program (NVLAP).

- **Compliance Safety and Health Manager, the U.S. Department of Labor – OSHA (1983 - 1988).** Managed a team or safety engineers and industrial hygienists to perform workplace inspections/investigations for compliance with standards for occupational safety and health protection, including asbestos, lead, benzene and other toxic materials. Conducted accident/fatality investigations in maritime, general industry and construction environments.

The

American Board of Industrial Hygiene

ABIH

AMERICAN BOARD OF INDUSTRIAL HYGIENE

organized to improve the practice of Industrial Hygiene
proclaims that

Clark A. Roberts

having met all requirements through
education, experience, and examination,
is hereby certified in the

COMPREHENSIVE PRACTICE
of
INDUSTRIAL HYGIENE

and has the right to use the title and designations

CERTIFIED INDUSTRIAL HYGIENIST
CIH

date June 30, 1988

Chairman ABIH
Charles E. Adkins, CIH

certificate number 3957

Secretary ABIH
Larsen A. Anderson, Jr., CIH

Institute of Hazardous Materials Management

Certifies that

Clark Roberts

has successfully met all requirements of education, experience and examination, and is hereby designated a

Certified Hazardous Materials Manager

Master Level

September 2007	*14467*	*September 30, 2013*	John H Frick
Certified	Number	Expiration Date	Executive Director

So long as this credential is renewed according to schedule and is not otherwise revoked.

U.S. ENVIRONMENTAL PROTECTION AGENCY

This certifies that

CLARK ROBERTS

has completed the

HAZARDOUS MATERIALS INCIDENT RESPONSE OPERATIONS

Supervisor Training

April 1, 1991

Presented by the

OFFICE OF EMERGENCY AND REMEDIAL RESPONSE

In Cooperation With
Marine & Environmental Testing, Inc.

Jay Carlin
Course Director

Bruce Potoka
Training Coordinator,
Environmental
Response Branch

MOLLY WELKER

Senior Project Manager

Years Experience

Total: 23; Bristol: 5

Areas of Expertise

Project Management

Regulatory Compliance

Hydrology

Geology

Research

Water, Stormwater, and Wastewater Analysis

Water Quality Programs

Environmental Baseline Studies

Public Outreach and Education

Training and Certifications

HazMat Transportation – (DOT/IATA) Section 1.5 IATA Compliance Refresher

HazMat Transportation – (DOT/IATA) 49 CFR 172.700-704 Compliance Refresher

8-Hr HAZWOPER Supervisor Training

8-Hr HAZWOPER Refresher Training

RCRA Hazardous Waste for Supervisors

USACE Construction Quality Management for Contractors

40-Hr HAZWOPER

First Aid / CPR

Education

M.S., Geology, Texas A & M University, 1985

B.S., Geology, Montana State University, Bozeman, 1982

Ms. Welker began her career in developing and administering water quality monitoring programs for private, state, and federal agencies in 1985. Project responsibilities have included proposal development, budget administration, field logistics, quality control, regulatory agency coordination, community relations, and preparation of planning documents and final reports. Ms. Welker has been responsible for managing USACE environmental remediation contracts in Alaska totaling over $20M. Ms. Welker is experienced in partnering with federal, state, city, and county government agencies, educational institutions, and environmental consulting firms. She serves on the board of directors for the non-profit Anchorage Waterways Council. Ms. Welker is well versed in regulatory compliance for Alaska Department of Conservation, U.S. Environmental Protection Agency (EPA), EPA Drinking Water Standards, Chronic Aquatic Life Criteria, National Pollutant Discharge Elimination System permits, the Total Maximum Daily Load Program, and Storm Water Pollution Prevention Plans.

As a Senior Project Manager with Bristol, Ms. Welker is responsible for developing proposals, contract negotiations, project management, coordination of field work and subcontractors, and development of plans and report preparation.

Project Experience

Senior Project Manager, NE Cape HTRW Remedial Actions, USACE, Alaska District, NE Cape, St. Lawrence Island, Alaska (11/2009 – Present; $16.4M). Projects included designing and constructing a landfill cap, excavating, processing and disposing of approximately 9,500 tons of PCB- and petroleum-contaminated soils, removing miscellaneous debris, metal and pole stumps tundra-wide from the remote site, developing and implementing a monitored natural attenuation program for sediment and groundwater, and conducting an ultraviolet optical screening tool (UVOST) investigation. A project presentation at RAB meetings in Savoonga is part of the scope of work for these two contracts.

- **Senior Project Manager, NE Cape In-Situ Chemical Oxidation (Phase I ISCO) and Intrusive Drum Removal/Landfill Cap Project, USACE, Alaska District, NE Cape, St. Lawrence Island, Alaska (03/2009 – 09/2010; $6M).** Responsible for developing proposals, project management, coordination of field work, and plans and report preparation. The project included mobilization and demobilization to a remote site; designing and implementing the Phase I ISCO treatability study, designing and constructing a landfill cap, and excavation, removing, and disposing contaminated soil, drums, and miscellaneous waste streams off site.
- **Senior Project Manager, Hoonah RRS Remedial Action Project Phase I and II, USACE, Alaska District, Hoonah, Alaska (03/2008 – 03/2009; $3.9M).** Responsible for developing proposals, project management, coordination of field work, and plans and report preparation, and conducting a public outreach meeting. The project included mobilization and demobilization to the site; excavation, sampling, and backfilling; transport of contaminated soils off site; and a final report. The work consisted of excavation of approximately 1,271 tons of PCB-contaminated soil from a former soil stain area; a composite building area and generator room trench discharge area; a 32,000-gallon diesel underground storage tank (UST) area and radio relay building area; a gasoline UST and AST area and stockpile area; a bulk tank dike and fuel transfer area; and a former septic tank outfall.
- **Senior Project Manager, Nuvagapak/Kogru/Collinson Remedial Investigation Project, USACE Alaska District, North Slope, Alaska (06/2007 – 02/2008; $489K).** The work included soil, water, and sediment sample collection and analysis for various contaminants, including DRO, GRO, RRO, PCBs, PAH, TAHs, TAqHs, lead, and arsenic, from various areas of concern. The project included preparing planning documents, mobilization and demobilization to and from the sites, performing a coastal erosion study and sample collection, sample transport and laboratory analysis, and final RI report for the Nuvagapak Point (BAR-A) Distant Early Warning (DEW) Line Station, Collinson Point (POW-D) DEW Line Station, and Kogru DEW Line Station. The sites are located on the remote northeast coast of Alaska within the Arctic Wildlife Refuge. .

Professional Experience

- **Project Manager/Lead Scientist, HDR Alaska, Inc., (2004 - 2006).**
  - Senior Project Manager, Baseline Water Quality Project – Mine Site, Northern Dynasty Mines, Inc., near Iliamna, Alaska (10/2004 – 10/2006; $350K). Performed project management activities and managed field program related to the Pebble Gold/Copper Mining project. Managed a team of interdisciplinary scientists conducting baseline field studies related to surface water quality, seep, and fine-grain bed sediment sampling in the project area. Project objective was to collect water quality data for an environmental baseline report for a proposed copper-gold mine.
  - Contract Technical Writer, Multiple-Scale Ecosystem Assessment and Conservation Project, U.S. Forest Service, Rocky Mountain Region, Denver, Colorado (2002 - 2004). Editor and technical writer for this document which involved terrestrial, riparian, wetland, and aquatic ecosystems for the Species Conservation Project for Region 2 of the USDA Forest Service Water Outreach Coordinator for the City of Laramie, Wyoming, 1999 to 2002. Interfaced science, management, and public opinion for the protection and

conservation of the City's drinking water supply. Served as editor and project manager of Laramie Regional Drinking Water Protection Plan. Managed state and federal grants, and wrote draft municipal ordinances, and quarterly and final reports. Responsible for budget administration and student intern supervision. Provided staff support to City Manager, City Council, and City/County Environmental Advisory Committee.

- **Research Associate, University of Wyoming, Water Resources Center, Laramie, Wyoming (1997 - 1999).** Successfully acquired state funding and drafted a statewide ambient groundwater quality monitoring plan for the Wyoming Department of Environmental Quality – Water Quality Division.
  - Project Manager, Colorado State University, National Atmospheric Deposition Program, Fort Collins, Colorado (1993 to 1997). Developed and administered an environmental monitoring program that collected weekly samples for total mercury in precipitation from more than 30 sites in the country. Responsibilities included fundraising, grant writing, budget administration, laboratory contract oversight, marketing, oral and written presentations, and development of field methodology, data collection, and quality assurance protocols.
- **Associate Engineering Geologist, California Department of Health Services, Toxic Waste Division, Sacramento, California (1990).** Provided technical reports for the cleanup and abatement of hazardous and toxic wastes at contaminated sites throughout the state. Reviewed geologic, engineering, and chemical data for proposed remedial actions. Interpreted state and federal water laws.
- **Hydrologist, U.S. Geological Survey (USGS), Water Resources Division, Sacramento, California (1985 - 1990).** Assembled geohydrologic and geochemical information for analysis related to a regional surface and groundwater study. Supervised hydrologic technicians, performed quality assurance/quality control procedures, and published study results as USGS Water Supply Paper.

Awards

USFS Certificate of Merit 2003

Other Training and Certifications

8-Hour Hazardous Waste Operations & Emergency Response (HAZWOPER) Supervisor Training

8-Hour HAZWOPER Refresher Training

Security Awareness Training

Sampling for Defensible Environmental Decisions

Environmental Monitoring Workshop

Bear Safety

Hypothermia Awareness

Helicopter Safety

Remote Site Safety

Water and Boating Safety

Avalanche Awareness

Hazard Communication

Office Safety

Bristol

INDUSTRIES

Molly Welker

Has completed 8 hours of Supervisor training as required by

29 CFR 1910.120

Hazardous Waste Operations & Emergency Response

March 6, 2008

Clark Roberts, CIH, CHMM

Instructor

ENVIRONMENTAL
MANAGEMENT
INCORPORATED

Certificate of Training

T - 20125 - 11660
Certificate Number

This is to certify that

Molly Welker

has satisfactorily completed 40 hours

of

Hazardous Waste Operations & Emergency Response - 40 Hours

In compliance with 29 CFR 1910.120

Class Start Date: 4/2/2007 *Class End Date: 4/6/2007*

Dennis Bromley	*4/6/2007*	*4/6/2008*	*Stuart M. Jacques*
	Exam Date	*Cert. Exp. Date*	*Director*

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ENVIRONMENTAL
MANAGEMENT
INCORPORATED

Certificate of Training

T - 20610 - 11660
Certificate Number

This is to certify that

Molly Welker

has satisfactorily completed 16 hours

of

Hazardous Materials Transportation - (DOT/IATA)

In compliance with 49 CFR 172.700-704 (3 Year Expiration)

Class Start Date: 5/8/2008 *Class End Date: 5/9/2008*

John Wolfe, CET	*5/9/2008*	*5/9/2011*	*Stuart M. Jacques*
	Exam Date	*Cert. Exp. Date*	*Director*

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ENVIRONMENTAL
MANAGEMENT
INCORPORATED

Certificate of Training

T - 20610 - 11660
Certificate Number

This is to certify that

Molly Welker

has satisfactorily completed 16 hours

of

Hazardous Materials Transportation - (DOT/IATA)

Section 1.5 of IATA Dangerous Goods Regulations (2 Year Expiration)

Class Start Date: 5/8/2008 *Class End Date: 5/9/2008*

John Wolfe, CET	*5/9/2008*	*5/9/2010*	*Stuart M. Jacques*
	Exam Date	*Cert. Exp. Date*	*Director*

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ENVIRONMENTAL
MANAGEMENT
INCORPORATED

Certificate of Training

T - 20573 - 11660
Certificate Number

This is to certify that

Molly Welker

has satisfactorily completed 24 hours

of

RCRA Hazardous Waste for Supervisors

In Accordance with 40 CFR 262.34 and 265.16

Class Start Date: 3/25/2008 *Class End Date: 3/28/2008*

Chris Burns	*3/28/2008*	*3/28/2009*	*Stuart M. Jacques*
	Exam Date	*Cert. Exp. Date*	*Director*

Environmental Management Inc. 206 E. Fireweed Lane Suite 201, Anchorage Alaska 99503 907-272-8852

U.S. ARMY CORPS OF ENGINEERS

PROFESSIONAL DEVELOPMENT SUPPORT CENTER
HUNTSVILLE, ALABAMA

CERTIFICATE

This is to certify that

Molly Welker

has completed the Corps of Engineers Training Course

CONSTRUCTION QUALITY MANAGEMENT FOR CONTRACTORS

Given at AGC of Alaska By Anchorage February 9, 2007
Location Instructional District Date

Ronald Flodin Facilitator

THIS CERTIFICATE EXPIRES FIVE YEARS FROM DATE OF ISSUE

Chief, USACE Professional Development Support Center

ENVIRONMENTAL
MANAGEMENT
INCORPORATED

Certificate of Training

T - 22370 - 11660
Certificate Number

This is to certify that

Molly Welker

has satisfactorily completed 8 hours

of

Hazardous Materials Transportation Refresher DOT

In compliance with 49 CFR 172.700-704 (3 Year Expiration)

Class Start Date: 1/20/2011 *Class End Date: 1/20/2011*

Steven Schuler	*1/20/2011*	*1/20/2014*	*Stuart M. Jacques*
	Exam Date	*Cert. Exp. Date*	*Director*

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ENVIRONMENTAL
MANAGEMENT
INCORPORATED

Certificate of Training

T - 22371 - 11660
Certificate Number

This is to certify that

Molly Welker

has satisfactorily completed 8 hours

of

Hazardous Materials Transportation Refresher IATA

Section 1.5 of IATA Dangerous Goods Regulations (2 Year Expiration)

Class Start Date: 1/20/2011 *Class End Date: 1/20/2011*

Steven Schuler	1/20/2011	1/20/2013	Stuart M. Jacques
	Exam Date	*Cert. Exp. Date*	*Director*

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Bristol

ALLIANCE OF COMPANIES

Molly Welker

Has completed 8 hours of annual refresher training as required by

29 CFR 1910.120

Hazardous Waste Operations & Emergency Response

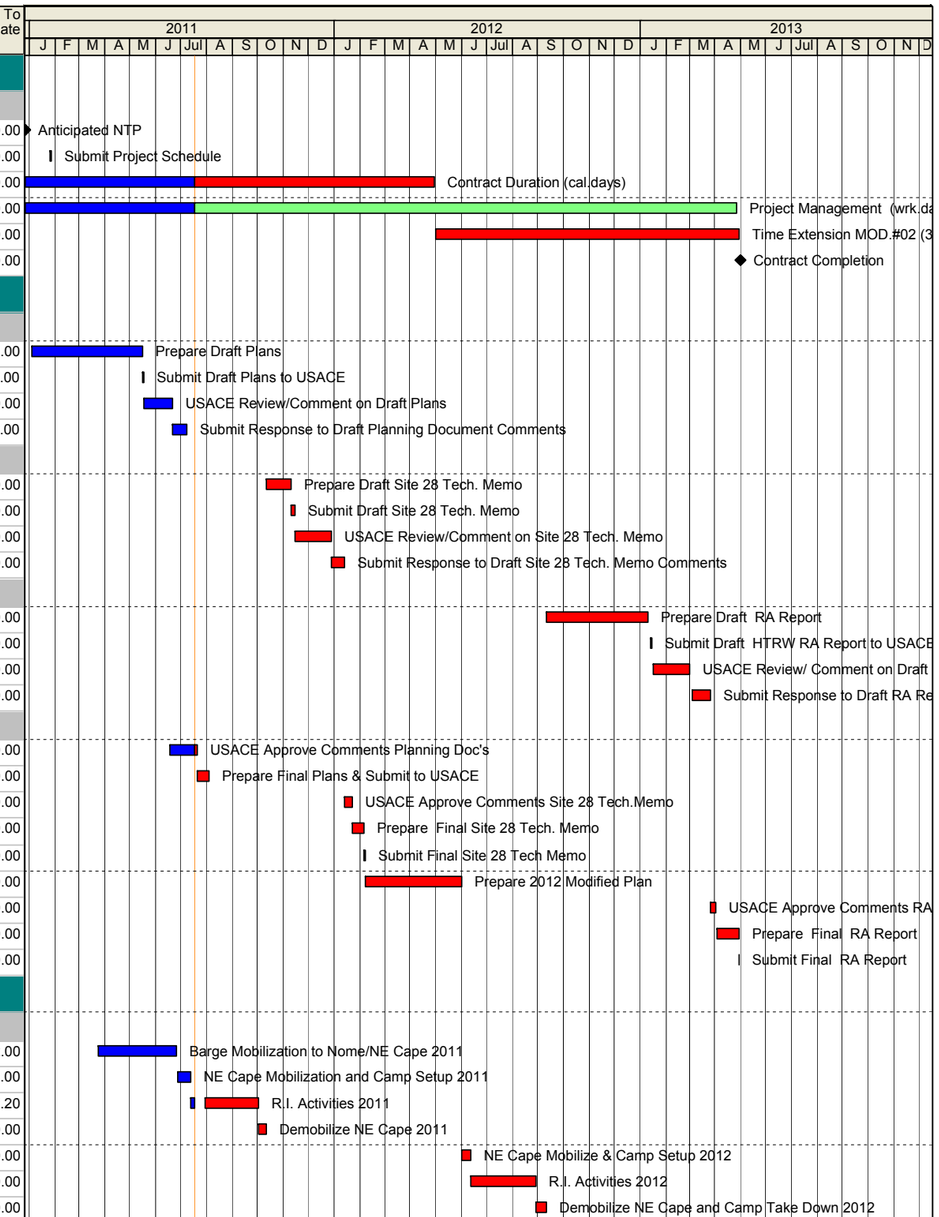
March 25, 2011

Maxey Riggs.
Instructor

APPENDIX H

Project Schedule and Response to Comments

Activity ID	Activity Name	OD	Early Start	Early Finish	TF	JTD%	Actual Start	Actual Finish	Budgeted Total Cost	Period Earned	Earned To Date
General Conditions											
General Conditions											
GC01	Anticipated NTP	0	Jul-18-11			100%	Dec-27-10		$0.00	$0.00	$0.00
GC06	Submit Project Schedule	1	Jul-18-11	Jul-18-11		100%	Jan-26-11	Jan-26-11	$0.00	$0.00	$0.00
GC03	Contract Duration (cal.days)	491	Jul-18-11	Apr-30-12	0	41.34%	Dec-27-10		$0.00	$0.00	$0.00
GC05	Project Management (wrk.days)	336	Jul-18-11	Apr-26-13	2	0%	Dec-27-10		$124,740.00	($24,131.25)	$0.00
GC03-1	Time Extension MOD.#02 (365 cd's)	365	May-01-12	Apr-30-13	0	0%			$0.00	$0.00	$0.00
GC04	Contract Completion	0		May-01-13	0	0%			$0.00	$0.00	$0.00
Submittals											
Planning Doc's Draft											
P01	Prepare Draft Plans	59	Jul-18-11	Jul-18-11		100%	Jan-03-11	May-16-11	$70,000.00	$17,796.61	$70,000.00
P01-1	Submit Draft Plans to USACE	1	Jul-18-11	Jul-18-11		100%	May-17-11	May-17-11	$106.00	$106.00	$106.00
P01-2	USACE Review/Comment on Draft Plans	32	Jul-18-11	Jul-18-11		100%	May-18-11	Jun-21-11	$0.00	$0.00	$0.00
P02	Submit Response to Draft Planning Document Comments	8	Jul-18-11	Jul-18-11		100%	Jun-21-11	Jul-08-11	$497.00	$497.00	$497.00
Site 28 - TECH MEMO											
P50	Prepare Draft Site 28 Tech. Memo	21	Oct-12-11	Nov-10-11	0	0%			$39,000.00	$0.00	$0.00
P50-1	Submit Draft Site 28 Tech. Memo	1	Nov-10-11	Nov-14-11	0	0%			$358.00	$0.00	$0.00
P50-2	USACE Review/Comment on Site 28 Tech. Memo	45	Nov-14-11	Dec-29-11	0	0%			$0.00	$0.00	$0.00
P50-3	Submit Response to Draft Site 28 Tech. Memo Comments	11	Dec-29-11	Jan-13-12	0	0%			$119.00	$0.00	$0.00
2011- 2012 RA Report											
P70	Prepare Draft RA Report	83	Sep-10-12	Jan-11-13	0	0%			$66,778.00	$0.00	$0.00
P70-1	Submit Draft HTRW RA Report to USACE	1	Jan-14-13	Jan-15-13	0	0%			$387.00	$0.00	$0.00
P70-2	USACE Review/ Comment on Draft RA Report	45	Jan-16-13	Mar-02-13	0	0%			$0.00	$0.00	$0.00
P70-3	Submit Response to Draft RA Report Comments	17	Mar-04-13	Mar-26-13	0	0%			$922.00	$0.00	$0.00
Final Doc's											
P02-2	USACE Approve Comments Planning Doc's	5	Jul-18-11	Jul-20-11	0	40%	Jun-18-11		$0.00	$0.00	$0.00
P02-1	Prepare Final Plans & Submit to USACE	11	Jul-20-11	Aug-04-11	0	0%			$31,000.00	$0.00	$0.00
P50-4	USACE Approve Comments Site 28 Tech.Memo	5	Jan-13-12	Jan-23-12	0	0%			$0.00	$0.00	$0.00
P51	Prepare Final Site 28 Tech. Memo	10	Jan-23-12	Feb-06-12	0	0%			$0.00	$0.00	$0.00
P51-1	Submit Final Site 28 Tech Memo	1	Feb-06-12	Feb-07-12	0	0%			$13,000.00	$0.00	$0.00
P51-2	Prepare 2012 Modified Plan	81	Feb-07-12	Jun-01-12	0	0%			$0.00	$0.00	$0.00
P70-6	USACE Approve Comments RA Report	5	Mar-27-13	Apr-02-13	0	0%			$0.00	$0.00	$0.00
P70-4	Prepare Final RA Report	19	Apr-03-13	Apr-29-13	0	0%			$0.00	$0.00	$0.00
P70-5	Submit Final RA Report	1	Apr-30-13	Apr-30-13	0	0%			$42,000.00	$0.00	$0.00
Remedial Activities											
Remedial Activities											
1001	Barge Mobilization to Nome/NE Cape 2011	66	Jul-18-11	Jul-18-11		100%	Mar-25-11	Jun-26-11	$1,266,212.00	$1,266,212.00	$1,266,212.00
1002	NE Cape Mobilization and Camp Setup 2011	12	Jul-29-11	Jul-29-11		100%	Jun-27-11	Jul-13-11	$755,473.00	$755,473.00	$755,473.00
1003	R.I. Activities 2011	48	Jul-30-11	Oct-01-11	0	10%	Jul-14-11		$4,883,966.00	$406,997.20	$406,997.20
1004	Demobilize NE Cape 2011	10	Oct-02-11	Oct-11-11	0	0%			$626,374.00	$0.00	$0.00
1005	NE Cape Mobilize & Camp Setup 2012	12	Jun-01-12	Jun-13-12	0	0%			$653,107.00	$0.00	$0.00
1006	R.I. Activities 2012	78	Jun-13-12	Aug-30-12	0	0%			$7,754,312.00	$0.00	$0.00
1007	Demobilize NE Cape and Camp Take Down 2012	11	Aug-30-12	Sep-10-12	0	0%			$1,326,085.00	$0.00	$0.00



Actual Work
Remaining Work
Critical Remaining Work
Milestone

Cape03

NE Cape 2011 - 2012 Remedial Action DD7-18-11

Bristol
ENVIRONMENTAL
REMEDIATION SERVICES, LLC

Date	Revision	Checked	Approved
Jan-14-11	cost edits		
Jan-18-11	review		
Apr-07-11	update DD3-31-11		

REVIEW COMMENTS **PROJECT: Northeast Cape Remedial Action**
DOCUMENT: Storm Water Pollution Prevention Plan

U.S. ARMY CORPS OF ENGINEERS CEPOA-EN-ES-M	**DATE:** 10 JUNE 2011 **REVIEWER: Teresa Lee** **PHONE: 907-753-2788**	**Action taken on comment by:**

Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
1.	SWPPP			Bristol received form on 6/23/11	
2.	Section 1.5	Each area of on-site and off-site areas of disturbance should be listed separately. Each individual site should be included in the site total. Totals should be estimated to the nearest quarter of an acre. This project utilizes a borrow source. This must be included in the project estimate and listed separately.		Each area of on-site and off-site areas of disturbance will be listed separately. Sites 13, 31, 21 and the MOC will have estimates made on the total acreage of disturbance and estimated to the nearest quarter of an acre. The area that will be disturbed from the borrow source will be estimated in this section.	A
3.	Site Map	Only the MOC site plan is offered. There are many more earth disturbing locations. Please include all site locations, including the borrow source area and applicable BMPs.		Site 13 and the MOC impoundment will be added to the MOC site plan map. A map of Site 31 with the proposed diversion ditch upgradient of the site will be added to the SWPPP. Construction berms using clean borrow source material will be used to keep any on-site water from moving off-site at Site 31to any nearby receiving waters. The SWPPP will include the following statement: At the end of the 2011 field season Bristol will stabilize the borrow source area by regrading it to match the surrounding topography and try to match the natural angle of repose as much as possible.	D Site maps for each earth disturbing location with the information listed in comment 4 should be included as specified in the permit.

U.S. ARMY CORPS OF ENGINEERS CEPOA-EN-ES-M	**DATE:** 10 JUNE 2011 **REVIEWER: Teresa Lee** **PHONE: 907-753-2788**	**Action taken on comment by:**

Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
4.	Site Map	Site maps should include drainage patterns, locations of all structural and nonstructural controls identified in the plan. For the one site you have a site map for, the impoundment area is on a separate map. Its location should be indicated on BMP plan as well.		The MOC map indicates the area of use of BMPs (silt fence) that are also a BMP for Site 13. The MOC impoundment and Site 13 will be included on the MOC BMP Plan Map. Topographic lines and arrows showing the direction of surface runoff towards Site 28 will be added to the figure. A site map of Site 31 will be included in the SWPPP. There are no BMPs proposed for Site 21. A generalized map of Site 21 will be added showing the direction of surface water runoff in the area.	D A Site map for Site 21 should still be included for review so proximity to surface water features, topography, and surface water flow can be reviewed.
5.	Site Map	Locations where stabilization activities will take place should be indicated. Stabilization activities should take place where ever soil disturbing activities take place.		The revised MOC BMP Plan Map and the Site 31 Map will be revised to add a note to the figure stating that any excavated areas will be permanently stabilized using angular coarse material from the borrow source area.	D Site maps for each location where stabilization will be taking place should be included as specified in the permit.

U.S. ARMY CORPS OF ENGINEERS CEPOA-EN-ES-M	**DATE:** 10 JUNE 2011 **REVIEWER: Teresa Lee** **PHONE: 907-753-2788**	**Action taken on comment by:**

Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
6.	General Location Map Site Map	Locations of wetlands should be indicated. Areas where stormwater will be entering surface waters should be indicated as well.		There is no National Wetland Inventory data for the Northeast Cape project area. The excavation plan at the MOC doesl not include digging in any wetlands but will occur on the gravel pad at the MOC. Sites 31 and 13 are not wetlands but in areas that were previously disturbed and on gravel building pads. Site 31 is in an upland area. Site 21 is in a wetland. Given the near surface groundwater and the melting frozen ground at Site 21 no BMPs are plausible at this site. The runoff patterns will be shown on the maps using arrows.	A
7.	2.3.1	This needs to noted on the site map. Where will the storm water be diverted to?		A diversion ditch will be shown on the Site 31 Map and included in Section 2.3.1 as a BMP. This BMP is to divert the potential runoff upgradient of Site 31 from flooding the PCB excavation area. The location of the diversion ditch will be documented and the project CESCL will make an amendment to the SWPPP figure.	A

U.S. ARMY CORPS OF ENGINEERS CEPOA-EN-ES-M	DATE: 10 JUNE 2011 REVIEWER: Teresa Lee PHONE: 907-753-2788	Action taken on comment by:

Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
8.	Section 2.4.2	The stabilization measures noted are not adequate. In order to attain NOT, final stabilization must be reached. This is defined as: all soil disturbing activities at the site have been completed and either of the 2 following criteria are met: a. A uniform perennial vegetative cover with a density of 70 percent of the native background background vegetative cover for the area has been established on all unpaved areas and aeas not covered by permanent structures, or b. Equavalent stabilization measures (such as riprap, gabions, or geotextiles) have been employed. What is described here is only relevant by definition on agricultural land. This is not agricultural land. This must be amended in order to comply with your permit.		Bristol believes that the use of coarse angular rock from the borrow source area meets the rip-rap requirement under Criteria b for the permanent stabilization of the excavations. The BMP description will be changed to say "placement of rock or "riprap" from the local borrow source A stabilization analysis was completed by Bristol Engineering Services Corporation and determined that the borrow pit material will provide adequate protection against erosion and therefore seeding is not needed. The analysis is included in the SWPPP.	D There are four classes of riprap recognized by the state of Alaska. The borrow source utilized at NE cape last year does not meet the specifications. Furthermore, this is typically used for bank or slope protection. It would have to be established prior to stabilization activities that the source can meet the specifications set forth in the Alaska Department of Transportation and Public Facilities *Standard Specifications for Highway Construction*, section 611 for Riprap. If the source does not meet these specifications, then the sites **must be seeded** for stabilization as prescribed in the permit.

REVIEW COMMENTS **PROJECT: Northeast Cape Remedial Action**
DOCUMENT: Storm Water Pollution Prevention Plan

U.S. ARMY CORPS OF ENGINEERS CEPOA-EN-ES-M	DATE: 10 JUNE 2011 REVIEWER: Teresa Lee PHONE: 907-753-2788	Action taken on comment by:

Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
9.	Appendix C	I notice a new permit was applied for. Why wasn't the previous permit simply extended and the SWPPP amended?		This is a new project under a new contract and therefore a new permit was applied for.	This is not a new project, nor a new contract. Rather a new task order, 007, was incorporated into the existing contract.
10.	Appendix C	Has an NOT been applied for the previous permit AKR100000? If so, what documentation is there that final stabilization has been attained?		A NOT has been received for the 2010 project and will be included in the 2010 NE Cape Final Report. Documentation includes the 2010 Final Report, the Photograph Log in the 2010 Final Report, on-site approval by the QAR in the field in 2010, and documentation in the Daily Quality Control Reports submitted to the USACE.	D I was the QAR in the field at the end of the field season in 2010. Final stabilization, as defined by the permit, for submittal of an NOT, had not been achieved.

REVIEW COMMENTS

PROJECT: NE Cape Remedial Actions (W911KB-06-D-0007)
DOCUMENT: Draft SWPPP, May 2011 Location: St. Lawrence Island, Alaska

U.S. ARMY CORPS OF ENGINEERS	DATE: 14 June 2011 REVIEWER: Aaron Shewman PHONE: 907.753.5558	Action taken on comment by:

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED/ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
1.	Page 3 Section 1.3	Capitalize "S" on Site 31. Add a description of mechanical soil screening and how the less than 2-inch fraction will be disposed off site and the greater than 2-inch fraction will be used as backfill in MOC excavations.		The "S" will be capitalized. The following text will be added: Whether materials will be screened will be determined by contaminants affecting the soil and by the soil type. PCB effected soil will not be screened. All PCB soil will be packaged for shipment and disposal offsite. Fine grained, POL affected, soil, such as, the dense silt found in much of the MOC area, will not go through the screen plant. An attempt to separate any coarse rock found in the dense silt, will be made by utilizing the excavators. The coarse grained soil affected with POL above the clean up level of 9,200 ppm will be screened. The screen plant separates grain size as 2" minus, 2" to 6", and 6" and greater. Only POL affected soil that is 2" minus and greater than 9,200 ppm will be packaged for shipment and disposal offsite.	A
2.	Page 5 Section 1.4.2	For consistency, please delete periods after each letter in MOC.		Periods will be deleted	A
3.	Page 5 Section 1.4.3	Delete "flows" because it is redundant.		"flows" will be deleted	A

U.S. ARMY CORPS OF ENGINEERS	DATE: 14 June 2011 REVIEWER: Aaron Shewman PHONE: 907.753.5558	Action taken on comment by:

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED/ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
4.	Page 6 Section 1.6.3	First sentence: the first letter of project should not be capitalized as used in this sentence.		The "P" in project will be changed to lower case	A
5.	Page 9 Section 1.12	Delete "Location" and insert "Vicinity". Realign second sentence with the left hand margin in this section.		"Location" will be replaced with "Vicinity" Sentence will be realigned	A
6.	Page 11 Section 2.2	Capitalize "Site 31" and "Sites 31 and 13"		"sites" will be capitalized in the suggested manner	A
7.	Page 12 Section 2.4.1	BMP Description: Change "temporally" to "temporarily".		"Temporally" will be changed "temporarily"	A
8.	Page 13 Section 2.4.2	BMP Description: insert "of" between "placement" and "material".		"of" will be inserted between "placement" and "material" in section 2.4.2 BMP description	A
9.	Page 14 Section 2.9.1	BMP Description: It states, "All entrances will consist of a rock pad for vehicles and…area." I believe only gravel pad will be used and no rock will be placed, but please clarify.		The sentence will be modified to state that the pad will consist of gravel and rocks minded from the borrow pit.	A
10.	Page 15 Section 2.10.1	Please insert a space between "5" and "foot".		A space will be placed between "5" and "foot"	A
11.	Page 21	Last paragraph, last sentence: Please modify to read, "If		Sentence will be modified as suggested	A

U.S. ARMY CORPS OF ENGINEERS	DATE: 14 June 2011 REVIEWER: Aaron Shewman PHONE: 907.753.5558	Action taken on comment by:

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED/ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
	Section b.	equipment is operating on, or adjacent to, waterways and has a petroleum leak that cannot be immediately repaired or controlled, as soon as the leak is discovered, the equipment will be removed from service until repairs can be made.			
12.	Page 22 Section a) 1.	Please change “or” to “and”.		“or” will be changed to “and”	A
13.	Page 23 Section 3.7.1	“Installation Schedule”: It states, “The stockpile must be covered after 14 days of non-use”. In my opinion, what is the purpose of covering stockpiles that are not used after 14 days? The requirement could also be 7 days, or not at all. The only stockpiled material on this project should be used as only backfill in MOC excavations. Stockpiled material should be free of POL and other contaminants. Only uncontrolled compaction is required during backfill placement, so moisture is not a major concern. If dust is produced, then a cover may be necessary. I am available to discuss this topic.		This section will be modified to state that the stockpile of soil below the cleanup level of 9.200 ppm will be very temporary and will not need to be covered due to the fact that it will be used to backfill at the MOC as the project progresses	A
14.	Figure 3	Will the westernmost AST footprint be removed pre- or post- impoundment construction? How will Hypalon liner be anchored outside the berm? How will sump be emptied for water treatment? What are the sources for “sand” and “rock”?		1. The Site 11 tank footprints will be removed prior to the impoundment construction. 2. The liner will be anchored outside of the berm with soil. 3. The sump will be emptied by a mechanized pump, and water will be put through a series of filtering and cleansing procedures prior to discharge. 4. Rock will come from the borrow pit. “Sand” will be clean soil from the surrounding area and Figure 3 will be modified to reflect this	On Figure 3, please add notes for items 1 through 4, then the response will be acceptable.

U.S. ARMY CORPS OF ENGINEERS	DATE: 14 June 2011 REVIEWER: Aaron Shewman PHONE: 907.753.5558	Action taken on comment by:

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED/ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
				change from sand to soil.	
15.					
16.		----- End of Comments ----			

REVIEW COMMENTS

PROJECT: NE Cape Remedial Actions (W911KB-06-D-0007)
DOCUMENT: Draft RA Work Plan, May 2011 Location: St. Lawrence Island, Alaska

U.S. ARMY CORPS OF ENGINEERS	DATE: 14 June 2011 REVIEWER: Aaron Shewman PHONE: 907.753.5558	Action taken on comment by:

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED/ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
Work Plan, Main Text					
1.	Page 11 4th and 5th bullets	Describe "processing". This bullet appears several times within the planning documents, not all of which are called out in these comments.		Processing for the PCB and arsenic soil will be removed from these bullets and other places in the Work Plan because no processing will occur. The PCB and arsenic soils will not be screened they will be directly placed in the bulk bags.	A
2.	Page 11 5th bullet	Please include background soil sampling for arsenic.		A bullet will be added for the collection of the background arsenic soil samples prior to excavation at Site 21	A
3.	Page 13 Second paragraph	Third sentence: Is the mass of POL-contaminated soil at the MOC the mass of soil greater than 9,200 mg/Kg DRO? Is it the mass of POL-contaminated soil that can be feasibly excavated due to the presence of groundwater? Please clarify.		A clarification will be included to state that this mass of POL-contaminated soil is what can be feasibly excavated due to the presence of groundwater and based on the UVOST data	A
4.	Page 15 Section 3.2.5	Second paragraph, second sentence: "…the middle drainage originates from a culvert which directs flow from Site 27…". I believe a more accurate statement would be "…the middle drainage originated from a culvert removed during 2010 that previously directed flow from Site 27…". Fourth paragraph, second sentence: consider modifying to read "These structures were cleaned and removed in 2010, and a portion of the associated culvert was removed and a cap was welded on the exposed culvert-end." Sixth paragraph, third sentence: consider modifying to read "The most heavily…below the former locations of two culverts that were located…"		These paragraphs will be rewritten to incorporate these text changes.	A

U.S. ARMY CORPS OF ENGINEERS	DATE: 14 June 2011 REVIEWER: Aaron Shewman PHONE: 907.753.5558	Action taken on comment by:

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5.	Page 16 Section 3.2.5	8th paragraph: delete the first sentence, "In 2010…Site 28" because it is redundant.		This section will be rewritten to eliminate the redundant text.	A
6.	Page 17 Section 4 4th and 5th bullets	Describe "processing".		Processing will be deleted. See response to Comment #1	A
7.	Page 17 Section 4 5th bullet	Please include background soil sampling for arsenic.		Background soil sampling for arsenic will be added	A
8.	Page 20 Section 4.1.4.3	First paragraph: add one sentence to the end of the paragraph, "Greater than 2-inch material will be used as backfill".		The section will be modified to incorporate this text	A
9.	Page 25 Section 4.3	Second paragraph, third and fourth sentences: Where in the planning docs is heavy equipment decon to be used when moving a crew from PCB excavation to a non-PCB excavation? Please refer to SOP BERS-05. Where will the decon area be located? How will rinsate water be collected and treated?		Excavators and any equipment exposed to contamination will be added to Section 4.3. The decon will be a dry decon with shovels, rakes and brushes. The deviation from the SOP will be noted in Section 4.3 and the SOP section of the QAPP.	A
10.	Page 28 Section 4.4	Sixth paragraph, last sentence: To avoid potential contradiction and redundancy, I recommend modifying this sentence to simply refer to Section 4.16 which includes a description of water treatment.		Sentence will be modified to incorporate this suggestion	A

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11.	Page 28 Last paragraph	Delete this paragraph because it is redundant.		Paragraph will be deleted	A
12.	Page 30	First paragraph, first sentence: Add “mechanical” after “The” but before “screen”. Second sentence: add “rock” between “to” and “screening” Fourth sentence: Where will berm material originate from? Please add a location to the document. Fifth sentence to end of paragraph: consider rewriting to “Prior to berm removal at the end of the project, the soil in the berm will be field screened to determine whether or not it is above 9,200 mg/Kg DRO cleanup level. Berm soil above 9,200 mg/Kg DRO will be disposed off site, and soil below 9,200 mg/Kg DRO will be used as backfill beneath at least 3 feet of backfill material from the borrow source located south of the MOC. The concrete pad will be swept clean at the end of the project, and sweepings will be placed in bulk bags for offsite disposal.” Second paragraph, third sentence: Consider rewriting to “Surveyors will maintain vertical and horizontal control for the POL excavations.” Fourth sentence: change “direct” to “guide”. Fifth sentence: insert “primarily” between “be” and “used” and delete “mostly”.		Sentence will be modified as suggested The text will be modified to state that the berm material will come from the borrow pit located south of the MOC. Sentence will be modified as suggested. A brief protocol based on EPA recommended methods for determining the presence of PCBs on smooth surfaces (e.g., concrete) (April 1991) will be added to this section. It will state that the samples will be collected from locations most likely to be exposed to PCBs (e.g., edge of floor drains, areas contacted by PCB contaminated soil, etc.). One sample per 250 square feet of exposed concrete will be collected. The sampler will brush the area to be sampled with a hand brush or push broom to remove any soil, sediment, dust or other non-concrete material from the sample location.	A

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				Bristol will measure and mark an area 10 cm x 10 cm square for the wipe test. The wipe will be analyzed by the field screening lab. Note if Bristol overwinters the berm will not be removed in 2011. Second paragraph, third sentence will be modified as suggested Fourth and Fifth Sentences will be changed as suggested	
13.	Page 31	First complete sentence: delete “the” before “Site 21”.		Sentence will be modified as suggested	A
14.	Page 31 Section 4.7	First sentence: Change “approval” to “concurrence”. Second sentence: “Insert “MOC” between “the” and “excavation” and delete “at the MOC”. Third sentence: Insert “overburden stockpiles and” between from” and “the”, and insert “south of the MOC” between “pit” and “will”.		Sentences will be modified as suggested	A
15.	Page 32 Section 4.8	Fourth paragraph, second sentence: Delete “A” and insert “An approximate”.		Sentence will be modified as suggested	A
16.	Page 33 Section 4.8	Please define biogenic chemical analysis.		Biogenic will be defined as natural organic material	A
17.	Page 36	First paragraph: Please add miscellaneous metal debris, and drum and drum liquids to the “laundry list”.		Paragraph will be modified as suggested	A

U.S. ARMY CORPS OF ENGINEERS	DATE: 14 June 2011 REVIEWER: Aaron Shewman PHONE: 907.753.5558	Action taken on comment by:

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED/ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
	Section 4.12.1				
18.	Page 38 Section 4.16	Third paragraph, second to last sentence: insert "that is below the DRO cleanup level of 9,200 mg/Kg DRO prior to being" between "confirmation" and released; delete "to be" in this sentence. Last sentence: insert "offsite" before "facility".		Paragraph and sentence will be modified as suggested	A
19.	Page 40 Section 4.17.2	Last sentence: Correct the table reference from 4-2 to 4-3.		Table reference will be corrected	A
20.	Page 42	7th bullet: no surface water samples will be collected from the MOC, so please delete "surface water and"		Bullet will be modified as suggested	A
21.	Page 49 Section 6.3	Fifth sentence. This sentence currently implies work will be occurring at Site 6. No work is planned at Site 6, so please clarify as necessary.		Sentence will be clarified to state supplies will be stored at Site 6 and two other work areas (camp area and mechanic shop area)	A
22.	Page 51 Section 7	Please add the Site 28 Tech Memo		A bullet stating that technical memorandum for the sediment/soil sampling at Site 28 will be submitted in October 2011 will be added.	A
23.	Figure 13	Please label the western, middle, and eastern drainages.		The Figure 4 from the SOW showing labels on the drainages will be added to the Work Plan	A
WMP					
1.	Table 1-1	Should "PCB-Contaminated Soil, >50 ppm PCBs" be added to this table to make it more complete? It appears POL-Liquids < 1000 ppm is accounted for, but not "pure" POL…		These suggestions will be included in Table 1-1 (i.e., PCB-contaminated soil > 50 ppm and pure POL)	A

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2.	Page 3 Section 1.4.2	First paragraph, third sentence: Please capitalize all letters of "CON-HTW"		CON-HTW will be corrected in capitalize letters	A
UFP-QAPP					
1.	General	Global change: "approve" should be "accept" as indicated in Section 5 of the SOW.		Approved will be changed to accepted where applicable.	A
2.	WS #2	Part 4: Please add dates of all "scoping sessions"		Dates will be added for March 10, April 13, and March 30 RAB meeting	A
3.	~~WS #2~~	~~Part 6: USACE has a valid ROE for this project, so please remove the landowner from this list.~~	W		
4.	WS #6	Fourth item listed under "Communication Drivers": Please add the COR to the people the QAR will consult when significant issues arise.		A line will be added stating: The on-site QAR will contact the COR when significant or undiscovered issues need to be addressed.	A
5.	WS #10 Page 33	First bullet on page: insert "background" after "natural", and delete the period and add "in the vicinity of Site 21." "The Environmental Questions Being Asked", third sentence: delete and replace with "Have all the arsenic contaminated soils not attributable to background conditions been removed?"		Background will be added to site 21 . Modified sentence to state: Have all the arsenic contaminated soils at Site 21not attributable to background conditions been removed?	A
6.	WS #10 Page 34	Last paragraph on page, last sentence: delete period and add "above 9.2%."		"above 9.2% RE" will be added to the sentence.	A
7.	WS #10 Page 35	Second paragraph, second sentence: Modify sentence to read "The roughly 4-foot wide wetland slopes southward for approximately 300 feet toward the Suqitughneq River."		The wetland is actually closer to 40 feet wide, will insert the last sentence of third paragraph as replacement for the second sentence in the	A

U.S. ARMY CORPS OF ENGINEERS	DATE: 14 June 2011 REVIEWER: Aaron Shewman PHONE: 907.753.5558	Action taken on comment by:

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		Fifth sentence: "The vegetation does not appear stressed, though petroleum contamination is evident when a person walks across the vegetative mat." Previously only a biogenic sheen was reported…what evidence of POL contamination exists as one walks across the veg mat? Please describe. Third paragraph: Delete the last sentence. Fourth paragraph, fourth sentence: was it "24" or "four"? Please clarify.		second paragraph. Added "odor" to sentence to state:. This vegetation does not appear stressed, though petroleum odor is evident when a person walks across the vegetative mat. It was 24, "four" will be deleted from the sentence.	
8.	WS #10 Page 36	First paragraph: For clarity, please add the cleanup levels for each COC. Second paragraph, first sentence: Delete "from" and insert "during 2010:" Also insert "and one" after "Site 8" and before "from".		Cleanup levels for 2-methylnaphthalene and DRO will be added to the paragraph. Sentence will be modified as suggested.	A
9.	WS #10 Page 39	Fourth paragraph, first sentence: Modify to read "Site 28 Drainage Basin has been investigated…" Insert the last paragraph of this section below the fourth paragraph. Fifth paragraph, third sentence: Please update Figure 13 to show the referenced data. Sixth paragraph, second sentence: Delete the second "total recoverable petroleum hydrocarbons"		Added Site 28 to sentence as suggested. Moved last paragraph of section as suggested. Figure 13 will be updated with historical information. TPH will be deleted.	A
10.	WS #10	First complete paragraph: Please explain the following statement, "No COCs were retained for the shallow		Sentence will be corrected: No VOC samples were collected in 2001 from the shallow wells	A

U.S. ARMY CORPS OF ENGINEERS	DATE: 14 June 2011 REVIEWER: Aaron Shewman PHONE: 907.753.5558	Action taken on comment by:

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED/ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
	Page 40	groundwater."		at the MOC.	
11.	WS #10 Page 42	Third bullet: change "in" to "from".		Change made.	A
12.	WS #11 Page 45	"What Type of Data are Needed" section, first sentence: Please insert "ADEC" between "USACE" and "and".		ADEC will be added to sentence as suggested.	A
13.	WS #11 Page 48	First complete paragraph: See previous comment on WS #10, Page 35 regarding the following statement - "This vegetation does not appear stressed, though…mat"		Added "odor" to sentence.	A
14.	WS#11 Page 49	Site 13 appears to be missing. Please insert a discussion regarding Site 13. Site 21 discussion: "In 2011…" please add background sampling prior to soil removal.		Added Section on Site 13.	A
15.	WS #11 Page 50	"When" section, Second sentence: Add background sampling.		Background sampling will be added.	A
16.	WS #11 Page 51	Partial sentence at top of page: add "potentially" between "and" and "impacted". Site 8 MNA Samples, third sentence: are these sediment or soil samples?		Added potentially to sentence. Changed to soil. Changed all references to soil at Site 8.	A
17.	WS #11 Page 52	Third paragraph, last sentence: Why not also use PID in accordance with BERS-01?		PIDs had not been useful in the past at NE Cape.	A
18.	WS #17	Sediment and Surface Soil at Site 28, sixth sentence: Correct typo of "form" to "from."		Corrected.	A

U.S. ARMY CORPS OF ENGINEERS	DATE: 14 June 2011 REVIEWER: Aaron Shewman PHONE: 907.753.5558	Action taken on comment by:

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED/ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
	Page 85				
19.	WS #17 Page 86	Bulk Waste Sampling Protocol, first sentence: The approach described in this sentence contradicts the approach described on WS #14, page 78. Please make consistent.		Modified first sentence to be consistent with WS #14 stating that bulk bags will be sampled from 2 locations within each bulk bag.	A
20.	WS #17 Page 88	"Sample Identification" section: Insert "project" before "location".		Project inserted before location.	A
21.	WS #30 Page 129	Last sentence: Consider changing "signify" to "indicate."		Changed signify to indicate.	A
22.	WS #37 Page 137	Last paragraph, first sentence: "Removal" should instead be "Remedial."		Changed removal to remedial	A
23.	Table 11-1	Some values show as "##", so print formatting should be changed. A total depth (bgs) of 0 feet is shown for "MOC floor and sidewalls of excavation area(s)". Perhaps "variable" would be a more accurate term since the value will change during excavation. This comment applies to all "Sample Locations" noted to be from "Floor and sidewalls of excavation area(s). "Point ID (Location ID)" column, "MOC, Floor and sidewalls of excavation area(s)" row: replace "go up" with "increase" "Site 28 Background": please clarify "Sample Location"		Will reformat Table 11-1 to fit all numbers. 'Variable' will be added Replaced "go up" with increase Site 28 Background section will be clarified to state: Twelve primary background samples will be	A

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Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED/ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
		information regarding transects and sample locations per transect. The SOW calls for a total of 12 samples.		collected from a nearby undisturbed location that does not show anthropogenic impact.	
24.	Table 11-2	Only nine (9) wells will be samples at the MOC, not 10. "Sampling Method/Tool": Not all wells can be sampled using the peristaltic pump. Recommend adding another sampling method for wells with depth to water greater than about 25 feet bgs.		Will correct to indicate only 9 wells will be sampled. Added centrifugal pump to Table 11-2.	A
25.	BERS-01	If a "gloved-hand" will be used to collect a soil sample, this method should be included in this SOP.		Gloved hand sampling will be removed from the Work Plan to be consistent with the SOP.	A
26.	BERS-05	Heavy Equipment Decontamination: Add other types of equipment to the list such as an excavator. The procedure described in this SOP should be referenced on Page 25, Section 4.3.		Excavators and any equipment exposed to contamination will be added to Section 4.3. The decon will be a dry decon with shovels, rakes and brushes. The deviation from the SOP will be noted in Section 4.3 and the SOP section of the QAPP.	A
SPCC Plan					
1.	Page 8 Section 4.2	Third sentence: Will a truck really be parked inside the containment berm on a 20-foot-long by 8-foot-wide flat bed truck? Or will the truck instead be parked on a ramp?		The statement will be clarified to state that the truck will be parked inside the containment berm on a 20-foot long by 8-foot wide flat.	A
2.		----- End of Comments ----			

REVIEW COMMENTS

PROJECT: NE Cape HTRW Remedial Actions W911KB-06-D-0007 Task Order 0007
DOCUMENT: Work Plan Rev 0 – May 2011 Location: St. Lawrence Island, Alaska

U.S. ARMY CORPS OF ENGINEERS	DATE: June 8, 2011 REVIEWER: Carey Cossaboom PHONE: 753-2689	Action taken on comment by:

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED/ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
1.	Pg. 12, 4th par.	Wording: See WORD Document with Tracked Changes.		Text changes will be made as suggested	A
2.	Pg. 14, Sec, 3.2.4, 1st par.	Wording: See WORD Document with Tracked Changes.		Text changes will be made as suggested	A
3.	Pg. 15, 1st par.	Wording: See WORD Document with Tracked Changes.		Text changes will be made as suggested	A
4.	Pg. 15, 1st par., last sen.	Per contract Mod 1, the background sampling will be conducted first. Results of the sampling will be discussed with USACE before initiating further soil from Site 21.		This additional text will be included in this section.	A
5.	Pg. 15, Sec. 3.2.5, 2nd par.	A better figure that shows these sites and drainages would be nice.		A figure will be added for this section to show the sites and drainages (e.g., Figure 4 from the SOW provided by the USACE)	A
6.	Pg. 15, Sec. 3.2.5, 3rd par.	A one sentence paragraph?		This sentence will be merged with the following paragraph	A
7.	Pg. 15, Sec. 3.2.5, 4th par.	1st sen – Middle drainage?	W	As stated in the Decision Document and observed in the field: The western drainage originates from a manhole and small concrete supporting structure just north of the perimeter access road, which emptied into an artificially created swale. The manhole likely served as the drain for Building 110 Heat and Electric Power	A
8.	Pg. 15, Sec. 3.2.5, last par.	In two places you've used the word elevated. That's ambiguous. Do they exceed cleanup levels? You fixed the 2001 elevated, but still use the ambiguous		The text in this paragraph will be changed to the following: Surface water samples were collected in the drainage basin in 1994, 1996, and 2001. Concentrations of DRO, total	~~D~~ A

U.S. ARMY CORPS OF ENGINEERS	DATE: June 8, 2011 REVIEWER: Carey Cossaboom PHONE: 753-2689	Action taken on comment by:

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED/ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
		term for the 1994 sampling event. What does elevated mean? It means nothing to me. Elevated above what? Elevated above background? Above cleanup levels?		recoverable petroleum hydrocarbons (TRPH), PCBs, and lead were elevated in 1994. Surface water samples collected in 2001 were analyzed for DRO, RRO, and PCBs. The samples were not analyzed for lead. DRO was detected at concentrations ranging from 0.39 to 2.3 mg/L, which is not above the ADEC Table C cleanup level. PCBs and RRO were not detected. Response 7/6/11- The highlighted text above was taken from the Scope of Work and the Decision Document. I do not have the 1994 results to know whether they are above cleanup levels. I will remove this text from the section.	
9.	Pg. 16, 2nd par.,	Where exactly is the culvert that was capped? I am still confused. Is this all the Western drainage? Or was the capping done on the Middle drainage? Was 91 feet all one culvert?		Text will be modified to include the following: The culvert was capped just at the north side of the perimeter road. Response 7/6/11- the text will be modified to state the following: In the western drainage a 12-inch corrugated metal pipe that was attached to a manhole and continued in a S-SW direction towards the MOC was removed in 2010. The concrete manhole structure was also removed in 2010. Approximately 63 feet of pipe was removed and the pipe was capped just north of the perimeter road at the head of the western drainage. The open end of the pipe that extended from the MOC was filled with bentonite and welded shut. Another 12-inch	~~D~~ A

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				corrugated metal pipe in the eastern drainage measuring approximately 32 feet in length was completely removed.	
10.	Pg. 16, last par.,	Wording: See WORD Document with Tracked Changes.		Text changes will be made as suggested	A
11.	Pg. 20, Sec. 4.1.4.1	Is the container storage area the same as the fuel storage area? Show on map.		A container area will be near the mechanic shop and on a pad at the southeast corner of the MOC but not with the fuel storage containment area . These locations will be added to the text and to Figure 3	A
12.	Pg. 20, Sec. 4.1.4.1	There should be some intermediary steps, unless the demobe landing craft is going all the way up to the MOC.		The text will be modified to include the following: Bags will be picked up by the loader and temporarily stored at the site where they were excavated. Then when time allows the bags are transported by the loader to the weigh station at Site 6. After being weighed and recorded the bags will be either stored at Site 6 until the demobilization phase or moved down to the Cargo Beach where they are placed on flats. There is not enough room on the beach to store all the bags and also the NALEMP program will be at the Site 3 which may prohibit temporarily having access to Cargo Beach.	A
13.	Pg. 20, Sec. 4.1.4.3, 1st par.,	1st two sen.: Separation alone does not decrease off-site shipments. This is unsatisfactory wording. You have to say that the coarser fraction will not be bagged for off-island disposal. And you should mention how you know this is a satisfactory procedure with regards to regulations.		The statement…"This will result in far less material being shipped offsite for disposal and therefore a cost savings" will be deleted. The following text will be included: The POL-	A

U.S. ARMY CORPS OF ENGINEERS	DATE: June 8, 2011 REVIEWER: Carey Cossaboom PHONE: 753-2689	Action taken on comment by:

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED/ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
				coarser material will be used as backfill in the POL excavation areas in accordance with ADEC Petroleum Hydrocarbon Cleanup for Oversize Material Technical Memorandum, which states: Rock material greater than two inches does not require remediation or testing, unless it has the potential to hold excessive amounts of contamination or contains visible petroleum product on the surface (surface stain).	
14.	Pg. 20, Sec. 4.1.4.3, 1st par.,	Wording: See WORD Document with Tracked Changes.		Text changes will be made as suggested	A
15.	Pg. 21, Sec. 4.1.4.4	Please identify the Alaska methods.		Method AK 102/103 will be included in this section	A
16.	Pg. 21, Sec. 4.1.4.7	The Quarry Agreement is not signed.		A signed quarry agreement has now been received and will be included in the final Work Plan submittal	A
17.	Pg. 24, Sec. 4.2, 2nd par.	Clean fill extracted from the pit should either be placed on a liner or the area below the stockpile should be tested for PCB's prior to placement.		The text will be modified to include the following: The area where the clean fill will be stockpiled will be screened for PCBs by the field laboratory. Then the soil will be placed on a liner and prior to being used as backfill the stockpile will be analyzed by the field laboratory for PCBs. Results will be discussed with the QAR prior to being used as backfill. After the stockpile and liner is removed the area will be screened again for PCBs by the field laboratory.	A

U.S. ARMY CORPS OF ENGINEERS	DATE: June 8, 2011 REVIEWER: Carey Cossaboom PHONE: 753-2689	Action taken on comment by:

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18.	Pg. 25, top par.	Does the plus 2-inch fraction have to be tested? Why or why not?		The following text will be included in this section: According to the ADEC Technical Memorandum for Petroleum Hydrocarbon Cleanup for Oversize Material (September 2005) "rock material greater than two inches does not require remediation or testing, unless it has the potential to hold excessive amounts of contamination or contains visible product on the surface (surface stain)".	A
19.	Pg. 25, Sec. 4.3, 1st par.	This is the first mention of removal of the concrete foundations. Is it being removed because of the PCBs or the POL? I think you mention later it will be used for backfill. Would it need to be tested first?		Bristol anticipates that to clean-up the POL-contamination at Site 13 the concrete foundations will need to be removed. Testing of the concrete will be done by a wipe test and analyzed by the field laboratory for PCB contamination prior to being used for backfill. A brief protocol based on EPA recommended methods for determining the presence of PCBs on smooth surfaces (e.g., concrete) (April 1991) will be added to this section. It will state that the samples will be collected from locations most likely to be exposed to PCBs (e.g., edge of floor drains, areas contacted by PCB contaminated soil, etc.). One sample per 250 square feet of exposed concrete will be collected. The sampler will brush the area to be sampled with a hand brush or push broom to	A

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				remove any soil, sediment, dust or other non-concrete material from the sample location. Bristol will measure and mark an area 10 cm x 10 cm square for the wipe test. The wipe will be analyzed by the field screening lab. Results will be discussed with the QAR prior to using the concrete as backfill. Note: If the concrete cannot be used as backfill it will become part of the tonnage requirements of the SOW or will require a contract modification to cover the costs of transportation and disposal.	
20.	Pg. 26, last par.	Wording: See WORD Document with Tracked Changes.		Text changes will be made as suggested	A
21.	Pg. 27, Sec. 4.3.2	Regarding Figure 5: Several of the areas you indicate will be excavated should be tested before excavation because it seems likely that they may not exceed cleanup levels. These areas are: 1) Samples 101-107; 2) Samples 82-88; 3) Sample 89; 4) Samples 119-121, and 5) Samples 133-136.		All these areas will be field screened prior to excavating	A
22.	Pg. 30, 2nd par.	See comment # 19		See response to comment #19	A
23.	Figure 5	Legend Item "Previous Samples" – Did these come out less than 1 ppm PCB? Please indicate if so. Since these were 2005 samples, they were at a higher elevation. That should be noted somehow.		The 2005 samples ranged from 1.53-7.09 and are above the PCB cleanup level and will be noted on the figure. Response 7/6/11: This information will be included on Figure 5 and in the text.	~~D~~ A
		----- End of Comments ----			

U.S. ARMY CORPS OF ENGINEERS	DATE: June 8, 2011 REVIEWER: Carey Cossaboom PHONE: 753-2689	Action taken on comment by:

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED/ADEC RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)

PROJECT: Northeast Cape **DOCUMENT:** Draft Remedial Actions Work Plant , May 2011
REVIEW COMMENTS **LOCATION:** Northeast Cape Installation, St. Lawrence Island, Alaska
DATE: 06/08/2011 **REVIEWER:** R. J. Scrudato **PHONE:** 8455982413

1.	5	Speculative characterization on the depth and lateral extent of permafrost. Little to no data on role of channeling within permafrost and transport of contaminants within the permafrost		Comment acknowledged
2.	7	Fox lived in the Site 7 landfill; are they still using the landfill for dens?		No fox dens were observed in 2010 at Site 7
3.	11	MNA procedures need to be defined. Type of sampling, frequency, methods?? Island residents need to know that MNA includes all forms of contaminant reductions including dilution and relative sorption affects.		Section 4.9 describes the Site 8 natural attenuation monitoring and Section 4.10 describes the MNA parameters that will be monitored in the groundwater wells at the MOC.

PROJECT: Northeast Cape **DOCUMENT:** Draft Remedial Actions Work Plant , May 2011
REVIEW COMMENTS **LOCATION:** Northeast Cape Installation, St. Lawrence Island, Alaska
DATE: 06/08/2011 **REVIEWER:** R. J. Scrudato **PHONE:** 8455982413

4.	12	Include PAH contam. locations including concentrations and specific PAHs. Iso-concentration depictions would be helpful in understanding the distribution of the PAHs.		*The following PAH information from Site 8 is included in the 2010 Final Report and will be included in the Work Plan:* From the middle decision unit (MDU) Soil concentrations of 2-Methylnaphthalene exceeded ADEC soil cleanup levels in field duplicate samples 10NC08SB02 and 10NC08SB03, with concentrations of 7,500 µg/kg and 7,600 µg/kg, respectively. –SBO03 had a reportable concentration of fluorene at 820 ug/kg, which exceeded the 800 ug/kg cleanup level. Sample -SB02 had a fluorene concentration of 630 ug/kg
	13	The Phase 1 in-situ Chemical Oxidation failed because it was poorly planned, managed, poorly executed and conducted in an environment (peat deposits) and contaminated groundwater channeling within the peat deposits.		Comment acknowledged
	13	The contaminated groundwater in the southern areas of the MOC will continue to provide contaminants to the down gradient regions of the NEC including the Suqi drainage (stream and Estuary including associated marsh areas. End results-- the areas that have been remediated and are to be remediated during the 2011 field season will be re-contaminated as the contaminated groundwater migrates through the southern regions of the MOC as well the downgradient marsh areas of the NEC. The sources of the contaminants need to be addressed to prevent continuing contamination of the southern areas of the MOC and northern regions of the NEC.		Comment acknowledged
	14	What MNA results? (3.2.2)		*The following information is provided in the 2010 Final Report and will be summarized in Section 3.2.2:* MW 88-4, 88-5 and 88-10 had the lowest DO concentrations. Of these, the two wells with the highest concentrations of DRO, MWs 88-4 and 88-5, contained the highest concentrations of ferrous iron (21.4 mg/L and 45.5 mg/L), alkalinity (120 mg/L and 80 mg/L), and methane (2,100 µg/L and 99 µg/L), metabolic byproducts of microbial respiration. The wells with the highest contaminant concentrations had comparatively low DO, suggesting that aerobic microbial respiration and degradation of DRO has occurred, depleting DO concentrations. The high ferrous iron, alkalinity and methane suggest that degradation of DRO is occurring through anaerobic degradation, which is much slower than aerobic degradation. The high concentrations of methane in monitoring wells 88-4 and 88-5 indicate that in the absence of oxygen, methanogenic respiration has become energetically favorable and anaerobic degradation of DRO by methanogenic microbes may be occurring.
	14	Site 13 contamination MAY be removed? What are the criteria being assessed to determine whether this site will be remediated? Note: I believe Ron's comment refers to Page 13, 4th par._CCC		Site 13 is one area at the MOC that has been shown to contain DRO contamination above the regulatory cleanup levels by the 2010 UVOST investigation. Bristol is scoped to remove 4,500 tons of POL contaminated soil from the MOC in 2010 and therefore this area may or may not be excavated in 2010 but will most likely be excavated when additional POL-contaminated soil is approved to be removed by the USACE in 2011 or 2012.
	35	What if MNA monitoring of the groundwater does not show any decrease of the monitored groundwater over the monitoring period? If MNA does not demonstrate significant decreases in contaminants of concern, are there alternatives under consideration?		Comment acknowledged and will be considered by the USACE after several years of MNA monitoring occurs and results are evaluated.

PROJECT: Northeast Cape	**DOCUMENT:** Draft Remedial Actions Work Plant , May 2011	
REVIEW COMMENTS	**LOCATION:** Northeast Cape Installation, St. Lawrence Island, Alaska	
DATE: 06/08/2011	**REVIEWER:** R. J. Scrudato	**PHONE:** 8455982413

Note from Bristol: No land farming will occur at NE Cape in 2011.

I wanted to also include comments on the potential Land Farming (LF) of the more northern regions of the MOC. Soils within the three large fuel storage tanks is primarily composed of fill material. What other areas (sites) are under consideration to be included in the LF approach? I would like to review the proposed Land Farm approach, including site characterization of the areas to be excavated, including the monitoring plan(s) to determine whether the LF process results in reductions in contaminants of concern (COCs) and whether the reductions are related to degradation and not to volatile or runoff losses of the COCs. Monitoring should therefore include air monitoring of select COCs to determine whether the monitoring differences are attributed to degradation of the COCs or through volatile and/or runoff losses.

If the soils to be included in the LF process contain significant concentrations of ferrous iron and low concentrations of organic material, the LF approach will be significantly enhanced and actually result in degradation of the COCs by using low concentrations of H202 spread and mixed with the treated soils to affect oxidation and to provide the aerobic bacteria a source of oxygen due to the degradation of the H202 to O2.

If the soils to be LF are relatively coarse (sand/silt) and contain relatively low concentrations of organic material (TOC), peroxide additions (~3-5%), dependent on organic concentrations,) may be an alternative to the standard LF approach. If iron is required to affect Fenton Reactions, the solid ferrous iron can be mixed into the excavated soils as the material is being relocated and deposited in the selected site(s). This approach will enhance contaminant degradation due to chemical oxidation, be a source of oxygen for aerobes and enhance the overall degradation of the COCs rather than placing reliance on aerobes in the low temperature soils and minimize volatilization of the COCs.

REVIEW COMMENTS **PROJECT: NE Cape HTRW RA**
DOCUMENT: Workplan/ QAPP

U.S. ARMY CORPS OF ENGINEERS CEPOA-EN-ES-M	DATE: 15 June 2011 REVIEWER: Teresa Lee PHONE: 907-753-2788	Action taken on comment by:

Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
1.	Workplan Section 1.0 page 2 1st bullet Section 3.1 and 4.0 2nd to last bullet	Reference is made to revegetation or stabilization according to the SWPPP. There is no mention of revegetation in the SWPPP and the stabilization methods noted are not in compliance for final stabilization according to the NOI permit.		The permanent stabilization measures for the excavations will be done using clean borrow pit material that is coarse angular rock (rip-rap). The borrow pit material will cover any clean overburden from the MOC that is also used to backfill excavations at the MOC. This measure is in compliance with the NOI permit. Reference to revegetation in the Work Plan will be deleted. A stabilization analysis was completed by Bristol Engineering Services Corporation and determined that the borrow pit material will provide adequate protection against erosion and therefore seeding is not needed. The analysis is included in the SWPPP.	D There are four classes of riprap recognized by the state of Alaska. The borrow source utilized at NE cape last year does not meet the specifications. Furthermore, this is typically used for bank or slope protection. It would have to be established prior to stabilization activities that the source can meet the specifications set forth in the Alaska Department of Transportation and Public Facilities *Standard Specifications for Highway Construction*, section 611 for Riprap. If the source does not meet these specifications, then the sites **must be seeded** for stabilization as prescribed in the permit.

REVIEW COMMENTS **PROJECT: NE Cape HTRW RA**
DOCUMENT: Workplan/ QAPP

U.S. ARMY CORPS OF ENGINEERS CEPOA-EN-ES-M	DATE: 15 June 2011 REVIEWER: Teresa Lee PHONE: 907-753-2788	Action taken on comment by:

Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
2.	Workplan Section 1.0 page 2 1st bullet Section 3.1 2nd to last bullet	The RA report also requires data review as described in the SOW.		Data review will be added to the text of the referenced bullets.	A
3.	Workplan Section 3.2 Figure 3	It states that figure 3 has an overview of the work sites, however, all the sites listed above are not indicated on figure 3. This appears to be last years figure. Please amend.		The spilled roofing tar area south of the MOC will be added to the map. The other 2011 work sites are shown on Figure 3.	A

REVIEW COMMENTS **PROJECT: NE Cape HTRW RA**
DOCUMENT: Workplan/ QAPP

U.S. ARMY CORPS OF ENGINEERS CEPOA-EN-ES-M	DATE: 15 June 2011 REVIEWER: Teresa Lee PHONE: 907-753-2788	Action taken on comment by:

Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
4.	Work plan Section 4.2	In paragraph 2, reference is made to the excavation and field screening locations being determined by analytical composite samples and field laboratory results. The 2010 SAP stated that composite samples that were above limits would have analysis run on the individual discrete samples that comprised the composite sample. This did not occur. As such, how do you plan to locate the contaminated areas. The entire area that comprised the grid cannot be assumed contaminated. Has a figure been supplied to the USACE indicating final field sampling results for these sights?		Please note that the price proposal associated with the contract modification (P0005) for the additional 800 tons of PCB contaminated soil from Sites 13 and 31 in 2010 did not include the analyses of discrete samples. All sample locations at Sites 13 and 31 have been surveyed and areas to be field screened and/or excavated are shown in revised Figures 4 and 5 (see attachment) in the Work Plan.	D The funding for confirmation analyticals was included in the line item for soil excavations of the original contract. Figures 4 and 5 supplied still indicate excavation prior to field screening in some areas. I believe that due to the lack of the ability to pinpoint areas of contamination due to the discrete samples of the composite groups not having been analyzed as prescribed, field screening prior to any excavation in all areas of site 13 and 31 is warranted.

U.S. ARMY CORPS OF ENGINEERS CEPOA-EN-ES-M	DATE: 15 June 2011 REVIEWER: Teresa Lee PHONE: 907-753-2788	Action taken on comment by:

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5.	Work plan Section 4.3 SWPP	Regrading surface runoff, what does this involve? What BMPs will be utilized to achieve this? There is no discussion of this in the SWPPP. No site map indicating proposed location.		The regrading above Site 31 is a BMP to divert the natural runoff upgradient of Site 31. It will occur in a fairly flat sloped area. This will help reduce the amount of flooding of the PCB excavation at Site 31. The regrading will consist of a shallow ditch dug with a road grader that will be less than 100' long in an area to be determined based on the current natural runoff patterns.	A
6.	Work plan Section 4.3.1 Section 4.3.2	The last paragraph refers to figure 4 and 5 for proposed field screening areas versus those that will be initially excavated due to composite sampling results. I restate, 2010 composite samples did not have individual discrete sample analysis performed as stipulated in the approved SAP. In addition, there are composite groups within site 31 that are not even contiguous (another unapproved plan deviation). As such, the entire composite group cannot be assumed to be above regulatory limits. Due to this, it seems that field screening should be performed in these areas prior to excavation to pinpoint those areas within the composite grid where contamination remains. As for those areas where confirmation composite samples came back below regulatory limits, why are these being field screened?		Please note that the price proposal associated with the contract modification (P0005) for the additional 800 tons of PCB contaminated soil from Sites 13 and 31 in 2010 did not include the analyses of discrete samples. Field screening will be performed at Sites 31 and 13 as shown on Figs. 4 and 5. Field screening will occur prior to excavation to pinpoint those areas within the composite grids where contamination remains as shown on Figure 5 for Site 31. Field screening will also confirm that those confirmation composite samples that were below the regulatory limit in 2010 are still below in 2011 prior to collecting confirmation samples at Sites 13 and 31.	A
7.	Work plan Section 4.4	Paragraph 2 states that the 2010 NE Cape Final Report is in appendix E. It is not.		The 2010 NE Cape Final Report will be included in Appendix E	A

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DOCUMENT: Workplan/ QAPP

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8.	Work Plan Section 4.7	The stabilization measures noted are not adequate. This is defined as: all soil disturbing activities at the site have been completed and either of the 2 following criteria are met: a. A uniform perennial vegetative cover with a density of 70 percent of the native background background vegetative cover for the area has been established on all unpaved areas and aeas not covered by permanent structures, or b. Equavalent stabilization measures (such as riprap, gabions, or geotextiles) have been employed. What is described here is only relevant by definition on agricultural land. This is not agricultural land. This must be amended.		The permanent stabilization measures for the excavations will be done using clean borrow pit material that is coarse angular rock (e.g., rip-rap). The borrow pit material will be used to stabilize and cover any of clean overburden from the MOC that is also used to backfill excavations at the MOC. This measures is compliant with Criteria b. The excavation areas are on former gravel pads where there is no native background vegetation cover. A stabilization analysis was completed by Bristol Engineering Services Corporation and determined that the borrow pit material will provide adequate protection against erosion and therefore seeding is not needed. The analysis is included in the SWPPP.	D There are four classes of riprap recognized by the state of Alaska. The borrow source utilized at NE cape last year does not meet the specifications. Furthermore, this is typically used for bank or slope protection. It would have to be established prior to stabilization activities that the source can meet the specifications set forth in the Alaska Department of Transportation and Public Facilities *Standard Specifications for Highway Construction*, section 611 for Riprap. If the source does not meet these specifications, then the sites **must be seeded** for stabilization as prescribed in the permit.

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9.	Work Plan Section 4.8	Samples for TOC analysis must be taken in areas without contaminants of an organic nature. How will this be accomplished? How will the differing soil types within the site be established?		Soil/sediment samples will be collected from a drainage(s) similar to Site 28 that do not exhibit the presence of POL and outside the area of impact from the NE Cape site. The drainages selected will have similar topography and vegetation to Site 28. Two locations have been proposed and will be confirmed with the on-site QAR. The background soil types will be sediments of similar character to Site 28. Samples will be collected in accordance with ADEC Tech Memo 08-002. The results will not be used to determine alternative site cleanup levels with ADEC Method 3 or 4 calculators. Site specific cleanup levels are presented in the 2009 NE Cape Decision Document.	A
10.	Work Plan 4.2	It is stated in multiple areas that presumed clean soils excavated would not be placed on a liner. ADEC guidance and regulations require that soils presumed to be clean during excavation need to be placed on a liner. Confirmation sampling should be conducted to confirm the stockpile is clean prior to backfilling backfill. There are multiple places within this work plan that state that no liner will be used. Last year presumed clean stockpiles were found to be contaminated.		Temporary stockpiles of overburden below the regulatory cleanup levels will be placed on liners. Confirmation sampling of the stockpile to confirm that the stockpile is clean prior to backfilling will occur according to Table 2A in the 2010 ADEC Draft Field Sampling Guidance	A
11.	QAPP wks #1	Why is a document control number not required? This is how revisions are documented.		A document control number (revision with date) will be placed on all future submittals to differentiate versions.	A

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12.	QAPP Wks #2	There are multiple QAPPs and SAPs written for previous site work. Please list those here.		2010-SAP/QAPP for 2010 FUDS No. F10AK096993_07.04_0503_p 2009-SAP/QAPP for 2009 ISCO F10AK096905_07.04_0501_a Will be added to WS#2. Previous SAP/QAPPs from other contractors were not supplied as GFM.	A
13.	QAPP wks #5	The organization chart in the QAPP does not match the one in the figures section.		The organization chart from QAPP WS#5 will be substituted for the organization chart (Figure 17) in the work plan.	A
14.	QAPP wks #6	Limit of Quantitation shall be reviewed to determine if any non-detect results exceed the LOQ specified in the QAPP. Who will be conducting this review? Where QAPP-specified LOQs are exceeded, the USACE project chemist will be contacted to assess data usability as it pertains to the project. Who will be responsible for supplying the USACE project chemist with this information? If usability is significantly impacted, corrective actions must be taken, including possible recollection of impacted samples.		A row will be added to WS#6 noting that the communication driver is elevated non-detect LOQs, responsible entity is Bristol (Marty Hannah) and the procedure will be notification of elevated LOQs via email with a table highlighting elevated LOQs. The table will be preliminary until data verification is complete. Corrective actions may be taken if the LOQ is above site specific cleanup levels.	A
15.	QAPP wks #8	Where is ATV training ?		Only side by side UTVs will be used on the project, which does not require training.	
16.	QAPP Wks #10	Classes of contaminants and the affected matrices All COCs are not listed.		BTEX, GRO and RRO will be added to WS #10.	A
17.	Table 11-1	Sampling frequency for QC samples should not be “once”. Pleas indicate the appropriate frequency for the collection of field duplicates and MS/MSDs.		Tables 11-1 and 11-2 will be modified to state that field duplicates will be submitted at a 10% or greater frequency and MS/MSD samples will be included with each extraction batch.	A

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18.	Table 11-1 Site 21 MOC Tar Removal MOC	The sampling frequency is not adequate. Please see table 2b of the ADEC Field Sampling Guidance and amend accordingly. Subsequently, amend sample totals. In addition, there is no reference to field screening frequency. Please consult table 2a of the ADEC Field Sampling Guidance and incorporate accordingly. Include field screening QC samples. Also, please add methods utilized.		Bristol believes the sampling frequency for the MOC and MOC Tar Removal are correct. The Site 21 arsenic frequency will be restated as two samples for the first 250 square feet plus one for each additional 250 square feet or portion thereof. Methods are listed in WS#12 and WS#15. WS#15 lists both extraction and analytical methods.	D In section 1.1 of the SOW it states that the contractor shall perform the work identified in accordance with the ADEC Field Sampling Guidance. As such, the present frequency is not sufficient. To be more specific, the requirements for the frequency of sampling at excavation sidewalls does not seem to be factored. The excavation sidewalls should be sampled with a minimum of 1 per 20 linear feet. Can we find a way to incorporate this necessary sampling location with an alternate frequency into this table somehow?

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19.	Table 11-1 Site 28	Missing analysis for GRO. Does not require full suite of VOCs, just BTEX. The sample numbers say ## instead of the amount. The SOW says 10 transects with 7 samples each, the table states 7 transects of 10. Some field duplicates have 21, some 23. Why? The field depth states that the depth locations will be based on field observations, however, the SOW details at what depth the samples will be taken. Your sampling method and tool is a spoon. How are you going to dig a foot and a half in tundra with just a spoon? That may take a while…Your MS/MSD is way higher than it needs to be also varying from one analysis to another. The trip blank needs to be analyzed and be in accompaniment of GRO and BTEX.		GRO and BTEX will be added to Table 11-1. Table 11-1 will be corrected stating 10 transects with 7 locations per transect. The field duplicates will be corrected to all being 21 duplicates. The additional QC for background sampling was included in the QC sample count. Sample depth will be changed to 0.5, 1.0 and 1.5 feet bgs as stated in the SOW. T-handled sampler and shovel will be added to sampling method. MS/MSD counts will be corrected throughout Table 11-1. The trip blank count will be adjusted and the rationale will state that trip blanks will be included in all coolers containing GRO and BTEX.	A

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20.	Table 11-1 Site 31	Please indicate field screening frequency. Include QC samples associated with field screening. This is a composite sample, not a grab sample. A one time frequency may not be sufficient, this would be dependant on the size of the excavation, indicate grid size for sampling. It states that up to 9 contiguous samples "may" be collected. May? May not be collected? May not be contiguous? What does this mean? Indicate the need for discrete sampling of individual samples if composite is above limits. This was not performed as indicated in the work plan last year. Why is there more MS/MSD samples than duplicates?		Discrete PCB field screen samples will be collected for each 25 square feet of excavation or 5 linear feet of sidewall and will be repeated until results indicate that all excavation areas have potentially reached cleanup goals. Extraction blanks and LCS/LCSD accuracy and precision are the field screening QC. ADEC Field Sampling Guidance does not state any QC requirements for field screening, nor does the SOW. Table 11-1, Site 31 states that up to 9 contiguous grab samples may be collected and composited at the laboratory. The reason they are listed as grab samples is in the event that the sample results fail the 1/n quantitation, the grab samples that made up the composite will be analyzed as discrete samples. The 1/n rationale is stated in WS #11 (HOW), under the POL and PCB Confirmation Samples. WS#11 How and Table 11-1 will be restated that grab samples will be collected for every 25 sq feet of excavation floors and per 5 linear feet of side and "may" be composited at the laboratory. The rationale for "may" is in the event that field screening results indicated cleanup levels have potentially been achieved but still above 0.11 that composites may have fewer than 9 samples or possibly submitted as discrete samples if field screening results are above 0.5 mg/Kg. The analysis of discrete samples within composite samples on the add'l 800 tons of PCB-contaminated soil in 2010 from Sites 13 and 31 were not incorporated in the price proposal for the P00005 contract modification. Field duplicates are collected at a frequency of one sample per 10 primary samples, MS/MSDs are collected and submitted at a frequency of one set per extraction batch. Extraction batches of less than 20 samples still require MS/MSDs. The sample count is MS+MSD=2	A

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21.	Table 11-1 Site 13	Please indicate field screening frequency. Include QC samples associated with field screening. A one time frequency may not be sufficient, this would be dependant on the size of the excavation, indicate grid size for sampling. It states that up to 9 contiguous samples "may" be collected. May? May not be collected? May not be contiguous? What does this mean? Indicate the need for discrete sampling of individual samples if composite is above limits. This was not performed as indicated in the work plan last year. Why is there more MS/MSD samples than duplicates?		Please see responses to Item 20. .	A
22.	Table 11-1	Missing Site 21 background sampling.		Site 21 background sampling will be added to Table 11-1 and WS#11.	A
23.	Table 11-1	MS/MSD collection quantities are off throughout.		MS/MSD counts will be corrected throughout Table 11-1.	A
24.	Table 11-1	Multiple areas where the sample number is depicted as ##		Table 11-1 columns will have widths adjusted to remove ## and show actual sample quantities.	A
25.	Table 11-2	Include QC sample frequency. "Once" is not a frequency. MS/MSD sample numbers are off throughout.		QC frequency will be corrected to indicate one duplicate for up to 10 primary samples. And MS/MSD counts will be corrected throughout Table 11-2.	A

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26.	Table 11-2 MNA Decision Units Site 8	What will be used to collect the sample?		Peristaltic pump will be added as sampling method to WS#11 and Table 11-2. Peristaltic pump was used in 2010.	A
27.	Table 11-2	Include well id numbers for MOC wells. Also, only BTEX is required, not the full suite of VOCs, please amend.		Well IDs will be added to Table 11-2 and analytical suite for the MOC wells be modified for BTEX only.	A
28.		Why does it jump from table 11 to table 15?		The formatting rationale is Tables 11-1 and 11-2 are in WS#11 and Tables 15-1 and 15-2 are in WS#15.	A
29.	Table 15-2	Table 11-2 indicates PCB analysis, PCB analysis is not included in this table. Only BTEX analysis is required, hence the contaminants that have LOQs above the cleanup levels is not an issue.		PCBs will be added to Table 15-2. VOCs will be modified to only include BTEX.	A
30.	Table 15-1	DOD QSM requires that the LOQ be 2 times below the action level. There are several VOCs that do not meet this criteria, however, only BTEX analysis is required hence no variance request is required.		Thank You. VOCs will only include BTEX as target analytes.	A
31.	Wks #11				
32.	QAPP wks #11	In the "How much data is needed section?" section, please reference 2b of the ADEC Field Sampling Guidance for further clarification in relation to confirmation sampling.		Will include reference to ADEC May 2010 Draft Field Sampling Guidance in WS#11, "How much data is needed" section.	A

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33.	QAPP wks #11	The surface soil sampling frequency for confirmation sampling in excavations is not in compliance with ADEC Field Sampling guidance. Compliance with this document is required by the SOW. Please amend throughout the "how" section and applicable tables.		Will correct WS#11 and other sampling references to be in compliance with ADEC Draft Field Sampling Guidance (May 2010).	A
34.	QAPP wks #11	Where applicable, reference figures for sample locations and general locations.		Will reference figures when describing sample locations.	A
35.	QAPP wks #11	All data to be archived must be presented in accordance with the Manual for Electronic Deliverables and all digital documents shall be FIIP compliant .		Will state reports and all documents will be MED compliant in 'How will the data be reported" and How will the data be archived" sections of WS#11.	A
36.	QAPP wks #12	Throughout: for Blanks, add >1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). For common laboratory contaminants, no analytes detected above LOD.		Will include it in WS#12. It is also stated in WS#37 under usability assessment.	A
37.	QAPP wks #12	Throughout: Add rows for DQI sample handling to include temp and hold times.		Will include temperature and holding times in WS#12.	A
38.	QAPP wks #12	Missing metals in the soils section.		Will correct analytical group to metals in WS#12-7. WS#12-7 has metals DQIs, the analytical group was incorrect.	A
39.	QAPP wks #14 table 1	What are the proposed sample locations for these areas?		References to figures will be added to tables 11-1 and 11-2. There is no table 1 in the QAPP.	A

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40.	QAPP wks #14 table 1	The DOD QSM requires that MS/MSD samples are to be submitted for each laboratory preparation batch, for each matrix, and each analyte to be analysed. Depending on how your samples are put into coolers, this may exceed the 5 percent frequency stated. Please account for this in the sampling description for MS and MSD.		The inclusion of MS/MSD samples in each preparation/extraction batch will be included in Tables 11-1 and 11-2 under Sampling Rationale column.	A
41.	QAPP wks #14	Laboratory needs to abide by the DOD QSM as well.		Will state that laboratory must abide by DOD QSM under Analysis Tasks.	A
42.	QAPP wks #14	In data management tasks, indicate that report and EDDs will be provided after data verification and review. EDDs will be error free. Who will these items be provided to?		Will state that lab reports and EDDs will be provided after data verifications, EDDs will be error free and full reports and EDDs will be provided in Supplemental Data. Can we also state that hardcopies of samples results and QC summaries will be provided to the USACE Chemist with the final report? That is how lab data has been provided in the past.	The hardcopies of samples results and QC summaries may be provided to the USACE Chemist with the final report. However the USACE Chemist would still like to receive the EDDs within 14 days of contractor's receipt of the complete chemical analytical data as specified n the SOW.
43.	QAPP wks #14	The statement of work requires that much more information is included in the field book than is indicated here. Please indicate all information required to be entered into the field book.		A section will be added to Documentation and Records that includes Field Log/Sampling Book entries as stated in Section 4.4.6 of the SOW.	A

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44.	QAPP wks #14	The scope of work requires that data verification and review be performed as well as the completion of ADEC checksheets for each sample delivery group. Will AECOM be performing all of these tasks or a portion?		WS#14 "Data Review Tasks" will be re-stated to indicate that Bristol will complete ADEC checklists upon receipt of final reports and AECOM will perform data verification tasks after receiving all final reports for the 2011 field season.	A
45.	QAPP Wks #19	Please see ADEC Field Sampling Guidance Appendix E and add missing information such as TLC/TLS where applicable.		Will add TLC and TLS to WS#19 Container Size/type	A
46.	QAPP wks #19	Where is the ADEC/ELAP certification for the laboratory methods proposed for this laboratory?		ADEC and ELAP certifications are provided in Attachment 3 of the QAPP (end of Attachment 3 after QAM).	Found it. Thank You!
47.	QAPP Wks #22	All field screening lab equipment needs to be added to this list.		Will add lab equipment to WS#22.	A
48.	QAPP wks #27	Peristaltic pumps are not the preferred method for the collection of groundwater samples for volatile analysis.		Peristaltic pumps were used for sampling the groundwater wells at the MOC in 2010 and use in 2011 would maintain consistent methodology. However, Bristol will use a submersible pump for low-flow sampling if desired by the USACE. A peristaltic pump will be used where potential casing distortion from frost heaving preclude the use of the larger diameter submersible pump.	

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49.	QAPP wks #27	The following should be added to the laboratory sample custody procedures: Samples will be received in the laboratory in accordance with DOD QSM V 4.1 A cooler receipt form shall be prepared for each cooler of samples received by the project laboratory and will contain at a minimum; chain of custody (COC), signed custody seals, laboratory documentation of sample receipt, to include any discrepancies. The analytical laboratory shall e-mail a copy of the cooler receipt form to receipt.cooler@usace.army.mill within 24 hours of delivery of each sample data group. Please add this contractually required communication pathway to the worksheet.		Item #41 (WS#14) will be re-iterated in WS#27 that samples will be received in accordance with QSM 4.1 requirements. Cooler receipt form emailed to USACE is also stated in WS#6 (Communication Pathways) and will be re-iterated in WS#27.	A
50.	QAPP wks #28	For Blanks, add >1/10 the amount measured in any sample or 1/10 the regulatory limit (whichever is greater). For common laboratory contaminants, no analytes detected above LOD.		Will re-state the method blank corrective action to include reference to regulatory limit. The 1/10 amount is also stated in WS#37 under data qualifiers. It was also be included in all worksheets in WS#12.	A
51.	QAPP wks #28	Field duplicates are to be run at a minimum of 10 percent per *analytical group* per matrix.		Will include "per analytical group" under field duplicate frequency.	A
52.	QAPP wks #28	The method/SOP QC Acceptance Limits should be the same as the measurement performance criteria from wks 12-16 for trip blanks and method blanks		WS#12-16 is ICP/MS analysis for metals in water. Will include the 1/10 rule in WS#28 for trip blanks to be consistent with the corrective action stated under method blanks in WS#28.	A

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53.	QAPP wks #28	MS/MSD one per extraction batch of 20 or fewer field samples/analysis/matrix.		WS#28 does state one set per extraction batch of 20 or fewer samples of similar matrix. MS/MSDs do not need to be included in each analysis batch.	I mean per analysis as in analyte. Sorry about that . Like…I request DRO/RRO/GRO on the chain of custody. Then I will need an MS/MSD run on all three analytes DRO, RRO, and GRO. DOD QSM Box D-8
54.	QAPP wks #29	Field screening is a form of field analysis thus must be documented. Include in this column where and how the field screening will be documented.		Field screening will be added to WS#29. Field screening results will be included with the electronic Supplemental Data file in the final report.	A

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55.	QAPP wks #30	The laboratory's authorized contract representative and the laboratory Quality Assurance officer must declare laboratory conformance to the DOD QSM Version 4.1 per the DOD Policy and Guidelines for Acquisitions involving Environmental Sampling and Testing. This needs to be included for laboratory acceptance. Also, state/ELAP accreditation for the methods utilized in the field effort needs to be documented. Please supply.		State and ELAP certification is provided in Attachment 3 of the QAPP immediately following the QAM. The self declaration has been discussed with the laboratory several times and they stated that Self Declaration was under QSM 3.0. Application for ELAP certification under QSM 4.1 and 4.2 serve as declaration of laboratory conformance. If we are incorrect, please provide reference in QSM 4.1 with the self-declaration requirement.	I was under the impression that ELAP was not DOD specific and it is certainly not DOD QSM version specific, and as such I cannot see how one can substitute for the other. But then again, I am not at all familiar with the ELAP application process, so I have taken this question to the CX for guidance. I will let you know what the final verdict is. Jheez, how hard is it to write a letter☺ And it is not a requirement of DOD QSM, rather it is Required Quality Systems Documentation per DOD Policy and Guidelines for Acquisitions involving Environmental Sampling and Testing November 2007.
56.	QAPP wks #31and 32	Add cooler receipt forms and ADEC chemical data checksheets as an assessment type and all associated required information.		Will add cooler receipt form and ADEC checklists to WS#31 and #32.	A

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57.	QAPP wks #32	The USACE chemist should be added to individuals receiving all chemical data related corrective actions.		USACE chemist will be added as an individual receiving all chemical related corrective actions.	A
58.	QAPP wks #33	Add Field change request forms, QAPP addendums, Chemical Data Quality Review, and ADEC Laboratory Checksheets to the list and all associated information.		Field change request forms, QAPP addendums and ADEC laboratory data checklists will be added to WS#33. Data Evaluation Summary Report with be renamed Chemical Data Quality Review for clarity.	A
59.	QAPP wks #34	The data shall be verified and reviewed by those stipulations laid forth in the contract. Please review your contract and discern here who will be responsible for each aspect. AECOM is responsible for verification, will they be performing the review and completing the ADEC checksheets as well? If not list who.		WS#34 will state that ADEC checklists and data review will be performed by Bristol. The CDQR will be performed by AECOM.	A
60.	QAPP wks #37	I see multiple references to the fact that data validation will not be performed. See above comment. Please be familiar with your scope of work in reference to data verification and review so that if there are any questions, we can clear them up now. In areas where it is stated that data validation is not included, please follow up with the fact that data verification and review are.		WS#37 will be re-stated regarding data verification. Only one reference to data validation was found in the first paragraph of WS#37, please indicate other references. The first paragraph will be clarified to include a statement that data verification and review will be performed (and by whom) along with the completion of ADEC laboratory data checklists and when.	A
61.		What controls have been put in place to assure that individual discrete samples will be analyzed when composite PCB samples results are above cleanup limits? This will require timely review prior to sample exceeding hold times.		Samples will be analyzed on a rush basis in the event that the 1/n threshold is exceeded. The laboratory has also been provided with the 1/n stipulations and will notify the Bristol PM and Bristol Chemist when the threshold is exceeded.	A

REVIEW COMMENTS **PROJECT: NE Cape HTRW RA**
DOCUMENT: Workplan/ QAPP

U.S. ARMY CORPS OF ENGINEERS CEPOA-EN-ES-M	DATE: 15 June 2011 REVIEWER: Teresa Lee PHONE: 907-753-2788	Action taken on comment by:

Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	USAED RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
62.		Your NPDL# for this year's field effort is: 11-072		Thank You.	A

Alaska Department of Environmental Conservation (ADEC)
Contaminated Sites Program
Document Reviewed: May 2011 Northeast Cape HTRW Remedial Actions Work Plan
Commenter: Curtis Dunkin-ADEC
Date Submitted: July 07, 2011 (ADEC responses to RTC's on July 21, 2011)

Comment No.	Page/Line	Section	Comment	Response
1.			**Work Plan Narrative**	
2.	General	General	Throughout the document (incl. both the narrative and QAPP), whenever excavation of the POL-contaminated soils is discussed, it states '…to a depth of approximately 15 ft….'. The DD requires up to 15 feet if accessible. The word approximately needs to be replaced with 'up to'. This statement also needs to begin by stating 'all POL-contaminated soil exceeding 9,200 mg/Kg will be excavated and disposed offsite…'.	Approximately will be replaced with "up to" 15 ft. Where appropriate the statement regarding "all POL contaminated soil exceeding 9,200 mg/kg will be excavated offsite" will be added. ADEC-ACCEPTED
3.	3	2.2.1	The discussion re: wind speed is confusing. States the average wind speed is 23 and 18 mph – clarify.	"In the winter winds average 23 miles per hour" will be removed for clarity. ADEC-ACCEPTED
4.	4	2.2.2	The borrow source area on the side of the mountain is considered part of the work area. Is it not higher than 200 feet above sea level?	"with the exception of the borrow pit" will be added to the end of the sentence. ADEC-ACCEPTED
5.	6	2.4.1	Do Gambell residents currently utilize the hunting and fishing camp at Northeast Cape?	No, only Savoonga residents have been observed at the

Comment No.	Page/Line	Section	Comment	Response
				fish camps. ADEC-ACCEPTED (revise draft WP to state this)
6.	7	2.5.2	Has Arctic Char been documented on St. Lawrence Island? Please state the source referencing the identification of these fish species at Northeast Cape. The AK Fish and Game website depicts St. Lawrence Island as non-habitat range for Arctic Char.	The locals use verbage of sea run Dolly Varden and Arctic Char. Two Arctic Char were caught this past week at NE Cape. Uncertain of the source. Will remove reference to Arctic Char. ADEC-ACCEPTED
7.	10	3.0	Inspections of both the site 7 and site 9 landfills need to be included in this year's mobilization in order to determine the status of the cover, cap stability, etc. Any necessary repairs and/or reseeding need to be conducted as soon as possible.	This is not part of our Scope of Work but Bristol will inspect Site 7 and Site 9 landfills and repair and reseed if necessary. ADEC-ACCEPTED (revise draft WP to state this)
8.	10	3.0	Surface water samples associated with the 2010 site 9 landfill construction for which the data was determined to be not useable (exceeded holding time) need to be recollected and analyzed (both upstream, at the landfill/water interface, and downstream). The following was is ADEC's comment and the response to comment on the draft 2011 NECape RA Report. ADEC Comment: Laboratory Analysis: Because VOC analysis data was rejected due to exceedance of holding times for the site 9 surface water samples, the characterization of this site is incomplete. This needs to be discussed in the narrative(s) associated w/ this site. Samples will need to be recollected for analysis during the next mobilization – this should be stated in the appropriate narrative sections, including section 6.2. Response to Comment:	Bristol will discuss this comment with the USACE because it is not currently a part of our Scope of Work for 2011. ADEC-will await response from Corps

Comment No.	Page/Line	Section	Comment	Response
			The decision to resample the surface water at Site 9 for the VOC analyses will have to be made by the USACE. The laboratory only analyzed for BTEX, the Chain requested VOCs. BTEX was analyzed within holding times. This information will be included in the text. **ADEC-ACCEPTED *(on May 22, 2011)***	
9.	12	3.2.1	It has not yet been established/determined whether MNA is occurring at site 8. Rephrase the last sentence in this section: '…continue to monitor for the purpose of determining whether MNA is occurring..'	Text will be modified as suggested. ADEC-ACCEPTED
10.	13	3.3.2	State the contaminants associated or potentially associated with concrete.	In Section 3.2.2 the text will be modified to state PCB-contaminated concrete….. ADEC-ACCEPTED
11.	13	3.3.2	Reword the statement 'Bristol may excavate this area for the…' for clarification: PCB-contaminated soils remaining at Site 13 which exceed the cleanup action level must be excavated first. Based on the 2010 UVOST investigation, POL-contaminated soil exists at site 13 for which Bristol is scoped to remediate in 2011.	Text in Section 3.2.2 will be modified to state: PCB-contaminated soils remaining at Site 13 which exceed the cleanup action level must be excavated first. Based on the 2010 UVOST investigation, POL-contaminated soil exists at Site 13. The POL-contaminated soil at Site 13 will be excavated either in 2011 or 2012. ADEC-ACCEPTED
12.	14	3.3.3	Re: additional soils may be removed in 2011, state that if not in 2011 then will be removed in a future mobilization.	In Section 3.2.3 The text will be modified to state: The POL-contaminated soil at Site 13 will be excavated

Comment No.	Page/Line	Section	Comment	Response
				either in 2011 or 2012. ADEC-ACCEPTED
13.	16	3.2.6	Second paragraph of this section reword '…soil was' with 'soil were…' and elsewhere throughout document.	Text will be modified as suggested ADEC-ACCEPTED
14.	20	4.1.4.3	Reword the statement 'Due to the coarse nature…': not all soil/burden material at NECape is coarse in nature. Large percentages of the overburden materials at NECape contain varying amounts of coarse material.	The text will be modified to state: Due to a large percentage of the material being coarse in nature at NE Cape…. ADEC-ACCEPTED
15.	20	4.1.4.3	Briefly explain the mechanical process by which the >2" silts, peats, and frozen clumps will not be segregated.	The screen plant operator and laborer required to observe all of the materials moving across the belts will ensure that dense silts, peats, and frozen material not be run through the plant but will be placed directly into supersacks. How is the separaration of this material accomplished (by hand,shovel,skimmer?) revise draft WP to state this
16.	20	4.1.4.3	State the wind speed threshold for stopping work at the screening plant.	The text will state: Screening operations during inclement weather

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				conditions, such as heavy rains and winds (e.g., either gusting to or in excess of 30 mph) will cease. ADEC-ACCEPTED
17.	21	4.1.4.4	State the specific AK Methods being used for POL analysis.	Method AK102/103 will be included in text ADEC-ACCEPTED
18.	24	4.2	Clean backfill material should either be stockpiled on a liner and/or the soil beneath the stockpile should be sampled to confirm it is clean prior to placing the stockpile material.	The stockpiled soil will be placed on a liner ADEC-ACCEPTED
19.	24	4.2	Re: the statement: 'Ideally, contaminant concentrations….': replace the word 'Ideally' w/ 'Once…', replace '…will be below' w/ '…are confirmed to be' and restructure w/ the following sentence '…based on the fixed-base analytical laboratory results, the site will be backfilled…'.	Once contaminant concentrations from confirmation samples are confirmed to be below cleanup levels, based on the fixed-base analytical laboratory results, the site will be backfilled. The lab results and decision to backfill will be done with consultation with the Quality Assurance Representative (QAR).ADEC-ACCEPTED –revise draft WP to state this
20.	25	4.2	State that 18 AAC 75 does not allow porous or visibly stained POL-	The following text will be

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			contaminated material >2 inches to be segregated.	added: According to the ADEC Technical Memorandum for Petroleum Hydrocarbon Cleanup for Oversize Material (September 2005) "rock material greater than two inches does not require remediation or testing, unless it has the potential to hold excessive amounts of contamination or contains visible product on the surface (surface stain)". ADEC-ACCEPTED
21.	28	4.4	Second paragraph of this page, define what is meant by clean soil (non detect? Below ADEC Method Two migration to groundwater levels?). Clean material needs to be stockpiled in a clean area that has been adequately characterized prior to stockpile placement or else the materials need to be placed on a liner to prevent cross contamination.	Soil <9,200 mg/kg will be considered clean and stockpiled soil will be placed on a liner. ADEC-ACCEPTED- revise draft WP to state this
22.	28	4.4	The tank footprint area that is utilized for a wet material impoundment will need to be confirmation sampled once work is completed and the impoundment is deconstructed. State the Table C water cleanup level to which contaminated water generated from excavation and removal actions at the MOC will be treated to prior to being discharged to the ground.	The impoundment area will have confirmation samples collected once the project is complete and the impoundment is deconstructed. In Section 4.16 the text will state that

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				impoundment water will be treated with a water scrubber and then sampled to confirm that it is below the ADEC Table C groundwater cleanup level of 1.5 mg/L DRO prior to being released to the ground. ADEC-ACCEPTED
23.	28	4.4	Last paragraph of this page: any material that is being stored for later use as backfill that is contaminated but below site-specific cleanup levels needs to be stockpiled in areas that are also contaminated but below site-specific cleanup levels. If contaminated material is to be stockpiled in a clean area outside of the contaminated area then a liner and containment strategy must be used to prevent contaminant migration.	Stockpiled material will be placed on liners ADEC-ACCEPTED
24.	28	4.4	Excavation activities associated with the MOC that are at/in the ground water zone should also be accompanied by some type of absorbents/booms in order to remove as much as contamination from the water as feasible and to control potential contaminant migration to clean areas.	In 2011 excavations will not occur in wetlands at the MOC but only on the pad areas where the groundwater is typically >9'bgs. Booms are available on site and will be used to control potential contaminant migration to clean areas. Bristol is not scoped to clean up the groundwater. ADEC-ACCEPTED-revise

Comment No.	Page/Line	Section	Comment	Response
				draft WP to state this
25.	30	4.4	All concrete adjacent to and/or overlying contaminated areas must be adequately characterized and confirmed to not be contaminated above cleanup levels in order to use as backfill. Contaminated concrete exceeding cleanup levels must be disposed of offsite.	After the Site 13 PCB soil cleanup has been confirmed, the POL crew will break up the concrete foundations that will interfere with the DRO-contaminated soil removal at Site 13. Concrete removed from these foundations may be used as backfill for some of the POL excavations after wipe tests have been performed by the field screening laboratory. Samples from the concrete will be collected from locations most likely to be exposed to PCBs (e.g., edge of floor drains, areas contacted by PCB contaminated soil). One sample per 250 square feet of exposed concrete will be collected. The sampler will brush the area to be sampled with a hand brush or push broom to remove any soil, sediment, dust or other non-concrete material from the

Comment No.	Page/Line	Section	Comment	Response
				sample location. Bristol will measure and mark an area 10 cm x 10 cm square for the wipe test. The wipe will be analyzed by the field screening laboratory for PCBs. Wipe test results will be discussed with the QAR prior to using the concrete as backfill. ADEC-ACCEPTED-revise draft WP to state this
26.	30	4.4	Last sentence of this section, see comment 15 above.	See response to Comment 15. ADEC-ACCEPTED-see response to RTC 15 above
27.	31	4.5	Section needs to include information re: why the background areas were selected/rationale for what makes them suitable as background sample areas. Explain how the background level to be proposed will be calculated from the sample results.	The text will be modified to state that according to our scope of work background samples will be collected in the vicinity of Site 21 from locations upgradient and cross-gradient of the 2010 Site 21 soil excavation. The background locations will be outside of known or suspected anthropogenic sources. Sample locations

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				will exhibit vegetative cover and soil type similar to those observed during 2010 at the Site 21 soil excavation. The sample results will be provided to the USACE and Bristol will render an opinion regarding whether or not arsenic detected in previous soil samples collected at Site 21 was naturally occurring background or was a result of operations at the MOC. If arsenic concentrations at Site 21 exceed applicable cleanup levels (11 mg/kg) and are greater than naturally occurring background concentrations a removal will be recommended at Site 21. A cumulative risk calculation using the EPA PROUCL program will be done. ADEC-ACCEPTED-revise draft WP to state this
28.	31	4.5	What if arsenic-contaminated soil still remains above cleanup level at site 21	The USACE may have to

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			after/if the additional 10 ton removal option is utilized?	mod the contract. Bristol is currently contracted to remove a total of 20 tons of As-contaminated soil from Site 21 in 2011-2012 ADEC-ACCEPTED
29.	32	4.7	Will regraded backfilled areas be reseeded for stabilization and to promote the reestablishment of native plant species? Otherwise how will erosion be controlled?	Stabilization is based on using the coarse-grain angular borrow pit material that will be placed, compacted and graded to match existing topography and to reduce erosion. Note that the available borrow material runs ≤30% 2" minus, based on previous screening of borrow material. Previous attempts to grow grass at the MOC have only been marginally successful due to the coarse grain angular material that is available for backfill. ADEC-ACCEPTED-revise draft WP to state this
30.	32	4.8	Last sentence of first paragraph of this section is unclear re: '…areas of open water will be sampled in 2011' since soil and sediment are the matrices being sampled. Photographs of the sampling locations/transects should be	Photographs of sample locations will be included. The USACE has requested

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			documented to be included in the report.	that we target areas of open water for our sediment samples ADEC-ACCEPTED
31.	33	4.8	Explain the rationale for the three sampling depths. If transects are less than 70 feet wide, the remaining samples should be applied to a wider transect.	The sampling depths were based on the USACE Scope of Work and are due to the fact that historical samples at depths up to1.5' bgs had results above cleanup levels. If transects are less than 70' wide the QAR and field team leader will discuss where the additional samples will be collected (e.g., either in a wider transect or add another transect to fill data gaps and confirm existing site data.) ADEC-ACCEPTED-revise draft WP to state this
32.	33	4.8	Same as comment 27 above, explain the rationale for selecting the background sampling areas for the drainages. This rationale and the selected background areas need to be approved by ADEC – not just determined in the field.	The SOW requests that background samples be collected from a nearby, similar, unimpacted drainage to evaluate biogenic interference. Background sample

Comment No.	Page/Line	Section	Comment	Response
				locations will be provided to the ADEC prior to sampling. ADEC-ACCEPTED-revise draft WP to state this (ADEC's comments 27 and 32 also regard whether or not the degree of impact or lack thereof to these areas is known; and, what if results indicate the presence of contaminants above what would be expected of background?)
33.	35	4.10	The QAPP needs to state that all wells that are demolished/removed during excavation activities need to be replaced – preferably a year later to allow for settling.	This is a comment to be addressed by the USACE – Bristol is not scoped to replace wells that will be removed due to the excavations at the MOC. USACE will add additional wells to scope as necessary. ADEC-ACCEPTED-revise draft WP to state this
34.	41	4.17.5	50 gallons of POL liquids total? Why will 2,500 gallons of disposing capacity for POL liquids be available?	This is a typo - will have containers available for disposing 50 gallons ADEC-ACCEPTED

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35.	41	4.17.7	Section 4.17.7 states that 5 additional wells '…in excess of those quantities previously set forth in the contract'. Section 4.10 states that monitoring wells in the footprint of the excavation at the MOC may need to be dug up and abandoned but does not state a specific number. Clarify this in section 4.1 as well as section 4.17.7. Are 5 total wells scoped for removal if necessary?	The text will be clarified in Sections 4.17.7 and 4.10 to explain that Bristol is prepared to remove up to an additional 5 monitoring wells at the MOC if this option is exercised by the USACE. The base contract allows Bristol to abandon/remove/dispose in accordance with ADEC requirements 3 monitoring wells if these wells are within the footprint of the excavation at the MOC and these wells will be preferentially sampled prior to excavation at the MOC. ADEC-ACCEPTED-revise draft WP to state this
36.	49	6.2	Although the Army Corps. has argued in the past that the cargo beach would not be sampled as a site, because of the extensive volumes of contaminated PCB and POL soils (which have been and will continue to be transported and staged), the cargo beach needs to be characterized: 1) background sampled prior to this field season, 2) immediately after cleanup of any spills, escapement, etc. and 3) after the final demobilization.	This is not part of Bristol's Scope of Work and will need to be discussed with the USACE. Any spills will immediately be cleaned and reported according to ADEC requirements. The USACE will modify the Bristol

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				contract to sample the beach afterwards. ADEC-ACCEPTED-revise draft WP to state this
37.	51	7.0	Will these dates change if the contract is modified for the overwinter?	Bristol's contract has been modified to allow the overwintering of the camp, equipment and supplies. The Period of Completion is now 30 April 2013. The text in the Work Plan will be modified to reflect the changes due to Contract Modification 02. ADEC-ACCEPTED
38.	Figure 4		A) It would be helpful to have the composite analysis result inserted in the legend next to the respective group of samples. B) Why are the areas on the eastern edge of each of the three areas being proposed for excavation in 2011 when no exceedances are depicted there? C) Were the group 04 samples from the concrete surface or has this concrete been demolished and the samples were from the soil surface beneath the concrete?	A) Comment acknowledged B) Composite Group 14 and Composite Group 18 had PCB concentrations > 1 ppm (3 and 2.5 ppm respectively) C) Group 04 are soil samples there were not under concrete. No concrete was removed in 2010 prior to the removal of PCB-contamination soil at Site 13. ADEC-ACCEPTED-

Comment No.	Page/Line	Section	Comment	Response
				please insert the analysis results into the legend of Figure 4
39.	Figure 5		A) It would be helpful to have the composite analysis result inserted in the legend next to the respective group of samples. B) The entirety of two of the three areas (associated w/ samples 89-91 and 1-1-109) and most of the northeast area of proposed for excavation in 2011 do not have exceedances (either >1 or >50 mg/Kg) depicted; why are these areas proposed for excavation? C) The entire area proposed for screening in 2011 has no exceedances depicted. Why is it being screened again in 2011 when 2010 screening samples confirmed no exceedances in this area?	A) Comment acknowledged B) These areas have fixed-based lab composite samples that exceed 1 ppm C) To assure that prior to collecting confirmation samples that area remains below the cleanup level after removing the soil and liner that was placed in the excavation at the end of 2010. ADEC-ACCEPTED-please insert the analysis results into the legend of Figure 5;
40.	Figures 6-9		It would be helpful to depict the site location where the tank spill occurred on all future MOC figures.	Unsure of exact location of the tank spill other than the center tank was punctured during snow removal activities in the late 1960's and released a large amount of fuel. ADEC-ACCEPTED-please revise draft WP to state this and insert a reference depicting

Comment No.	Page/Line	Section	Comment	Response
				the center tank as the general source area of the spill.
41.	Figure 10		What is the square w/circle in it w/ line angled to right of page in this figure? Manhole? Please notate.	Figure 10 will have a note added that this is the end of utilidor outfall line ADEC-ACCEPTED
42.	90	Acronyms and Abb.	CON-HTW needs to be corrected to CON-HTRW.	Acronym has been corrected. ADEC-ACCEPTED
43.			**UFP-QAPP**	
44.	General		Please relocate the QAPP section in between the work plan narrative and the Figures sections of the document.	The USACE requested that the UFP-QAPP be listed as an appendix. ADEC-ACCEPTED
45.	General	Misc. Worksheets	There are numerous instances where information is inter dispersed between the work plan narrative and QAPP. All of the critical and necessary information required to execute the field work needs to be captured in the QAPP (i.e. the work plan narrative states stop work criteria because of wind speed, transect location information for site 28, etc. but this info is not stated in the QAPP). Non-field critical information (.i.e. historical investigations and removal actions, etc.) as well as redundancies should not be in the QAPP. Several worksheets make references to information being available in other worksheets. I.e. middle of the page 52 of worksheet 11 states that info is available on worksheet 18. However, worksheet 18 consists of two sentences that refer to the information being available in other worksheets. There are also instances in which the worksheets stated are not correct – see comment 70 below. Please revise and ensure that all required information is correctly	There is some unavoidable redundancy in the Work Plan and QAPP. The QAPP and Work Plan are both documents that will be used in the field. The UFP-QAPP will be revised based on both the ADEC and USACE comments. References to other worksheets and information will be verified and corrected.

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			referenced and detailed in the QAPP. State specifically where the information is instead of a worksheet or location that states it is somewhere else. The QAPP should not be a redundant document to a work plan, rather it needs to be the field work plan.	ADEC-ACCEPTED
46.	1	1.1	Third paragraph of this section, remove 'the' in the sentence 'Attachment 1 contains the Bristol's…'	"the" has been removed. ADEC-ACCEPTED
47.	3	1.3	See comment 1 above.	Changed bullet to state soils will be excavated "up to" 15 feet where accessible" ADEC-ACCEPTED
48.	5	Worksheet 1	Generally all stakeholders are considered as signatories on the QAPP, including the landowner(s). Although there are instances where landowners choose to not be a signatory. Note: it is standard practice to include all stakeholders in scoping, and technical project planning in order to complete the UFP-QAPP. ADEC was not informed or invited to any of the three meetings conducted in January, March, and April of 2011 and requests that ADEC be informed of future UFP-QAPP technical project planning meetings associated w/ NECape.	The QAPP will be sent to local representatives in Gambell and Savoonga for their review and signatures. ADEC will be informed of future TPP meetings regarding NE Cape. ADEC-ACCEPTED
49.	29	Worksheet 9	Have the MOC former fuel tank footprints been characterized (if not will they be?) If so this information should be included in the QAPP. If clean, why is the excavated material being disposed offsite and not being used as backfill? The proposed excavation and offsite disposal of the soil associated w/ the tank farm footprint needs to be clearly outlined as a project task in the appropriate sections and worksheets of the work plan narrative and QAPP.	The former tank footprint areas are darkly stained areas that have not been fully characterized and will be excavated to approximately 18" bgs. The tank footprint excavation will be incorporated into all appropriate sections of the planning documents.

Comment No.	Page/Line	Section	Comment	Response
				ADEC-ACCEPTED
50.	31	Worksheet 10	Worksheet 10 can be condensed significantly. Most of the historical info has already been stated in the work plan narrative. This worksheet should only discuss the problem definition, which pertains to the remaining site wide contamination and specifically to the remediation work planned for the 2011 mobilization. The two sections titled "The Problem To Be Addressed By The Project" and "The Environmental Questions Being Asked" are sufficient information for this worksheet. The remaining narrative information in this worksheet that is not already duplicated somewhere else in the document should either be moved to a more pertinent worksheet, the work plan narrative, or omitted.	The information contained in WS #10 follows the format and questions identified in the UFP-QAPP manual and examples. Information contained in WS#10 is sometimes redundant but necessary to answer the questions stated, which follow the UFP-QAPP format, including the questions themselves. ADEC-ACCEPTED
51.	34	Worksheet 10	Note: ADEC disagrees with the statement 'Only inert concrete foundations and pads remain' and requests it be omitted. There are contaminant exceedances in soils adjacent to and possibly still underneath existing concrete structures; meaning there may still be concrete present that is contaminated above cleanup levels.	The statement will be omitted. ADEC-ACCEPTED
52.	41	Worksheet 10	GRO, RRO, and VOC's need to be added to classes of contaminants of concern section. Concrete needs to be added as a potentially affected matrix in the same section (and also in the matrices section on worksheet 11).	GRO, RRO and BTEX have been added to WS #10. Concrete will be added to WS#10 and WS #11. ADEC-ACCEPTED
53.	43	Worksheet 10	Several of the 'if…, then…" statements in this section are worded such that it is unclear what is meant by '…the USACE may consider carrying…'. Does this mean specifically that action may be taken in the 2011 field season, but if not then in the future? These statements should be reworded to clarify. This	The statements will be restated to clarify that areas (including Site 28) are being further characterized in

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			and other information pertaining to planned 2011 site work and tasks should be relocated to Worksheet 14 which is titled 'project tasks'.	2011 and a remedial plan will be developed if the characterization indicates that contamination remains above cleanup levels. ADEC-ACCEPTED
54.	47	Worksheet 11	Last sentence of second paragraph on this page, insert the word 'to': '…necessary or [to] demonstrate'.	Correction noted and "to" will be added. ADEC-ACCEPTED
55.	47	Worksheet 11	Need to include surface water sampling at site 9; see comment 8 above.	Surface water sampling for VOCs, which requires a contract modification, will be discussed with USACE. The vast majority of the 2010 results for other COCs and BTEX were non-detect or well below cleanup levels. All sample results were below cleanup levels before, during, and after the landfill cap construction. ADEC-ACCEPTED
56.	49	Worksheet 11	Has subsurface soil characterization sampling been conducted deeper than 1.5 ft. bgs in previous investigations? What if sample results from the 1.5 ft. depth exceed cleanup levels - will deeper sampling/further characterization be conducted in the future?	No. Previous samples were collected up to 1.5 feet bgs. The results of the samples collected at Site 28 will be discussed with the USACE to determine future

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				remediation plans. ADEC-ACCEPTED
57.	49 and 50	Worksheet 11	Three statements in the last paragraph on this page (which runs over to page 50) are not clear and appear to conflict re: the highest concentrations of contaminants, the most heavily contaminated areas, and the highest concentrations of most COC's. Revise/clarify.	The paragraph will be restated for clarity to identify the drainage where the culvert and manhole were located are also the areas that historically have had the highest concentrations of COCs. ADEC-ACCEPTED
58.	52	Worksheet 11	The last paragraph of the POL and PCB Confirmation Samples Section makes a general statement that sidewall samples will be to a depth up to 15 ft. The 15 ft. depth is only specific to POL contamination per the 2009 Decision Document. The excavation depth of PCB contaminated soils may exceed 15 ft. if necessary to achieve cleanup levels. Revise.	The statement will be revised to state that POL locations will be sampled to depths of up to 15 feet and PCB sidewalls and floors will be excavated until no contamination remains above cleanup levels. ADEC-ACCEPTED
59.	Misc.	Worksheet 12	A) DRO and RRO surrogates are incorrect and need to be revised. B) PCB extraction method is incorrect and the analytical method is not listed and need to be revised. C) Need to list DOD QSM version for all applicable methods (latest version 4.2?) D) Analytical Group for worksheet 12-7 (page 61) should be ICP/MS Metals.	A) Surrogates were corrected. B) Extraction method changed to SW3550B, analytical method revised to SW8082A. C) QSM 4.1 added D) WS #12-7 Analytical

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				Group changed to ICP/MS metals. ADEC-ACCEPTED
60.	63	Worksheet 12-9	The narrative of the work plan and the QAPP should include references to the ADEC tech memo regarding TOC analysis. It should be stated in the QAPP that the purpose of the TOC analysis is only to determine the amount of total organic carbon in the matrix, and cannot be utilized to determine an alternative cleanup level. The ADEC tech memos 'silica gel cleanup' and 'TOC analysis' should be inserted as attachments in the work plan.	The Tech memo regarding TOC analysis will be referenced and put in as an attachment as suggested. A sentence stating "The purpose of the TOC analysis is to determine the amount of total organic carbon in the matrix; TOC data will not be utilized to determine an alternative cleanup level" has been added to the "The Rationale For Inclusion Of Chemical and Nonchemical Analysis". WS #10 references the Silica Gel Cleanup Tech Memo and a statement regarding the TOC analysis and silica gel cleanup will be added to Sections 4.8 and 4.9 of the Work Plan. Both tech memos will be added as attachments. ADEC-ACCEPTED

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61.	77	Worksheet 14	See comment 1 above.	WS#14 corrected to state up to 15 feet where accessible. ADEC-ACCEPTED
62.	79	Worksheet 14	Documentation and Records: correct 'All samples locations…' to 'All sample locations…'.	Corrected, "s" removed. ADEC-ACCEPTED
63.	83	Worksheet 16	The project schedule should be inserted in this worksheet and not later in the document as an attachment.	The project schedule will be added in worksheet. ADEC-ACCEPTED
64.	85	Worksheet 17 and Figure 13	<u>Sediment and Surface Soil Sampling:</u> A) Briefly discuss reasons for why the proposed transect locations at site 28 may need to be altered. B) Comments 28-30 above should also be addressed in this section. C) On page 33 of the work plan narrative it is stated that transects may be less than 70 ft. in length. What will be done with unused samples in transects that are less than 70 ft. in length? If shorter transects do not utilize all 21 samples, then remaining samples should be added to longer transects. How will the placement of the 70 ft. length of transect be determined in locations where the drainage is greater than 70 ft. wide? D) Why is a transect not associated with the 96NE28SW/SD-101 historical sample location as depicted on Figure 13? E) Edit: Sentence beginning w/ 'Three samples will be collected at each location…' change the word 'form' to 'from'.	A) Text will be added stating that visual observation or safety issues may alter transect locations. B) Responses to items 28-30 will be incorporated in WS #17. C) The text will be modified to state that if all samples are not used on a particular transect, it may be used on longer transects or other areas identified during the Site 28 investigation after consultation with the USACE on-site QAR. A total of 210 primary samples will be collected. D) To fill a data gap in areas where the drainage has not

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				been sampled E) "Form" has been corrected to "from". ADEC-ACCEPTED
65.	86	Worksheet 17	How will confirmation and/or screening soil samples be collected below water level?	Text will be added saying that a T-handled sampler will be used to collect soil samples. This technique was successfully used in 2010 at Site 8. The information is also presented on Table 11-1. ADEC-ACCEPTED
66.	86	Worksheet 17	Need to state the confirmation sampling density/frequency for arsenic-contaminated soil excavation (site 21).	Sample density/frequency consistent with ADEC field sampling guidance along with reference to sampling guidance will be added to WS#17. ADEC-ACCEPTED
67.	87	Worksheet 17	Groundwater: The sentence beginning w/ 'Samples from these existing…' does not make sense. Samples are meant to verify sample analytical results?	Sentence will be corrected to state: Samples from these existing wells are meant to provide additional information for MNA and to monitor contaminants of concern. The results will be used to establish contaminant trends and

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				determine if MNA is occurring. ADEC-ACCEPTED
68.	87	Worksheet 17	Groundwater: last sentence of the first paragraph of this section, insert 'to': 'used [to] establish'.	Added "to" ADEC-ACCEPTED
69.	87	Worksheet 17	Last sentence on this page: states levels of concentrations are expected to be low-to-medium. However, worksheet 12 states that GRO concentrations are low, not low-to-medium. Worksheet 12 also states that other COC's are low-to-high, not low-to-medium. Revise/clarify.	The GRO "low" statement in WS#12 is based on MOC GW results being below ADEC cleanup levels (non-detect). "Low to medium" will be removed from WS#17 and the text will be reworded to describe historical contaminant concentrations, and what the 2011 contaminant concentrations are expected to be based on the historical data. ADEC-ACCEPTED
70.	91	Worksheet 18	Worksheet 3 is a distribution list and does not contain any information re: sampling locations and methods.	Reference to WS # 3 will be removed from WS#18. ADEC-ACCEPTED
71.	101	Worksheet 21	Equipment type is stated only as 'various' for Groundwater Sampling – list the various equipment.	Text has been added to specify the groundwater sampling equipment as submersible or peristaltic pumps and disposable

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				tubing, YSI multi-meter and water level meters. ADEC-ACCEPTED
72.	121	Worksheet 27	In the sentence beginning with 'Each cooler will then be…' insert 'a': 'in [a] manner'.	"a" has been added before manner in the sentence as suggested. ADEC-ACCEPTED
73.	133	Worksheet 33	Why will there be no data verification and subsequent report from the laboratory?	WS#33 revised. "Data Verification TSA" line has been removed. Based on USACE input, "Laboratory Data Reports" line has been added with a frequency of within 14 days of receipt of final report. Projected delivery dates is various throughout the project to comply with the 14 days after receipt. Person responsible (Marty Hannah) and Report recipients are USACE project delivery team. USACE comments to the draft WP-QAPP requested that all data reports be checked and tabulated to show that non-detect LOQs

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				are below site-specific and/or ADEC cleanup levels. ADEC-ACCEPTED
74.	137	Worksheet 37	Note: 10X rule and blank flagging are acceptable only as long as elevated LOQ remains less than cleanup level.	See response to Item 73. ADEC-ACCEPTED
75.		Table 11-1	A) There are many '##' entries in this and other tables? The table needs to be formatted so that all the information can be displayed both electronically and hard copy. B) There appears to be wording below the sample location 'site 28 background' that is cutoff/not legible on the third page of Table 11-1.	A) The tables have been reformatted to address ## issues. B) Tables have been reformatted to display all information contained in the cells of all tables. ADEC-ACCEPTED
76.		Table 11-2	States that 10 monitoring wells will be sampled but elsewhere in work plan 9 wells are stated. Revise.	Table 11-2 has been corrected to state 9 wells. ADEC-ACCEPTED
77.		Table 15-2	Ethylene dibromide should be analyzed by method 504.1 or 8011; not the stated SW8260B.	Per USACE input, only BTEX will be sampled in GW at the MOC. All non-BTEX VOC compounds have been removed from the table. ADEC-ACCEPTED
78.		SOP BERS-01	Headspace PID Screening: Note that ADEC guidance states a minimum of 10 min. and no more than one hour. Bristol's SOP states 5 min. to one hour.	The SOP will be revised to minimum 10 minutes to be consistent with ADEC guidance.

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				ADEC-ACCEPTED
79.		Quarry Agreement	Final signed Quarry Agreement needs to be included in the final copy of the work plan.	The signed Quarry Agreement has been added to Appendix F of the Work Plan. ADEC-ACCEPTED
80.		SWPPP	Why does the SWPPP not include site 21?	Additional references to Site 21 have been added and a site map of Site 21 has been added to the SWPPP. ADEC-ACCEPTED
81.			**End of ADEC Comments**	