

WORK PLAN
2001 Supplemental Remedial Investigation
Gambell, St. Lawrence Island, Alaska

FINAL

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OSHA Job Safety & Health Protection
OSHA 200 Form

ACRONYMS AND ABBREVIATIONS

µg/Kg	micrograms per kilogram
µg/L	micrograms per liter
AAC	Alaska Administrative Code
A/E	architect/engineer
ACGIH	American Conference of Governmental Industrial Hygienists
ADEC	Alaska Department of Environmental Conservation
ADL	Arthur D. Little, Inc.
AK	Alaska Method
Alaska District	United States Army Engineer District, Alaska
ARAR	Applicable and Relevant or Appropriate Requirements
ARI	Analytical Resources, Inc.
ASTM	American Society for Testing and Materials
ATV	all-terrain vehicle
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CCVS	continuing calibration verification standard
CDAP	Chemical Data Acquisition Plan
CDQR	Chemical Data Quality Review
CERCLA	Comprehensive Environmental Response, Compensation and Liability Act
CF	calibration factor
CoC	chain-of-custody
COC	contaminants of concern
DERP	Defense Environmental Restoration Program
DoD	United States Department of Defense
DQO	data quality objectives
DRO	diesel range organics
E&E	Ecology & Environment
EDF	electronic deliverable format
ER	Engineering Regulation
FTL	Field Team Leader
FUDS	Formerly Used Defense Sites
GC/MS	gas chromatography/mass spectroscopy
GRO	gasoline range organics
HASP	Health and Safety Plan
HTSA	Historical Time Sequence Analysis
IDLH	immediately dangerous to life and health
IDW	investigative-derived wastes
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LIMS	Laboratory Information Management System
MDL	method detection limit
mg/Kg	milligrams per kilogram
mg/L	milligrams per liter

mL	milliliter
MS	matrix spike
MSD	matrix spike duplicate
MSDS	Materials Safety Data Sheet
MSL	mean sea level
NIOSH	National Institute for Occupational Safety and Health
OSCI	Oil Spill Consultants, Inc.
OSHA	Occupational Safety and Health Administration
PAH	polynuclear aromatic hydrocarbon
PARCC	precision, accuracy, representativeness, completeness, and comparability
PCB	polychlorinated biphenyl
PE	performance evaluation
PEL	permissible exposure limit
PID	photoionization detector
PL	Public Law
POL	petroleum, oil, or lubricant
PPE	personal protective equipment
ppt	parts per trillion
PQL	practical quantitation limit
QA	quality assurance
QA/QC	quality assurance/quality control
QAP	Quality Assurance Plan
QAPP	Quality Assurance Project Plan
QC	quality control
QSM	Quality Services Manager
RCRA	Resource Conservation and Recovery Act
REL	recommended exposure limit
RF	response factor
RI	Remedial Investigation
RL	reporting limit
RPD	relative percent difference
RRO	residual range organics
RSD	relative standard deviation
SAP	Sampling and Analysis Plan
SARA	Superfund Amendments and Reauthorization Act
SHM	Safety and Health Manager
SHSO	Site Health and Safety Officer
SIM	selected ion monitoring
SOP	standard operating procedure
SPIP	Strategic Project Implementation Plan
SSHASP	Site-Specific Health and Safety Plan
SW	Solid Waste Method
TAL	Target Analyte List
TEC	Topographic Engineering Center
TLV-TWA	threshold limit values-time weighted averages
USC	United States Code

URS	URS Corporation
USAED	United States Army Engineer District
USAEHA	United States Army Environmental Hygiene Agency
USAF	United States Air Force
USEPA	United States Environmental Protection Agency
VOC	volatile organic compounds

1.0 INTRODUCTION

Pursuant to Contract No. GS-10F-0061K, the United States Army Engineer District, Alaska (Alaska District), contracted with MWH, formerly Montgomery Watson, to address areas at Gambell, St. Lawrence Island, Alaska, where collecting data is necessary to resolve the extent of contamination resulting from Formerly Used Defense Sites (FUDS) activities (Figure 1-1). This 2001 Supplemental Remedial Investigation (RI) Work Plan was prepared according to the guidelines of the Defense Environmental Restoration Program (DERP) of the United States Department of Defense (DoD).

1.1 PURPOSE

Further study of some sites at Gambell is necessary because new information that warrants investigation has become available to the Alaska District. Previous information included the results of Phase I and Phase II RIs performed in the Gambell area in 1994 and 1998, respectively. The objectives of the previous RIs were to gather sufficient chemical, geophysical, and hydrogeologic data to identify and characterize sites requiring remediation. Based on the findings of the 1998 RI, many individual sites were recommended for no further action.

New information about sites at Gambell comes primarily from three sources. The first source of new information is a document entitled "GIS-Based Historical Time Sequence Analysis" (HTSA), completed in September 2000 by the U.S. Army Topographic Engineering Center (TEC). The HTSA combined information from historical aerial photographs and other documents with current aerial maps of the Gambell area and identified previously unknown locations of past military equipment and operations. The second source of new information is the Strategic Project Implementation Plan (SPIP) prepared by Montgomery Watson in December 2000. The SPIP included a questionnaire completed by Gambell residents to identify potentially contaminated areas not identified in previous investigations; many such sites were identified and investigated via geophysical surveys in 1999. The third source of new information is a report of remedial actions performed by Oil Spill Consultants, Inc. (OSCI) during summer 1999. Samples collected to confirm that contaminated soils had been removed indicated that contamination may remain at several sites.

1.2 OBJECTIVES

The focus of the 2001 fieldwork is to collect sufficient soil and groundwater samples at selected sites in the Gambell area to determine the nature and extent of contamination. Study sites are shown in Figure 1-2, and rationale for selecting these sites is discussed in Section 2. Specific study objectives include:

Soil

- Determine the nature and extent of fuel-related contamination at Sites 6, 7, 16, 25A, and 25B.
- Determine the source (military or other) of fuel-related contamination at Sites 7, 16, and 25A. The DQO is qualitative evaluation of petroleum hydrocarbons.
- Determine the nature and extent of solvent and metal contamination in soils at Sites 6 and 7.
- Confirm previous sampling results for fuel and metal contamination in soil at Sites 4A, 4B, 6, 8, and 12.
- Evaluate for the presence of fuel, solvent, and metal contamination in soils at areas not previously investigated at new Sites 25B, 26, 27, and 28.
- Evaluate for the presence of PCB contamination in soils at Sites 7 and 27.

Groundwater

- Determine the nature and extent of fuel-related contamination at Sites 6, 7, and 25A.

1.3 APPLICABLE AND RELEVANT OR APPROPRIATE REQUIREMENTS

This Supplemental RI for Gambell follows the CERCLA process (Comprehensive Environmental Restoration Compensation, and Liability Act of 1980, Public Law [PL] 96-510, as amended by the Superfund Amendments and Reauthorization Act [SARA] of 1986, PL-99-499 [codified as 42 USC 9601-9675]). In accordance with CERCLA, the Alaska State Oil and Other Hazardous Substance Pollution Control Regulations (18 AAC 75) that govern the cleanup of contaminated sites in Alaska were identified as applicable and relevant or appropriate requirements (ARAR) for Gambell. The following regulations and standards apply:

- The 18 AAC 75 Alaska Department of Environmental Conservation (ADEC) Method 1 matrix levels are used to support recommendations for no further actions where contaminant levels in soil fall below matrix levels. For sites where petroleum levels exceed Method 1 matrix levels, Method 2, under 40-inch zone, migration to groundwater criteria are used.
- Groundwater cleanup criteria are identified in 18 AAC 75.345, Table C.

1.4 DOCUMENT ORGANIZATION

This Work Plan includes eight sections and three appendices that describe all field operations and objectives, appropriate methodology, quality assurance (QA) procedures, health and safety actions, investigative-derived waste (IDW) handling activities, procedures for spill response and reporting, and waste management procedures that will be implemented during the 2001 Supplemental RI.

- Section 1 presents a project description, including project purpose and data objectives, ARAR, a brief history of operations and previous investigations at Gambell, project organization, and responsibilities of individual project personnel.
- Section 2 contains the Investigation Plan, which provides a description of the tasks to be performed during the 2001 RI and lists objectives for the sampling program.
- Section 3 includes the Sampling and Analysis Plan (SAP), which contains a description of field procedures to be used by the field team during the 2001 field program. The SAP references the Standard Operating Procedures (SOP) included in Appendix B and details departures from the SOPs.
- Section 4 contains the Quality Assurance Project Plan (QAPP), which establishes requirements for quality assurance/quality control (QA/QC) associated with sampling and analysis work conducted during the 2001 RI.
- Section 5 contains the Health and Safety Plan (HASP) Addendum, which establishes all health and safety guidelines that will be followed during field activities at St. Lawrence Island during the 2001 RI.
- Section 6 contains the Waste Management Plan, which details the handling, packaging, and final disposal of chemicals and investigative-derived waste (IDW), if any, to be removed from site.
- Section 7 contains the Spill Response and Reporting Plan, which describes the procedures that will be performed if a spill should occur during field activities.
- Section 8 lists the references used to develop this Work Plan.

1.5 SITE HISTORY AND PREVIOUS INVESTIGATIONS

The site history and previous investigation information contained in this Work Plan have been summarized from reports documenting previous investigation results from the Gambell area. More detailed site descriptions and background information, including results of field investigations, can be found in the documents listed below:

- Final Remedial Action Report for Debris Removal and Containerized Hazardous Waste and Toxic Waste Removal, Gambell, Alaska. Oil Spill Consultants, Inc., February 15, 2001.
- Strategic Project Implementation Plan, Gambell, St. Lawrence Island, Alaska. Final. Montgomery Watson, December 2000.
- GIS-Based Historical Time Sequence Analysis (Historical Photographic Analysis), Gambell Sites, St. Lawrence Island, Alaska. United States Army Corps of Engineers Engineer Research and Development Center, TEC, September 2000.
- Site 5 Remedial Investigation, Gambell, St. Lawrence Island, Alaska. Montgomery Watson, 1999.

- Phase II Remedial Investigation, Gambell, St. Lawrence Island, Alaska. Final. Montgomery Watson, December, 1998
- Final Investigation of Geophysical Anomaly, Gambell, St. Lawrence Island, Alaska. Final. Montgomery Watson, December 1997.
- Remedial Action Alternatives Technical Memorandum, Gambell, St. Lawrence Island, Alaska. Montgomery Watson, November 1995.
- Remedial Investigation, Gambell, St. Lawrence Island, Alaska. Montgomery Watson, January 1995.
- Chemical Data Acquisition Plan, Site Inventory Update, Gambell, St. Lawrence Island, Alaska. Ecology & Environment (E&E), February 1993.
- Site Inventory Report, Gambell Formerly Used Defense Site, St. Lawrence Island, Alaska. E&E, December 1992.

1.5.1 Site Description

Gambell is located off the coast of western Alaska on the northwest tip of St. Lawrence Island, in the western portion of the Bering Sea, approximately 200 air miles southwest of Nome, Alaska, and 39 air miles from the Siberian Chukotsk Peninsula (Figure 1-1). The village of Gambell, at an elevation of approximately 30 feet above mean sea level (MSL), is situated on a gravel spit that projects northward and westward from the island (Figure 1-2). St. Lawrence Island is currently owned jointly by Sivuuq, Inc., in Gambell, Alaska, and Savoonga Native Corporation in Savoonga, Alaska. Non-Native land on St. Lawrence Island is limited to state land used for airstrips and related facilities in Gambell (Montgomery Watson, 1995a).

The village of Gambell is inhabited primarily by Native St. Lawrence Island Yupik people who lead a subsistence-based lifestyle. The Gambell area supports habitat for a variety of seabirds, waterfowl, and mammals that either breed in or visit the area. The area surrounding the top of Sevuokuk Mountain, above the Village of Gambell, supports a large bird rookery. The birds and bird eggs serve as a subsistence food source for local inhabitants. The ocean surrounding the Gambell area is used extensively for subsistence hunting of whales, walrus, seals, sea birds, and fish.

1.5.2 Investigation History

The URS Corporation (URS) conducted a file search and preliminary reconnaissance of the Gambell area in 1985. The site reconnaissance included an inventory of all materials left by the military and collection of a limited number of soil and water samples. The samples were analyzed for physical, biological, and chemical characteristics. Soil samples were analyzed for polychlorinated biphenyls (PCBs) and none were detected. Surface water and groundwater samples from six wells were analyzed for oil and grease, PCBs, volatile organic compounds (VOCs), metals, and secondary water quality parameters. Oil and grease in groundwater samples collected from the Communications Facility and the Radar Power

Station exceeded groundwater standards; these contaminants were detected at concentrations of 14 and 115 milligrams per liter (mg/L), respectively. Arsenic, barium, cadmium, chromium, and lead were also detected; however, the elevated concentrations of metals reported by URS were not substantiated during subsequent investigations.

In 1991 and 1992, E&E conducted site reconnaissance visits and interviewed individuals living at Gambell during the period of DoD occupation. E&E then prepared a Chemical Data Acquisition Plan (CDAP) for further investigation of the areas of concern based on information gathered during the interviews and information reported in the URS document (E&E, 1993). Montgomery Watson implemented the CDAP in 1994 as part of a Phase I RI.

The objectives of the 1994 RI were to gather sufficient chemical, geophysical, and hydrological data to identify and characterize sites requiring remediation, and to identify remedial alternatives for those sites. During this RI, elevated concentrations of priority pollutant metals, including lead concentrations of up to 3,249 milligrams per kilogram (mg/Kg), were detected in soil; the maximum allowable concentration of lead in soil at residential areas is 400 mg/Kg. PCBs, dioxins, furans, and fuel-related contaminants were also detected in soils throughout the investigated area. Fuel-related contaminants and solvents were detected in groundwater. Recommendations were made for further evaluation at several sites (Montgomery Watson, 1995).

In 1996, a geophysical survey was performed at Site 5 where transformers were reportedly buried near the water supply at Gambell. The geophysical survey confirmed the presence of metallic debris. This area was investigated in 1997 to confirm if the anomaly was actually the reported transformers and whether any PCBs were associated with any transformers present. The investigation found that the geophysical anomaly was caused by non-hazardous metallic debris; no transformers were found. The debris was removed from the island in 1997 (Montgomery Watson, 1997).

A Phase II RI was conducted in 1998 to fill data gaps from the Phase I RI. Soil and groundwater samples were collected to delineate the extent of contamination at several sites. Results of the Phase II sampling program indicated no significant surface soil or groundwater contamination at several of the investigated sites; however, cleanup and removal of contaminated media were recommended for other sites (Montgomery Watson, 1998).

In 1999, OSCI performed remedial actions at several Gambell sites (OSCI, 2001). Following removal of contaminated soils, confirmation samples were collected to demonstrate that contaminated soils had been removed; however, confirmation samples showed that fuel-related contamination and metals were still present at some sites. Additionally, low levels of dioxins were detected in soils. Concentrations of many contaminants exceeded the levels permitted by ADEC Method 2, under 40-inch zone, migration to groundwater regulations.

Geophysical surveys were performed at several Gambell sites in 2000 to aid in developing the SPIP. These sites were identified during a community survey wherein local residents completed questionnaires regarding the whereabouts of remaining military debris. Based

upon the results of the geophysical surveys and questionnaires, several sites were targeted for further investigation (Montgomery Watson, 2000).

Potentially impacted sites were also identified in the HTSA (TEC, 2000). The HTSA combined data from historic aerial photographs with current maps of Gambell to identify areas of possible former military use. Following review of the HTSA, four new sites were targeted for investigation. These new sites are listed below, with aerial photograph dates, where applicable:

- Site 25B – Suspected Pits (located immediately west of Site 25A)
- Site 26 – Debris Burial Feature – 1953
- Site 27 – Drum Storage Area – 1955
- Site 28 – Disturbed Ground – 1972

1.6 PROJECT TEAM ORGANIZATION AND RESPONSIBILITIES

The primary personnel involved in the field investigations are the Project Manager, Safety and Health Manager (SHM), the Field Team Leader (FTL) who serves as Site Health and Safety Officer (SHSO), QA/QC Officer, the Project Chemist, and Environmental Samplers. The field team will perform the tasks described in this plan by following a management approach with clear project organization and well-defined authority and responsibilities for all key personnel. A project organization chart is shown in Figure 1-3.

1.6.1 Project Manager

The Project Manager will set and maintain the performance standards for execution of work, including technical project performance, internal QC, and adherence to schedule and budget. The Project Manager will consult with the Alaska District prior to any deviation from this Work Plan.

1.6.2 Safety and Health Manager

The SHM is responsible for developing, instituting, coordinating, and supervising the health and safety program for the project. The SHM's responsibilities include ensuring that the site-specific Health and Safety Plan (SSHASP) complies with all federal, state, and local health requirements and coordinating with the SHSO on all modifications to the SSHASP.

1.6.3 Field Team Leader

The FTL will coordinate all field activities that occur during the project investigations and will be the primary field contact. The responsibilities of the FTL will include coordinating all field activities with the Project Manager and laboratory; maintaining a detailed field notebook; establishing and maintaining a field records system; monitoring compliance of the sample custodian within the provisions of all project plans; and performing other

responsibilities as directed by the Project Manager. The FTL will communicate with the Project Manager for any necessary fieldwork clarification.

1.6.4 Site Health and Safety Officer

The SHSO will direct all personnel with respect to site health and safety. It is the responsibility of the SHSO to ensure that all requirements and protocols set forth in the HASP are followed by all field personnel.

1.6.5 QA/QC Officer

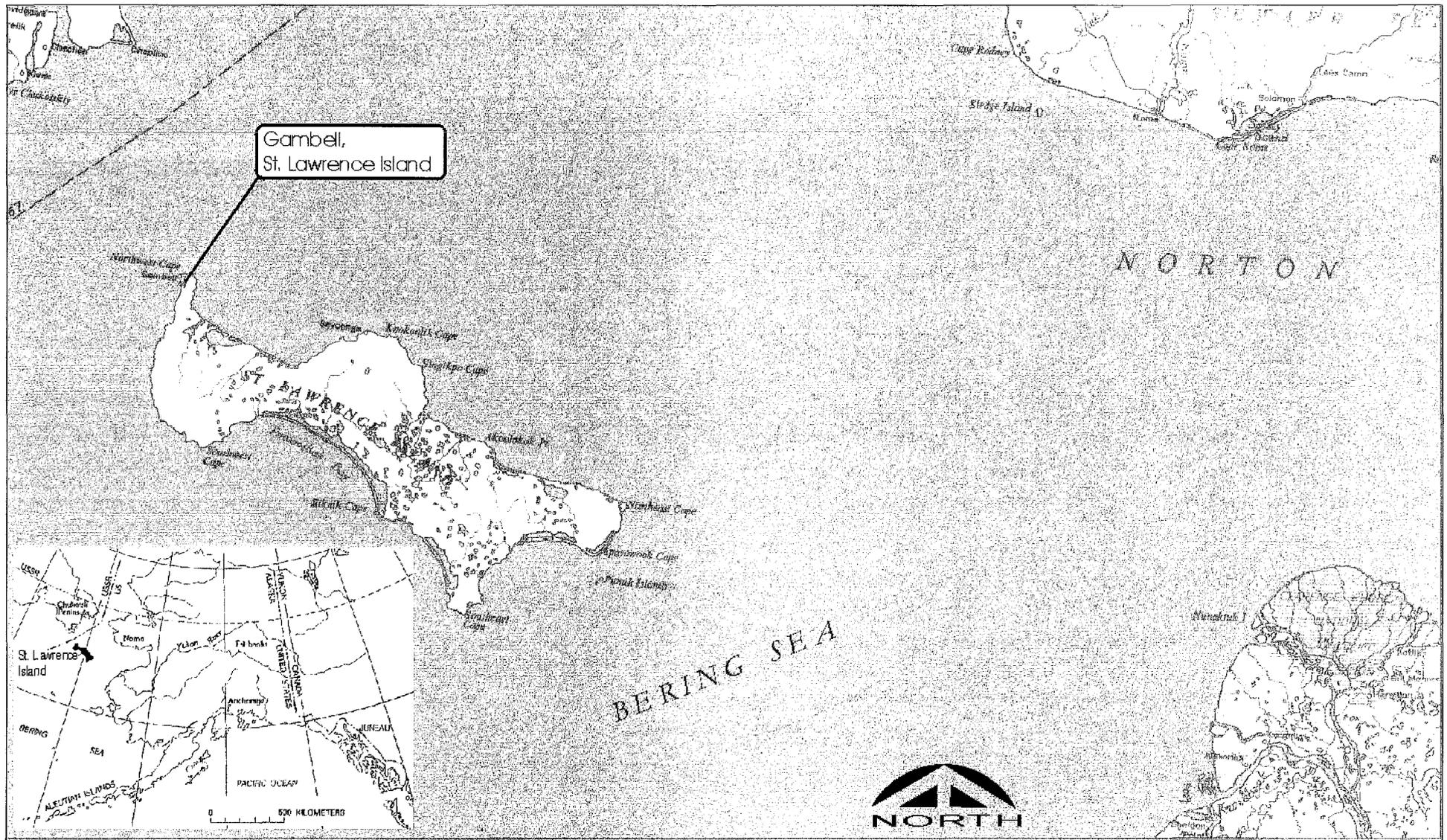
The QA/QC Officer is responsible for overseeing project QA and ensuring that established project QA/QC protocols are followed. The QA/QC Officer will provide an external, and thereby independent, QA function.

1.6.6 Project Chemist

The Project Chemist will ensure that project samples are analyzed in accordance with the QAPP and that the chain-of-custody (CoC) record is completed for each sample with appropriate information. The Project Chemist will oversee sample handling and will ensure that samples are preserved, packed, and shipped according to United States Army Corps of Engineers Regulation No. 1110-1-263 (USACE, 1990).

1.6.7 Environmental Sampler

The Environmental Sampler will work with the Project Chemist to ensure that the CoC record is completed for each sample with appropriate information and travels with the samples at all times. The Environmental Sampler will perform preservation, packing, and shipping of samples in accordance with United States Army Corps of Engineers Regulation No. 1110-1-263 (USACE, 1990).



SOURCE: U.S. Geological Survey
 Reston, Virginia 22092, 1976
 St. Lawrence, Alaska
 N6265 - W16830 /60x210
 Surveyed 1948, Compiled 1957
 Minor Revisions 1974
 Scale 1:250,000 Contour Interval 100'

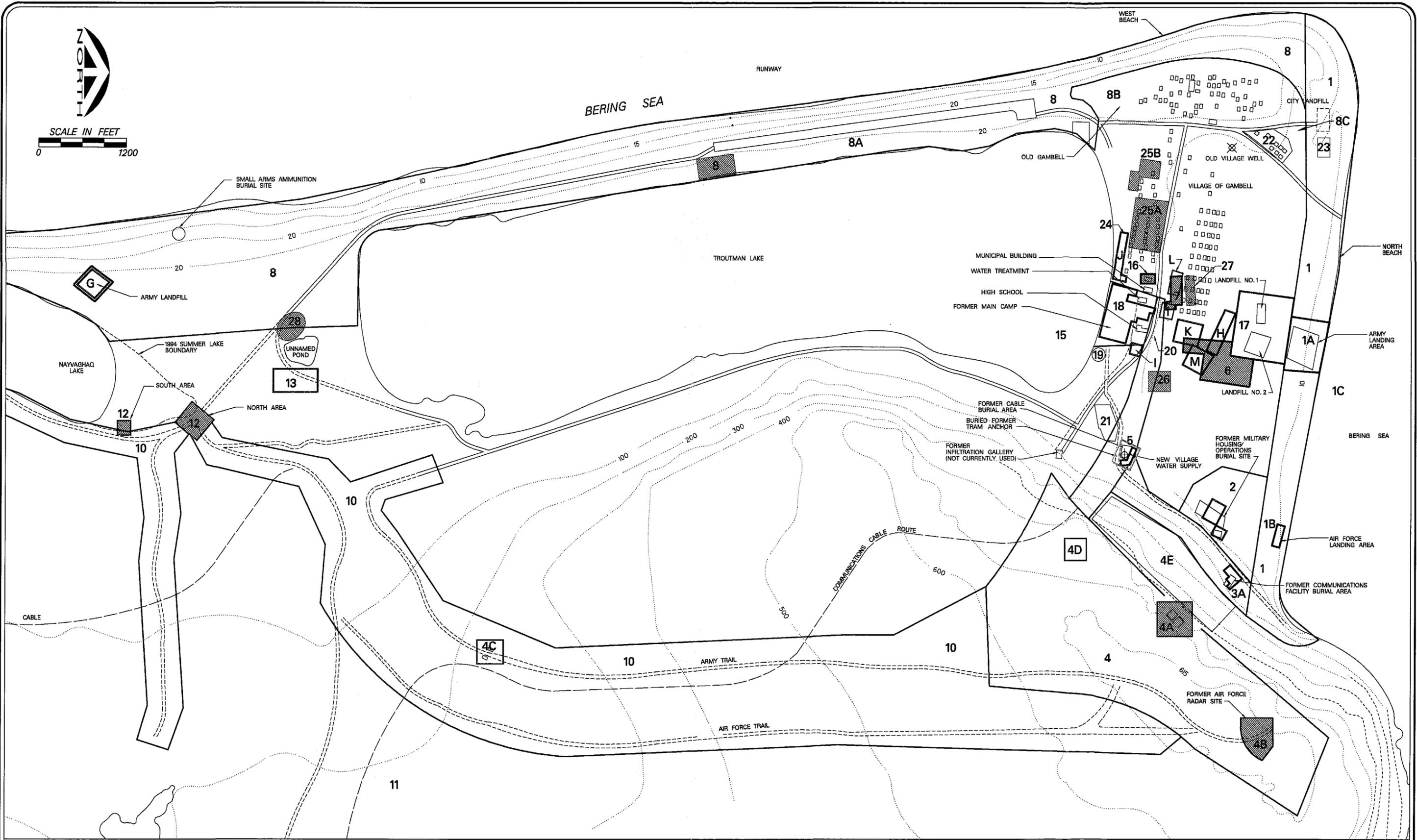
FIGURE 1-1
 U.S. ARMY ENGINEER DISTRICT, ALASKA
 GAMBELL, ST. LAWRENCE ISLAND, ALASKA



MONTGOMERY WATSON

Anchorage, Alaska

GAMBELL, ALASKA, LOCATION MAP



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- AREAS OF CONCERN (2001)
- GEOPHYSICAL SURVEY LOCATION PERFORMED IN 2000
- GEOPHYSICAL SURVEY LOCATION PERFORMED IN 1994
- GEOPHYSICAL SURVEY LOCATION PERFORMED IN 1996

FIGURE 1-2
 U.S. ARMY ENGINEER DISTRICT, ALASKA
 GAMBELL, ST. LAWRENCE ISLAND, ALASKA
 STRATEGIC PROJECT IMPLEMENTATION PLAN
GAMBELL VICINITY MAP

**U.S. ARMY ENGINEER DISTRICT,
ALASKA**

**PROJECT MANAGER
Gary Busse**

**QA OFFICER
Jane Whitsett**

**SAFETY & HEALTH MANAGER
Beth Darnell**

**PROJECT LABORATORY
Chemical Testing:
Arthur D. Little, Inc.
Columbia Analytical Services**

**FIELD TEAM LEADER /
SITE HEALTH & SAFETY
OFFICER
Bonnie McLean**

**PROJECT CHEMIST &
ENVIRONMENTAL SAMPLERS**

SUBCONTRACTORS
**SURVEYOR
Mullikin Surveys**
**DRILLER
Hughes Drilling**

FILE: E:\usace\gambell\2001\WP\Final\Fg-3.dgn

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MONTGOMERY WATSON
Anchorage, Alaska

FIGURE 1-3

U.S. ARMY ENGINEER DISTRICT, ALASKA
GAMBELL, ST. LAWRENCE ISLAND, ALASKA

PROJECT ORGANIZATION CHART

2.0 INVESTIGATION PLAN

Site descriptions, objectives for the 2001 RI fieldwork, and site activities at each area requiring data collection are briefly described below. Sites that will be investigated during the 2001 RI are listed in Table 2-1 and shown in Figure 2-1. A summary of the 2001 RI site sampling activities is provided in Table 2-2. Approximate sampling locations are shown in Figures 2-2 through 2-11. Actual sample locations will be determined by the field team based on field observations and using rationale outlined in this Work Plan.

Table 2-1 Gambell 2001 Supplemental RI Sites

Site Number	Site Description
Site 4A	Quonset Huts near Former USAF Radar Site
Site 4B	Former USAF Radar Site
Site 6	Military Landfill
Site 7	Former Military Power Facility
Site 8	West Beach/Army Landfill
Site 12	Nayvaghag Lake Disposal Site
Site 16	Municipal Building Site
Site 25A	Village of Gambell South Housing Units
Site 25B	Suspected Pits
Site 26	Debris Burial Feature – 1953
Site 27	Drum Storage Area – 1955
Site 28	Disturbed Ground – 1972
Unknown	Discretionary Samples

Key: USAF – United States Air Force

2.1 SITE 4A – QUONSET HUTS NEAR FORMER USAF RADAR SITE

Site 4A, located on Sevuokuk Mountain, formerly contained transformers and two Quonset huts. During the 1994 RI, surface soil samples were collected from Site 4A and analyzed for fuel-related contaminants, PCBs, solvents, and dioxins; no contaminants were detected above method detection limits (MDL). Confirmation samples collected by OSCI following the 1999 removal action contained diesel range organics (DRO) in soil at concentrations of up to 1,310 mg/Kg. OSCI's 1999 sample locations, including samples 99GAM014, -015 (field duplicate) -016SL (triplicate), -017, -018, and -019, were shown in OSCI's Figure 7 (see Appendix A of this Work Plan). The samples were collected from within and outside of the two Quonset hut footprints, following removal of the frames.

The objective for supplemental RI fieldwork at Site 4A is to confirm 1999 sampling results. Thirty-six surface soil samples (nine each from four triangular grids) will be collected and screened in the field using a photoionization detector (PID) and PetroFlag™ screening kits. The four triangular sampling grids will be established using the approximate locations of the

1999 samples as the grid centerpoints. Locations and orientations of the triangular grids will be decided in the field based on site observations. The four soil samples (one from each of the four grids) with the highest field screening results will be submitted for laboratory analysis. Two soil samples will be collected from former confirmation sampling locations 99GAM018SL and 99GAM019SL; these samples will be screened in the field for hexavalent chromium.

Proposed sampling grid locations for Site 4A are shown in Figure 2-2. Sample analyses and laboratory methods are listed in Table 2-2.

2.2 SITE 4B – FORMER USAF RADAR SITE

Site 4B, the Former United States Air Force (USAF) Site, is located on Sevuokuk Mountain and covers an area approximately 375 feet by 500 feet. This site housed buildings that burned and caused ordnance to explode and scatter debris. Analyses of soil samples collected during the Phase II RI showed elevated levels of metals and dioxins. Soil and debris removal actions were performed by OSCI in 1999. The OSCI Site 4B map (OSCI Figure 6, shown in Appendix A of this Work Plan) showed an area approximately 29 feet by 37 feet, portions of which had heavy staining, oily substances, and large rocks. This area was excavated in 1999 to a depth of approximately 24 inches; following excavation, confirmation soil samples were collected, including samples 99GAM020, -021 (field duplicate), -022 (triplicate), -023, -024, -025. The excavation confirmation samples showed DRO and dioxin levels in soil of up to 13,900 mg/Kg and 1,846 parts per trillion (ppt), respectively.

The objective for supplemental RI fieldwork at Site 4B is to confirm 1999 sampling results. Thirty-six surface soil samples (nine each from four triangular grids) will be collected and screened in the field using a PID and PetroFlag™ screening kits. The four triangular sampling grids will be established using the approximate locations of the 1999 samples as the grid centerpoints. Locations and orientations of the triangular grids will be decided in the field based on site observations and field notes from 1999. The four soil samples (one from each of the grids) with the highest field screening results will be submitted for laboratory analysis.

Proposed sampling grid locations for Site 4B are shown in Figure 2-3. Sample analyses and laboratory methods are listed in Table 2-2.

2.3 SITE 6 – MILITARY LANDFILL

Site 6 is located north of Gambell High School and east of the new housing area. This landfill was used to dispose of building materials, vehicles, machinery, drums, and miscellaneous debris. Exposed drums (7,897 pounds) and other metal debris (1,748 pounds) were removed in 1999 by OSCI. A confirmation soil sample (99GAM026SL) collected from the approximate center of the removed drum stockpile (see OSCI Figure 8 in Appendix A of this Work Plan) had low levels of residual range organics (RRO) and arsenic; no other fuel-related contaminants, solvents, PCBs, or pesticides were detected.

The objectives for supplemental RI fieldwork at Site 6 are to confirm 1999 sampling results and to determine the nature and extent of soil and groundwater contamination. To confirm the 1999 sample results, nine surface soil samples from one triangular grid will be collected and screened in the field using a PID and PetroFlag™ screening kits. The triangular sampling grid will be established using the approximate location of the 1999 sample as the centerpoint. The location will be approximated using site photographs, visual indicators such as staining, and input from local residents who worked on the site. The two soil samples with the highest field screening results will be submitted for laboratory analysis.

To determine the nature and extent of soil contamination, 3 soil borings will be advanced to 12 feet below ground surface (bgs), or to permafrost if permafrost is encountered within 12 feet of the ground surface. Soil boring locations were determined, in part, by the locations of depressions identified from 1980 aerial photographs in the HTSA report. Soil samples will be collected for laboratory analysis at the surface and at the bottom of each borehole. Boreholes will be continuously split-spoon sampled, and each sample will be field-screened using a PID. Two non-surface, non-bottom borehole soil samples at Site 6 with high PID screening levels will be submitted for laboratory analysis.

To determine the nature and extent of groundwater contamination, three well points will be installed and sampled; the locations of the well points will be determined in the field after the soil borings have been completed.

Proposed sampling grid and soil boring locations for Site 6 are shown in Figure 2-4. Sample analyses and laboratory methods are listed in Table 2-2.

2.4 SITE 7 – FORMER MILITARY POWER FACILITY

The Former Military Power Facility was demolished and buried north of the present Gambell Municipal Building. The burial site of this former military facility comprises Site 7. Electrical transformers were reportedly disposed of at this site. Additionally, Gambell residents have reported that the military may have dumped partially full barrels of oil or other petroleum products on the ground in the vicinity of this site. During previous investigations, DRO was detected in shallow soils in concentrations of up to 1,950 mg/Kg. Benzene and DRO were also detected in groundwater samples from Site 7.

The objectives for supplemental RI fieldwork at Site 7 are to determine the nature and extent of fuel and groundwater contamination and to determine the source of soil contamination. To determine the nature and extent of soil contamination, 3 soil borings will be advanced to 12 feet bgs, or to permafrost if permafrost is encountered within 12 feet of the ground surface. Soil boring locations were determined, in part, by the locations of pits and buildings identified from 1955 aerial photographs in the HTSA report. Soil samples will be collected for laboratory analysis at the surface and at the bottom of each borehole. The boreholes will be continuously split-spoon sampled, and each sample will be field-screened using a PID. Two non-surface, non-bottom borehole soil samples at Site 7 with high PID screening levels will be submitted for laboratory analysis.

To determine the nature and extent of groundwater contamination, three well points will be installed and sampled; locations of the well points will be determined in the field following completion of the soil borings.

To determine the source of soil contamination, two soil samples from locations with visible evidence of fuel-related contamination will be collected and submitted for laboratory fuel fingerprinting analyses.

Proposed soil boring locations for Site 7 are shown in Figure 2-5. Sample analyses and laboratory methods are listed in Table 2-2.

2.5 SITE 8 – WEST BEACH/ARMY LANDFILL

The Army Landfill at Site 8 is located near West Beach, which extends for approximately 3 miles from the southwest end of North Beach to Nayvaghq Lake. The Army Landfill is on the northwest side of Nayvaghq Lake. Surface debris removed by OSCI in 1999 included scattered metal, small quantities of wood and concrete, drums containing tar, and an exposed layer of metal landing mat approximately 30 feet wide and 4,500 feet long. A confirmation soil sample collected at the tar drum area (99GAM012SL; see OSCI Figure 3 in Appendix A of this Work Plan) showed DRO and RRO at concentrations below ADEC cleanup levels.

The objective for supplemental RI fieldwork at Site 8 is to confirm 1999 sampling results at the former tar drum area. Nine surface soil samples from one triangular grid will be collected and screened in the field using a PID and PetroFlag™ screening kits. The triangular sampling grid will be established using the approximate location of the 1999 sample as the grid centerpoint. Location and orientation of the triangular grid will be decided in the field based on site observations and interviews with Gambell residents who worked at the site and may be able to provide information on the exact location of the 1999 samples. The two soil samples with the highest field screening results will be submitted for laboratory analysis.

Proposed sampling grid locations for Site 8 are shown in Figure 2-6. Sample analyses and laboratory methods are listed in Table 2-2.

2.6 SITE 12 – NAYVAGHAQ LAKE DISPOSAL SITE

Site 12 is located north of Nayvaghq Lake on the southwest side of an all-terrain vehicle (ATV) trail. The site is divided into a north area and a south area, both of which were addressed during the OSCI 1999 fieldwork. The north area contained approximately 120 drums, battery remnants, and household refuse. The south area contained approximately 50 drums, 18 of which were full of garbage. Following the 1999 debris removal, confirmation soil samples were collected. The OSCI map of Site 12 (shown in Appendix A of this Work Plan) showed confirmation sample locations 99GAM009, -010, and -011SL, which had concentrations of DRO and lead of up to 463 mg/Kg and 562 mg/Kg, respectively.

The objectives for supplemental RI fieldwork at Site 12 are to confirm 1999 sampling results and to evaluate for the presence of contamination in the disturbed areas. To confirm the 1999

sampling results, 27 surface soil samples (9 each from 3 triangular grids) will be collected and screened in the field using a PID and PetroFlag™ screening kits. Because exact locations of the 1999 samples were not surveyed or permanently marked, the triangular sampling grids will be established using the approximate locations of the 1999 samples as the grid centerpoints. Locations and orientations of the triangular grids will be decided in the field based on site observations. The four soil samples with the highest field screening results (the highest from each grid plus the next highest) will be submitted for laboratory analysis.

Proposed sampling grid locations for Site 12 are shown in Figure 2-7. Sample analyses and laboratory methods are listed in Table 2-2.

2.7 SITE 16 – GAMBELL MUNICIPAL BUILDING SITE

Site 16 consists of an area of stained gravel located immediately west of the Gambell Municipal Building. The stained area is approximately 35 feet wide and 55 feet long and consists of a dark gray, oily coating on gravels from 0.5 feet to 2.5 feet bgs. The origin of the stain is unknown, but it may be related to former military use of the site or heavy ATV traffic in this area. During previous investigations of this area, DRO was found in the surface soils in concentrations of up to 16 mg/Kg. Gambell residents believe that presence of the contaminated soil may hinder further development of the area or pose a risk to local residents.

The objectives for supplemental RI fieldwork at Site 16 are to determine the nature and extent of fuel contamination in soil and to determine the source of soil contamination. To determine the nature and extent of soil contamination, 4 soil borings will be advanced to 12 feet bgs, or to permafrost if permafrost is encountered within 12 feet of the ground surface. Soil samples will be collected for laboratory analysis at the surface and at the bottom of each borehole. Boreholes will be continuously split-spoon sampled, and each sample will be field-screened using a PID. Three non-surface, non-bottom borehole soil samples at Site 16 with high PID screening levels will be submitted for laboratory analysis.

To determine the source of soil contamination, two soil samples collected from locations with visible evidence of fuel-related contamination and submitted for laboratory fuel fingerprinting analyses.

Proposed soil boring locations for Site 16 are shown in Figure 2-8. Sample analyses and laboratory methods are listed in Table 2-2.

2.8 SITE 25A – VILLAGE OF GAMBELL SOUTH HOUSING UNITS

The South Housing Units site was identified in the Gambell SPIP as an area that may be contaminated by fuel-related products of military origin. During construction work performed in 1997 by Alaska Village Safe Water, oily soils were encountered at the permafrost interface. Gambell residents reported encountering stove oil and an empty 55-gallon drum during excavation for installation of a water main in the vicinity of Site 25A. Residents have also expressed concern that the military may have dumped barrels of oil

directly on the ground at this site. Areas where trenches, pits, or disturbed ground may have been located are apparent on historical aerial photographs of Site 25A.

The objectives for supplemental RI fieldwork at Site 25A are to determine the nature and extent of soil and groundwater contamination and to determine the source of soil contamination. To determine the nature and extent of soil contamination, 6 soil borings will be advanced to 12 feet bgs, or to permafrost if permafrost is encountered within 12 feet of the ground surface. Soil boring locations were determined, in part, by the locations of depressions, trenches, and disturbed ground identified by Gambell residents and from aerial photographs in the HTSA report. Soil samples will be collected for laboratory analysis at the surface and at the bottom of each borehole. The boreholes will be continuously split-spoon sampled, and each sample will be field screened using a PID. Three non-surface, non-bottom borehole soil samples at Site 25A with high PID screening levels will be submitted for laboratory analysis.

To determine the nature and extent of groundwater contamination, three well points will be installed and sampled; locations of the well points will be determined in the field after the soil borings have been completed.

To determine the source of soil contamination, two soil samples collected from locations with visible evidence of fuel-related contamination and submitted for laboratory fuel fingerprinting analyses.

Proposed soil boring and well point locations for Site 25A are shown in Figure 2-9. Sample analyses and laboratory methods are listed in Table 2-2.

2.9 SITE 25B – SUSPECTED PITS

Site 25B was identified in a 1973 aerial photograph as a series of pits (TEC, 2000). The site is located immediately west of Site 25A. The purpose of the suspected pits is unknown.

The objective for RI fieldwork at Site 25B is to evaluate for the presence of soil contamination. To identify soil contamination, 2 soil borings will be advanced to 12 feet bgs, or to permafrost if permafrost is encountered within 12 feet of the ground surface. Soil samples will be collected for laboratory analysis at the surface and at the bottom of each borehole.

The proposed sampling location for Site 25B is shown in Figure 2-9. Sample analyses and laboratory methods are listed in Table 2-2.

2.10 SITE 26 – DEBRIS BURIAL FEATURE – 1953

Site 26 was identified in a 1953 aerial photograph as a possible debris burial site (TEC, 2000). The site is located east of Gambell High School near Site 18 (Former Main Camp). Residents of Gambell report finding metal debris, machinery, oily debris, and transformers in the area.

The objective for RI fieldwork at Site 26 is to evaluate for the presence of soil contamination. To identify contamination, two soil borings will be advanced to 12 feet bgs, or to permafrost if permafrost is encountered within 12 feet of the ground surface. Soil samples will be collected at the surface and at the bottom of each borehole.

Proposed sampling locations for Site 26 are shown in Figure 2-10. Sample analyses and laboratory methods are listed in Table 2-2.

2.11 SITE 27 - DRUM STORAGE AREA - 1955

Site 27 was identified in a 1955 aerial photograph as a drum storage area (TEC, 2000). The site is located north of Site 7 (Former Military Power Facility). Drums that were stored at this site have been removed.

The objective for RI fieldwork at Site 27 is to evaluate for the presence of soil contamination. To identify contamination, 3 soil borings will be advanced to 12 feet bgs, or to permafrost if permafrost is encountered within 12 feet of the ground surface. Soil samples will be collected at the surface and at the bottom of each borehole.

Proposed sampling locations for Site 27 are shown in Figure 2-5. Sample analyses and laboratory methods are listed in Table 2-2.

2.12 SITE 28 - GROUND DISTURBANCE - 1972

Site 28 was identified in a 1972 aerial photograph as a ground disturbance (TEC, 2000). The site is located south of Troutman Lake and west of an unnamed lake. This area was reportedly leased by the Army from January 1955 to May 1958; however, the Army's use of the land is unknown.

The objective for RI fieldwork at Site 28 is to evaluate for the presence of soil contamination. To identify contamination, 2 soil borings will be advanced to 12 feet bgs, or to permafrost if permafrost is encountered within 12 feet of the ground surface. Soil samples will be collected at the surface and at the bottom of each borehole.

Proposed sampling locations for Site 28 are shown in Figure 2-11. Sample analyses and laboratory methods are listed in Table 2-2.

2.13 DISCRETIONARY SAMPLING LOCATIONS

In addition to the site-specific sampling described in the preceding sections, soil samples will be collected from five additional locations. These additional sampling locations will be selected based on guidance from Gambell residents about areas of local concern, site observations of staining or other indications of contamination, and comparison of physical features observed in the field with features identified in the HTSA. The additional sampling locations may be outside of the specific sites described in the preceding sections. Sampling locations will be approved by the Alaska District prior to sample collection.

The objective for discretionary RI fieldwork is to evaluate for the presence of soil contamination. To identify contamination, five soil borings will be advanced to 12 feet bgs, or to permafrost if permafrost is encountered within 12 feet of the ground surface. Boreholes will be continuously split-spoon sampled, and each sample will be field-screened using a PID. Two samples from each borehole will be submitted for laboratory analysis: one sample with high PID screening levels and one sample selected at the discretion of the field investigative team based on characteristics such as staining, odor, PID readings, and proximity to the groundwater interface.

Sample analyses and laboratory methods are listed in Table 2-2.

Table 2-2 Analytical Sampling Summary

Site Number	Site Description	Number of Grids	Number of Boreholes	Sample Location	SOIL										GROUNDWATER		Sample Location	Site Number		
					Grid Only Headspace Volatiles	Grid Fuel Products	Hexavalent Chromium HACH Colorimetry (field)	DRO/RRO	GRO	BTEX	VOC	PCBs	RCRA Metals	TAL Metals	Fuel Fingerprint	DRO/RRO			GRO/BTEX	
					PID (field)	PetroFlag™ (field)		AK102/103	AK101	SW8260BSIM	SW8260B	SW8082	SW6010B / 7000	SW6010B / 7000	(see notes)	AK102/103	AK101/ SW8260B			
4A	Quonset Huts Near Former Radar Site	4	0	Surface Soil	36	32	2	4	4				4					Surface Soil	4A	
4B	Former Radar Site	4	0	Surface Soil	36	24		4	4				4					Surface Soil	4B	
6	Former Military Landfill	1	3	Surface Soil	9	5		2	2				2					Surface Soil	6	
				Borehole Near-Surface				3	3			3			3					Borehole Near-Surface
				Borehole High PID				2	2			2			2					Borehole High PID
				Borehole Bottom				3	3			3			3					Borehole Bottom
				Groundwater												3	3			Groundwater
7	Former Military Power Facility	0	3	Borehole Near-Surface				3	3		3	3		3				Borehole Near-Surface	7	
				Borehole High PID				2	2			2	2		2			Borehole High PID		
				Borehole Bottom				3	3			3	3		3			Borehole Bottom		
				Fuel Fingerprint												2		Fuel Fingerprint		
				Groundwater												3	3	Groundwater		
8	Army Landfill/West Beach	1	0	Surface Soil	9	5		2	2				2				Surface Soil	8		
12	Nayvaghag Lake Disposal Site	3	0	Surface Soil	27	16		4	4				4				Surface Soil	12		
16	Gambell Municipal Building Site	0	4	Borehole Near-Surface				4	4	4								Borehole Near-Surface	16	
				Borehole High PID				3	3			3					Borehole High PID			
				Borehole Bottom				4	4			4						Borehole Bottom		
				Fuel Fingerprint											2		Fuel Fingerprint			
25A	South Housing Units	0	6	Borehole Near-Surface				6	6	6								Borehole Near-Surface	25A	
				Borehole High PID				3	3			3					Borehole High PID			
				Borehole Bottom				6	6			6			2		Borehole Bottom			
				Fuel Fingerprint													Fuel Fingerprint			
25B	Suspected Pits	0	2	Borehole Near-Surface				2	2	2								Borehole Near-Surface	25B	
				Borehole Bottom				2	2			2						Borehole Bottom		
26	Debris Burial Feature - 1953	0	2	Borehole Near-Surface				2	2		2			2				Borehole Near-Surface	26	
				Borehole Bottom				2	2			2			2			Borehole Bottom		
27	Drum Storage Area - 1955	0	3	Borehole Near-Surface				3	3	3	3	3		3				Borehole Near-Surface	27	
				Borehole Bottom				3	3			3	3		3			Borehole Bottom		
28	Ground Disturbance - 1972	0	2	Borehole Near-Surface				2	2		2			2				Borehole Near-Surface	28	
				Borehole Bottom				2	2			2			2			Borehole Bottom		
unknown	Discretionary Boreholes	0	5	Borehole High PID				5	5		5			5				Borehole High PID	unknown	
				Borehole Discretionary				5	5			5			5			Borehole Discretionary		
TOTAL		13	30																	

TOTAL PRIMARY SAMPLES	117	82	2	86	86	24	46	14	16	46	6	9	9
Field Duplicates (QC)	10	8		9	9	3	5	2	2	5		1	1
Trip Blanks					9	3	5						1
Matrix Spike				5	5	2	3	1	1	3		1	1
Matrix Spike Duplicate				5	5	2	3	1	1	3		1	1
TOTAL PRIMARY PLUS QC SAMPLES	127	90	2	105	114	34	62	18	20	57	6	12	13
Field Triplicates (QA)				9	9	3	5	2	2	5		1	1
QA Trip Blanks					1	1	1						1
QA Matrix Spike				1	1		1	1	1	1		1	1
QA Matrix Spike Duplicate				1	1		1	1	1	1		1	1
TOTAL QA SAMPLES	0	0	0	11	12	4	8	4	4	7	0	3	4
TOTAL SAMPLES	127	90	2	116	126	38	70	22	24	64	6	15	17

RCRA Metals: As, Cd, Cr, Pb, Hg, Ag, Se, Ba

TAL Metals: Al, Sb, As, Ba, Be, Cd, Ca, Cr, Co, Cu, Fe, Pb, Mg, Mn, Hg, Ni, K, Se, Ag, Na, Ti, V, Zn

AK - Alaska Method

BTEX - benzene, toluene, ethylbenzene, and xylenes

DRO - diesel range organics

GRO - gasoline range organics

PID - photoionization detector

QA - Quality Assurance

QC - Quality Control

RCRA - Resource Conservation and Recovery Act

RRO - residual range organics

SIM - selected ion monitoring

SW - Solid Waste Method

TAL - Target Analyte List

VOC - volatile organic compounds

Fingerprinting will consist of the following tests:

PAH GC/MS/SIM

Gasoline range hydrocarbons GC/MS

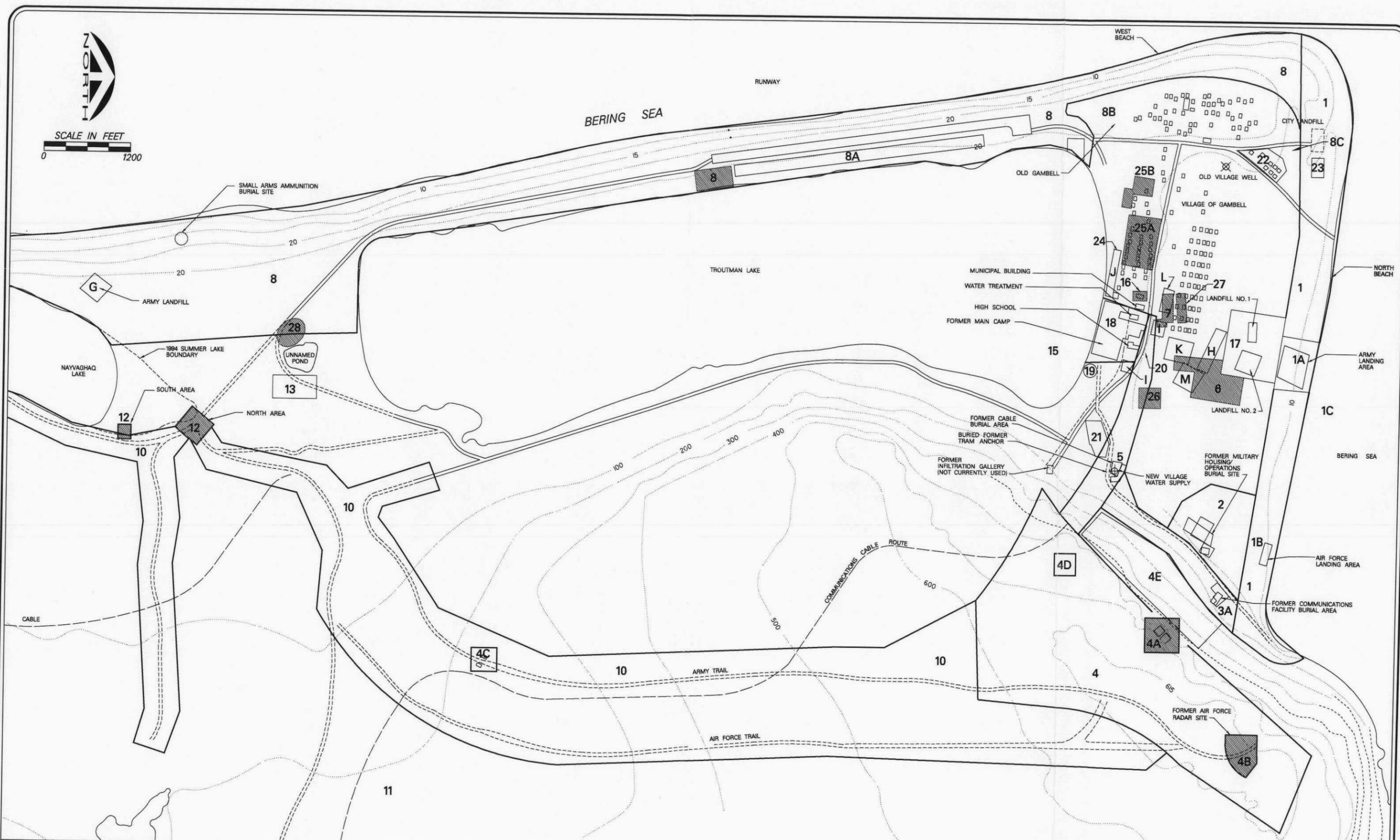
Brief interpretive report discussing results of the analytical testing, discussion of relationships to various petroleum product types.

Saturated hydrocarbons (SHC) and select isoprenoids in the diesel range (n-C8 to n-C40) by gas chromatography/ flame ionization detection (GC/FID)

Isotopic Carbon Distribution



SCALE IN FEET
0 1200



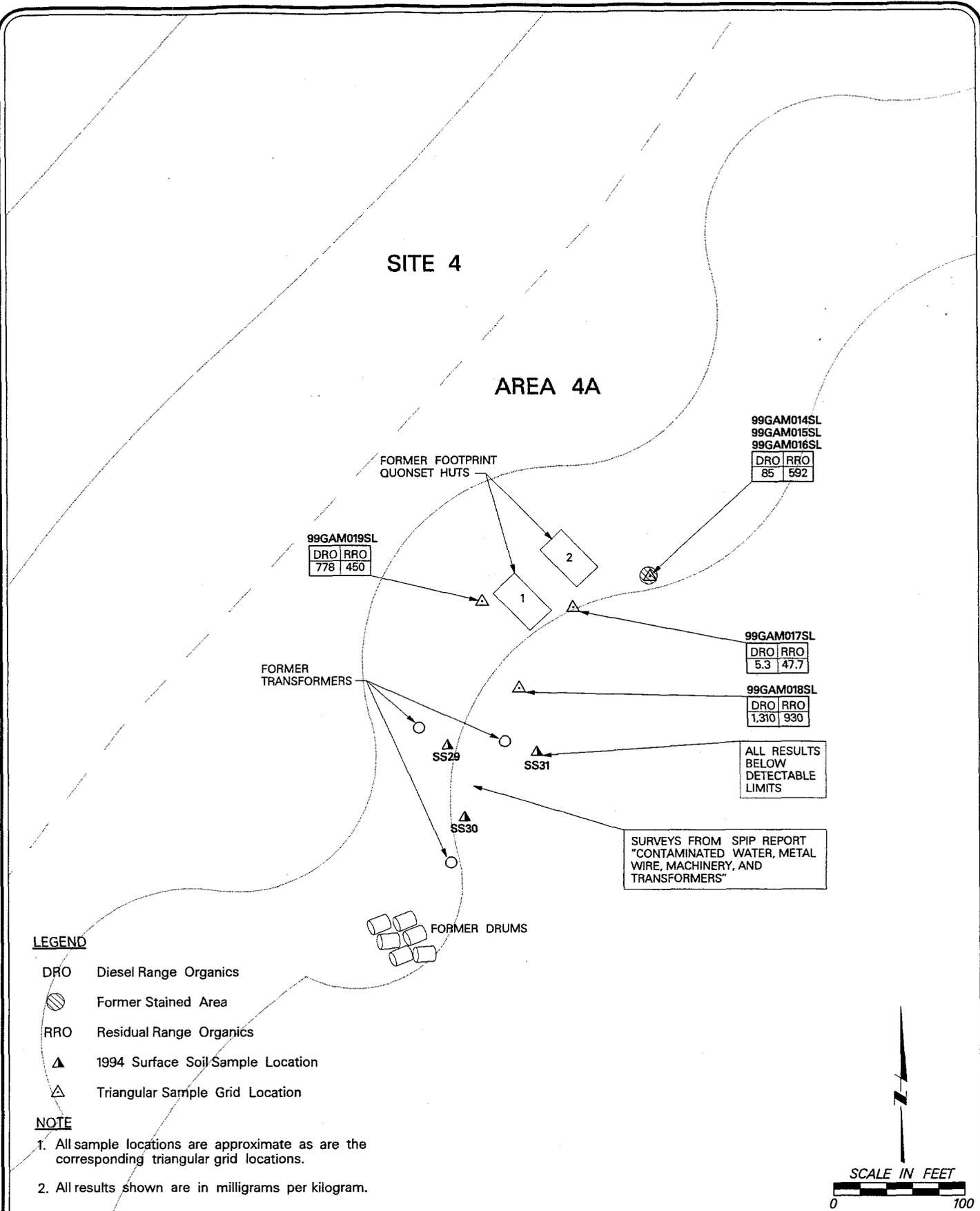
AREAS OF CONCERN (2001)



FIGURE 2-1
U.S. ARMY ENGINEER DISTRICT, ALASKA
GAMBELL, ST. LAWRENCE ISLAND, ALASKA
**GAMBELL 2001 SUPPLEMENTAL RI
STUDY SITES**

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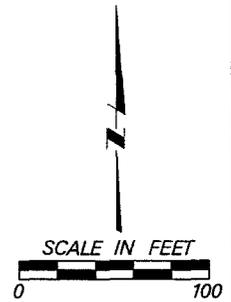


LEGEND

- DRO Diesel Range Organics
- Former Stained Area
- RRO Residual Range Organics
- ▲ 1994 Surface Soil-Sample Location
- △ Triangular Sample Grid Location

NOTE

1. All sample locations are approximate as are the corresponding triangular grid locations.
2. All results shown are in milligrams per kilogram.



MONTGOMERY WATSON

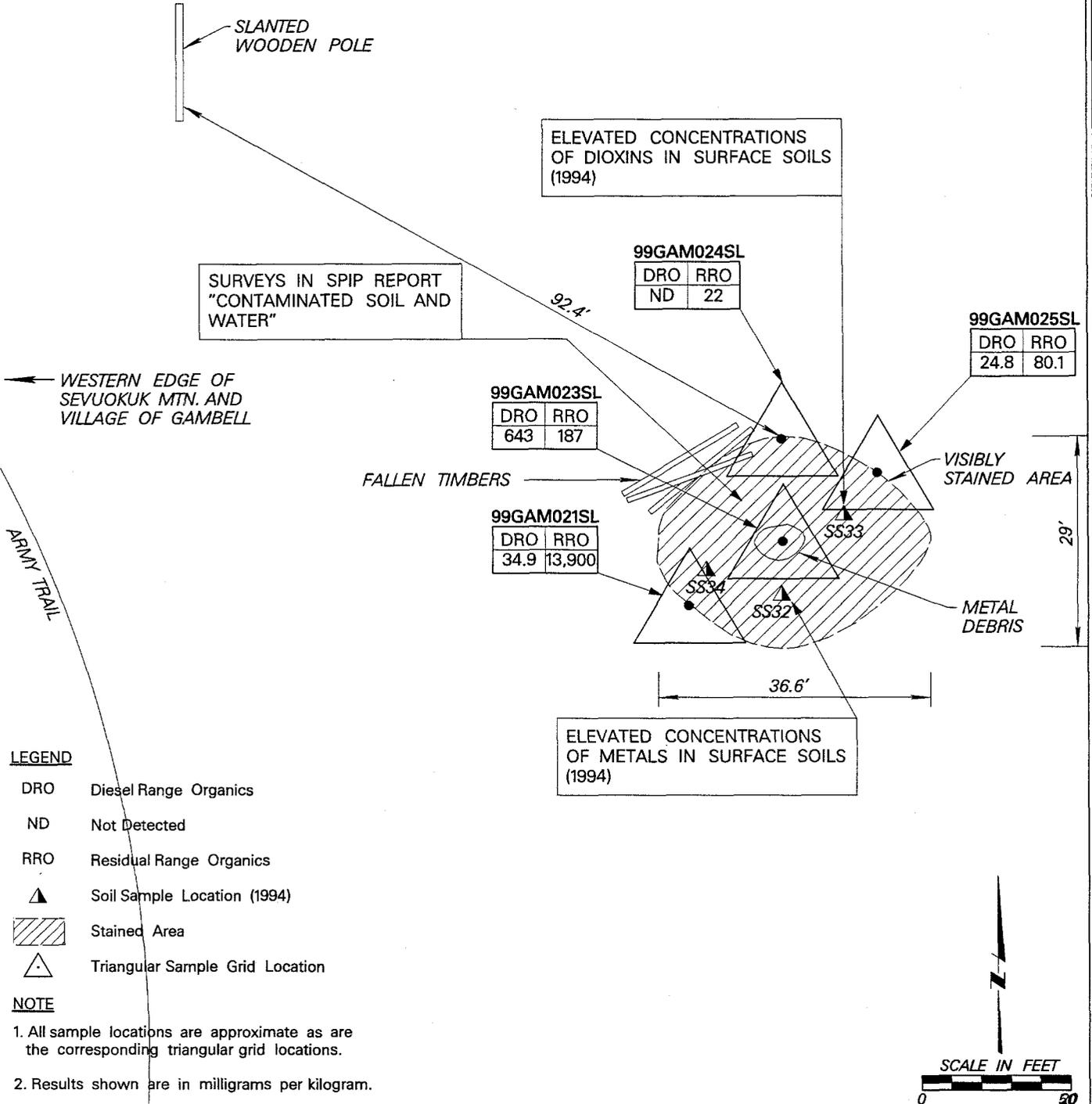
Anchorage, Alaska

FIGURE 2-2

U.S. ARMY ENGINEER DISTRICT, ALASKA
 GAMBELL, ST. LAWRENCE ISLAND, ALASKA

GAMBELL 2001 SUPPLEMENTAL RI SITE 4A

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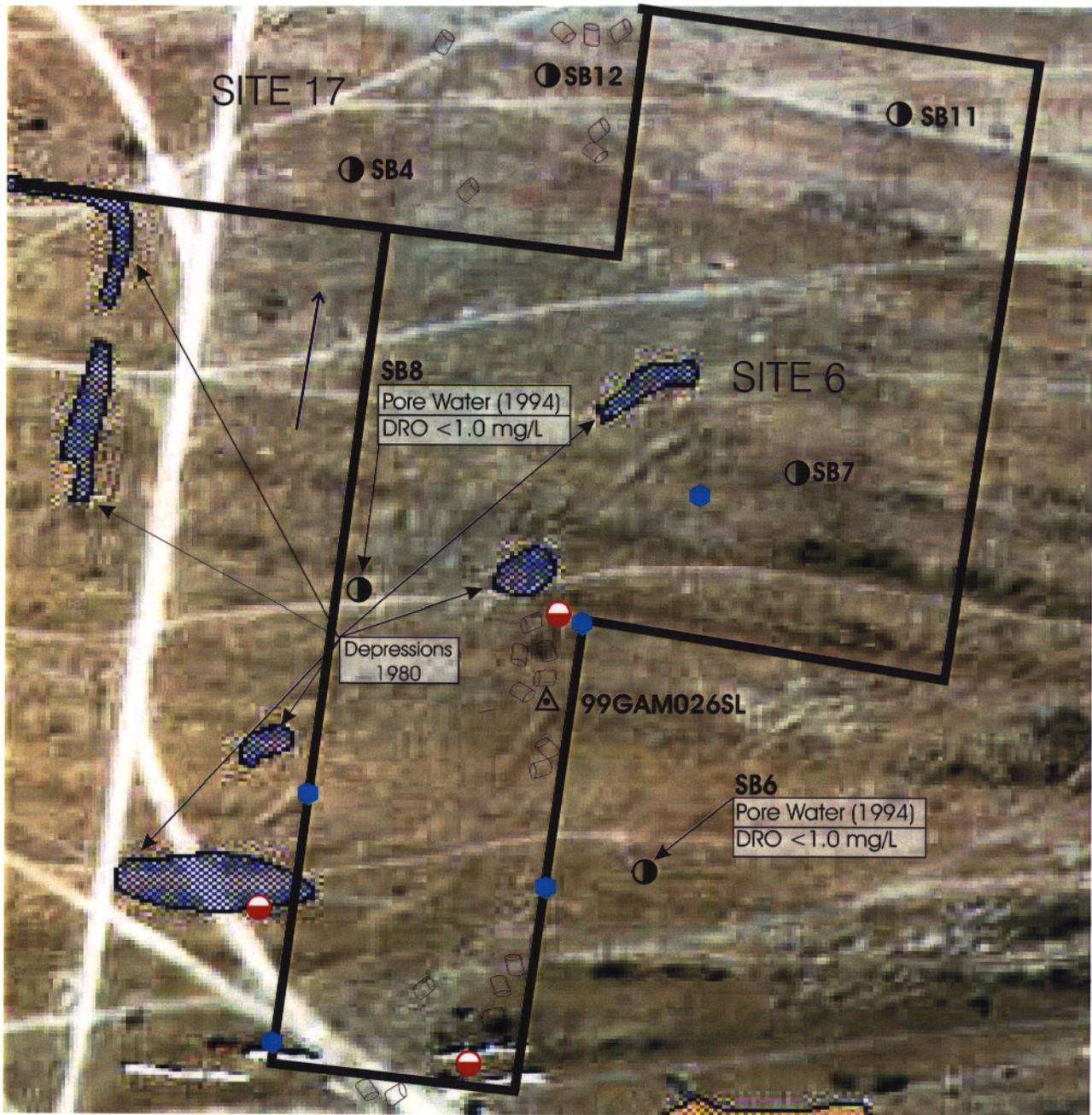


MONTGOMERY WATSON
 Anchorage, Alaska

FIGURE 2-3

U.S. ARMY ENGINEER DISTRICT, ALASKA
 GAMBELL, ST. LAWRENCE ISLAND, ALASKA

**GAMBELL 2001 SUPPLEMENTAL
 RI SITE 4B**



NOTES

1. All sample locations are approximate
2. Results shown are in milligrams per kilogram
3. Aerial Imagery: U.S. Army Topographic Engineering Center, 2000

LEGEND

- Former Drum Location
- Geophysical Anomalies (2000)
- Groundwater Flow (estimated)
- Proposed 2001 Soil Boring Location
- Soil Boring Location (1994)
- Triangular Sample Grid Location



Cad\Proj\USACE\Gambel\2001\WP\Final\G2-4.cdr

JOB No. 18...05.010102

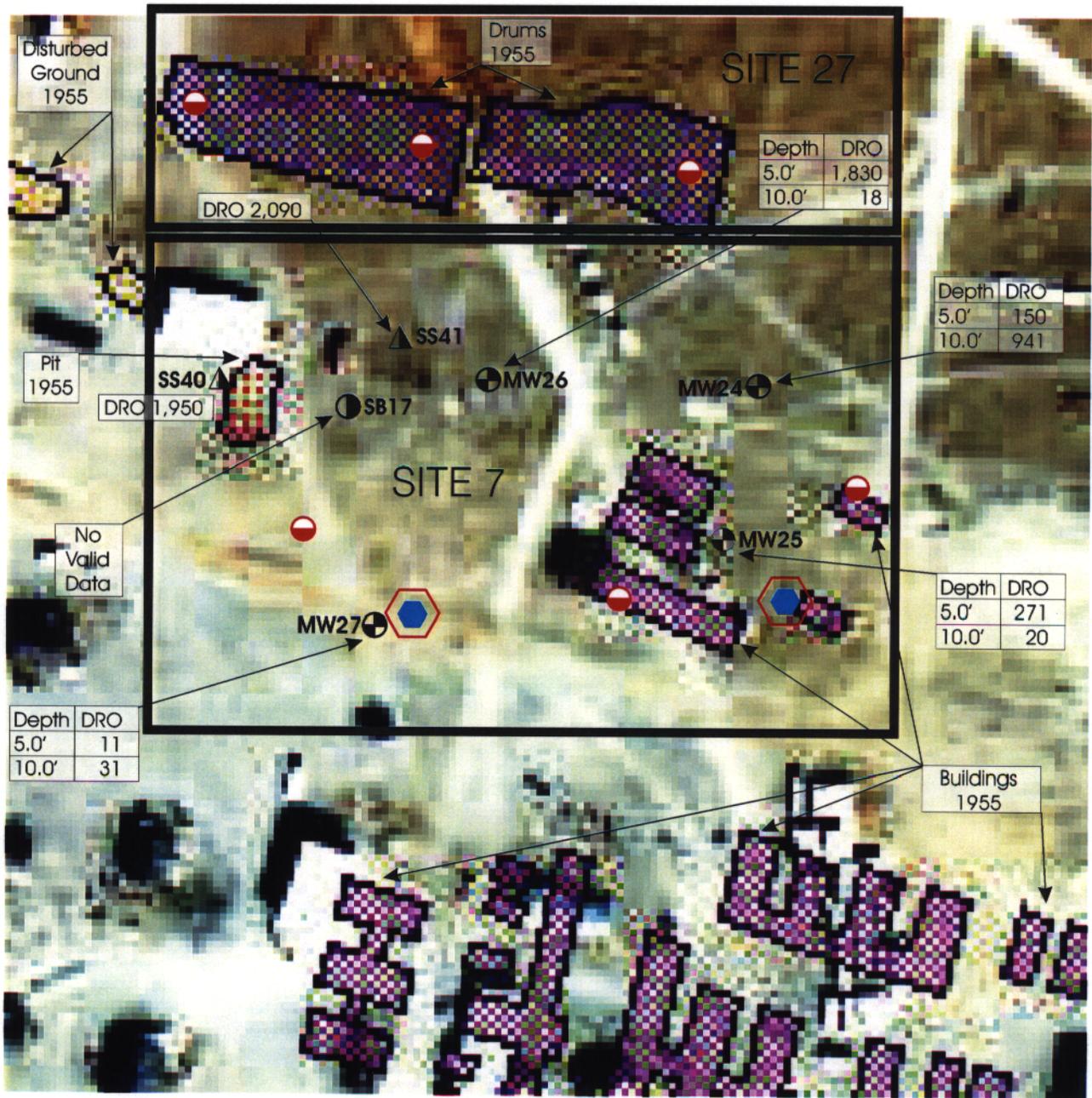


MWH
MONTGOMERY WATSON HARZA
Anchorage, Alaska

FIGURE 2-4

U.S. ARMY ENGINEER DISTRICT, ALASKA
GAMBELL, ST. LAWRENCE ISLAND, ALASKA

GAMBELL 2001 SUPPLEMENTAL RI SITE 6



NOTES

1. All sample locations are approximate
2. Results shown are in milligrams per kilogram
3. Aerial Imagery: U.S. Army Topographic Engineering Center, 2000

LEGEND

- Proposed 2001 Soil Boring Location
- Soil Boring Location (1994)
- Monitoring Well Location (1994)
- Geophysical Anomaly Location (1994)
- Geophysical Anomaly Location (2000 estimated)



FIGURE 2-5

U.S. ARMY ENGINEER DISTRICT, ALASKA
GAMBELL, ST. LAWRENCE ISLAND, ALASKA

GAMBELL 2001 SUPPLEMENTAL RI SITES 7 & 27

BERING SEA

10

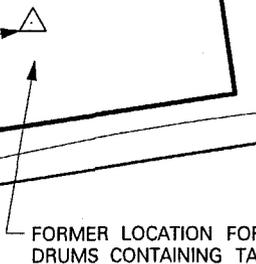
15

AIRCRAFT RUNWAY

SITE 8

99GAM012SL

DRO	RRO
ND	15.6



TROUTMAN LAKE

LEGEND

DRO Diesel Range Organics

ND Not Detected

RRO Residual Range Organics

△ Triangular Sample Grid Location

NOTE

1. All sample locations are approximate as are the corresponding triangular grid locations.
2. Results shown are in milligrams per kilogram.



FIGURE 2-6

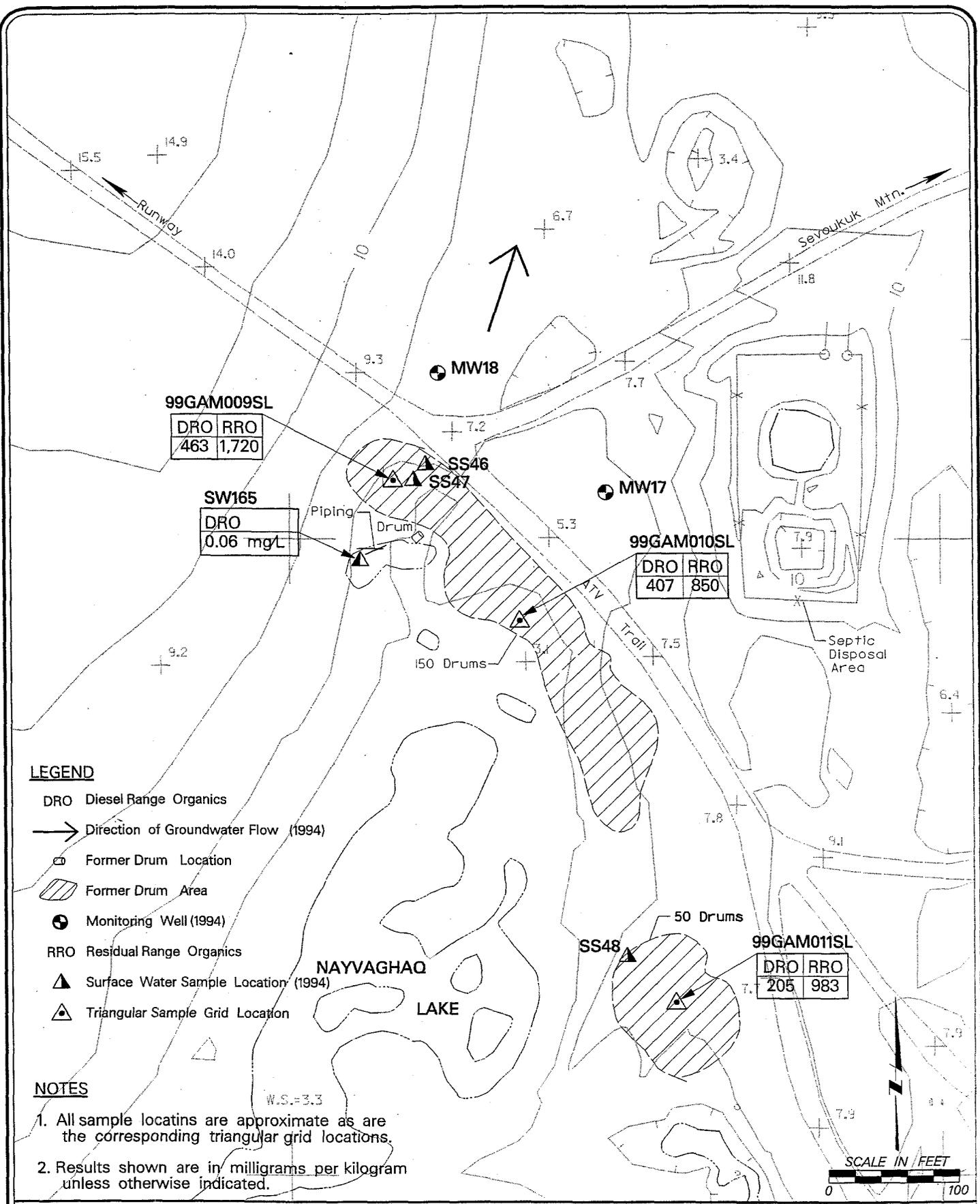
U.S. ARMY ENGINEER DISTRICT, ALASKA
GAMBELL, ST. LAWRENCE ISLAND, ALASKA

GAMBELL 2001 SUPPLEMENTAL RI SITE 8



MWH
MONTGOMERY WATSON HARZA
Anchorage, Alaska

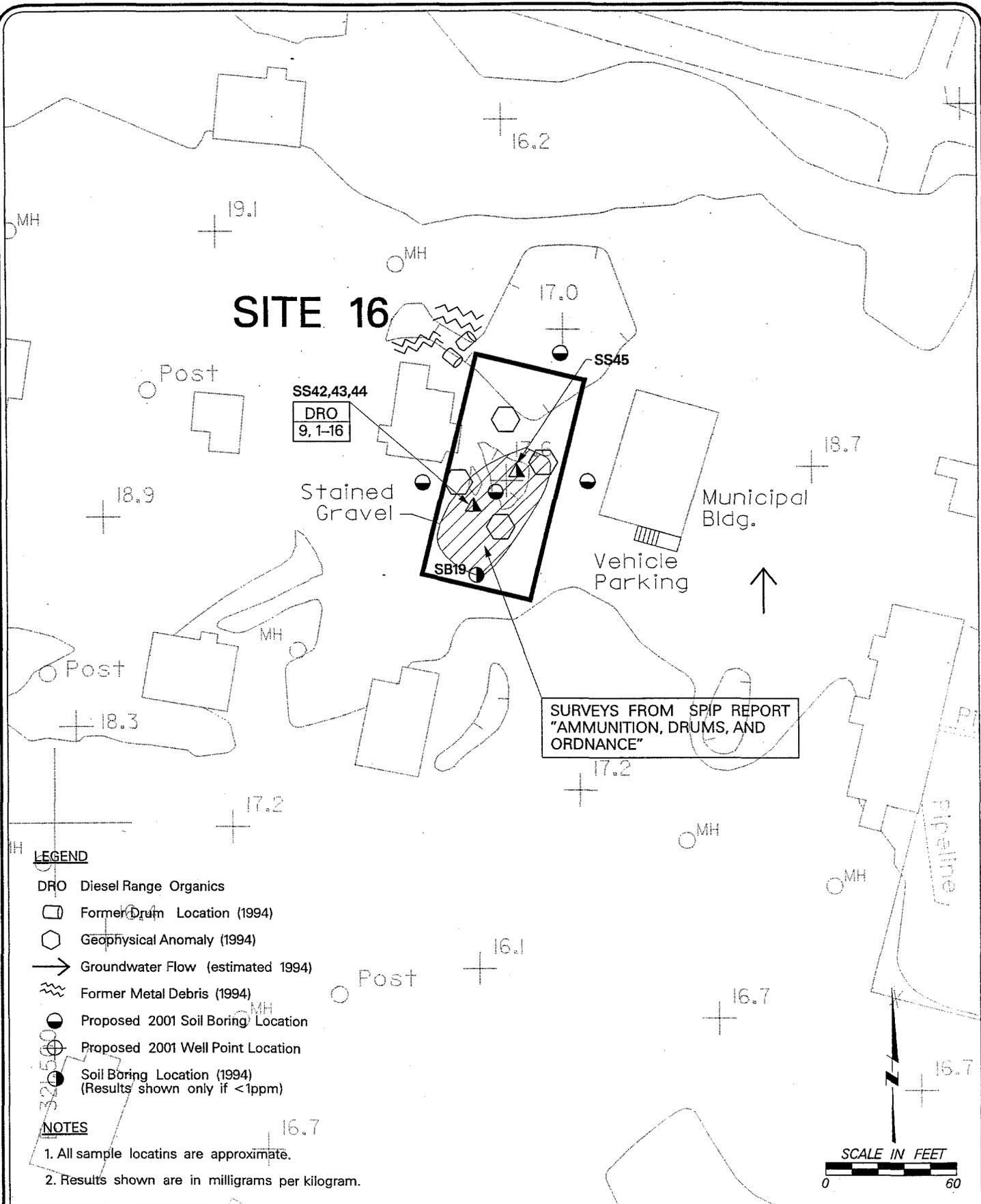
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MONTGOMERY WATSON
 Anchorage, Alaska

FIGURE 2-7
 U.S. ARMY ENGINEER DISTRICT, ALASKA
 GAMBELL, ST. LAWRENCE ISLAND, ALASKA
GAMBELL 2001 SUPPLEMENTAL RI SITE 12
 *AS ESTIMATED FROM OIL SPILL CONSULTANTS 1999 REPORT

FILE: E:\usace\gambell\2001\WP\Final\Fig2-B.dgn
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LEGEND

- DRO Diesel Range Organics
- Former Drum Location (1994)
- Geophysical Anomaly (1994)
- Groundwater Flow (estimated 1994)
- ⚡ Former Metal Debris (1994)
- Proposed 2001 Soil Boring Location
- ⊕ Proposed 2001 Well Point Location
- Soil Boring Location (1994)
(Results shown only if <1ppm)

NOTES

1. All sample locations are approximate.
2. Results shown are in milligrams per kilogram.



MONTGOMERY WATSON

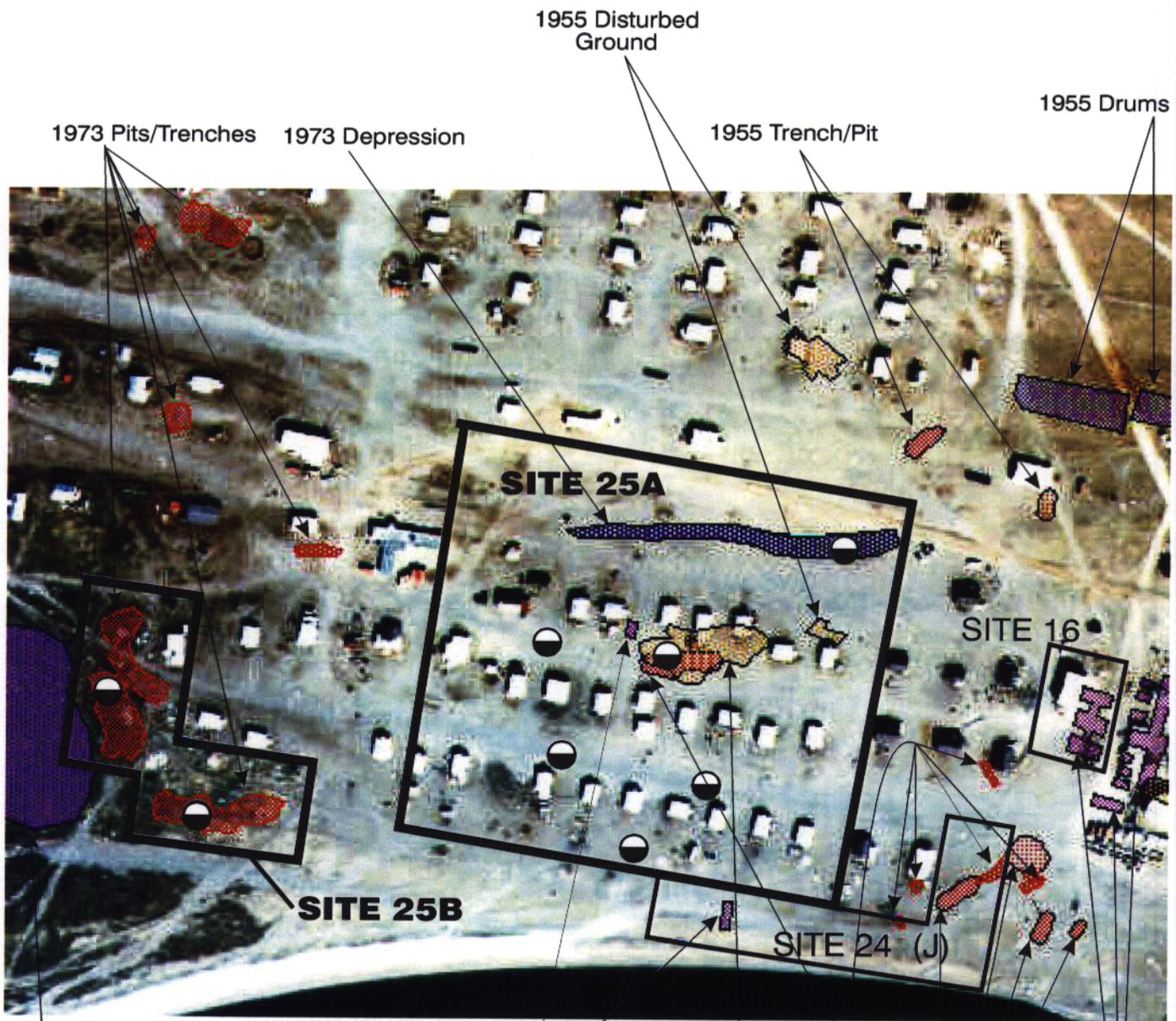
Anchorage, Alaska

FIGURE 2-8

U.S. ARMY ENGINEER DISTRICT, ALASKA
 GAMBELL, ST. LAWRENCE ISLAND, ALASKA

GAMBELL 2001 SUPPLEMENTAL RI SITE 16





Source: U.S. Army Topographic Engineering Center, 2000

Pre DOD Feature

1955 Building

1973 Disturbed Ground

1973 Disturbed Ground

1955 Buildings

1955 Trenches

LEGEND

● Proposed 2001 Soil Boring Location



FIGURE 2-9

U.S. ARMY ENGINEER DISTRICT, ALASKA
 GAMBELL, ST. LAWRENCE ISLAND, ALASKA
**GAMBELL 2001 SUPPLEMENTAL RI
 SITES 25A AND 25B**

1955 Drums

1955 Buildings

SITE 26

Troutman Lake

Source: U.S. Army Topographic Engineering Center, 2000

LEGEND

● Proposed 2001 Soil Boring Location



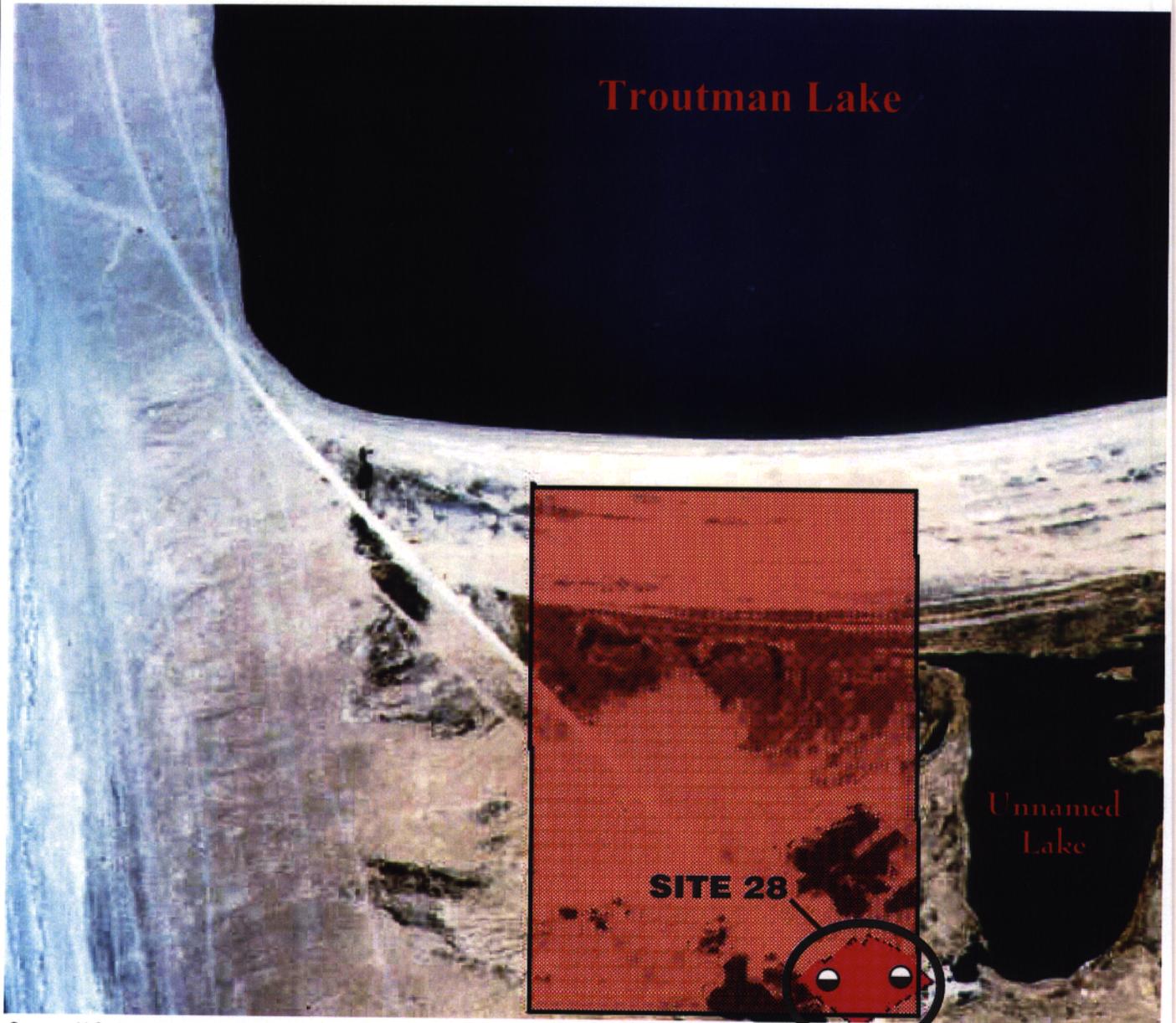
MWH
 MONTGOMERY WATSON HARZA
 Anchorage, Alaska

FIGURE 2-10

U.S. ARMY ENGINEER DISTRICT, ALASKA
 GAMBELL, ST. LAWRENCE ISLAND, ALASKA
**GAMBELL 2001 SUPPLEMENTAL RI
 SITE 26**

JOB No. 18b...05.010102 CadVPro\USACE\Gambell\2001\WP\FinalVg2-10.cdr

Troutman Lake



Source: U.S. Army Topographic Engineering Center, 2000

LEGEND

- Proposed 2001 Soil Boring Location

1972 Disturbed Ground



MWH
MONTGOMERY WATSON HARZA
Anchorage, Alaska

FIGURE 2-11

U.S. ARMY ENGINEER DISTRICT, ALASKA
GAMBELL, ST. LAWRENCE ISLAND, ALASKA
**GAMBELL 2001 SUPPLEMENTAL RI
SITE 28**

3.0 SAMPLING AND ANALYSIS PLAN

The purpose of this SAP is to describe the specific methods and protocols to be employed in the field during the 2001 Supplemental RI at Gambell.

3.1 GENERAL FIELD OPERATIONS

All fieldwork will comply with the provisions of Nationwide Permit No. 6, General Concurrence No. 24 of the Coastal Zone Management Plan, and Land Use Agreement No. DACA 85-9-98-41 between the Alaska District and the landowner. As stated in the Land Use Agreement, the field team will not bring any alcohol or firearms to St. Lawrence Island.

Archaeological artifacts may be present at the Gambell sites. Field personnel will exercise extreme care and caution when performing any field activities with the potential to encounter archaeological artifacts. Field personnel will not disturb any archaeological artifacts encountered during the work.

Biological artifacts may be present in the Gambell area, particularly at the beach areas. Field personnel will comply with the Marine Protection Act and will not disturb any bones, ivory, antlers, or other biological artifacts encountered on St. Lawrence Island.

3.2 FIELD ACTIVITIES

Field activities planned for the 2001 Supplemental RI at Gambell include site reconnaissance, environmental sampling, and fuel fingerprinting. Field activities will be performed in accordance with the SOPs included in Appendix B.

3.2.1 Site Reconnaissance

Site reconnaissance will be conducted prior to implementing the sampling program to confirm site conditions at all sites listed in Table 2-1. This activity will ensure that proposed field activities are commensurate with present field conditions. The following reconnaissance activities will be performed at all areas where 2001 RI site activities will occur:

- Visual observation and documentation in field notebooks
- Photographic documentation of site conditions and sampling areas
- Interviews with Gambell residents
- Comparison of site features with City of Gambell as-built maps

Field documentation will be conducted in accordance with SOP-14 (Field Documentation) and data will be recorded in field notebooks in accordance with SOP-15 (Site Logbook).

3.2.2 Well Point Installation

Nine HydroPunch II well points will be installed to collect groundwater samples. Well point locations will be determined in the field following drilling of soil borings. Well points will be installed in accordance with SOP-28 (HydroPunch) in Appendix B. A drill rig will be used to drive each well point through unsaturated soil to almost 2 feet below the water table. After the screen has filled with groundwater, each well point will be sampled using a new, ½-inch diameter disposable Teflon® bailer. Well points will not be developed or purged following installation. Well points will be removed upon completion of sampling.

If refusal occurs during well point installation, the removable portion of the well point will be removed. Reinstallation of well points will not be attempted.

3.2.3 Environmental Sampling

This section describes procedures to be implemented during environmental sampling activities at Gambell. Sampling procedures will be performed in accordance with the SOPs provided in Appendix B. The following media will be sampled at Gambell during 2001 RI fieldwork:

- Groundwater
- Soil

3.2.3.1 Groundwater Sampling

Groundwater samples will be collected from each well point using a new, ½-inch diameter disposable Teflon® bailer. The samples will be collected into containers provided by the project laboratories.

3.2.3.2 Soil Sampling for Field Screening

Soil samples for field screening will be collected from surface soils and from soil borings as described in the following sections.

3.2.3.2.1 Surface Soil Field Screening Samples

Surface soil samples for field screening will be collected from triangular grids and areas of stained or distressed soil. Equilateral 15-foot triangular sampling grids with 5-foot spacing will be established at each location targeted for field screening, for a total of 9 samples per grid. Each sampling grid represents a 90 percent confidence level for detecting a circular area of contamination with a radius of approximately 2.5 feet. The United States Environmental Protection Agency's (USEPA) guidance entitled "Methods for Evaluating the Attainment of Cleanup Standards, Volume 1: Soils and Solid Media" (1989) was used to develop the sampling grids.

Soil samples for field screening will be collected from 6 inches below grade, if possible; however, this may not be possible in some instances where limited soil deposits overlay bedrock. Field screening samples will be analyzed on site using PID headspace screening, PetroFlag™ screening kits, and colorimetry. Soil headspace screening will be performed in accordance with SOP-30 (Field Analytical Procedures) and PetroFlag™ screening will be performed in accordance with the manufacturer's instructions.

For two samples at Site 4A, hexavalent chromium will be analyzed in the field using a HACH DR/890 colorimeter. Each soil sample will be extracted with deionized water using a 1:1 ratio, by weight, of soil to water. The water will be decanted or removed by pipette from the mixture, then placed in the appropriate container in the colorimeter.

Thirteen grids will be established, each with nine sample locations. At each grid, all samples will be evaluated for volatile constituents using PID headspace screening. At Site 4A, the eight samples from each grid with the highest PID readings will be screened using PetroFlag™ kits. At Site 4B, the six samples from each grid with the highest PID readings will be screened using PetroFlag™ kits. At Sites 6 and 8, the five samples from each grid with the highest PID readings will be screened using PetroFlag™ kits. At Site 12, the six samples from one grid and five samples from each of two grids with the highest PID readings will be screened using PetroFlag™ kits. At Site 4A, two samples will be collected from the former confirmation sampling locations 99GAM018SL and 99GAM019SL and analyzed for hexavalent chromium in the field.

3.2.3.2.2 Soil Boring Field Screening Samples

Soil collected from split spoons will be field screened on site using PID headspace screening. Soil headspace screening will be performed in accordance with SOP-30 (Field Analytical Procedures).

3.2.3.3 Soil Sampling for Laboratory Analysis

Soil sampling from boreholes will be performed in accordance with SOP-7 (Soil Sampling). Disposable stainless steel spoons will be used for collecting surface soil samples and for transferring soil from split spoons to sample containers.

3.2.3.4 Decontamination

Work areas will be maintained to prevent the spread of contamination as a result of investigation procedures, to assure the integrity of the samples obtained, and to provide for the safety of fieldworkers. Where possible, disposable sampling equipment will be used. Non-disposable sampling equipment will be decontaminated at the sampling site whenever feasible. Procedures for decontaminating sampling equipment are detailed in the SOPs addressing the use of each sampling device type.

4.0 QUALITY ASSURANCE PROJECT PLAN

MWH has prepared this QAPP to establish QA/QC procedures for the Gambell 2001 Supplemental RI. These procedures will help ensure that analytical data generated are of suitable quantity and quality to meet project data quality objectives (DQO). Much of the information contained in this QAPP summarizes and references procedural descriptions contained in the project laboratory Quality Assurance Plan (QAP). The MWH Project Chemist will maintain a current, controlled copy of the laboratory's QAP and review relevant sections prior to sample collection to ensure that described procedures are consistent with project objectives.

The project laboratories are:

- For chemical analyses: Analytical Resources, Inc. (ARI), Seattle, Washington; phone (206) 621-6166, fax (206) 621-7523.
- For fuel fingerprinting analyses: Arthur D. Little, Inc. (ADL) – Environmental Monitoring and Analysis Unit, Cambridge, Massachusetts; phone (617) 498-5309, fax (617) 498-7296.
- For QA analyses: Laucks Testing Labs, Seattle, Washington; phone (206) 767-5060, fax (206) 767-5063.

The following chemical analytical methods will be performed by ARI:

- Solid Waste Method (SW) 8260B Selected Ion Monitoring (SIM) – benzene, toluene, ethylbenzene, xylenes (BTEX)
- Alaska Method (AK)102/103 - DRO/RRO
- AK101- gasoline range organics (GRO)
- SW8082 – PCBs
- SW6010B/7000 – Target Analyte List (TAL) and Resource Conservation and Recovery Act (RCRA) metals
- SW8260B – VOCs
- SW6010B – Total chromium

The following chemical analytical methods will be performed by ADL:

- Polynuclear aromatic hydrocarbons (PAHs), including alkylated homologous by gas chromatography-mass spectrometry (GC/MS) in the SIM mode.
- Fuel-specific homologous series of hydrocarbons (including n-alkanes, isoprenoids, and alkylcyclohexanes) in the C8-C24 range by GC/MS in the full-scan mode.
- Gasoline range hydrocarbons by purge-and-trap GC/MS analysis.

ADL will report analytical results as semi-volatile organic compounds (SVOCs) by SW8270 gas chromatograph/mass spectrometer (GC/MS) and volatile organic compounds (VOCs) by SW8260 GC/MS purge-and-trap (PT). ADL will provide a brief report describing fuel fingerprinting analytical results, including evaluation of fuel type in the samples analyzed and relationship of the sample contamination. Analytes for fuel fingerprinting analysis are provided in Table 4-1.

The Alaska District will provide sample containers for QA samples and matrix spike (MS)/matrix spike duplicate (MSD) volumes to the MWH Project Chemist. QA sample bottles will be requested using the form shown in Figure 4-1. MWH is not responsible for ground transportation of QA samples from the airport to the Alaska District contract laboratory.

Minor changes to the procedures described in this QAPP must be approved by the Project Manager and Project QA/QC Officer. Major modifications must be approved by the Project Manager, the Project QA/QC Officer, and the Alaska District Contracting Officer prior to implementing any changes. All modifications to existing procedures will be recorded in field logbooks and/or by memoranda to the project file.

4.1 ANALYTICAL DATA QUALITY OBJECTIVES

The purpose and use of the project data are outlined in Sections 1.2 and 2.0. DQOs as covered in this section are statements that specify the quantity and quality of data required to support project objectives. These statements prescribe the lower limits of contaminant detection and the total acceptable error due to sample collection, preparation, and analysis. For the Gambell Supplemental RI, field and off-site laboratory data are required for the objectives listed in below.

Soil

- Determine the nature and extent of fuel-related contamination at Sites 6, 7, 16, 25A, and 25B.
- Determine the source (military or other) of fuel-related contamination at Sites 7, 16, and 25A. The DQO is qualitative evaluation of petroleum hydrocarbons.
- Determine the nature and extent of solvent and metal contamination in soils at Sites 6 and 7.
- Confirm previous sampling results for fuel and metal contamination in soil at Sites 4A, 4B, 6, 8, and 12.
- Evaluate for the presence of fuel, solvent, and metal contamination in soils at areas not previously investigated at new Sites 25B, 26, 27, and 28.
- Evaluate for the presence of PCB contamination in soils at Sites 7 and 27.

Groundwater

- Determine the nature and extent of fuel-related contamination at Sites 6, 7, and 25A.

4.2 ANALYTICAL LEVELS

Based on the data uses identified above, analytical methods and levels of QC and documentation were selected for the project. For laboratory data, five analytical levels corresponding to varying degrees of data quality and documentation were considered. Selection criteria include providing data quality and documentation commensurate with project goals. The five analytical levels are:

- Level I - Field Screening. This level is characterized by the use of portable instruments that can provide real-time data to assist in optimizing sampling point locations and excavations, and for health and safety support. Typically, data are generated to determine the presence or absence of certain contaminants (especially volatiles) at sampling locations.
- Level II - Field Analysis. This level is characterized by the use of portable analytical instruments that can be placed on site or in mobile laboratories stationed at the project site. Depending upon the types of contaminants, sample matrix, and skills of the available personnel, qualitative and quantitative data can be produced.
- Level III - This level is used primarily in support of site characterization/RI studies using standard USEPA (or ADEC) approved procedures. Some procedures may be equivalent to Level IV, but with less rigorous documentation.
- Level IV - Routine Analytical Services equivalent to the analytical level required for the USEPA Contract Laboratory Program. This level is characterized by rigorous QA/QC protocols and documentation, and provides qualitative and quantitative analytical data.
- Level V - Non-Standard Methods. Analyses that may require method modification and/or development.

Analytical Level III was selected as the appropriate analytical level for chemistry data collected to assess contaminant concentrations. This analytical level specifies analysis of organics and inorganics using USEPA (or ADEC) procedures that will produce data that can be used for site characterization.

Analytical Level I has been selected for PID field screening procedures. Analytical Level II has been selected for field screening petroleum hydrocarbons in soil using PetroFlag™.

4.3 QUALITY ASSURANCE OBJECTIVES FOR MEASUREMENT DATA

QA objectives are quantitative and qualitative statements that specify the quality of data required to support its intended use. Simply stated, these objectives prescribe the total acceptable error due to sample collection, preparation, and analysis. Based on the achievement of these goals, the acceptability of the project data will be determined.

QA objectives are expressed as the practical quantitation limits (PQL) and precision, accuracy, representativeness, completeness, and comparability (PARCC) of the project data. Of these parameters, four are measured quantitatively while two are qualitative. Quantitative objectives include PQLs, precision, accuracy, and completeness requirements for both field measurements and laboratory data (Table 4-2). Qualitative objectives include comparability and representativeness. The following paragraphs define each parameter, and describe how they will be assessed for the 2001 Supplemental RI. Formulas for calculating the quantitative parameters are contained in Section 4.12. Methods for determining the validity of project data are discussed in Section 4.14.

PQL is the minimum concentration of a substance that can be reported based upon the analysis of a project specific matrix. PQLs should be 2 to 5 times below project action levels or criteria. Occasionally, a project PQL cannot be achieved due to some inherent characteristic of a sample matrix (e.g., high soil moisture).

Precision is a measure of agreement among individual measurements of the same analyte under prescribed, similar conditions. It is a measure of the variability or random error in sampling operations, field equipment, laboratory operations, and laboratory instrumentation. Combined field and laboratory precision will be assessed through calculation of the relative percent difference (RPD) between primary and blind-duplicate/replicate field samples. RPD values for each sample/duplicate pair will be compared to project goals.

Accuracy is a measure of the closeness of an individual measurement or an average of a number of measurements to a true value. Overall project accuracy for each analysis will be determined through assessment of MS results. These results are expressed as a percent recovery of the MS.

Representativeness is a measure of how closely data reflect the environmental conditions under study, and is obtained by collecting a sufficiently large number of accurate and precise data points from representative conditions. Project representativeness will be achieved through the appropriate design of the assessment program, including the sampling approach, number of samples collected, and sampling and analysis methods.

Completeness is the number of measurements judged valid, compared to the total number of measurements. Completeness will be calculated as the number of valid measurements reported, divided by the total number requested from the laboratory, expressed as a percentage. In cases when an analytical method measures multiple individual analytes, the criteria apply to each analyte.

Comparability is a qualitative characteristic that is an expression of the confidence with which one data set can be compared with another. Field sampling techniques, analytical procedures, and concentration units must be consistently followed if results are to be comparable. To ensure this comparability, field procedures are standardized by adhering to SOPs (Appendix B). The laboratory shall make the necessary provisions to ensure comparability of all data. The procedures include, but are not limited to, the use of standard approved methodologies, the use of standard units and report format, the use of calculations

as referenced in the methodology for quantification, and the use of standard measures of accuracy and precision for QC samples.

4.4 SAMPLING PROCEDURES

Environmental sampling methods for soil and groundwater will be in accordance with the SOPs in Appendix B, as amended by the SAP (Section 3 of this Work Plan). Field duplicate, QA triplicate, trip blank, and field blank samples will also be collected, as specified in Table 2-2.

4.5 FIELD INSTRUMENTATION

Anticipated field instruments include:

- Temperature, pH, and specific conductance instruments for measuring water quality parameters during collection of groundwater samples
- HACH DR/890 Colorimeter for hexavalent chromium
- Scale for weighing soil samples for field test of hexavalent chromium and for GRO, BTEX, and VOC analysis
- PID for monitoring organic vapors
- PetroFlag™ petroleum hydrocarbon assay kits

The FTL will maintain a copy of all instrument manuals at the project site. If necessary, manufacturers' guidelines for troubleshooting will be followed. Backup instruments will be available at the project site in the event a malfunction cannot be resolved in the field.

4.6 SAMPLE IDENTIFICATION

Each sample collected will be assigned a unique alphanumeric identifier code by the field team to track samples through all phases of the project. The numbering system will allow project personnel to easily catalog all samples collected, and provides an accurate means for data base manipulation after the field investigation is completed.

Sample identifiers are comprised of five elements:

Two-digit year designation: 01

Three-letter project site designation: GAM

Three-digit collection site designation: 04A – 028

Two-letter sample media designation

-SS = surface soil

-SB = borehole soil

-GW = groundwater

-TB = trip blank

Three-digit sample number

- 101 through 199 for primary samples
- 201 through 299 for QC duplicate samples
- 301 through 399 for QA triplicate samples

The following example illustrates the sample identifier scheme: Sample Ø1GAMØØ8SS1Ø1 represents the first surface soil sample collected at Site 8. Samples Ø1GAM25BSB1Ø2, Ø1GAM25BSB2Ø2, and Ø1GAM25BSB3Ø2 represent the primary, duplicate, and triplicate samples for the second soil boring sample collected at Site 25B.

4.7 SAMPLE CUSTODY

Sample custody and handling procedures will conform to USEPA and Engineering Regulation (ER)-1110-1-263 standards for preservation, holding times, documentation, custody, and packing and shipping, as described in SOP-6 (Sampling Management/Preservation). Additional requirements include the following:

- In each cooler, one 500-mL plastic bottle filled with water (temperature blank) will be packed in the same manner as the samples. The temperature blank must be packed in the same location within the cooler as the samples, not on top of the samples or in any manner not consistent with the sample packing.
- Coolers will be packed with 50 percent gel ice to ensure that sample temperatures are within $4 \pm 2^{\circ}$ C upon receipt by the laboratory.
- Samples will be shipped for receipt at the laboratory before the prescribed holding times expire.

Sample custody will be maintained by a CoC record. The custody record will be completed by the individual(s) collecting the sample(s). CoC records will be completed for all samples. A sample will be considered under proper custody if:

- It is in actual possession of the responsible person
- It is in view, following physical possession
- It is in the possession of a responsible person and is locked or sealed to prevent tampering
- It is in a secure area

The CoC is a continuously maintained custody record that travels with the samples at all times. The CoC must be signed by each person responsible for collecting, checking or otherwise handling, or shipping the samples to an outside laboratory or other agency. The CoC will include the following:

- Name of company collecting the samples
- Printed name and signature of each sampler
- Project name
- Sample identification numbers
- Sampling date

- Sample collection times
- Analyses to be performed on the samples
- Number of containers submitted for each sample set
- Laboratory report turnaround time
- Electronic data deliverable requirements

The project laboratory maintains a formal sample receipt and custody plan, including employment of a Sample Management Officer. The transfer of custody from the project site to the laboratory will be documented on the field generated CoC form. Once received at the laboratory facility, sample custody and control is maintained by:

- Unique Laboratory Sample Numbers. Each sample container must display a laboratory-assigned number that allows for unambiguous identification.
- Custody Log. Hard copy documentation of sample receipt by date and laboratory identification number will allow for sample tracking independent of the computer system.
- Laboratory Information Management System (LIMS). Computer-based sample tracking makes sample location and information instantly available.
- Internal CoC. Internal custody logs must be maintained to document sample removal from, and return to, locked storage areas.
- Laboratory Visitors Log. All visitors at the laboratory must sign in and out, and be escorted by laboratory personnel while in the facility.

Upon receipt at the laboratory, the Sample Management Officer inspects the samples for integrity and correct preservation, and checks the shipment against the CoC/analytical task order form. Cooler temperature is measured from both the temperature blank and air inside the cooler and is documented on the CoC and a sample receipt form. Any problems will be addressed and documented, and must be resolved before the laboratory can proceed with sample analysis. When the sample shipment and the CoC are in agreement, the custodian accepts custody of the samples and assigns each sample a unique laboratory number. This number is affixed to each sample bottle.

The laboratory must provide notification that project samples have been received. Notification includes facsimile transmittal of the signed CoC, internal laboratory work order form, and the completed sample receipt form. This notification process provides a mechanism for resolving problems with scheduled analyses and shipping samples while the field team is at the project site. In this manner, if samples need to be re-collected or packing/shipping procedures need to be adjusted, project objectives are not potentially compromised.

While in the laboratory, samples must be stored at 4°C in a locked refrigerator unless they have been checked out for analysis. Samples for purgeable organics (e.g., BTEX) must be stored in a separate locked refrigerator, away from other samples, sample extracts, and standards.

4.8 ANALYTICAL METHODS

The methods listed in Table 4-2 have been selected to meet project objectives. These objectives include Level III analysis of the contaminants of interest and maintaining comparability with previous RI data. Analytical methods are from the following primary documents:

- Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW846), Third Edition, Including Updates. USEPA. December 1996.
- Annual Book of ASTM Standards (for soil classification). 1998.
- Alaska Department of Environmental Conservation, Underground Storage Tanks Procedures Manual. December 1, 1999.

To achieve the necessary PQLs shown in Table 4-2, a modification will be made to the method for benzene in soil. Samples for BTEX in soil by SW8021B will be weighed in the field to ensure that 50 grams of sample are placed in the container. The samples will be covered with 25 milliliters (mL) of methanol. This sample mass to methanol ratio (2:1) is larger than typical (1:1) in order to meet the PQL.

Sampling activities for each site are listed in Table 2-2. Table 2-2 includes the number of primary, QA, and QC samples for each analyte. Analytical methods, containers, preservatives, and holding times are summarized in Table 4-3.

4.9 CALIBRATION PROCEDURES AND FREQUENCY

Written procedures are used by the project laboratory for all instruments and equipment subject to calibration. Detailed descriptions of all calibrations are contained in the laboratory QAP and SOPs. Whenever possible, recognized procedures, such as those published by USEPA, American Society for Testing and Materials (ASTM), or the equipment manufacturer are adopted. At a minimum, the procedures include descriptions of:

- Equipment to be calibrated
- Calibration technique and sequential actions
- Acceptable performance tolerances
- Frequency of calibration
- Calibration document format
- Corrective action
- Reference standards used for calibration

Equipment calibration and maintenance requirements that are critical to project objectives are summarized below.

Analytical Support Areas

- Analytical balances shall maintain an annual manufacturer calibration and have a calibration check performed daily, or before each use.
- All refrigerators and freezers shall be monitored for proper temperature by measuring and recording internal temperatures on a daily basis.
- Preparation and maintenance of standards and reagents will be performed per the specified methods.
- The laboratory shall maintain an appropriate water supply system that is capable of furnishing ASTM Type II “polished” water to the various analytical areas.

Laboratory Instruments

- All analyses will be performed on an instrument with a current multi-point calibration, not including the calibration blank.
- All reported analytes are to be bracketed by the calibration curve.
- The low standard for each calibration will be at or near the project PQL.
- All analytical batches (typically 10 field samples) analyzed shall be bracketed by appropriate calibration verification standards.

4.10 PREVENTIVE MAINTENANCE

Preventive maintenance is an organized program of actions (such as equipment cleaning, lubrication, reconditioning, adjustment, and/or testing) taken to maintain proper instrument and equipment performance and to prevent instruments and equipment from failing during use.

Implementation of the preventive maintenance program depends on the specific instruments and equipment used. The laboratory is responsible for preparing, executing, and documenting the program. At a minimum, the preventive maintenance program includes the following:

- A listing of the instruments and equipment included in the program.
- The frequency of maintenance, considering manufacturers' recommendations and/or previous experience with the equipment.
- A file for each instrument in the program containing the following information:
 - A list of spare parts
 - External service contracts
 - Items to be checked and/or serviced during maintenance and directions for performing maintenance (if external service is not provided or if not stated in manufacturer's instrument manual)

Preventive maintenance will be conducted by qualified laboratory personnel or outside vendors and documented in instrument logbooks. Date of service, person performing service, reason for service, type of maintenance performed, and replacement parts will be recorded.

4.11 LABORATORY INTERNAL QC CHECKS

Internal QC checks are used to verify and control the validity of individual analyses. The laboratory QAP describes the use of QC samples and procedures for these checks for both analytical and batch QC. Descriptions include requirements for laboratory QC samples, frequency of analysis, control limits, and methods for establishing control limits.

The following sections present the laboratory QC samples and indicators that will be used for the Gambell Supplemental RI.

4.11.1 Preparatory Batch QC

Samples must be assigned to preparatory batches of no more than 20 samples. A sample batch is defined as the number of samples, including QC samples that can be processed through the entire extraction procedure during a 24-hour period. One method blank, one laboratory control sample (LCS), and an MS/MSD must be included in each batch. All samples within a batch must be processed simultaneously using reagents with the same lot numbers.

Method Blanks consist of analyte-free laboratory grade water, or a purified solid that is carried through the entire sample preparation and analysis scheme in the same manner as environmental samples. The method blank matrix volume or weight is approximately equal to the associated samples. Method blanks, also called reagent or preparation blanks, are used to monitor interferences caused by contaminants introduced by solvents, reagents, glassware, and other processes.

LCSs are aqueous or solid samples spiked at a known concentration with the analyte of interest. The sample is then analyzed using the same sample preparation, reagents, and analytical methods employed for environmental samples. Also known as a blank spike, LCSs are prepared from standard materials different from initial calibration standards. LCSs are used to demonstrate that the accuracy and precision of an analytical method (as affected by both preparation and analysis) are in control.

One LCS will be analyzed with each batch of samples. The percent recovery is calculated, plotted on control charts, and compared to control limits empirically established by the laboratory. If the recovery is outside of limits, corrective action must be taken.

For some methods, such as volatile organic analysis of water, in which the samples are not subjected to any processing steps that are not performed on standards, the LCS and calibration verification standard are the same, and are not separately prepared.

MSs are prepared by adding a known amount of analyte to an environmental sample aliquot before sample preparation and analysis. MSs indicate the performance of the entire method in

a given matrix. For multi-analyte methods, the spiked sample is fortified with a representative suite of analytes. MSs will be performed in duplicate (MSD) with every batch of samples.

Duplicate Samples are samples that have been divided into two portions at some step in the measurement process. Each portion is then carried through the remaining steps of the analysis. Duplicate samples provide information on the precision of the operations involved. For the Gambell Supplemental RI, MSs will be analyzed in duplicate for all methods.

Surrogates are organic compounds similar to the analytes of interest in chemical composition, extraction characteristics, and chromatography, but are not normally found in environmental samples. Prior to purging or extraction, these compounds are spiked into all method blanks, standards, samples, and spiked samples to monitor the accuracy and precision of individual sample analysis. Surrogates are used in chromatographic analyses only. Recoveries must fall within the control limits empirically established by the laboratory; however, they are not calculated if sample dilution causes the surrogate concentration to fall below the quantitation limit.

4.11.2 Analytical Batch QC

Calibration Blanks are analyte-free organic or aqueous solutions that contain all of the reagents and solvents in the same proportions as those used to prepare calibration standards. Calibration blanks are analyzed to demonstrate that instrument response returns to baseline when the analyte is not present, usually at a frequency of 1 per 10 field samples. In this manner, the instrument is shown to be operating correctly and free of carryover contamination from previously analyzed samples or standards. At least one calibration blank is analyzed with each initial calibration and with standards used to subsequently verify the calibration.

Continuing Calibration Verification Standards (CCVS) are midrange calibration standards analyzed at a predetermined frequency (usually 1 per 10 field samples) to verify instrument calibration during the analysis sequence.

Gas Chromatography/Mass Spectroscopy (GC/MS) Instrument Performance Check Standards (also called tuning standards) are analyzed to document mass resolution, identification, and to some degree, sensitivity.

4.12 CALCULATION OF DATA QUALITY INDICATORS

The following formulas are to be used for calculating both the QC sample results and the DQOs' precision, accuracy, completeness, and reporting limits (MDLs and PQLs).

4.12.1 Precision

Precision is the mutual agreement among individual measurements of the same property, under similar conditions. Precision can be expressed in several different ways, such as RPD and relative standard deviation (RSD). RPD is used for duplicate measurements and is

calculated by dividing the absolute difference between the values by their mean and multiplying by 100:

$$RPD = \frac{|X1 - X2|}{(X1 + X2)/2} \times 100 \quad \text{Where } X1 \text{ and } X2 \text{ are the duplicate values}$$

RSD is used for replicate measurements and is the ratio of the standard deviation of the measurements to their mean:

$$RSD = \frac{S}{X} \quad \text{Where } S = \text{standard deviation} \\ X = \text{mean}$$

4.12.2 Accuracy

Accuracy is the degree of agreement of a measured value with the true or expected value of the measured quantity. The accuracy of control sample measurements is generally expressed as a percent recovery (%R). For surrogates and samples without a background level of the analyte, such as reference materials and LCSs, the percent recovery is calculated from:

$$\%R = \frac{X}{T} (100) \quad \text{Where } X = \text{measured concentration} \\ T = \text{true or expected concentration}$$

The percent recovery for measurements when a known amount or analyte is added to an environmental sample (such as an MS) is calculated from:

$$\%R = \frac{X - B}{T} (100) \quad \text{Where } B = \text{concentration of analyte in unspiked} \\ \text{environmental sample} \\ X \text{ and } T \text{ are defined as above}$$

4.12.3 Completeness

Completeness (%C) is the ratio of the number of valid sample results, relative to the total number of results expected. The value is expressed as a percentage:

$$\%C = \frac{V}{T} (100) \quad \text{Where } V = \text{number of results judged valid} \\ T = \text{number of results expected}$$

4.12.4 Method Detection Limits

MDLs are empirically determined at the laboratory by calculating the t-distribution on a number of replicate analyses (typically seven). MDLs are defined as the minimum concentration of a substance that can be measured and reported with 99 percent confidence that the analyte concentration is greater than zero. MDLs are determined using the USEPA procedure published in 40 CFR 136, Appendix B, and are determined from analysis of a sample in a given matrix containing the analyte. This process requires that all sample processing steps of the analytical method be included in determining the MDL. MDLs are influenced by the sample matrix, sample preparation steps, and the analytical measurement

process. PQLs are the minimum concentration of a substance that can be reported based upon the analysis of a project specific matrix. PQLs are established by the low initial calibration standard.

4.13 CORRECTIVE ACTION

The objectives of the corrective action procedures presented below are to ensure that recognized errors in performance of data acquisition lead to effective remedial measures and that those steps required to correct an existing condition are documented to provide assurance that any data quality deficiencies are recognized and not recurrent. Two types of corrective action are discussed below, minor, and corrective action for nonconformance.

4.13.1 Response

Minor corrective actions are of a routine nature, such as correcting malfunctioning equipment, correcting data transcription errors, and other actions routinely taken in the field or laboratory. Specific documentation for these errors will be limited to notations in logbooks, notebooks, or on data sheets.

Laboratory nonconformances are defined as any analytical procedure that deviates from standard protocol, or those data associated with QC samples that failed to meet acceptance criteria. Data reporting errors are also considered nonconformances.

The analyst has primary responsibility for verifying that all daily QC parameters fall within acceptance limits before submitting data for review. Review at the analyst's level enables most errors to be caught immediately, preventing the untimely delays that occur when error is first caught by the supervisor. The reviewer checks the data to ensure that the QC parameters fall within the acceptance criteria and calculations are error-free. If the reviewer discovers a problem, the analyst is notified immediately and corrective action is taken. All samples associated with unacceptable QC samples are rerun unless there is insufficient sample, in which case the Project QA/QC Officer must be notified by the laboratory. All samples that miss holding times will be brought to the immediate attention of the laboratory's client services group, who will, in turn, notify the Project QA/QC Officer.

The check of daily QC parameters assists in identifying immediate problems with the data; however, slowly developing trends and biases are usually only evident when control charts are used. If a nonconformance is present, the analyst is responsible for stopping an analysis and initiating appropriate corrective actions before continuing.

4.13.2 Re-Establishment of Control

Control of analyses is re-established by fixing the problem, reanalyzing the samples and QC samples in question, and demonstrating that QC indicators are within acceptance criteria. It is the ultimate responsibility of the group leader to ensure that suspect data are not reported and that control of the analyses is re-established. The QA department performs periodic system audits to ensure that this procedure is working properly, and prepares reports to laboratory management based on these audits.

4.13.3 QA Reports to Management

The laboratory QA Coordinator provides the laboratory director with monthly Quality Assurance and Corrective Action reports. The project manager and client are informed verbally of analytical nonconformance events by the laboratory managers or supervisors within 24 hours of occurrence, and the decisions made after an evaluation of the situation are documented. Issues raised are addressed in the narrative of the final data report.

The monthly Quality Assurance and Corrective Action reports include the following information:

- Name of analysts, and the test and the parameter(s) that went out-of-control
- Instrument make and model
- Method reference number
- Date when the analysis went out of control
- Date the analysis was brought back into control
- Particular project samples analyzed during the period of the out-of-control event, and the dates these samples were reanalyzed

4.14 LABORATORY DATA REDUCTION, REVIEW, AND REPORTING

The methods to be used for data reduction, review, and reporting by the project laboratory are described in the following sections. Laboratory reports will meet current ADEC and Alaska District reporting requirements. Analytical reports will be sent by the project laboratory to the architect/engineer (AE) firm designated by the Alaska District (CEPOA-EN-6-MI) to produce the Chemical Data Quality Review (CDQR). For validation, a copy of the results will be sent simultaneously to MWH.

4.14.1 Reduction

Data reduction includes all processes that change either an analytical result, or the number of data items. The data reduction processes used in the laboratory include establishing calibration curves and calculation of sample concentrations from instrument responses.

Calibration Curve. The calibration or standard curve relates instrument response to analyte concentration. The curve is prepared by measuring the responses of a series of analyte solutions (calibration standards) with known concentrations. Least-squares regression can be used to fit a curve through the standard concentration/response data. The regression analysis also provides parameters, such as the correlation coefficient, that can be used to assess the accuracy of the curve. For linear regression, a curve of the following form is obtained:

$$Y = mX + b$$

Where Y = instrument response
X = analyte concentration
m, b = slope and Y - intercept, respectively

For chromatographic methods, the calibration curve is used to establish the linearity of the instrument response over the calibration range. If the calibration curve satisfies the specified linearity criteria, a calibration factor (CF) averaged from the calibration standards can be used in place of the calibration curve.

Sample Calculations. The reduction of instrument responses to sample concentrations takes different forms for different methods. The discussion below summarizes the use of a response factor (RF) for analyte quantitation in water samples using GC/MS methods. Additionally, concentrations of analytes in water samples measured by GC methods, solid sample calculations, and significant figures and units are described.

Response Factors. GC/MS methods require the internal standard method for determining an RF, which is calculated from the following equation:

$$RF = \frac{A_s C_{is}}{A_{is} C_s}$$

- Where A_s = area of the characteristic ion of the target compound in the standard
 A_{is} = area of the characteristic ion of the internal standard
 C_{is} = concentration of the internal standard ($\mu\text{g/L}$)
 C_s = concentration of the target compound standard ($\mu\text{g/L}$)

When the compound has been identified, the quantitation of that compound is based on the integrated abundance of the primary ion(s). If the sample produces an interference for the primary ion, a secondary ion is used to quantify. The concentration in the water sample is calculated using the RF.

$$\text{Concentration } (\mu\text{g/L}) = \frac{C_{is} A_s}{RF A_{is}}$$

- Where A_s = area of the characteristic ion of the target compound in the sample

Other variables are as described above

Calculation of Analytes in Water Samples Using GC Analyses. Quantitation by the external standard technique for GC analyses involves calculating concentrations of the target compounds from the sample response and the CF. The initial calibration establishes the linear dynamic range of the instrument. Standards are analyzed at the beginning of each day, and if acceptance criteria are met, samples are quantified using the following equation:

$$\text{Concentration } (\mu\text{g/L or mg/L}) = \frac{A_i \times V_f}{CF \times V_i}$$

Where CF = calibration factor
 AO = peak area of target compound
 Vi = initial volume of sample extracted (ml)
 Vf = final volume of extracted sample (ml)

These calculations are generally performed by the computerized data system interfaced with the instrument.

Solid Samples. The dry-weight concentration of a solid sample is calculated from the analytical concentration of the processed sample using the following formula:

$$K = \frac{C \times V \times D}{W (\%S / 100)}$$

Where C = analyte concentration from instrument (mg/L)
 D = dilution factor
 K = dry-weight concentration (mg/Kg)
 V = final volume (ml) of processed sample solution
 W = wet weight (g) of sample aliquot analyzed
 %S = percent solids of sample

Significant Figures and Units. The number of significant figures in the reported data is consistent with the limits of uncertainty inherent in the analytical method. Concentrations in liquid samples are expressed in terms of weight per unit volume (e.g., mg/L or $\mu\text{g/L}$). Concentrations in solid or semisolid matrices are expressed in terms of weight per unit weight (e.g., mg/Kg or $\mu\text{g/Kg}$). In addition, soil and sediment concentrations for all analyses must be converted to a dry-weight basis using the percent solids of the sample.

4.14.2 Data Review

The following section describes laboratory and MWH data review steps.

4.14.2.1 Laboratory Review

Review of analytical and QC data is initially performed at the laboratory by the responsible analyst. The data are checked for errors in transcription, calculations, and dilution factors and for compliance with QC requirements. Failure to meet method performance criteria results in reanalysis of the sample or batch of samples, depending on the nature of the failure. After the initial review is completed, the data are collected from summary sheets, workbooks, or computer files and assembled into a data package.

The next level of data review is the prime responsibility of the laboratory manager or designated laboratory supervisors. The areas addressed in the checking steps include the following:

- Proper CoC and sample handling
- Sample preparation and analysis within holding times
- Sample preparation and analysis according to specified methods
- Instruments calibrated according to specified methods
- Spike (surrogate and standard) recoveries within specified ranges
- Blanks prepared and analyzed as required
- Calculations performed and verified correctly
- Correct transcriptions of raw and final data
- Detection limits determined correctly and within required limits

The check list is completed and signed by the designated data reviewers, usually chemists, and the laboratory supervisor. Any problems discovered during the review, and the corrective actions necessary to resolve them, are communicated to the laboratory manager. All problems and associated corrective actions are discussed with the Quality Services Manager (QSM) prior to final approval of the data.

4.14.2.2 MWH Data Review Process

Gambell Supplemental RI analytical data will be reviewed in the manner described below.

Data Verification

Data packages for primary and field duplicate will be evaluated for completeness, correctness, consistency, and compliance with contract requirements. The completeness evaluation will include both verifying that data are present for all requested analytes and that all hard copy and electronic deliverables are present. Verification of correct analysis methods and reporting limits (RL) is also performed as part of this step.

Data Review

After verification, data packages for primary and field duplicate samples will be reviewed for compliance with analytical DQOs. For Gambell, these objectives are defined in this QAPP and by respective laboratory control limits stated in the data packages.

USEPA Contract Laboratory Program National Functional Guidelines for Organic Data Review (USEPA, 1999) and Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses (USEPA, 1998) will be used to evaluate data quality. These guidance documents do not address the use of temperature blanks for assessing cooler temperatures. Appendix J of EM 200-1-3 defines the temperature blank as “a container filled with water which is packaged along with the field samples to allow the receiving laboratory a mechanism to accurately measure the temperature of the cooler and associated samples upon receipt. The [cooler temperature blank does] not undergo any chemical analysis.” For this project, the receiving laboratory will record the temperature of coolers from both the temperature blank, and air inside the cooler. Documented air temperatures of coolers are for informational purposes only and are not considered during the data review process for primary, field duplicate (QC), or QA samples. Results from temperature blanks will be used to assess data quality.

Results outside project DQOs or laboratory limits will be qualified using Alaska District electronic data format (EDF) valid values.

Specific review items include:

- Sample-handling procedures documented on CoC and cooler receipt forms and in case narratives
- Temperature of cooler temperature blank
- Sample holding times
- Laboratory QC samples, including:
 1. Method blanks
 2. LCSs/laboratory control sample duplicates (LCSD)
 3. MS/MSD samples
 4. Sample duplicates
 5. Surrogates
 6. CCVs
- Comparison of primary and field duplicates for Gambell samples to assess field precision.
- Review of project correspondence to determine if changes made to the analytical program during the project were implemented in the laboratories.

MWH will verify data usability and attainment of analytical DQOs and will apply qualifiers to the results.

4.14.2.3 Data Reporting

The laboratory will produce data reports, including summary results and raw data that are suitable for submittal to the Alaska District, including:

- Alaska District project name
- Field sample ID number as reported on CoC form
- Laboratory name, city and state
- Laboratory report number
- Lab ID number for sample
- Dates sample collected, received at laboratory, extracted, and analyzed
- Extraction or preparation method number, if appropriate
- Analysis method number
- Analyte or parameter
- Chromatograms

- Sample detection limits and sample reporting limits
- Analytical results for LCSs, MSs, and method blanks
- Units
- Dilution factor
- Matrix
- Sample description
- Soil sediment and solid waste data shall be reported on dry weight basis with percent moisture included
- Original CoC and sample cooler receipt forms
- All forms shall be properly signed and dated

All laboratory data will also be furnished in accordance with "USAED Laboratory Electronic Deliverable Format" using EDF version 1.2a. All chemical laboratory data will be delivered in the EDF format along with a printed error-free summary log generated with the consistency tool check.

Data reports will be reviewed by an independent reviewer selected by the Alaska District.

4.15 PERFORMANCE AND SYSTEM AUDITS

Audits are systematic checks to determine the quality of operation of some activity or function. The two types of audits described below, performance and system, are to be performed for the Gambell Supplemental RI.

4.15.1 Performance Audits

Performance audits are independent sample checks made by a supervisor or auditor to arrive at a quantitative measure of data quality produced by the measurement process. Performance audits are conducted by introducing control samples, in addition to those used routinely, into the data production process. These control samples may include: performance evaluation (PE) samples of known concentrations; field samples spiked with known amounts of analyte; and triplicate samples that are analyzed by two or more analysts within or outside the organization.

The laboratory participates in external performance audits as part of its laboratory certification efforts. PE samples from USEPA water supply and water pollution studies are analyzed twice yearly for the certification programs that require participation.

Results of performance audits are summarized and maintained by the laboratory QC manager and distributed to the supervisors who must investigate and respond to any results that are outside control limits.

QA triplicate samples are analyzed at the rate of 10 percent per analysis per matrix.

4.15.2 System Audits

System audits are on-site qualitative inspections and reviews of the QA system used by the entire measurement system. System audits are conducted by the laboratory QA group with the assistance of field, laboratory, and project personnel. The audits are performed against a set of requirements, which may be a QA project or program plan, a standard method, or a project statement of work. A checklist is generally generated from the requirements and becomes the basis for the audit. The results of any deficiencies noted during the audit are summarized in an audit report. System audits are conducted by the Alaska District, and are required for certification of the laboratory by the Alaska District.

Table 4-1 Arthur D. Little Laboratory Analytical Methods and Target Parameters

Semi-Volatile Organic Compounds (SVOCs) by SW8270 GC/MS		
Decalin	Dibenzothiophene	Naphthalene
C1-decalins	C1-Dibenzothiophenes	C1-naphthalenes
C2-decalins	C2-Dibenzothiophenes	C2-naphthalenes
C3-decalins	C3-Dibenzothiophenes	C3-naphthalenes
C4-decalins	C4-Dibenzothiophenes	C4-naphthalenes
Benzo(b)thiophene	Fluoranthene	Biphenyl
C1-benzo(b)thiophenes	Pyrene	Acenaphthylene
C2-benzo(b)thiophenes	C1-fluoranthene/pyrenes	Acenaphthene
C3-benzo(b)thiophenes	C2-fluoranthene/pyrenes	Dibenzofuran
C4-benzo(b)thiophenes	C3-fluoranthene/pyrenes	Chrysenes
Anthracene	C4-fluoranthene/pyrenes	C1-Chrysenes
Phenathrene	Benzo(b)fluoranthene	C2-Chrysenes
C1-phenanthrenes/anthracenes	Benzo(k)fluoranthene	C3-Chrysenes
C2-phenanthrenes/anthracenes	Benzo(e)pyrene	C4-Chrysenes
C3-phenanthrenes/anthracenes	Benzo(a)pyrene	Fluorene
C4-phenanthrenes/anthracenes	Perylene	C1-fluorene
Benz(a)anthracene	Indeno(1,2,3-c,d)pyrene	C2-fluorene
Dibenz(a,h)anthracene	Benzo(g,h)perylene	C3-fluorene
Volatile Organic Compounds (VOCs) by SW8260 GC/MS/PT		
Paraffins	Olefins	Aromatics (continued)
n-pentane	1-pentene	1,2,4 trimethylbenzene
n-hexane	2-me-1-butene	1,2,5 trimethylbenzene
n-heptan-octane	t-2-pentene	1,2,3-trimethylbenzene
n-octane	c-2-pentene	Sec-butylbenzene
n-nonane	Oxygenates	1-methyl-3-isopropylbenzene
n-decane	Methyltertbutyl ether	1-methyl-4-isopropylbenzene
n-undecane	di-isopropyl ether	1-methyl-2-isopropylbenzene
n-dodecane	Methyl tert amyl ether	1-methyl-3-isopropylbenzene
Isoparaffins	Ethyl tert butyl ether	1-methyl-4-isopropylbenzene
2-methylbutane	Aromatics	n-butylbenzene
2-methylpentane	Benzene	1,3-dimethyl-5-ethylbenzene
3-methylpentane	Toluene	1,2-diethylbenzene
2,3-dimethylpentane	Ethylbenzene	1-methyl-2-n-propylbenzene
2,4 dimethylhexane	m-xylene	1-methyl-4-n-propylbenzene
2-methylheptane	p-xylene	1,3-methyl-2-n-propylbenzene
2,2,4-trimethylpentane	o-xylene	1,3-methyl-4-n-propylbenzene
Naphthenes	Isopropylbenzene	1,2dimethyl-3-ethylbenzene
Cyclopentane	Propylbenzene	1,2-dimethyl-3-ethylbenzene
Methylcyclopentane	1-methyl-3-ethylbenzene	1,2,4,5-tetramethylbenzene
Cyclohexane	1-methyl-4-ethylbenzene	1,2,3,5-tetramethylbenzene
Methylcyclohexane	1,3,5-trimethylbenzene	1,2,3,4-tetramethylbenzene
	1-methyl-2-ethylbenzene	n-pentylbenzene

Key:
 µg/L – micrograms per liter
 AK – Alaska Method
 DRO – diesel range organics
 EPA – United States Environmental Protection Agency
 EPA – United States Environmental Protection Agency

GC/MS – gas chromatography/mass spectioscopy
 GRO – gasoline range organics
 mg/Kg – milligrams per kilogram
 PT – purge and trap
 SIM – selective ion monitoring
 SVOC – semivolatile organic compound
 SW – Solid Waste Method
 VOC – volatile organic compound

Table 4-2 QA Objectives for Measurement Data

Method¹	Matrix (units)	Analyte	Method Reporting Limit	Precision (RPD)	Accuracy (% REC)
EPA 150.1	Water	pH	NA	20	NA
HACH DR/890	Water (mg/L)	Hexavalent chromium	0.007	20	NA
SW6010B	Soil (mg/Kg)	Aluminum	10	30	75-125
SW6010B	Soil (mg/Kg)	Antimony	10	30	75-125
SW7060	Soil (mg/Kg)	Arsenic	1	30	75-125
SW6010B	Soil (mg/Kg)	Barium	1	30	75-125
SW6010B	Soil (mg/Kg)	Beryllium	1	30	75-125
SW6010B	Soil (mg/Kg)	Cadmium	1	30	75-125
SW6010B	Soil (mg/Kg)	Calcium	10	30	75-125
SW6010B	Soil (mg/Kg)	Chromium	2	30	75-125
SW6010B	Soil (mg/Kg)	Cobalt	2	30	75-125
SW6010B	Soil (mg/Kg)	Copper	2	30	75-125
SW6010B	Soil (mg/Kg)	Iron	4	30	75-125
SW7421	Soil (mg/Kg)	Lead	1	30	75-125
SW6010B	Soil (mg/Kg)	Magnesium	4	30	75-125
SW6010B	Soil (mg/Kg)	Manganese	1	30	75-125
SW7471	Soil (mg/Kg)	Mercury	0.02	30	75-125
SW6010B	Soil (mg/Kg)	Nickel	4	30	75-125
SW6010B	Soil (mg/Kg)	Potassium	400	30	75-125
SW6010B	Soil (mg/Kg)	Silver	2	30	75-125
SW7740	Soil (mg/Kg)	Selenium	1	30	75-125
SW6010B	Soil (mg/Kg)	Sodium	20	30	75-125
SW7841	Soil (mg/Kg)	Thallium	1	30	75-125
SW6010B	Soil (mg/Kg)	Vanadium	2	30	75-125
SW6010B	Soil (mg/Kg)	Zinc	2	30	75-125
AK101	Soil (mg/Kg)	Gasoline Range Organics	5	30	76-119
	Water (µg/L)	Gasoline Range Organics	100	30	80-120
AK102	Soil (mg/Kg)	Diesel Range Organics	4	30	31-140
	Water (mg/L)	Diesel Range Organics	0.1	30	51-180
AK103	Soil (mg/Kg)	Residual Range Organics	5.0	30	31-140
	Water (mg/L)	Residual Range Organics	0.5	30	51-180
SW8260B SIM	Soil (mg/Kg)	Benzene	0.02	30	77-115
		Toluene	0.05	30	69-113
		Ethylbenzene	0.05	30	74-122
		m+p-xylene	0.1	30	70-130
		o-xylene	0.05	30	70-130
SW8260B	Soil (µg/Kg)	Dichlorodifluoromethane (CFC 12)	10	20	70-130
		Chloromethane	10	20	70-130
		Vinyl Chloride	10	20	70-130
		Bromomethane	10	20	70-130
		Chloroethane	10	20	70-130
		Trichlorofluoromethane (CFC 11)	10	20	70-130
		Acetone	50	20	70-130
		1,1-Dichloroethene	10	20	70-130
		Carbon Disulfide	10	20	70-130
		Methylene Chloride	30	20	70-130
		trans-1,2-Dichloroethene	10	20	70-130
		1,1-Dichloroethane	10	20	70-130

Table 4-2 (cont.) QA Objectives for Measurement Data

Method ¹	Matrix (units)	Analyte	Method Reporting Limit	Precision (RPD)	Accuracy (% REC)
		2-Butanone (MEK)	50	20	70-130
		2,2-Dichloropropane	10	20	70-130
		<i>cis</i> -1,2-Dichloroethene	10	20	70-130
		Chloroform	10	20	70-130
		Bromochloromethane	10	20	70-130
		1,1,1-Trichloroethane (TCA)	10	20	70-130
		1,1-Dichloropropene	10	20	70-130
		Carbon Tetrachloride	10	20	70-130
		1,2-Dichloroethane	10	20	70-130
		Benzene	10	20	70-130
		Trichloroethene (TCE)	10	20	70-130
		1,2-Dichloropropane	10	20	70-130
		Bromodichloromethane	10	20	70-130
		Dibromomethane	10	20	70-130
		2-Hexanone	50	20	70-130
		<i>cis</i> -1,3-Dichloropropene	10	20	70-130
		Toluene	10	20	70-130
		SW8260B (continued)	Soil (µg/Kg) (continued)	<i>trans</i> -1,3-Dichloropropene	10
1,1,2-Trichloroethane	10			20	70-130
4-Methyl-2-pentanone (MIBK)	50			20	70-130
1,3-Dichloropropane	10			20	70-130
Tetrachloroethene (PCE)	10			20	70-130
Dibromochloromethane	10			20	70-130
1,2-Dibromoethane (EDB)	10			20	70-130
Chlorobenzene	10			20	70-130
1,1,1,2-Tetrachloroethane	10			20	70-130
Ethylbenzene	10			20	70-130
Total Xylenes	10			20	70-130
Styrene	10			20	70-130
Bromoform	10			20	70-130
Isopropylbenzene	10			20	70-130
1,1,2,2-Tetrachloroethane	10			20	70-130
1,2,3-Trichloropropane	30			20	70-130
Bromobenzene	10			20	70-130
<i>n</i> -Propylbenzene	10			20	70-130
2-Chlorotoluene	10			20	70-130
4-Chlorotoluene	10			20	70-130
1,3,5-Trimethylbenzene	10			20	70-130
<i>tert</i> -Butylbenzene	10			20	70-130
1,2,4-Trimethylbenzene	10			20	70-130
<i>sec</i> -Butylbenzene	10			20	70-130
1,3-Dichlorobenzene	10			20	70-130
4-Isopropyltoluene	10			20	70-130
1,4-Dichlorobenzene	10			20	70-130
<i>n</i> -Butylbenzene	20			20	70-130
1,2-Dichlorobenzene	10			20	70-130
1,2-Dibromo-3-chloropropane (DBCP)	50			20	70-130
1,2,4-Trichlorobenzene	50			20	70-130
1,2,3-Trichlorobenzene	50			20	70-130
Naphthalene	50			20	70-130

Table 4-2 (cont.) QA Objectives for Measurement Data

Method ¹	Matrix (units)	Analyte	Method Reporting Limit	Precision (RPD)	Accuracy (% REC)
SW8260B	Water (µg/L)	Hexachlorobutadiene	50	20	70-130
		Dichlorodifluoromethane (CFC 12)	1.0	20	70-130
		Chloromethane	1.0	20	70-130
		Vinyl Chloride	1.0	20	70-130
		Bromomethane	1.0	20	70-130
		Chloroethane	1.0	20	70-130
		Trichlorofluoromethane (CFC 11)	1.0	20	70-130
		Acetone	5.0	20	70-130
		1,1-Dichloroethene	1.0	20	70-130
		Carbon Disulfide	1.0	20	70-130
		Methylene Chloride	2.0	20	70-130
		<i>trans</i> -1,2-Dichloroethene	1.0	20	70-130
		1,1-Dichloroethane	1.0	20	70-130
		2-Butanone (MEK)	5.0	20	70-130
		2,2-Dichloropropane	1.0	20	70-130
<i>cis</i> -1,2-Dichloroethene	1.0	20	70-130		
SW8260B (continued)	Water (µg/L) (continued)	Chloroform	1.0	20	70-130
		Bromochloromethane	1.0	20	70-130
		1,1,1-Trichloroethane (TCA)	1.0	20	70-130
		1,1-Dichloropropene	1.0	20	70-130
		Carbon Tetrachloride	1.0	20	70-130
		1,2-Dichloroethane	1.0	20	70-130
		Benzene	1.0	20	70-130
		Trichloroethene (TCE)	1.0	20	70-130
		1,2-Dichloropropane	1.0	20	70-130
		Bromodichloromethane	1.0	20	70-130
		Dibromomethane	1.0	20	70-130
		2-Hexanone	5.0	20	70-130
		<i>cis</i> -1,3-Dichloropropene	1.0	20	70-130
		Toluene	1.0	20	70-130
		<i>trans</i> -1,3-Dichloropropene	1.0	20	70-130
		1,1,2-Trichloroethane	1.0	20	70-130
		4-Methyl-2-pentanone (MIBK)	1.0	20	70-130
		1,3-Dichloropropane	1.0	20	70-130
		Tetrachloroethene (PCE)	1.0	20	70-130
		Dibromochloromethane	1.0	20	70-130
		1,2-Dibromoethane (EDB)	1.0	20	70-130
		Chlorobenzene	1.0	20	70-130
		1,1,1,2-Tetrachloroethane	1.0	20	70-130
		Ethylbenzene	1.0	20	70-130
		Total Xylenes	1.0	20	70-130
		Styrene	1.0	20	70-130
		Bromoform	1.0	20	70-130
		Isopropylbenzene	1.0	20	70-130
1,1,2,2-Tetrachloroethane	1.0	20	70-130		
1,2,3-Trichloropropane	3.0	20	70-130		
Bromobenzene	1.0	20	70-130		
<i>n</i> -Propylbenzene	1.0	20	70-130		
2-Chlorotoluene	1.0	20	70-130		
4-Chlorotoluene	1.0	20	70-130		

Table 4-2 (cont.) QA Objectives for Measurement Data

Method ¹	Matrix (units)	Analyte	Method Reporting Limit	Precision (RPD)	Accuracy (% REC)
		1,3,5-Trimethylbenzene	1.0	20	70-130
		tert-Butylbenzene	1.0	20	70-130
		1,2,4-Trimethylbenzene	1.0	20	70-130
		sec-Butylbenzene	1.0	20	70-130
		1,3-Dichlorobenzene	1.0	20	70-130
		4-Isopropyltoluene	1.0	20	70-130
		1,4-Dichlorobenzene	1.0	20	70-130
		n-Butylbenzene	1.0	20	70-130
		1,2-Dichlorobenzene	1.0	20	70-130
		1,2-Dibromo-3-chloropropane (DBCP)	5.0	20	70-130
		1,2,4-Trichlorobenzene	5.0	20	70-130
		1,2,3-Trichlorobenzene	5.0	20	70-130
		Naphthalene	5.0	20	70-130
		Hexachlorobutadiene	5.0	20	70-130
SW8270C Base Neutral Acid Extractables	Water (µg/L)	N-Nitrosodimethylamine	1.0	30	30-160
		Aniline	1.0	30	30-160
		Bis(2-chloroethyl) Ether	2.0	30	30-160
		1,2-Dichlorobenzene	1.0	30	30-160
		1,3-Dichlorobenzene	1.0	30	30-160
		1,4-Dichlorobenzene	1.0	30	12-100
		2,2'-oxybis(1-chloropropane)	1.0	30	30-160
		N-Nitroso-di-n-propylamine	2.0	30	26-102
		Hexachloroethane	2.0	30	30-160
		Nitrobenzene	1.0	30	30-160
		Isophorone	1.0	30	30-160
		Bis(2-chloroethoxy)methane	1.0	30	30-160
		1,2,4-Trichlorobenzene	1.0	30	15-100
		Naphthalene	1.0	30	30-160
		4-Chloroaniline	3.0	30	30-160
		Hexachlorobutadiene	2.0	30	30-160
		2-Methylnaphthalene	1.0	30	30-160
		Hexachlorocyclopentadiene	5.0	30	30-160
		2-Chloronaphthalene	1.0	30	30-160
		2-Nitroaniline	5.0	30	30-160
		Dimethyl Phthalate	1.0	30	30-160
		Acenaphthylene	1.0	30	30-160
		3-Nitroaniline	6.0	30	30-160
		Acenaphthene	1.0	30	52-100
		Dibenzofuran	1.0	30	30-160
		2,4-Dinitrotoluene	5.0	30	49-103
		2,6-Dinitrotoluene	5.0	30	30-160
		Diethyl Phthalate	1.0	30	30-160
		4-Chlorophenyl Phenyl Ether	1.0	30	30-160
		Fluorene	1.0	30	30-160
		4-Nitroaniline	6.0	30	30-160
		N-Nitrosodiphenylamine	1.0	30	30-160
		4-Bromophenyl Phenyl Ether	1.0	30	30-160
		Hexachlorobenzene	1.0	30	30-160
Phenanthrene	1.0	30	30-160		
Anthracene	1.0	30	30-160		

Table 4-2 (cont.) QA Objectives for Measurement Data

Method ¹	Matrix (units)	Analyte	Method Reporting Limit	Precision (RPD)	Accuracy (% REC)
		Di- <i>n</i> -butyl Phthalate	1.0	30	30-160
		Fluoranthene	1.0	30	30-160
		Pyrene	1.0	30	22-156
		Butyl Benzyl Phthalate	1.0	30	30-160
		3,3'-Dichlorobenzidine	5.0	30	30-160
		Benz(a)anthracene	1.0	30	30-160
		Bis(2-ethylhexyl) Phthalate	1.0	30	30-160
		Chrysene	1.0	30	30-160
		Di- <i>n</i> -octyl Phthalate	1.0	30	30-160
		Benzo(b)fluoranthene	1.0	30	30-160
		Benzo(k)fluoranthene	1.0	30	30-160
		Benzo(a)pyrene	1.0	30	30-160
		Indeno(1,2,3-cd)pyrene	1.0	30	30-160
		Dibenz(a,h)anthracene	1.0	30	30-160
		Benzo(g,h,i)perylene	1.0	30	30-160
SW8270C Base Neutral Acid Extractables (continued)	Water (µg/L) (continued)	Phenol	2.0	30	46-100
		2-Chlorophenol	1.0	30	33-100
		Benzyl Alcohol	5.0	30	30-160
		2-Methylphenol	2.0	30	30-160
SW8270C	Water(µg/L)	3- and 4-Methylphenol ²	1.0	30	30-160
		2-Nitrophenol	1.0	30	30-160
		2,4-Dimethylphenol	3.0	30	30-160
		Benzoic Acid	10	30	30-160
		2,4-Dichlorophenol	3.0	30	30-160
		4-Chloro-3-methylphenol	2.0	30	49-104
		2,4,6-Trichlorophenol	5.0	30	30-160
		2,4,5-Trichlorophenol	5.0	30	30-160
		2,4-Dinitrophenol	5.0	30	30-160
		4-Nitrophenol	5.0	30	38-124
		2-Methyl-4,6-dinitrophenol	10.0	30	30-160
		Pentachlorophenol	5.0	30	15-128
		GC/MS-SIM Polynuclear Aromatic Hydrocarbons	Soil(µg/Kg)	Naphthalene	6.7
2-Methylnaphthalene	6.7			30	30-160
Acenaphthylene	6.7			30	30-160
Acenaphthene	6.7			30	30-160
Fluorene	6.7			30	30-160
Phenanthrene	6.7			30	42-127
Anthracene	6.7			30	30-160
Fluoranthene	6.7			30	30-160
Pyrene	6.7			30	30-160
Benz(a)anthracene	6.7			30	30-160
Chrysene	6.7			30	35-128
Benzo(b)fluoranthene	6.7			30	30-160
Benzo(k)fluoranthene	6.7			30	33-130
Benzo(a)pyrene	6.7			30	30-160
Indeno(1,2,3-cd)pyrene	6.7			30	30-160
Dibenz(a,h)anthracene	6.7			30	30-160
Benzo(g,h,i)perylene	6.7			30	30-160
GC/MS-SIM Polynuclear	Water (µg/L)	Naphthalene	0.1	30	30-160
		2-Methylnaphthalene	0.1	30	30-160

Table 4-2 (cont.) QA Objectives for Measurement Data

Method ¹	Matrix (units)	Analyte	Method Reporting Limit	Precision (RPD)	Accuracy (% REC)
Aromatic Hydrocarbons		Acenaphthylene	0.1	30	30-160
		Acenaphthene	0.1	30	30-160
		Fluorene	0.1	30	30-160
		Phenanthrene	0.1	30	65-120
		Anthracene	0.1	30	30-160
		Fluoranthene	0.1	30	30-160
		Pyrene	0.1	30	30-160
		Benz(a)anthracene	0.1	30	30-160
		Chrysene	0.1	30	70-115
		Benzo(b)fluoranthene	0.1	30	30-160
		Benzo(k)fluoranthene	0.1	30	56-145
		Benzo(a)pyrene	0.1	30	30-160
		Indeno(1,2,3-cd)pyrene	0.1	30	30-160
		Dibenz(a,h)anthracene	0.1	30	30-160
		Benzo(g,h,i)perylene	0.1	30	30-160
SW8082 PCBs	Soil (µg/Kg)	Aroclor TM 1016	33	30	30-160
		Aroclor TM 1221	66	30	30-160
		Aroclor TM 1232	33	30	30-160
		Aroclor TM 1242	33	30	30-160
		Aroclor TM 1248	33	30	30-160
		Aroclor TM 1254	33	30	30-160
		Aroclor TM 1260	33	30	30-160
SW8082 PCBs	Water (µg/L)	Aroclor TM 1016	0.5	30	30-160
		Aroclor TM 1221	1.0	30	30-160
		Aroclor TM 1232	0.5	30	30-160
		Aroclor TM 1242	0.5	30	30-160
		Aroclor TM 1248	0.5	30	30-160
		Aroclor TM 1254	0.5	30	30-160
		Aroclor TM 1260	0.5	30	30-160

Key:
 µg/Kg – micrograms per kilogram
 µg/L – micrograms per liter
 EPA – United States Environmental Protection Agency
 GC/MS – gas chromatography/mass spectroscopy
 mg/Kg – milligrams per kilogram
 mg/L – milligrams per liter
 NA – not applicable
 NTU – nephelometric turbidity units
 PCB – polychlorinated biphenyls
 QA – quality assurance
 RPD – relative percent difference
 SIM – selected ion monitoring
 SOP – standard operating procedure
 TBD – to be determined

¹ Unless otherwise noted, all extraction and analytical methods refer to those contained in: ADEC UST Procedures Manual, Sept. 22, 1995, and Test Methods for Evaluating Solid Waste, Physical/Chemical Methods, SW-846, Third Edition, 1997.
² These compounds coelute; therefore, results are reported as the combined concentration.

Table 4-3 Containers, Preservation Techniques, and Holding Times

Analyte	Method	Container	Preservatives	Holding time
SOIL				
DRO/RRO	AK102/103	One 4-oz. amber glass jar w/Teflon®-lined cap	Cool, 4°C	14 days to extraction; 40 days to analysis
BTEX	SW8260B SIM	One 2-oz. glass jar w/Teflon®-lined septum cap	Cool, <25°C, Methanol	14 days to analysis
GRO	AK101	One 2-oz. glass jar w/Teflon®-lined septum cap	Cool, <25°C, Methanol	28 days to analysis
VOCs	SW8260B	One 2-oz. glass jar w/Teflon®-lined septum cap	Cool, <25°C, Methanol	14 days to analysis
PCBs	SW8082	One 4-oz. amber glass jar w/Teflon®-lined cap	Cool, 4°C	14 days to extraction; 40 days to analysis
RCRA and TAL Metals	SW6010B/7000	One 4-oz. amber glass jar w/Teflon®-lined cap	Cool, 4°C	28 days to analysis for Hg; all others 180 days to analysis
Gasoline Range Hydrocarbons for fuel fingerprinting	Lab SOP ¹	2-4 oz jar w/Teflon®-lined septum cap	Cool 4°C	14 days to analysis
C8 – C24 Fuel Specific Hydrocarbons for fuel fingerprinting	Lab SOP ¹	2-4 oz jar w/Teflon®-lined cap	Cool 4°C	14 days from collection to extraction (s); 40 days from extraction to analysis
WATER				
DRO/RRO	AK102/103	Two 1-liter amber glass bottles w/Teflon®-lined cap	Cool, 4°C, HCl to pH<2	7 days to extraction; 40 days to analysis
GRO/BTEX	AK101/SW8260B	Three 40-ml glass vials w/Teflon®-lined cap, no headspace	Cool, 4°C, HCl to pH<2	14 days to analysis

KEY:

- 1 – Lab SOP for fuel fingerprinting performed by Arthur D. Little laboratory
- BTEX - benzene, toluene, ethylbenzene, and xylenes
- DRO - diesel range organics
- GRO - gasoline range organics
- RCRA – Resource Conservation and Recovery Act
- RRO - residual range organics
- SIM - selected ion monitoring
- SVOC - semi-volatile organic compound
- TAL – Target Analyte List
- VOC - volatile organic compound

Figure 4-1 QA Sample Bottle Request Form

Approximate Sampling Dates: September 10 - 24, 2001

Project-Specific Sample Turnaround Time: 30-day TAT

State or other laboratory certifications required for this project: State of Alaska

Alaska District Project Manager: Richard Jackson

Address: P.O. Box 898, Anchorage, Alaska 99506

Phone: (907) 753-5606 Fax: (907) 753-5626

USACE Chemist: Gerald Archibald

Phone: (907) 753-2691 Fax: (907) 753-2636

A-E Contractor: MWH State: Alaska

Lab Name: Analytical Resources, Inc.

Address: 333 9th Ave N, Seattle, Washington 98109

Point of Contact (POC): Sue Snyder Phone: (206) 389-6167

Fax: (206) 621-7523

The following table shows required analytical parameters, methods (including extraction methods), and approximate number of samples to be collected for the project listed above.

Analyte (Matrix)	Extraction Method	Instrument Method	Primary Samples	Field Duplicate Samples	QA Samples
GRO (water)	SW5030	AK101	9	1	1
BTEX (water)	SW5030	SW8260B	9	1	1
DRO/RRO (water)	AK102/103	AK102/103	9	1	1
GRO (soil)	SW5035	AK101	86	9	9
DRO/RRO (soil)	AK102/103	AK102/103	86	9	9
BTEX (soil)	SW5035	SW8260B SIM	24	3	3
VOCs (soil)	SW5035	SW8260B	46	5	5
PCBs (soil)	SW3540 or SW3550	SW8082	14	2	2
RCRA metals (soil)	SW3050B	SW6010B/7000	16	2	2
TAL metals (soil)	SW3050B	SW6010B/7000	46	5	5
Chromium	SW3050B	SW6010B	2	0	0

5.0 GAMBELL HEALTH AND SAFETY PLAN ADDENDUM

A HASP for Gambell was developed in 1993 (E&E, 1993). A SSHASP was added to the HASP as Appendix B in 1994 and was updated by Montgomery Watson in 1996, 1997, and 2000. This Addendum has been prepared for 2001 Supplemental RI field activities. Where information in the HASP and SSHASP (Appendix B of the HASP) differs from the information contained in this Addendum, this Addendum shall be followed.

5.1 2001 SUPPLEMENTAL RI PROJECT ACTIVITIES

Gambell 2001 Supplemental RI investigation activities include collecting samples for field screening and laboratory analysis to resolve the extent of contamination at selected Gambell sites. The following field activities will be conducted:

- Surface and subsurface soil sampling for DRO, GRO, RRO, BTEX, VOCs, PCBs, metals, and fuel fingerprint analyses.
- Groundwater sampling for DRO, GRO, RRO, and BTEX.

5.2 OCCUPATIONAL HEALTH EXPOSURE STANDARDS

Table 5-1 presents occupational health exposure guidelines, ionization potentials, routes of exposure, and exposure symptoms for known or suspected site contaminants, including American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values-Time Weighted Averages (TLV-TWA), National Institute for Occupational Safety and Health (NIOSH) Recommended Exposure Limits (RELs), Federal Occupational Safety and Health Administration (OSHA) permissible exposure limits (PELs), and OSHA/NIOSH Immediately Dangerous to Life and Health (IDLH) values.

The OSHA 200 Form and OSHA Job Safety Poster must be prominently displayed at the project site. These are included in Appendix D.

5.3 PROJECT ORGANIZATION

MWH personnel conducting field investigation activities at Gambell will include the FTL, also serving as the SHSO, and up to three field team members. Additional personnel who may be present in the areas of investigation include subcontractors, client personnel, and federal and state agency personnel. Individuals with varying degrees of organizational responsibility for health and safety activities during the 2001 Supplemental RI fieldwork include:

- Project Manager
- SHM
- FTL/SHSO
- Field team members
- Project Chemist

- Environmental Sampler
- Subcontractor staff
- Site visitors

5.4 PERSONAL ACKNOWLEDGMENT

Each project field team member must sign an acknowledgment indicating that they have read and understood the HASP, the SSHASP (Appendix B of the HASP), and this Addendum. The Personal Acknowledgment Form is included in Appendix C.

5.5 TAILGATE SAFETY MEETINGS

Personnel must be aware of the potential chemical and physical hazards present at the site. For this reason, personnel training will be mandatory prior to working on site and a Tailgate Safety Meeting will be conducted and documented at the beginning of each shift, when new personnel arrive at the site, or when site conditions change. All site personnel shall sign the Tailgate Safety Meeting Form (Appendix C).

5.6 EMERGENCY ASSISTANCE INFORMATION

Minor injuries can be treated at the Gambell Health Clinic (Figure 5-1). Serious emergencies will require evacuation by air to the hospital in Nome and/or Anchorage (Figure 5-2). For an airlift to the hospital in Nome, arrangements can be made by contacting the Norton Sound Regional Hospital in Nome. The hospital in Nome is an 18-bed facility, has been notified of the impending arrival of the field team, and can accommodate any potential chemical hazard encountered. The hospital will be provided with the appropriate material safety data sheet (MSDS) for those chemicals that may be encountered.

LifeGuard Alaska works with health care providers throughout the state by transporting patients to the facility of choice. The following numbers can be used in the event of a medical emergency:

Gambell Health Clinic	(907) 985-5012
Gambell Police	(907) 985-5333
Norton Sound Regional Hospital	(907) 443-3311
Emergency Number for All Services	911
Medevac LifeGuard Alaska Flight	(800) 478-5433

Have the following information ready when making a flight request:

- Who is requesting the flight
- Your calling agency/call-back number
- Exact location of accident/illness
- Number of patients
- Sex, age, and vital signs of patient(s) if available
- Specific injuries/level of consciousness
- Any other information that may be helpful to the flight team

Table 5-1 Occupational Health Exposure Standards

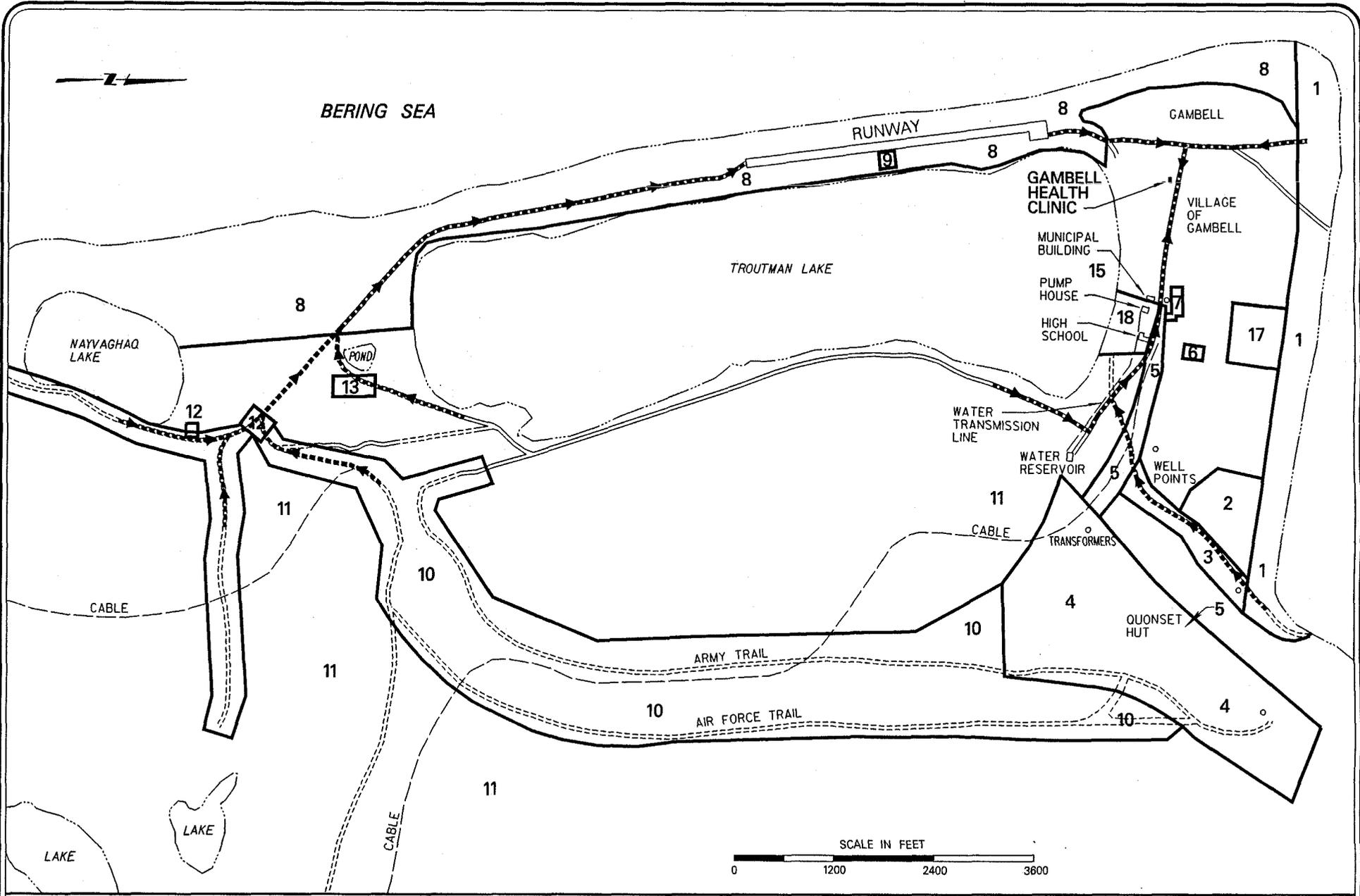
Site Contaminant	State/Federal-OSHA PEL-TWA	NIOSH REL-TWA	ACGIH TLV-TWA	NIOSH IDLH	Ionization Potential Electron-Volt (eV)	Routes of Exposure	Symptoms
Benzene (ppm)	1.0	0.1, Ca	10, A1	3,000 Ca	9.24	Inhalation Ingestion Skin absorption Skin and/or eye contact	Irritation to eyes, nose, respiratory system; giddiness; headache; nausea; staggered gait; fatigue; lassitude; dermatitis; bone marrow depression; carcinogen
Ethylbenzene (ppm)	100	100	100	2,000	8.76	Inhalation Skin absorption Ingestion Skin and/or eye contact	Eye, skin, mucous membrane irritant; central nervous system depressant; narcosis, coma
n-Hexane (ppm)	50	50	NL	5,000	10.18	Inhalation Ingestion Skin and/or eye contact	Light-headed; nausea; headache; numbness in extremities; weakness; irritated eyes, nose; giddiness
Hydrochloric acid (ppm)	5	5	5	100	12.74	Inhalation Ingestion Skin and/or eye contact	Apnea; coma; convulsion; irritant to eyes; conjunctivitis; pain; lachrimation; photophobia; corneal vesiculation; irritant to respiratory tract; dizziness; headache; fatigue; irritability; insomnia; gastrointestinal disturbance NOTE: This chemical deadens the olfactory nerve. Once the smell disappears, the chemical may be concentrating in higher levels, becoming very dangerous.
Nitric acid (ppm)	2	2	2	100	11.95	Inhalation Ingestion Skin and/or eye contact	Irritated eyes, mucous membranes, skin; delayed pulmonary edema, pneumonia, bronchitis; dental erosion
PCBs (mg/m ³) polychlorinated biphenyls, used chlorodiphenyl, 54% chlorine for health analysis	0.5	0.001	0.5, A1	5	NL	Inhalation Ingestion Skin and/or eye contact	Irritated eyes, skin; acne-form dermatitis; liver damage; carcinogen
Toluene (ppm)	100	100	50	2,000	8.82	Inhalation Skin absorption Ingestion Skin and/or eye contact	Fatigue; weakness; confusion; euphoria; dizziness; headache; dilated pupils; watery eyes; nervousness; muscle fatigue; insomnia; dermatitis
Xylene (ppm)	100	100	100	1,000	8.44/8.56	Inhalation Skin absorption Ingestion Skin and/or eye contact	Dizziness, excitement, drowsiness, incoordination, staggering gait; eye, nose and throat irritation; nausea, vomit, abdominal pain; dermatitis

Key:

A1 – ACGIH notation for a confirmed human carcinogen
ACGIH – American Conference of Governmental Industrial Hygienists
Ca – carcinogen
IDLH – immediately dangerous to life and health

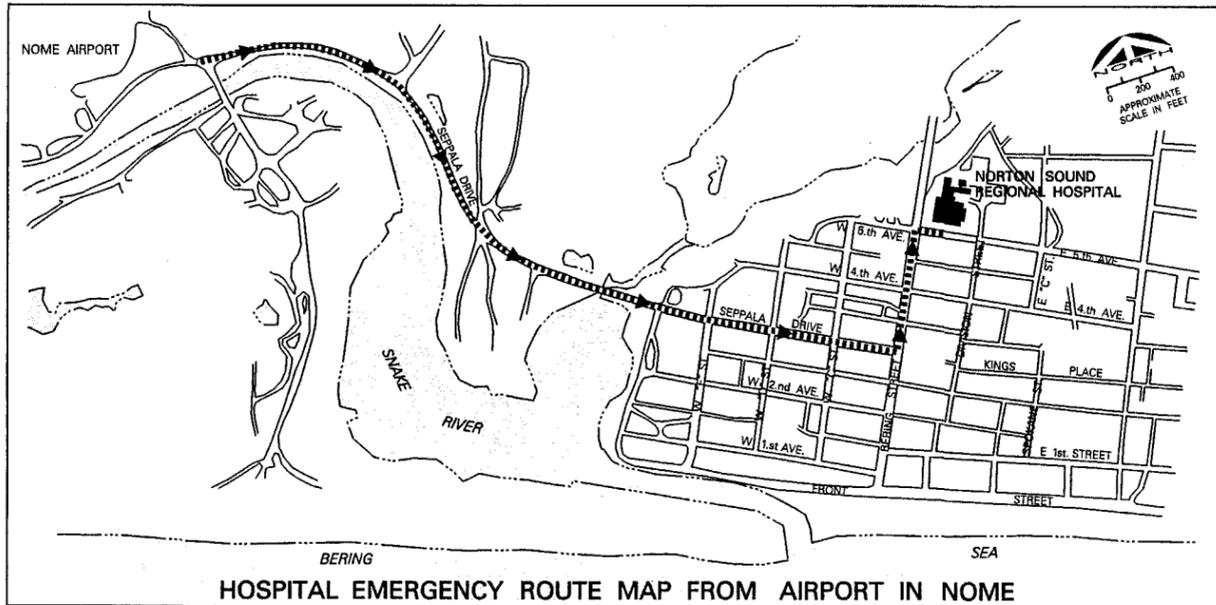
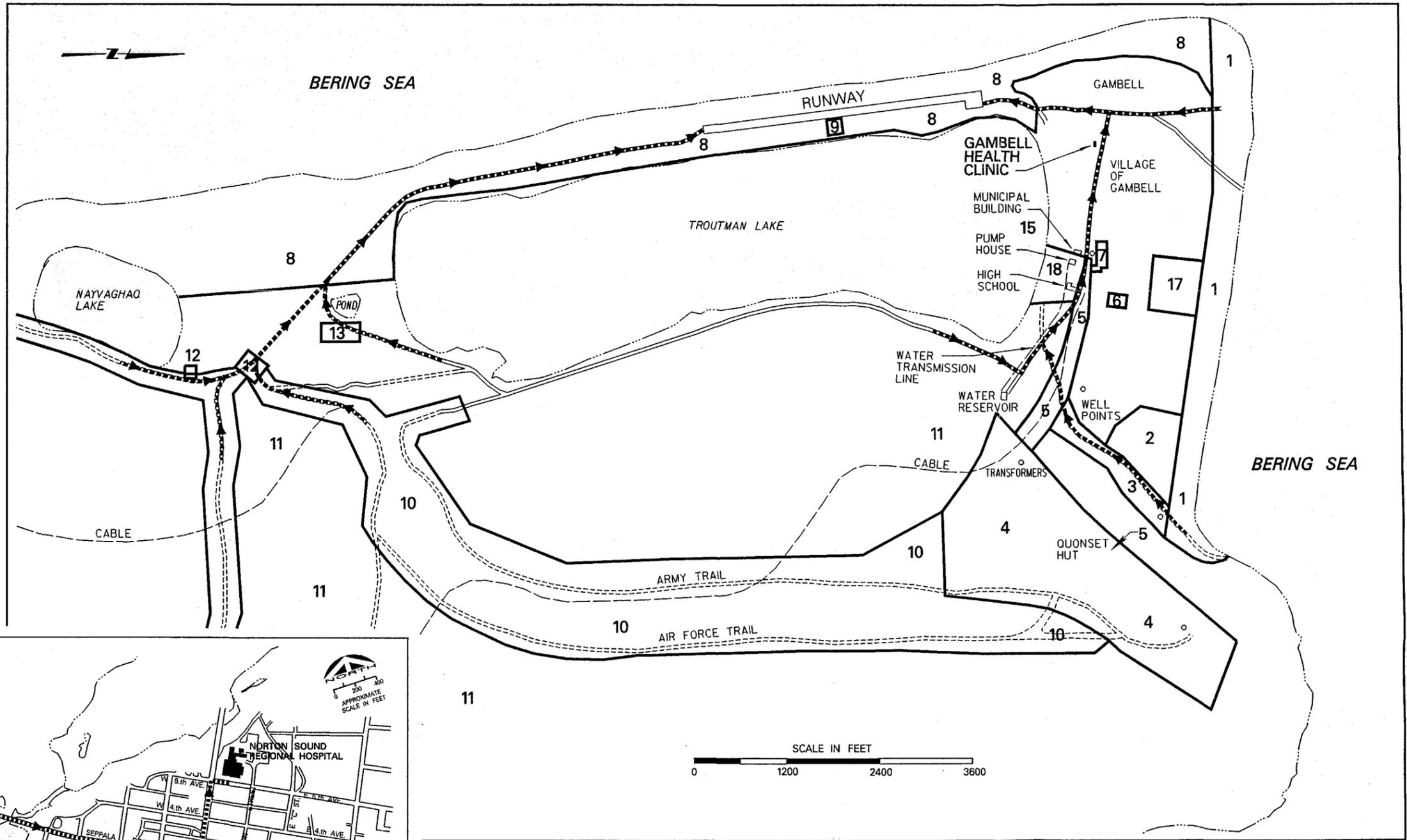
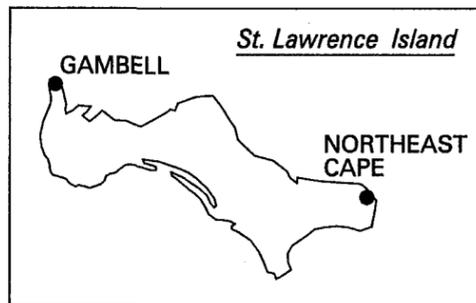
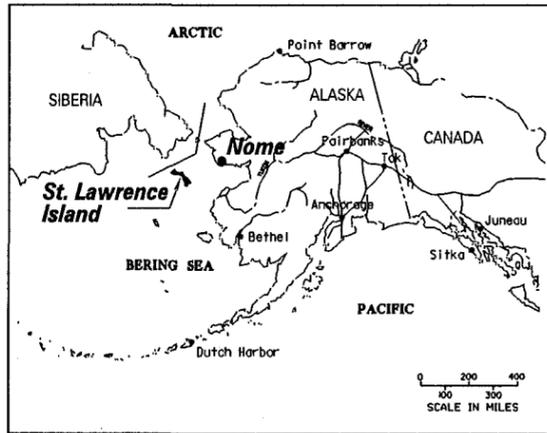
mg/m³ – milligrams per cubic meter
NIOSH – National Institute for Occupational Safety and Health
NL – not listed
OSHA – Occupational Safety and Health Administration
PCB – polychlorinated biphenyl
PEL – permissible exposure limit

ppm – parts per million
REL – recommended exposure limit
TLV – threshold limit value
TWA – time-weighted average



- LEGEND:**
- 10 SITE NUMBER
 - >--- EMERGENCY ROUTE

FIGURE 5-1
 U.S. ARMY ENGINEER DISTRICT, ALASKA
 GAMBELL, ST. LAWRENCE ISLAND, ALASKA
MAP TO GAMBELL HEALTH CLINIC



LEGEND:
 10 SITE NUMBER
 - - - - - EMERGENCY ROUTE

FIGURE 5-2
 ALASKA DISTRICT - CORPS OF ENGINEERS
 GAMBELL, ST. LAWRENCE ISLAND, ALASKA
MAP TO HOSPITAL IN NOME, ALASKA

JOB No. 1850...-01002 TIME: 14-SEP-2001 14:32
 FILE: E:\usace\gambell\2001\WP\Final\Fig5-2.dgn

6.0 WASTE MANAGEMENT PLAN

IDW will be handled in accordance with SOP-35 (IDW Management) (Appendix B). Project waste is anticipated to consist of three waste streams:

- Spent chemicals from PetroFlag™ test kits
- Decontamination water from cleaning non-disposable equipment
- Disposable protective clothing, supplies, and sampling equipment

6.1 SPENT PETROFLAG™ COMPONENTS

Spent PetroFlag™ chemicals and supplies will be returned to Anchorage for disposal.

6.2 DECONTAMINATION WATER

Decontamination water shall be filtered through a 15-gallon carbon filter canister, visually inspected for sheen, and discharged to the ground surface if no sheen is visible. If breakthrough occurs, the carbon will be replaced with new material and the water will be refiltered. The spent carbon will be returned to Anchorage for disposal at Cleanair, Inc.

6.3 DISPOSABLE PROTECTIVE CLOTHING, SUPPLIES AND SAMPLING EQUIPMENT

Based on previous data collected at the site, disposable protective clothing, supplies, and sampling equipment are designated as nonhazardous and will be bagged and shipped to Anchorage for disposal as solid waste.

7.0 SPILL RESPONSE AND REPORTING PLAN

Care will be taken to avoid spills at the site. The greatest risk of a reportable spill is during equipment fueling; however, operating vehicles and equipment and conducting site activities in close proximity to tanks and drums may also present the risk of a spill. To minimize the risk of a spill during equipment fueling, the following procedures will be followed:

- Check the vehicle or equipment. Ensure that it has been properly maintained and there are no petroleum, oil, or lubricant (POL) leaks prior to operation.
- Stage vehicles in a central location, away from waterbodies, tundra, or other sensitive areas.
- Position equipment so that valves, piping, tanks, or other fuel-containing parts are protected from damage by other vehicles or equipment.
- Verify that adequate secondary containment and absorbent pads are on site.
- Before starting any fuel transfer operation, inspect all hoses, connections, valves, etc. Ensure that these items have been properly maintained and all connections are properly tightened.
- Use secondary containment or absorbent pads under all appropriate connections, vents, or any other likely source of spillage. Use as many secondary containers as necessary.
- During fuel transfer, maintain line of sight with equipment operator and/or all connections and other potential sources of spillage.
- Never leave a fuel transfer unattended.
- Maintain secondary containment while disconnecting filling hoses.

Should a spill occur, mitigation and reporting procedures are described below.

- The SHSO will assess the need to don personal protective equipment (PPE) higher than Level D by taking air monitoring readings.
- Absorbent material will be used to temporarily berm and contain the spill and also will be used to clean up spilled material.
- Spilled material and affected soil will be scooped up and placed in an appropriate drum or container.
- If the spill is too large to be handled safely by the field team, the area around the spill will be secured and the Project Manager, SHSO, and Alaska District Contracting Officer and Engineering Manager will be notified.
- State (18 AAC 75.300) and federal CERCLA regulations require immediate notification of a hazardous material discharge or release. Consequently, field personnel will immediately record the following information for a spill of any volume, and contact the Project Manager and/or the Alaska District for reporting:

- Date, time, and location of discharge
- Name, mailing address, and telephone number of person(s) causing or responsible for the discharge
- Cause of discharge
- Environmental damage, including volume of soil or water affected, caused by the discharge, to the extent damage can be identified
- Cleanup actions taken
- If the material has been disposed of, the date, location, and method of hazardous substance and cleanup materials
- Estimate of the volume of cleanup materials used
- Any actions taken to prevent recurrence of the discharge
- Other information the field team considers important to the discharge episode

If directed by the Alaska District, the Project Manager will contact the following agencies, as appropriate. (If necessary to prevent further environmental damage, and the Project Manager or the Alaska District cannot be contacted, the FTL will contact the agencies.)

- Alaska Spill Response Center (800) 478-9300
- Alaska State Troopers Statewide (800) 478-9300
- United States Army Engineer District, Alaska (907) 753-2504
- Alaska Department of Environmental Conservation (ADEC) (907) 269-7505
- United States Coast Guard National Response Center (800) 424-8802
- United States Environmental Protection Agency (USEPA), (907) 586-7619
Alaska Operations Office

The ADEC Oil and Hazardous Substances Spills posters, which include phone numbers for ADEC Area Response Teams, will be prominently displayed at work areas. These posters are included in Appendix D.

8.0 REFERENCES

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- Montgomery Watson. 1999a. Site 5 Remedial Investigation, Gambell, St. Lawrence Island, Alaska.
- Montgomery Watson. 1999b. Final Investigation of Geophysical Anomaly, Gambell, St. Lawrence Island, Alaska. Final. December.
- Montgomery Watson. 2000. Strategic Project Implementation Plan, Gambell, St. Lawrence Island, Alaska. Final. December.
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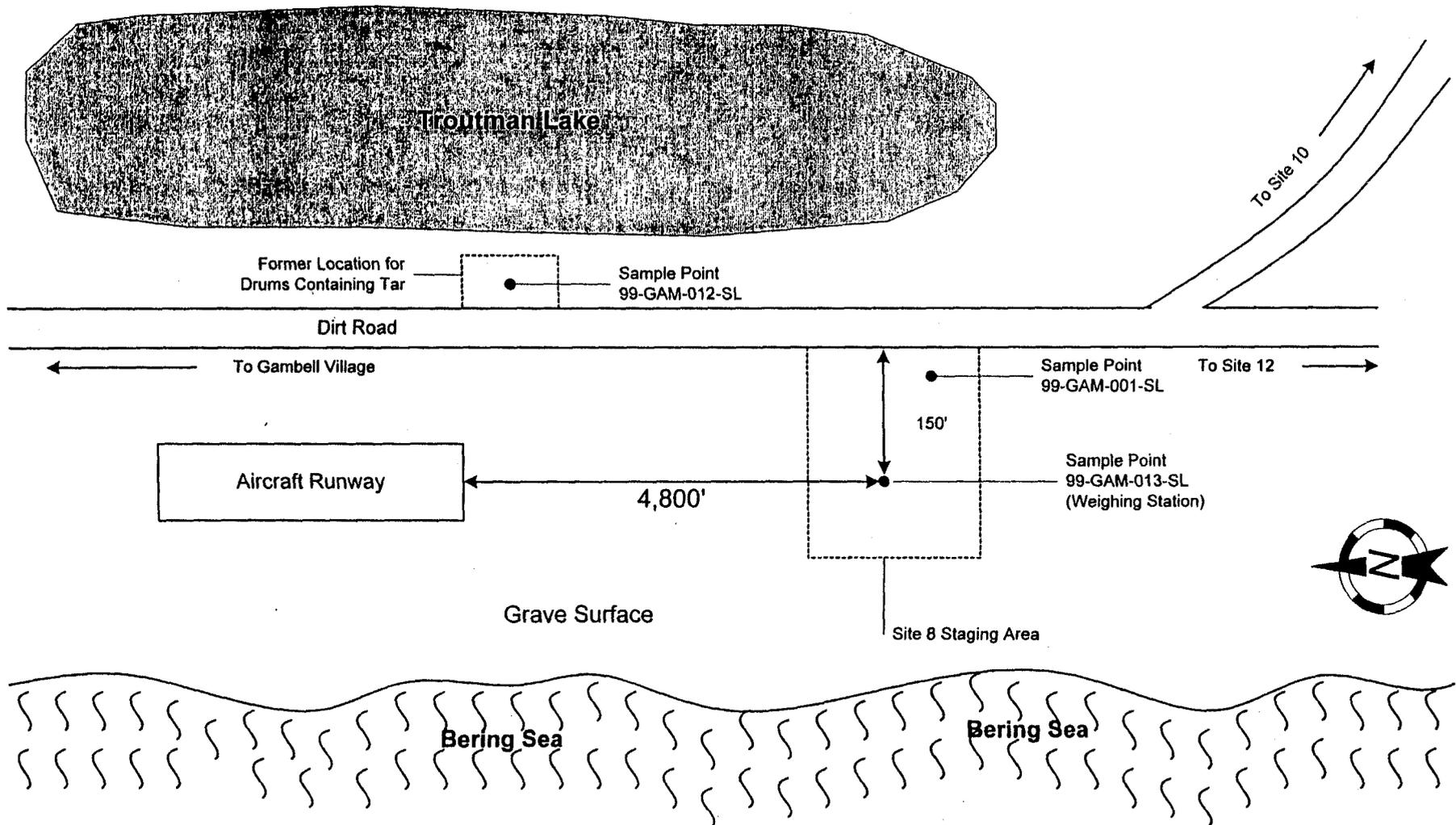
- United States Army Corps of Engineers Engineer Research and Development Center, Topographic Engineering Center (TEC). 2000. GIS-Based Historical Time Sequence Analysis (Historical Photographic Analysis), Gambell Sites, St. Lawrence Island, Alaska. September.
- United States Army Corps of Engineers (USACE). 1990. Regulation No. 1110-1-263.
- URS Corporation and Rittenhaus-Zeman & Associates (URS). 1985. Defense Environmental Restoration Program (DERP), Gambell, St. Lawrence Island, Alaska, Geotechnical, Geophysical, Soil, and Groundwater Quality Studies, Prepared for URS Engineers, W-4581. August.
- United States Environmental Protection Agency (USEPA). 1989. Methods for Evaluating the Attainment of Cleanup Standards, Volume 1: Soils and Solid Media.
- USEPA. 1996. Test Methods for Evaluating Solid Waste, Physical/Chemical Methods (SW846), Third Edition, Including Updates. December.
- USEPA. 1999. Contract Laboratory Program National Functional Guidelines for Organic Data Review.
- USEPA. 1998. Laboratory Data Validation Functional Guidelines for Evaluating Inorganics Analyses.

APPENDIX A

Figures from OSCI Report



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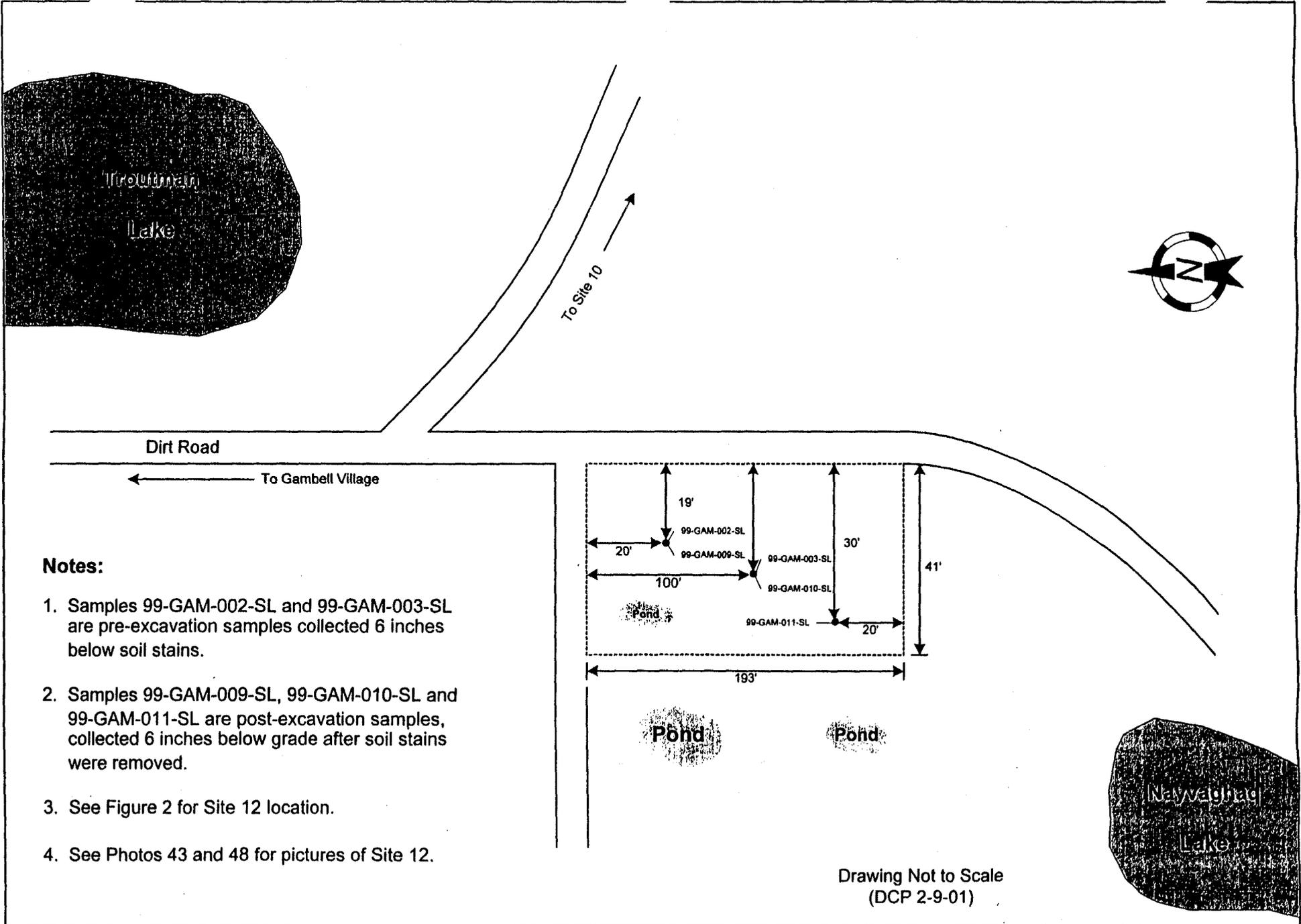
Notes:

1. See Figure 2 for Site 8 location.
2. Site 8 staging area was used to weigh and load debris and HTW into connex containers.
3. Sample 99-GAM-001-SL was obtained from supersack filled with oil stain soil from various locations in Site 8.
4. Samples 99-GAM-012-SL and 99-GAM-013-SL were collected 6 inches below grade.

Drawing Not to Scale
(DCP 2-9-01)

Figure 3

Site 8 - Sample Collection Locations



36

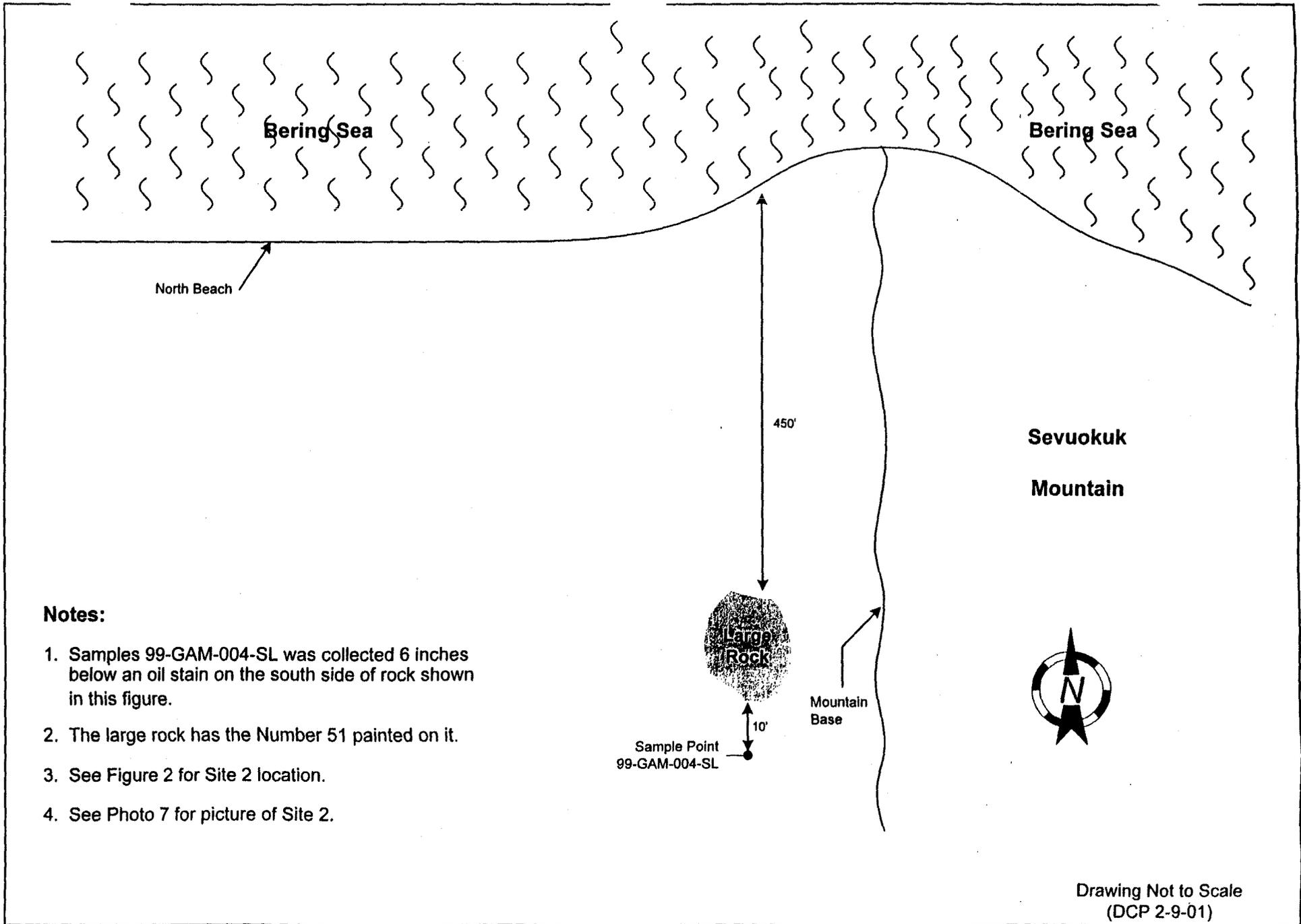
Notes:

1. Samples 99-GAM-002-SL and 99-GAM-003-SL are pre-excavation samples collected 6 inches below soil stains.
2. Samples 99-GAM-009-SL, 99-GAM-010-SL and 99-GAM-011-SL are post-excavation samples, collected 6 inches below grade after soil stains were removed.
3. See Figure 2 for Site 12 location.
4. See Photos 43 and 48 for pictures of Site 12.

Drawing Not to Scale
(DCP 2-9-01)

Figure 4

Site 12 - Sample Collection Locations



Notes:

- 1. Samples 99-GAM-004-SL was collected 6 inches below an oil stain on the south side of rock shown in this figure.
- 2. The large rock has the Number 51 painted on it.
- 3. See Figure 2 for Site 2 location.
- 4. See Photo 7 for picture of Site 2.

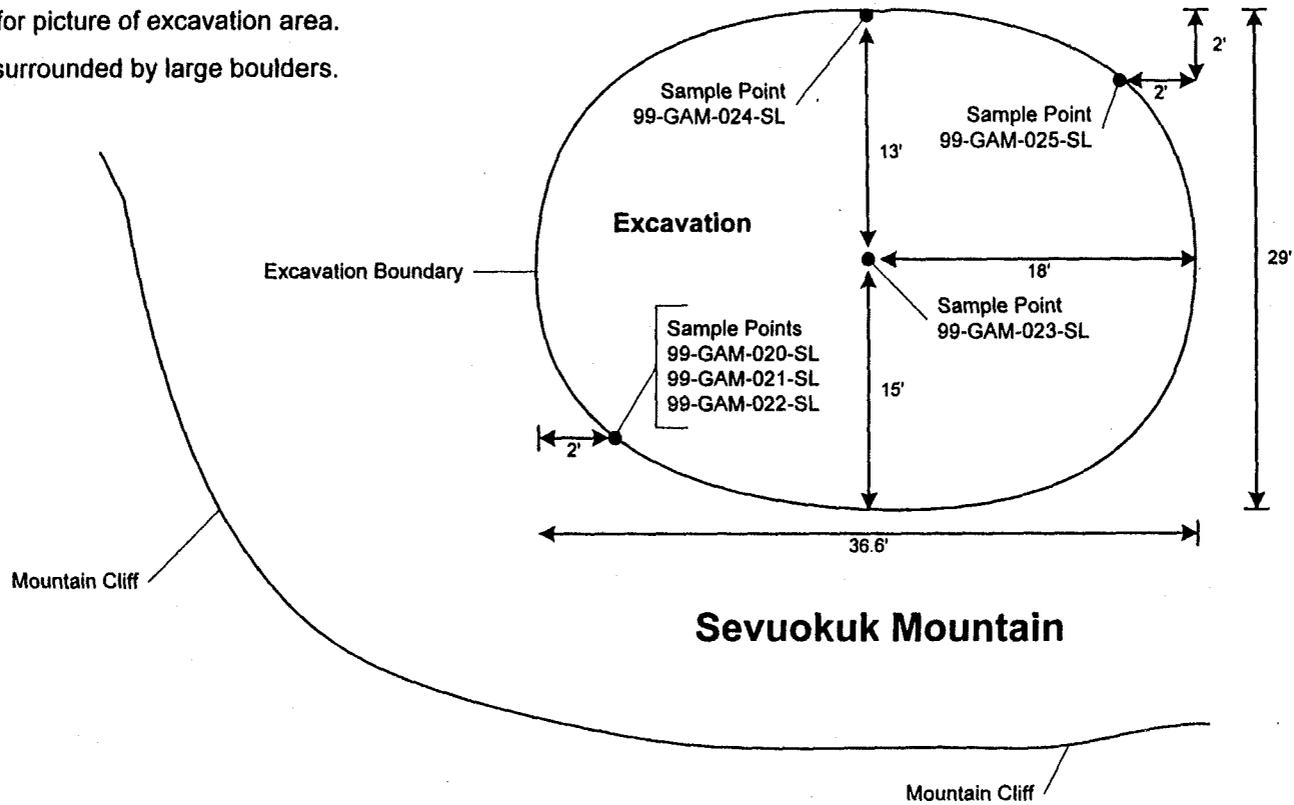
Drawing Not to Scale
(DCP 2-9-01)

Figure 5

Site 2 - Sample Collection Location

Notes:

1. See Figure 2 for Site 4/Area 4B location.
2. Excavation is 22 inches to 24 inches deep.
3. Excavation was not backfilled per government instructions.
4. Sample 99-GAM-005-SL was a pre-excavation composite sample collected from soil 6 inches below the surface of the excavation area.
5. Other samples are post excavation samples collected 6 inches below excavation bottom.
6. See Photo 22 for picture of excavation area.
7. Excavation is surrounded by large boulders.

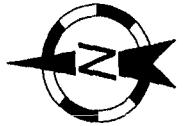


Drawing Not to Scale
(DCP 2-9-01)

Figure 6

Site 4/Area 4B - Sample Collection Locations

Trail to Site 10 →

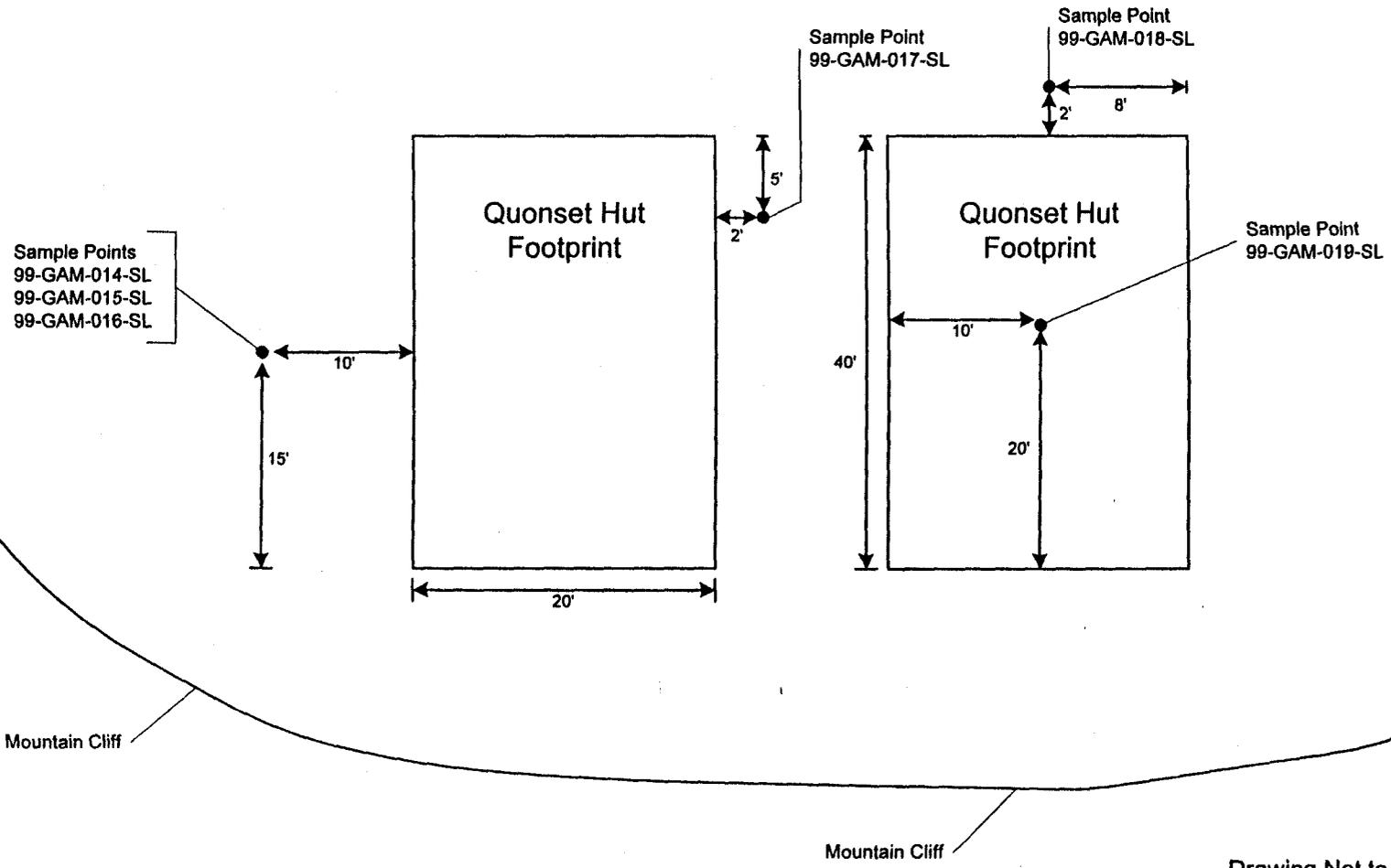


Sevuokuk Mountain

Notes:

- 1. Samples were collected 6 inches below the surface after soil stains were removed.
- 2. See Photo 13 for picture of Site 4/Area 4A.
- 3. See Figure 2 for Site 4/Area 4A location.

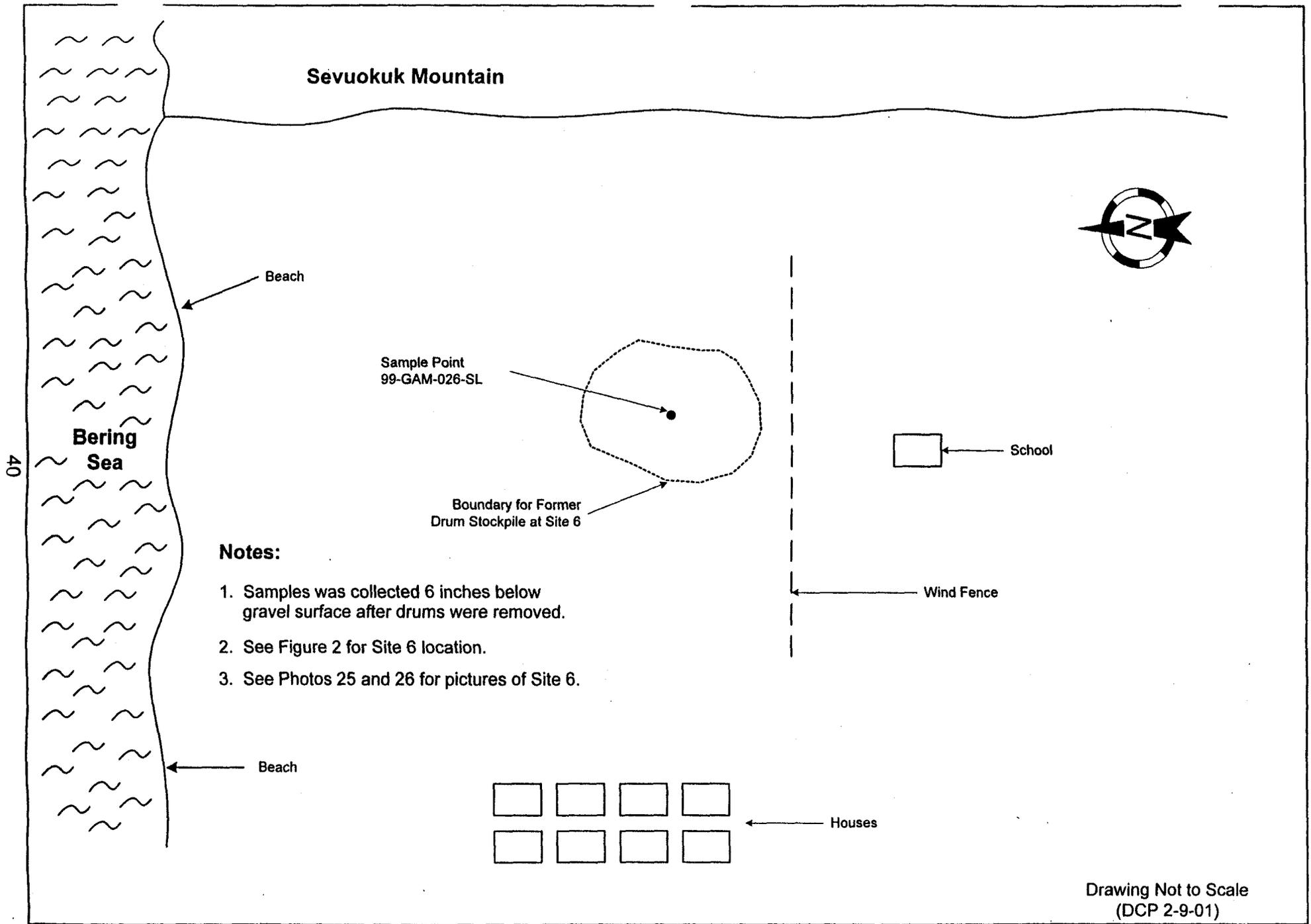
39



Drawing Not to Scale
(DCP 2-9-01)

Figure 7

Site 4/Area 4A - Sample Collection Locations



Drawing Not to Scale
(DCP 2-9-01)

Figure 8

Site 6 - Sample Collection Location

APPENDIX B

Standard Operating Procedures



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SOP 6

Field Notes and Logs



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STANDARD OPERATING PROCEDURES

SOP-6: SAMPLE MANAGEMENT AND PRESERVATION

1.0 INTRODUCTION

This guideline for sample management describes the requirements for sample identification, chain of custody (COC), sample handling, storage and shipping. The purpose of this SOP is to define sample management activities as performed from the time of sample collection to the time they are received by the laboratory.

2.0 DEFINITIONS

Sample: Physical evidence collected for environmental measuring and monitoring. For the purposes of this SOP, sample is restricted to solid, aqueous, air, or waste matrices. This SOP does not cover samples collected for lithologic description nor does it include remote sensing imagery or photographs.

Field Team Leader: The individual responsible for the supervision of fieldwork at the site during a given phase of investigation or monitoring.

Sampler: The individual who collects environmental samples during fieldwork.

3.0 RESPONSIBILITIES

The following is a general description of responsibilities related to sample management; specific responsibilities are described in project work plans.

Program QC Coordinator: The program QC coordinator (QCC) is responsible for ensuring that client sample management requirements can be accommodated within Montgomery Watson quality requirements.

Project Manager: The project manager is responsible for ensuring that the requirements for sample management are included in the appropriate project plans. The project manager is responsible for fully communicating the sample management requirements to the Field Team Leader (FTL) by providing a copy of project plans or issuing written notice that the SOP is to be used exclusively.

Project QC Coordinator: The project QC coordinator is responsible for reviewing documentation developed from sample management to determine compliance with this SOP and project plan requirements.

Field Team Leader: The FTL is responsible for conducting the procedures described herein and, if applicable, the requirements of the project plan. Any variance from these procedures is considered a nonconformance, and written documentation is required, at a minimum, as described in the SOP for Corrective Action.

4.0 PROCEDURES

4.1 APPLICABILITY

These procedures apply to all work conducted for Montgomery Watson clients, by Montgomery Watson, or under the direction of Montgomery Watson. The information in this SOP may be incorporated into project-specific plans. Deviations or modifications to procedures not addressed in the project plans must be handled as a corrective action (see SOP for Corrective Action).

4.2 SAMPLE MANAGEMENT

4.2.1 Sample Containers

The sample containers to be used will be dependent on the sample matrix and analyses desired. The containers to be used for various analyses are specified in the project plan. Sample containers are to be filled (approximately 90 percent), with adequate headspace for safe handling upon opening, except containers for volatile organic compound (VOC) analyses, which are to be filled completely with no headspace. This applies to soil samples and water samples.

Once opened, the containers are to be used immediately. If the container has been received unsealed or is not used upon opening, it is to be recycled. If the container is used for any reason in the field (i.e., screening) and not sent to the laboratory for analysis, it should be discarded. The contents of the used container and the container itself may require disposal as a hazardous material. When storing before and after sampling, the containers must remain separate from solvents. Sample containers with preservatives added by the laboratory should not be used if held for an extended period on the job site or exposed to extreme conditions.

4.2.2 Numbering and Labeling

Sample Label: A sample label will be affixed to all sample containers except those pre-weighed for analysis of volatile compounds in soil. Pre-weighed containers will be sealed in "ziplock"-type bags, with the sample label affixed to the bag. Labels provided by the laboratory may be used. Each sample label will be completed with the following information:

Client name, project title, or project location (sufficiently specific for data management; e.g., Bayou Chemical Corp., East Suburbs Interceptor, Sawatch AFB).

- Sample location
- Sample identification number
- Date and time of sample collection
- Initials of sampler
- Preservative used
- Analyte(s) of interest

After labeling, each sample will be refrigerated or placed in a cooler containing ice or "blue ice" to maintain the sample temperature of 4 degrees Celsius (•C).

Custody Seals: Custody seals will be used on each sample and/or shipping container to ensure custody. Custody seals used during the course of the project will consist of security tape with the date and initials of the sampler. As a minimum, one custody seal will be placed on the front of the cooler overlapping the tape and one on the side of the cooler. If required by the client, a seal will be placed on each sample container so that it must be broken to gain access to the contents. Since VOC samples may be subject to contamination by the tape, VOC sample containers will first be secured in a "ziplock"-type plastic bag. The plastic bag will be sealed with a completed custody seal.

4.2.3 Chain of Custody

COC procedures require a written record of the possession of individual samples from the time of collection through laboratory analyses. A sample is considered to be in custody if it is:

- In a person's possession
- In view after being in physical possession
- In a secured condition after having been in physical custody
- In a designated secure area, restricted to authorized personnel

The COC record shall be used to document the samples collected and the analyses requested. Information recorded by field personnel on the COC record includes the following:

- Client name
- Project name
- Project location
- Sampling location
- Signature of sampler(s)
- Sample identification number
- Date and time of collection
- Sample matrix
- Signature of individuals involved in custody transfer (including date and time of transfer)
- Airbill number (if appropriate)
- Number and type of bottles collected for each analysis
- Type of analysis and laboratory method number
- Any comments regarding individual samples (e.g., HNU readings, special instructions)

COC records will be placed in a plastic bag, secured to the inside of the cooler lid, and transported with the samples. When the sample(s) are transferred, the record is signed by both the receiving and relinquishing individuals. Signed airbills will serve as evidence of custody transfer between the field sampler and courier as well as courier and laboratory. If a carrier service is used to ship the samples (e.g., Federal Express), custody will remain with the sampler until it is relinquished to the laboratory. Copies of the COC record and airbill will be retained by the sampler. If the COC records are sequentially numbered, the record number and airbill

number will be cross-referenced in both the field logbook and the sample register. If the COC record is not previously numbered, a tracking number of four digits or more should be added to the top of the form and recorded as above.

4.2.4 Sample Register/Sample Tracking

The sample register is a bound logbook with sequentially numbered pages used to document which samples were collected on a particular day. The sample register is also used as the key to correlate field samples with duplicate samples. Information that should be recorded in the sample register includes the following:

- Client name
- Project name and location
- Job number
- Date and time of collection
- Sample identification number
- Sample matrix
- Number and type of bottles
- Type of analysis
- Sample destination
- Sampler's initials

A sample tracking database, which includes the above information, may be substituted for a handwritten sample register. However, a hardcopy of each day's sampling activities should be maintained in the field files.

4.2.5 Sample Preservation/Storage

The requirements for sample preservation are dependent on the analyses desired and the sample matrix. Sample preservation requirements are provided in the project plan.

4.2.6 Shipping

Procedures for packaging and transporting samples to the laboratory are based on the actual chemical, physical, and hazard properties of the material. The procedures may also be based on an estimation of contaminant concentrations/properties in the samples to be shipped. Samples will be identified as either environmental samples, excepted quantities samples, limited quantities samples, or standard hazardous materials. Environmental samples are defined as soil or water samples that are not saturated or grossly contaminated with product material. Excepted quantities involve the shipment of a few milliliters of either an acid or base preservative in an otherwise empty sample container. Limited quantities are restricted amounts of hazardous materials that may be shipped in generic, sturdy containers. Standard hazardous material shipments require the use of stamped/certified container.

The following instructions pertain to shipments on Federal Express (FedEx).

4.2.6.1 Environmental Samples

Environmental samples, such as soil or water that are not saturated or grossly contaminated are not considered hazardous substances/dangerous goods by U.S. Department of Transportation guidelines. Except for pure product, environmental samples may be shipped in the following manner:

- Each sample will be placed in a separate plastic or "bubble-wrap" bag. As much air as possible is squeezed from the bag before sealing. Bags may be sealed with evidence tape for additional security. If brass or stainless steel tubes are used, bubble wrap is not required.
- An ice chest (sturdy construction) is typically used as the shipping container. In preparation for shipping samples, the drain plug is taped shut from the outside and a large plastic bag is used as a liner for the cooler. Approximately 1 inch of packing material, such as vermiculite or other type absorbent sufficient to retain any liquid that may be spilled, is placed in the bottom of the liner. Sufficient packing material should be used to prevent sample containers from making contact during shipment.
- The bottles are placed in the lined ice chest. Cardboard or foam separators may be placed between the bottles at the discretion of the shipper.
- Water samples for organic analysis and inorganic analysis will be cooled to 4°C with ice or "blue ice" during shipment. If ice is used, it will be contained such that the water will not fill the cooler as the ice melts. Dry ice should not be used as it has a tendency to freeze samples. If dry ice is used, however, it needs to be noted in the box in Section 6 of the FedEx USA Airbill (i.e., number of packages and weight in kilograms of dry ice per package).
- As described previously, the COC record will be placed inside a plastic bag, sealed, and taped to the inside of the cooler lid. For Federal Express, the COC record should be placed in a pouch or plastic bag attached to the top of the cooler. The airbill will be filled out before the samples are handed over to the carrier. The laboratory will be notified if the shipper suspects that the sample contains any substance for which the laboratory personnel should take safety precautions.
- The cooler is closed and taped shut around the lid and around both ends.
- Two signed custody seals will be placed on the cooler, one on the front and one on the side overlapping tape if possible. Additional seals may be used if the sampler and shipper think more seals are necessary. Wide clear tape will be placed over the seals to ensure against accidental breakage.
- The cooler is handed over to FedEx, a cargo-only air service. A standard airbill is sufficient for shipping environmental samples.

4.2.6.2 Excepted Quantities

Usually, corrosive preservatives (i.e., hydrochloric acid, sulfuric acid, nitric acid, or sodium hydroxide) are added to otherwise empty sample bottles by the analytical laboratory prior to shipment to field sites. However, if there is an occasion whereby MW personnel are required to

ship bottles with these undiluted preservatives, the containers must be shipped in the following manner:

- Each individual sample container must have not more than 30 milliliters of preservative.
- Collectively, these individual containers must not exceed 500 milliliters in the same outer box or package.
- Despite the small quantities, only chemically compatible material may be placed in the same outer box, i.e., sodium hydroxide, a base, must be packaged separately from the acids.
- Federal Express will transport nitric acid only in concentrations of 40% or less.
- A "Dangerous Goods in Excepted Quantities" Label must be affixed to the outside of the outer box or container. Information required on the label includes:
 - Signature of Shipper
 - Title of Shipper
 - Date
 - Name and Address of Shipper
 - Check of Applicable Hazard Class
 - Listing of UN Numbers for Materials in Hazard Classes

4.2.6.3 Limited Quantities

Occasionally, it may become necessary to ship known hazardous materials, such as pure or floating product. DOT regulations still permit the shipment of many hazardous materials in merely "sturdy" packages, such as an ice chest or cardboard box (not a specially constructed and certified container), provided that certain conditions are met. This option permits a more convenient and economical method for shipping hazardous materials. Instructions for shipping most liquid samples include the following:

- Each sample bottle is placed in a plastic bag, and the bag is sealed. Each VOC vial is wrapped in a paper towel and placed in a plastic bag. As much air as possible is squeezed from the bag before sealing. Bags may be sealed with evidence tape for additional security.
- Each bottle is placed in a separate paint can, the paint can is filled with vermiculite, and the lid is fixed to the can. The lid must be sealed with metal clips, filament, or evidence tape. If clips are used, the manufacturer typically recommends six clips.
- The cans will be placed upright in a cooler that has had the drain plug taped shut inside and outside, and the cooler is lined with a large plastic bag. Approximately 1 inch of packing material, such as vermiculite or other type absorbent sufficient to retain any liquid that may be spilled, is placed in the bottom of the liner. Three sizes of paint cans are used: pint, half-gallon, and gallon. The pint or half-gallon paint cans can be stored on top of each other; however, the gallon cans are too high to stack. The cooler will be filled with additional packing material, and the liner will be taped shut. Only containers having chemically compatible material may be packaged in each cooler or other outer container.

- As mentioned, the COC record going to the laboratory via FedEx will be sealed inside a plastic bag and attached to the inside lid of the cooler. The sampler retains one copy of the COC record. The laboratory will be notified if the sample is suspected of containing any substance for which the laboratory personnel should take safety precautions.
- The cooler is shut and sealed with tape around the lid and around both ends. Two signed custody seals will be placed on the cooler, one on the front and one on the back. Additional seals may be used if the sampler and shipper think more seals are necessary. Wide clear tape will be placed over the seals to ensure against accidental breakage.

The following markings are placed on the side of the cooler:

- Proper Shipping Name (Column B, List of Dangerous Goods, Section 4, IATA Dangerous Goods Regulations [DGR])
- UN Number (Column A, List of Dangerous Goods, Section 4, IATA DGR)
- Shipper's name and address
- Consignee's name and address
- The words "LIMITED QUANTITY"
- Hazard Labels (Column E, List of Dangerous Goods, Section 4, IATA DGR)
- Two Orientation (Arrow) labels placed on opposite sides
- The FedEx Airbill/Declaration of Dangerous Goods form should be completed as follows:
- Shipper's name and address
- Consignee's name and address
- Services, Delivery & Special Handling Instructions
- Cross out "Cargo Aircraft Only" in the Transport Details Box
- Cross out "Radioactive" under Shipment Type
- Nature and Quantity of Dangerous Goods
- Proper Shipping Name (Column B, List of Dangerous Goods, Section 4, IATA DGR)
- Class or Division (Column C, List of Dangerous Goods, Section 4, IATA DGR)
- UN Number (Column A, List of Dangerous Goods, Section 4, IATA DGR)
- Packing Group (Column F, List of Dangerous Goods, Section 4, IATA DGR)
- Subsidiary Risk, if any (Column D, List of Dangerous Goods, Section 4, IATA DGR)
- Quantity and type of packing (number and type of containers: for example, "3 plastic boxes", and the quantity per container, "2 L", is noted as "3 Plastic boxes X 2 L". This refers to 3 plastic boxes (coolers are referred to as plastic boxes) with 2 liters in each box.
- Packing Instructions (Column G, List of Dangerous Goods, Section 4, IATA DGR)
- Note: Only those Packing Instructions in Column G that begin with the letter "Y" may be used. These refer specifically to the Limited Quantity provisions.

- Authorization (Write in the words Limited Quantity)
- Emergency Telephone Number (List 800-535-5053. This is the number for INFOTRAC, to whose emergency response services we subscribe.)
- Printed Name and Title, Place and Date, Signature

All DOT regulations will be followed for packaging and shipping.

4.2.6.4 Standard Hazardous Materials

Shipment of hazardous materials using this option presents the most difficulty and expense. However, there may be occasion whereby a hazardous material cannot be shipped under the Limited Quantity provisions, e.g., where there is no Packing Instruction in Column G, List of Dangerous Goods, IATA Dangerous Goods Regulations, that is preceded by the letter "Y".

If this is the case, the general instructions noted in 4.2.6.3 above but for non-Limited Quantity materials would apply, and with one other important difference. Standard hazardous materials shipment would require the use of certified outer shipping containers. These containers have undergone rigorous testing and are, therefore, so designated by a "UN" stamp on the outside, usually along the bottom of a container's side. The UN stamp is also accompanied by codes specifying container type, packing group rating, gross mass, density, test pressure, year of manufacturer, state of manufacturer, and manufacturer code name.

The transport of lithium batteries in Hermit Data Loggers is an example of a standard hazardous material, and where only a designated outer shipping container may be used. Contact the Group or Corporate Health & Safety Office for a copy of the latest approved shipping procedure.

4.2.7 Prohibited Samples

Montgomery Watson prohibits the collection of the following types of samples:

- Gasses in compressed gas cylinders
- Radioactive substances
- Biohazards and infectious agents
- Chemical warfare agents
- Drugs (controlled substances)
- Explosive ordnance
- Explosives (DOT Hazard Class 1)
- Shock-sensitive materials

4.2.8 Holding Times

The holding times for samples will depend on the analysis and the sample matrix. Holding times are specified in the project plan

4.2.9 Ground Transport

Employees may on occasion be asked to transport small quantities of hazardous materials in a company vehicle or personal vehicle. This is permissible, but the employee must perform the following:

- Complete a simple manifest
- Who (MW name and address)
- Where (Destination name and address)
- What (Name of chemical transported)
- How Much (Quantity of chemical)
- When (Date)
- Store chemicals (group or segregate) according to chemical compatibility
- Secure containers against rolling, tipping, or falling

4.2.10 Training

The U.S. Department of Transportation requires that all employees involved in any aspect of hazardous materials transport (shipping, transport, receipt, preparing documents) receive training at least bi-annually. The company has a formal training program that conforms to these requirements; participation and completion are mandatory.

4.2.11 Additional Information

General questions regarding this SOP, or inquiries on the safe transport of other specific chemicals or by other carriers should be referred to the Group or Corporate Health & Safety Office.

5.0 REFERENCES

Enforcement Considerations for Evaluations of Uncontrolled Hazardous Waste Disposal Sites by Contractors, Draft, Appendix D. April 1980.

SOP 7

Soil Sampling



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STANDARD OPERATING PROCEDURES

SOP-7: SOIL SAMPLING

1.0 INTRODUCTION

For remedial investigations, primary consideration must be given to obtaining samples that are representative of existing conditions and valid for chemical analysis. The samples must not be contaminated by drilling fluids or by the sampling procedures.

This guideline provides a description of the principles of operation, applicability, and implementability of standard soil sampling methods used during remedial investigations. The purpose of this document is to aid in the selection of soil sampling methods that are appropriate for site specific conditions. It is intended to be used by the project manager (PM), project engineer (PE), field team leader (FTL), and site geologist to develop an understanding of each method sufficient to permit work planning, scheduling, subcontracting, and resource planning.

This guideline focuses on methods and equipment that are readily available and typically applied. It is not intended to provide an all-inclusive discussion of soil sampling methods. Sample types, samplers, and sampling methods are discussed.

2.0 DEFINITIONS

Blow Counts: Number of hammer blows needed to advance a split spoon sampler. Blow counts are usually counted in 6-inch increments.

Background Samples: Samples collected near the project site but not influenced by contamination. These samples are analyzed to provide data regarding "natural" site conditions.

Baseline Samples: Samples collected at the project site in areas that may have been influenced by contamination. These samples are collected before site activities are conducted, and the results are compared to those of samples collected after site activities have been completed (confirmation samples). Comparison of the "before and after" data can reveal if site activities affected contaminant levels.

Composite Sample: A sample comprised of material collected from two or more locations or intervals and mixed together to represent a larger area or interval. This type of sampling is often used for bulk waste characterization.

Confirmation Samples: Samples submitted for laboratory analysis to verify the results of field screening, or samples collected after site activities have been completed to reveal if those activities affected contaminant levels (see Baseline Samples).

Discrete Sample: A sample collected from a single location or a limited interval. Also known as a "grab" sample. All samples are assumed to be discrete unless labeled otherwise (see composite sample).

Screening Samples: Screening samples are collected for field assessment of physical or chemical parameters and are not submitted for laboratory analyses. To verify the results of field screening, confirmation samples are collected and submitted for laboratory analyses.

VOCs: Volatile organic compounds.

3.0 RESPONSIBILITIES

Project Manager: Selects site specific soil sampling methods with input from the FTL and site geologist. Oversees and/or prepares drilling subcontracts.

Site Geologist: Selects site specific drilling/sampling options. Helps prepare technical provisions of drilling subcontracts.

Field Team Leader: Implements selected drilling program. Aids in the selection of drilling methods and preparation of subcontracts.

Rig Geologist: Supervises and/or performs actual sampling procedures.

4.0 SOIL SAMPLING

4.1 TYPES OF SAMPLES

Three basic types of samples are collected in site investigation work: bulk samples, representative samples, and "undisturbed" samples.

4.1.1 Bulk Samples

Bulk samples are generally a shovelful or trowelful of material taken from drill cuttings. There is usually significant uncertainty regarding which interval the cuttings represent. This type of sampling is typically used for general characterization of site soils and is not acceptable for chemical analyses.

4.1.2 Representative Samples

Representative samples are collected with a drive or push tube or with a spoon. They do not represent undisturbed conditions but do represent all the constituents that exist at a certain interval. Representative samples are often homogenized, meaning they are composited over a discrete interval. For example, if a sample represented the 10- to 11.5-foot interval, the material from that interval would be mechanically blended before being put into the appropriate sample containers. VOC samples are never homogenized.

4.1.3 Undisturbed Samples

"Undisturbed" samples are high-quality samples collected under strictly controlled conditions to minimize the structural disturbance of the sample. Undisturbed samples should be collected when all the presampling relationships need to be preserved. Every effort is made to avoid altering the sample during the sampling process. Undisturbed samples are generally required for geotechnical work and are rarely necessary to assess environmental quality.

4.2 SUBSURFACE SAMPLING METHODS

4.2.1 Solid-Barrel Samplers

The length of the solid barrel sampler is 1 to 6 inches and the length is between 12 and 60 inches. The sampler is usually made out of steel or stainless steel and can be used with thin-walled liners that can be slid into or out of the sampler barrel. Liners may be made of brass, aluminum, stainless steel, or synthetic materials. Allowable liner materials is based on the types of materials, tests, and analyses performed.

4.2.2 Split-Spoon Samplers

Split-spoon samplers are the most commonly used sampler for monitoring and geotechnical work and can be applied to a variety of drilling methods. Split-spoon samplers are usually made out of steel or stainless steel. They are tubular in shape and are split longitudinally into two semi-cylindrical halves. They may be lined or unlined. Liners are made of brass, aluminum, stainless steel, or various synthetic materials. Split-spoon samplers are generally available in 2-, 2.5-, 3-, 3.5-, and 4-inch outside diameters (OD). Lengths range between 12 and 60 inches. The 18-inch long sampler is the most commonly used. Three 6-inch liners are commonly used with this sampler. Sixty-inch samplers are commonly used when continuous coring is necessary.

Driving (hammering) is the most common method of obtaining split-spoon samples up to 2.5 feet in length. For most sampling a 140-pound hammer is used. The hammer may either be at the ground surface or in-hole. A standard penetration test should be conducted in accordance with American Society for Testing and Materials (ASTM) D1586. Samples are collected from the split-spoon sampler by driving the sampler into undisturbed material beneath the bottom of the casing or borehole with a weighted hammer. The number of blow counts per 6-inch increment of total drive is recorded. An estimate of the density and consistency of the subsurface soils can be made from the relationships among the hammer weight, drop, and number of blows required to advance the split spoon in 6-inch increments.

If the sampler cannot be advanced 6 inches with a reasonable number of blows (usually about 50) than sampler refusal occurs and the sampling effort at that particular interval is terminated. If "auger refusal" has not occurred, the hole is advanced to the next sampling interval where another attempt at sample retrieval is made.

After the split spoon is removed it is opened for visual inspection and classification. If an adequate volume of sample has not been retrieved, additional sample shall be collected from a second sampler from the interval immediately below the preceding interval.

If VOCs are to be analyzed, the sample is to be immediately transferred into the appropriate sampling jars upon retrieval of the split spoon from the borehole. Following sample description the contents of the samples for non-VOC analyses shall be emptied into a stainless steel bowl and the sample shall be thoroughly blended before transfer into the sample jars. Care shall be taken to ensure that the sample collected is representative of the sample interval, and not slough material. All slough material shall be discarded. A representative sample shall be retained in an archive box.

4.2.3 Thin-Walled Tube Samplers

The thin-walled tube (Shelby tube) sampler is a 30- or 36-inch-long, thin-walled steel, aluminum, brass, or stainless steel tube equipped with a connector head. It is primarily used in soft or clayey formations where it will provide more sample recovery than a split-spoon sampler and when relatively undisturbed samples are desired. The most commonly used sampler has a 3-inch OD and a 2.81-inch cutting diameter, and is 30 inches long.

Pressing or pushing without rotation is the normal mode of advance for the thin-walled sampler. If the tube cannot be advanced by pressing, it may become necessary to drive the sample with drill rods and hammers without rotation. The tubes are generally allowed to stay in the hole 10 to 15 minutes to allow the buildup of skin friction prior to removal. The tube is then rotated to separate it from the soil beneath it, prior to being brought to the surface.

After removal, the sample is inspected to ensure an adequate sample volume has been collected. If an inadequate volume has been collected, the above sampling procedure shall be repeated.

Upon retrieval, the soil core shall be described and recorded in the logbook and any disturbed soil shall be removed from the end of the tube. VOC samples shall be removed and placed in the appropriate sample containers immediately upon sample retrieval. Thin-walled tubes shall be capped with nonreactive material for transport.

4.2.4 Continuous Coring

Continuous coring is usually performed with a 60-inch split-spoon sampler that is advanced by pressing without rotating while the drill bit is rotating. The sampling tube is lowered into and retrieved from the augers or drill stem using a wireline or drill rods.

The sampling tube is locked into place so that the sampler protrudes slightly ahead of the drill bit. As the bit is advanced, the auger is pressed into the formation. After the hole has been advanced the length of the sampling tube, the full sampler is retrieved and an empty sampler is put down the hole. Sampling procedures will follow those described in Section 4.2.2.

4.3 Surface Sampling Methods

A shovel or trowel is typically used to remove the top 6 inches of soil. Once the desired sampling depth is reached, a disposable stainless steel spoon is used to collect soil for VOC analysis. Collection of soil for VOC analysis should occur immediately after the desired sampling depth is exposed to reduce loss of volatile analytes. After VOC soils are collected, a volume of soil sufficient to fill the remaining sample jars is collected into a decontaminated stainless steel bowl or disposable pie pan. This soil is homogenized by thorough mixing using the collection spoon, then sample jars are filled.

Applications

- Surface soil samples
- Trench and test pit samples
- Soil stockpile samples

Limitations

- Limited to very shallow depths
- Unable to penetrate dense or rocky soil
- Labor intensive

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SOP 10

Surveying



MWH
MONTGOMERY WATSON HARZA

STANDARD OPERATING PROCEDURES

SOP-10: SURVEYING

1.0 INTRODUCTION

Surveying is the science and art of making the measurements necessary to determine the relative positions of points above, on, or beneath the surface of the earth or to establish such points. This SOP provides a description of the general types of surveys and requirements for performing the various surveys. This document will describe the applicability and operation of control, land, topographic, and aerial surveys along with precision and accuracy required for each. This document is intended for the project leader to help develop work plans and manage resources. For those in need of detail descriptions of theory, books on the particular survey type are recommended.

2.0 DEFINITIONS

Accuracy: Accuracy refers to the closeness between measurements and expectations or true values. The farther a measurement is from its expected value, the less accurate it is. Observations may be accurate but not precise if they are well distributed about the expected value but are significantly disbursed from one another.

Accuracy is often referred to in terms of its order (i.e., first, second, or third order accuracy). The order of accuracy refers to the error of closure allowed; guidelines for each order of accuracy are as follows:

<u>Order of Accuracy</u>	<u>Maximum Error</u>
1st	1/25,000
2nd	1/10,000
3rd	1/5,000
4th	1/3,000
5th	1/1,000
Lowest	1/500

Benchmarks: Benchmarks are a type of monument placed by surveyors to serve as permanent reference points. They are elevation markers, and their location and elevation are definitely established and recorded on surveyors' level notes. They are set upon some permanent object to ensure they remain undisturbed.

Monuments: Classified as natural, artificial, record, or legal. Examples of natural are trees, large stones, or other substantial, naturally occurring objects in place before the survey was made. Artificial monuments can consist of iron pipe or bar driven in the ground, concrete or stone monument with a drill hole, cross, or metal plug marking an exact location (such as a corner). The standard for monumenting public-land surveys as adopted by the Bureau of Land Management (BLM) is a post made of iron pipe filled with concrete, the lower end of the pipe

split and spread to form a base and the upper end fitted with a brass cap with identifying marks. A record monument exists because of a reference in a deed or description (i.e., the side line of street). A legal monument is one that is controlling in the description (i.e., "to a concrete post").

Precision: Precision pertains to the closeness to one another of a set of repeated observations of a random variable. Thus, if such observations are closely clustered together, then the observations are said to have been obtained with high precision. Observations may be precise but not accurate if they are closely grouped together but about a value that is different from the expectation or true value by a significant amount.

Station: A station is a 100-foot section of a measurement from a reference point such as a benchmark. For example, a stake placed 1,500 feet from a reference point is at station 15 and is labeled "15+00," and a stake placed 1,325 from a reference point is labeled "13+25."

3.0 RESPONSIBILITIES

Surveyor (Surveying Contractor): The surveyor is responsible for assuring that all surveying field operations, office calculations, map preparation, and related surveying activities performed by the subcontractor conform with these guidelines and the specific requirements of the surveying subcontract (including health and safety requirements).

All surveying operations shall be performed under the direction of a Licensed (or Registered) Land Surveyor (licensed in that particular state), who shall sign and seal all final drawings, maps, and reports submitted for the assignment.

Project Manager: The project manager has overall responsibility for establishing the specific technical requirements for surveying services and coordinating the Surveying Contractor's performance of such services. Specific technical activities may be delegated to other project personnel (e.g., field team leader [FTL]), who may have more detailed knowledge of these technical requirements and would be on-site to observe these technical activities performed by the Surveying Contractor.

To facilitate the management and administration of surveying services procured for a particular site, the project manager may delegate a single field team member (usually the FTL) as the focal point for all matters involving surveying services. In addition to the Surveying Contractor services, this person manages, reviews, coordinates, and schedules all surveying matters, and he/she must be aware of any other activities and/or communications involving the Surveying Contractor.

Field Team Leader: The FTL is responsible for day-to-day review of the actual field activities performed on-site by the Surveying Contractor. This responsibility may be delegated to an appropriate technical field person. The FTL may be delegated overall responsibility for the surveying task by the project manager (see above).

4.0 GUIDELINES

The following sections provide guidelines to the performance of several types of surveys and the precision and accuracy required for each. Emphasis is placed on the application of surveying techniques to environmental investigations.

4.1 PERFORMING SURVEYS

There are many types of surveys that can be performed; however, this SOP discusses those surveys that are typically used for environmental investigations. Surveys are used to measure horizontal and vertical distances between objects, to measure angles between lines, to determine the direction of lines and to establish points by predetermined angular and linear measurements. The following sections briefly describe these various types of surveys that may be performed, what information may be required to perform the survey, and when each survey may be appropriate.

4.1.1 Establishing Control (Monuments, Baselines, etc.)

Prior to initiating any type of survey, control must be established. The type of control needed depends on the order (first, second, or third) of accuracy that is required. Established control points are based on the National Geodetic Survey which publishes specifications for first-, second-, and third-order horizontal and vertical control surveys. These specifications provide a starting point for establishing standards on most jobs that required basic control surveys. The surveying contractor should be familiar with established control points near the site to be surveyed. From these control points the surveyor will measure angles and distances to the site to be surveyed to establish local control at the site. Based on the project requirements, monuments can be set at the site that can be used in future site-surveys as a control point. Care must be taken when establishing new control points and elevations from other agencies' vertical control points that all the old control bench marks are on the same datum or reference plane. The monument will be stamped with the state planar coordinates and the elevation (feet above mean sea level) such that it will serve as a reference point for additional surveys. This can save time in future surveys as the surveying contractor will not have to survey new locations from distant established control points.

For boundary surveys, the Bureau of Land Management keeps a file on property survey data related to public lands. State, county, city and town engineering and surveyors offices may also be consulted for useful survey data on private property. This information is used by the surveyor to locate property boundaries based on existing markers, monuments, angles and distances.

4.1.2 Control Survey

This is the most common type of survey performed in an environmental investigation. It is used to establish the horizontal and vertical positions of points such as soil borings or monitoring wells. Control is typically established horizontally from a theodolite and electronic distance measurement instrument or using a transit and stadia as part of a three-dimensional traverse. The traverse is used to measure the distance and direction from a known point and the elevation with

reference to a known monument. Horizontal and vertical data are then plotted and elevation data interpolated. This type of survey should be used for small areas and for locating particular points.

4.1.3 Boundary Survey

A boundary, land, or property survey is performed to determine the length and direction of land lines and to establish the position of these lines on the ground. The area of the tract bounded by the lines can also be determined. This type of survey is made using established control monuments and establishing angles and distances from those monuments based on a legal description of the property.

4.1.4 Topographic Survey

A topographic survey is made to secure data from which a map can be made indicating the configuration of the terrain and location of natural and man-made objects. This type of survey can be performed either using established control monuments or by aerial photography using a digital terrain model (DTM) or digital elevation model (DEM). Contour intervals should be determined before measurement and specified such that enough detail of the site topography is provided. The field surveying methods employed will be determined by the scale to which the map is drawn. The topographic survey is used to identify high and low spots at a site as well as natural drainage patterns. Topographic surveys can be performed on a site of any size but contour intervals will dictate the time and cost of the survey.

4.1.5 Aerial Survey

An aerial survey is performed by a high-precision camera mounted in an aircraft. Photographs are taken in an organized manner as the aircraft flies over the terrain. Aerial surveys are commonly used for larger sites where boundaries and topography are to be defined. Ground surveys are also required in conjunction with aerial surveys to establish control points for the aerial survey.

The main advantages of aerial surveys over ground methods include the following: 1) speed of compilation; 2) reduction in the amount of control surveying required to control the mapping; 3) high accuracy of the locations of planimetric features; 4) faithful reproduction of the configuration of the ground by continuously-traced contour lines; 5) not restricted due to inaccessible terrain; and 6) can be designed for a map scale ranging from 1 inch = 20 feet to 1 inch = 20,000 feet with as small as 0.5-foot contour intervals.

The disadvantages associated with aerial surveys include: 1) difficulties in plotting areas with heavy ground cover (high grass, timber, and underbrush); 2) high cost per acre of mapping areas smaller than 5 acres; 3) difficulties in locating positions of contour lines in flat terrain; and 4) editing requirements to include road classifications, boundary lines, drainage classification, and names of places, roads, and other map features.

4.1.6 As-Built Survey

An as-built survey is a post-construction survey that shows the exact final location and layout of civil engineering works. This type of survey provides positional verification and records that include design changes.

4.2 REQUIRED ACCURACY AND PRECISION

The required survey accuracy and precision depends on the intended purpose of the survey work. Such requirements could range from gross estimation of a sampling station for inclusion on a small-scale vicinity map to the determination of top of casing elevations to 0.01 feet to establish groundwater gradients. In general, no more than third order accuracy is required for sampling station location and elevation measurements performed in environmental investigations. However, higher accuracies may be required for boundary surveys, topographic surveys, etc. The following sections discuss accuracy and precision requirements for specific survey types.

4.2.1 Environmental Investigations

For environmental investigations, surveying activities generally consist of obtaining horizontal and vertical coordinates of sampling locations to assess the migration and extent of contaminants in the soil and/or groundwater. The following sections describe precision and accuracy requirements for various field investigation activities.

4.2.1.1 Borings and Test Pits

Surveyed horizontal locations and ground surface elevations for borings and test pits are used to graphically indicate locations on site maps and are often included in boring logs and test pit logs. The surveyed locations are also used to construct geologic sections or profiles. Horizontal locations should be staked out to ± 1.0 foot, and ground surface elevations measured to ± 0.1 feet.

Typically, locations of borings/test pits are surveyed after completion, and care must be taken to measure the original surface elevation as accurately as possible (e.g., a mound or depression may remain in the trench area). The location and outline of the trench/test pit must be adequately staked to permit the required surveying, and stakes should be used to facilitate locating the trench. Stakes can also be used to make boring locations readily visible; in paved areas it is usually more convenient to spray paint the location and other information directly on the paving.

4.2.1.2 Monitoring Wells, Pumping Wells and Piezometers

Horizontal location and ground surface and top of casing elevation criteria for wells and piezometers are generally similar to those of test pits or borings. However, vertical precision in the elevation measurements is essential due to the groundwater elevation measurements that will be collected subsequent to the well installation.

All surveying data, including horizontal location, ground surface elevation, and the elevation of the top of the inner casing will be surveyed after well installation. The accuracy of the horizontal plane survey should be ± 1 foot (unless greater accuracy is desired) and is measured to any point on the well casing cover. The vertical plane survey measurements at the ground surface and on the north side of the top of the inner casing must be accurate to ± 0.01 feet. The point at which the elevation was measured on the inner casing should be scribed so that water level measurements may be taken at the same location. The FTL is responsible for ensuring that the inner casing is scribed appropriately by the field team and for directing the Surveying Contractor to collect vertical measurements from the correct location. This procedure is used for both aboveground and flush-mounted monitoring well completions.

4.2.1.3 Surface Water Sampling Locations

When grab samples are obtained from the edges of surface water bodies, the sampler can often estimate and mark the approximate location and elevation directly on a site topographic map. Typically, such sampling locations do not require great location accuracy (within several feet), since they are usually only indicated graphically on the site map. However, depending on the accuracy required for the project, a location stake at the shoreline may be installed that marks the sampling location with the station number, coordinates, and water surface elevation.

When samples are to be taken within the surface water body away from the shoreline, better horizontal control is usually required. Sampling locations are determined by the sampler using on-shore baselines or ranges. In tidal waterbodies, the use of a tide staff (existing or installed previously by the surveyors) may be required by the client. During sampling, tidal elevations should be read to 0.1 feet on the tide staff at a sufficient frequency to observe significant tide changes.

4.2.1.4 Surface Soil Sampling Locations

The measurement and layout requirements for obtaining a single grab sample of surface soil are comparable to those for obtaining surface water grab samples from the shoreline. Where a composited sample is to be collected from a sampling grid, the surveyors should stake out the grid and indicate the station number(s), coordinates or orientation of the grid, and ground elevation(s) on the stakes. Generally, a precision of 1.0 foot for location and 0.1 feet for elevation will suffice for grab or grid surface sampling.

4.2.1.5 Air Sampling Stations

Air sampling stations generally need no more layout precision than grab sampling. Therefore, horizontal and vertical plane survey accuracy should be within 1.0 and 0.1 feet, respectively.

4.2.1.6 Other Sampling Locations

Other sampling points can be located using methods similar to those described above. For example, biological sampling stations can be established with the same surveying methods and precision as for the air, water, or soil grab sampling. For unusual or unique sampling methods,

appropriate surveying requirements must be developed in consideration of the specific intentions and site conditions. For sampling man-made facilities such as drums, tanks, and pipelines, it is usually most convenient if the sampler identifies these locations at the time of sampling, directly on a topographic map of these facilities.

4.2.2 Boundary Surveys

Accuracies for boundary maps are usually determined by State or Municipal law. Generally, second order accuracy is required for the survey so that property boundaries can be established to a precision of one second in their bearing and 0.01 feet in their length. In addition to being graphically plotted to scale on the boundary map, the results of the boundary survey are also numerically recorded on the map as the actual bearing and length of each site border.

4.2.3 Topographic Surveys

The results of topographic surveys are usually only represented graphically on maps. Thus, the required accuracy and precision of the field survey is dependent upon the required accuracy and precision for the map as determined by the map scale. Typically, when the scale of 1 inch = 100 feet is to be used, horizontal distances can be plotted to the nearest 1 or 2 feet, while if the scale is 1 inch = 1,000 feet, the plotting will be to the nearest 10 or 20 feet and the field measurements can be correspondingly less precise. For most purposes, horizontal measurements in the field need be no more than third order accuracy and to a precision of the nearest foot. Vertical field survey measurements are depicted on maps graphically as contour lines, and numerically as spot elevations. For most purposes, such vertical field measurements can be performed to no more than third order accuracy and to a precision of 0.1 feet. Commonly, maps showing contour intervals of one foot or more indicate spot elevations between or beyond contour lines to the nearest tenth of a foot.

4.2.4 Aerial Surveys

The standards to be followed in using aerial photography in preparing topographic maps are dependent upon the specific equipment and techniques used in obtaining the photographs and preparing the map.

4.2.5 As-Built Surveys

As-built surveys will show locations of all buildings, utilities, curbs, roads, walks or other structures constructed during the course of the investigation. Locations should be referenced to base lines or to at least two other fixed points with an accuracy to the nearest 1.0 foot.

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SOP 13

*Operating and Calibration Procedures
for Field Equipment*



MWH
MONTGOMERY WATSON HARZA

STANDARD OPERATING PROCEDURES

SOP-13: OPERATING AND CALIBRATION PROCEDURES FOR FIELD EQUIPMENT

1.0 INTRODUCTION

This guideline provides basic information on operating procedures for equipment that is typically used in the field. Field monitoring instruments are used when data quality objectives specify Level I and Level II analytical support. Level I analysis provides data for on site, real-time measurements, evaluation of existing conditions, refinement of sampling locations, and health and safety evaluations. The objective of Level I analysis is to generate data that are generally used in refining sampling plans and in estimating the extent of contamination at the site. This type of support also provides real-time data for health and safety purposes. The purpose of this SOP is to define the calibration and operating procedures for equipment used for field monitoring.

2.0 DEFINITIONS

None.

3.0 RESPONSIBILITIES

The following is a general description of responsibilities related to calibration and operating procedures for equipment used for field monitoring.

Project Manager: The Project Manger is responsible for identifying the appropriate equipment necessary to adequately define the parameters.

Health and Safety Coordinator: The Health and Safety Coordinator will work with the Project Manager in identifying the appropriate safety equipment. The Health and Safety Coordinator will also perform audits to observe field personnel using the equipment. If the equipment is not being used properly, the Health and Safety Coordinator will provide the necessary training and resources.

Field Team Leader (FTL): The FTL will be responsible for including a refresher course as part of the kick-off meeting on the proper use, calibration, and maintenance of all equipment to be used on the project. The FTL will ensure that all field team members continue to properly use the equipment through the duration of the project.

Field Team Members: Prior to mobilization, a field team member will be required to check out equipment or supplies requested for the project and sign an equipment checklist form stating that all equipment is functioning, can be calibrated, is in good condition, all the necessary parts are included in the case, and all supplies requested are present. The warehouse manager and/or assistant warehouse manager will also be responsible for signing the equipment checklist. Upon

demobilization, the checklist will be used to check the equipment back into the warehouse. At that time, all equipment will be calibrated, if applicable, and checked for proper use by a field team member and the warehouse manager and/or the assistant warehouse manager. Both the field team member and the warehouse manager and/or warehouse assistant manager will be required to sign the checklist.

The field team members will be responsible for carefully reviewing the SOP and instruction manuals for the equipment to be used on the project. All field team members will be required to sign a form indicating that they know how to properly operate each piece of equipment that will be used on their project.

Warehouse Supervisor: An appropriate training and certification procedure must be developed and incorporated into the responsible organization's training procedures. All users are trained and certified to operate equipment before using the instrument in the field. Refresher courses are given every 6 months and as part of each project's kickoff meeting.

Warehouse Manager/Assistant Warehouse Manager: When the instrument is scheduled or requires maintenance, these functions are conducted by qualified individuals. Maintenance responsibilities are restricted to two individuals who are responsible for logging the equipment in and out. Documentation of instrument user, dates of use, instrument number, maintenance and calibration functions, and project identification are maintained.

Before the instrument is taken into the field, it will be inspected and calibrated by a qualified individual to ensure that it is operating properly.

This SOP provides a summary of the calibration and operating procedures outlined in the manufacturer's instruction manual which accompanies each piece of equipment. This SOP should be reviewed and used in conjunction with the manufacturer's instruction manual by field team members when using the equipment.

4.0 GUIDELINES

4.1 APPLICABILITY

These procedures apply to all work conducted for Montgomery Watson clients, by Montgomery Watson, or under the direction of Montgomery Watson. The information in this SOP may be incorporated into project-specific plans. Deviations or modifications to procedures not addressed in the project plans must be handled as a corrective action (see SOP for Corrective Action).

To protect the equipment, it must be kept in the proper cases, packaged properly, and/or secured during transport. If equipment is damaged during transport because it was not properly secured in its case, resulting charges will be directly applied to the job.

Equipment or supplies at job sites should never be left unsecured where they can be lost or stolen. Warehouse equipment should not be left at job sites between jobs without the warehouse manager's approval. Warehouse equipment is also not to be kept in offices or garages. If

equipment is lost or stolen while it is checked out to a project, that project will be responsible for replacing the equipment.

Any equipment failures are to be reported immediately to the warehouse manager and returned as soon as possible for repairs. This notification ensures that proper charges/credits are documented and that a replacement is delivered to the site.

All equipment will be decontaminated at the job site prior to returning the equipment.

4.2 TEMPERATURE

Temperature readings are used in the calculation of various forms of alkalinity, in studies of saturation and stability with respect to calcium carbonate, in the calculation of salinity, and in general laboratory operations. An outline of procedures for the proper calibration and measurement of temperature in groundwater samples while in the field follows.

4.2.1 Calibration Procedures

Any temperature measurement devices should be calibrated with a National Bureau of Standards-certified thermometer before field use. Readings are made with the thermometer or device immersed in water long enough to permit complete equilibration. Results should be reported to the nearest 0.1 or 1.0 degree Celsius ($^{\circ}\text{C}$), depending on the need.

4.2.2 Operating Procedures

Temperature measurements may be made with any good mercury-filled Celsius thermometer. At a minimum, the thermometer should have a scale marked for every 0.1°C , with markings etched on the capillary glass. The thermometer should have a minimal thermal capacity to permit rapid equilibration. Periodically, the thermometer should be checked against a precision thermometer certified by the National Bureau of Standards used with its certificate and correction chart. For field operations, thermometer with a metal case should be used to prevent breakage.

Temperature is measured as follows: 1) measure temperature downhole or in a small flow through cell, 2) record measurements periodically throughout the time of purging, and 3) record the measurement in the field logbook and on the appropriate data form.

4.3 FIELD MEASUREMENT OF PH

Determining pH is critical for predicting and interpreting the reactions and migration of dissolved chemical constituents in ground or surface water. Ground or surface water pH should be determined when the sample is collected in the field.

The pH probe measures the hydrogen electric potential of the external solution by comparing it to an isolated solution with a known hydrogen electric potential. A thin glass membrane functions as a cation exchange surface. When the electric potential of the interior of the glass membrane is compared to the electric potential of a standard solution kept isolated from the

environment, a quantitative determination of the change in the internal solution's electric potential, induced by the external solution, can be made.

There are numerous adequate pH meters available. Meters used should have temperature and slope adjustments and a repeatability of ± 0.01 standard pH units. Meters used for pH field measurement should also be of rugged construction. A foam-lined carrying case is convenient both for transport and for use as a work table. Also, a spare electrode and batteries should be available in the field.

4.3.1 Hydac pH/Conductance/Temperature Meter

4.3.1.1 Calibration

Always calibrate the instrument according to the manufacturer's instructions taking into account the guidelines provided in this section. The meter must be calibrated before the start of each work day and checked periodically throughout the work day. Refer to Attachment 1 for part identification on the Hydac Meter. Consult the Hydac instruction manual for further details.

1. The two buffers used for calibration should bracket the anticipated pH of the groundwater samples. For an anticipated pH of 6, calibrate with pH 4 and pH 7 buffers; for an anticipated pH of 8, calibrate with pH 7 and pH 10 buffers. Buffers and samples are kept at the same temperature. This action will eliminate the need to correct values for temperature effects. Theoretically, buffer solutions are stable indefinitely; however, they are susceptible to contamination. Therefore, old, partially full bottles are often contaminated and should be replaced.
2. Temperature and conductance are factory calibrated. However, conductance accuracy can be checked with a standard solution of known conductance. If recalibration is necessary, the following procedures are necessary. Remove the block plug revealing the adjustment potentiometer screw. Rinse sample cup with standard solution, discard, and refill. Adjust the potentiometer until the digital display indicates the known value of the conductivity standard solution. To increase the digital display reading, turn the potentiometer screw counterclockwise and clockwise to decrease.
3. The pH electrode and meter are standardized as follows. Place the pH in a container of 7.0 buffer solution. Adjust the ZERO potentiometer on the face of the meter so that the digital display indicates 7.00. Then place the pH electrode in a container with the pH 4 or 10 buffer, depending on estimated pH of the sample. Adjust the SLOPE potentiometer on the face of the meter so that the digital display indicates the value of the buffer chosen. Check the pH calibration by repeating step 2 several times.

4.3.1.2 Operation

The following procedures are for operation of the Hydac Meter.

1. Connect the pH cable connector onto the tester. Push and twist clockwise. Rinse the inside of the sample cup with sample to be measured.

2. Fill sample cup at least 2/3 full.
3. Slide function switch to TEMP and push the READ button. Read temperature on digital display panel and note in field logbook and appropriate data form. Adjust both temperature controls accordingly. If temperature reading is not stable, rinse the sample cup several times to bring the sample cup to the same temperature as the sample.
4. Slide function switch to COND and select the appropriate range. Push the READ button. Read the conductivity on the digital display panel and multiply the digital display reading by the factor indicated by the range switch to determine the conductance. Note the conductivity reading in the field logbook and appropriate data form. If a single "1" appears on the lefthand side of the digital display panel, the conductivity of the sample is higher than the selected range. Slide the range switch to the next selection. If a decimal display appears (such as 0.11) move the range selector switch to the left until a 3- or 4-digit number appears.
5. Always obtain conductivity reading before placing the pH probe in the sample container to avoid cross contamination. Slide the function switch to pH. Remove the storage cap from the pH electrode. Rinse the electrode with distilled sample. Shake the electrode with a snap motion to remove residual drops of solution to avoid cross contamination. Place the pH electrode in the sample cup. Press the READ button. Note the pH value on the digital display panel in the field logbook and the appropriate data form.

4.3.1.3 Maintenance

The following procedures are for maintenance of the Hydac meter.

1. Do not subject the pH electrode to freezing temperatures. Electrodes should be immersed in a pH 4 or pH 7 buffer solution when not in use. Always rinse the electrode with distilled water prior to use.
2. The meter is NOT waterproof. Take care to keep the meter dry.
3. Keep the cotton in the electrode cap moist with distilled water. Always keep the cap on the electrode while being stored. If bubbles are seen in the bulb area of the electrode, hold the electrode by its cap and shake downwards.
4. Replace the 9-V battery when the LO BAT can be read on the digital display panel. Battery is located behind the snap-off cover on the bottom of the meter.
5. After each sample, wipe the sample cup with a paper towel or kleenex and rinse again. The carbon electrodes in the cup may be cleaned with a mild abrasive on the end of the flat surface.
6. Keep in mind that all pH electrodes age with time. Aging is characterized by shortened span and slower speed of response. The pH meter slope control can be adjusted to compensate for electrode span errors and will not affect the speed of response. When the slope control can no longer be adjusted to compensate for the span errors, the electrode should be cleaned and/or reconditioned. If reconditioning does not restore electrode performance, the electrode should be replaced.

7. Coating of the pH bulb can lead to erroneous readings including shortened span. Soft coatings can be removed by vigorous stirring or by use of a squirt bottle. Organic chemical or hard coatings should be chemically removed. In no case should the bulb be mechanically cleaned; abrasion can lead to permanent damage.

4.3.2 Orion Model SA 250 pH Meter

4.3.2.1 Calibration

Always calibrate the instrument according to the manufacturer's instructions taking into account the guidelines provided in this section. The meter must be calibrated before the start of each work day and checked periodically throughout the work day. Refer to Attachment 2 for part identification on the Orion SA 250 pH Meter. Consult the Orion Model SA 250 instruction manual for further details.

1. The two buffers used for calibration should bracket the anticipated pH of the groundwater samples. For an anticipated pH of 6, calibrate with pH 4 and pH 7 buffers; for an anticipated pH of 8, calibrate with pH 7 and pH 10 buffers. Keep buffers and samples at the same temperature. This action will eliminate the need to correct values for temperature effects. Theoretically, buffer solutions are stable indefinitely. However, they are susceptible to contamination. Therefore, old, partially full bottles are often contaminated and should be replaced.
2. Connect the pH electrode to the meter. Slide the mode switch to either pH .1 or 0.1. Choose either 4.01 and 7.00 or 7.00 and 10.01 buffers to calibrate the meter, whichever will bracket the expected sample range.
3. Place the electrode in the one of the buffers selected. Press CAL. The display will alternate between .1. and the pH value of the buffer, indicating this is the first buffer and a value has not been entered. Wait for a stable pH display and press ENTER. The correct display will freeze for three seconds then advance to .2. indicating the meter is ready for the second buffer.
4. Rinse the electrode and place into the second buffer. Wait for a stable pH display and press ENTER. After the second buffer value has been entered the letters PH will be displayed. The meter is now calibrated and automatically advances to sample mode.

4.3.2.2 Operation

1. Rinse the electrode and place into sample. Note the pH value displayed on the digital panel in the field logbook and appropriate field data form.
2. To manually compensate for temperature, use a thermometer accurate to $\pm 1^{\circ}\text{C}$ to determine the temperature of the solution to be measured. Slide the mode switch to TEMP. Scroll using ^, v or the x10 keys, until the correct temperature value is displayed. Press ENTER. Return the mode switch to either pH .1 or pH .01.

4.3.2.3 Maintenance

1. To verify the instruments calibrations, press the SLOPE key and note the reading on the display. A properly functioning electrode will have a 92 to 102 percent slope. The slope value is retained in the meter's memory until another two buffer calibration is performed or another value is entered.
2. Consult Attachment 3 for definition of error messages and associated remedy.

4.4 FIELD MEASUREMENT OF SPECIFIC CONDUCTANCE

Specific conductance is used as a indicator of water quality. It is a simple indicator of the change within a system and provides useful information to laboratory. Specific conductance is the reciprocal of electrical resistivity. The value of electrical resistivity is dependent upon the amount of ions in the solution. Pure water has 100 percent resistivity and 0 specific conductance.

There are numerous adequate specific conductance meters available. Any meter used to collect field specific conductance measurements should be equipped with a temperature compensator, and read directly in micromhos per centimeter ($\mu\text{mhos/cm}$) corrected to 25°C. A foam lined carrying case is essential. A relative accuracy of ± 3 percent is adequate for the type of measurement being performed.

1.1.1 YSI Model 33 Conductivity Meter

The YSI Model 33 meter is designed to read conductivity measurements in ranges 0 to 500 (x1), 0 to 5,000 (x10), and 0 to 50,000 micromhos/cm (x100). The "micromho" designations on the meter are shorthand form for micromhos/cm. The YSI Model 33 meter does not compensate for temperature when measuring for conductivity.

1.1.1.1 Calibration

Always calibrate the instrument according to the manufacturer's instructions taking into account the guidelines provided in this section. The meter must be calibrated before the start of each work day and checked periodically throughout the work day. Refer to Attachment 4 for part identification on the YSI Model 33 Conductivity Meter. Consult the instruction manual for further details.

Reagent-grade potassium chloride (KCL) is universally used for the standardization of specific conductance equipment. Standard solutions are made up at 0.001 molar (M), 0.01M, 0.1M, or 1M KCL. A concentration of 0.01M is typically used because its specific conductance is closest to most natural samples.

The electrodes are calibrated by reading the specific conductance of standard KCL solutions. The following guidelines should be used in conjunction with the manufacturer's instructions:

1. Calibration is done at the factory. However, the instrument calibration should be checked periodically against a standard solution of KCL. Measure the temperature of the standard solution and the water used for the dilution if applicable. Ideally, they should be the same temperature. Note the temperatures in the field logbook and field form specified in
2. Use the table furnished with the commercial standard to determine the expected specific conductance of the standard being used to calibrate the instrument at the measured temperature.
3. Large changes in the cell constant are generally an indication that the electrodes are dirty. Cleaning and replatinizing instructions are included below and can also be found in the instrument manual.

1.1.1.2 Operation

1. Switch MODE control to OFF. Use meter screw on the meter face to adjust meter needle to 0 conductance.
2. Plug probe into jack.
3. Switch MODE to RED LINE. Use the RED LINE control to adjust the needle to the red line on the conductivity scale.
4. Switch MODE to TEMPERATURE. Place probe in sample. Allow time for the probe temperature to come equilibrium with that of the sample. Read the temperature on the bottom scale of the meter in degrees Celsius. Note the temperature in the field logbook and the appropriate data form.
5. Switch to x100 on the conductivity scale. If the reading is below 50 on the 0-500 range, switch to x10 on the conductivity scale. If the reading is still below 50, switch to the x1 scale. Read the meter scale and multiply the reading appropriately. Measurements are not temperature compensated. Note the reading in the field logbook and the appropriate data form.

1.1.1.3 Maintenance

1. Replace batteries every 6 months. Two "D" size alkaline batteries will provide 200 hours of operation. Batteries should also be replaced if the redline adjustment cannot be accomplished. To replace the batteries, remove the screws from the rear cover. The battery covers are color coded. The positive end must go on red.
2. When the cell test indicates low readings, the probable cause is dirty electrodes. Hard water deposits, oils, and organic matter are the most likely contaminants. Either soak the electrodes in bathroom cleaner or a solution of 10 parts distilled water, 10 parts isopropyl alcohol, and 1 part HCl. Always rinse the probe thoroughly in tap water, and distilled or deionized water after cleaning and before storage. If the cell test still indicates low readings, replatinizing is required.
3. Store the conductivity cell in deionized water. This will decrease the frequency that the cells need to be replatinized.

4. Large changes in the cell constant are generally an indication that the electrodes are dirty. To replatinize the cell, place the cell in a container filled with enough YSI 3140 Platinizing Solution to cover the electrodes. Plug the probe into the meter, switch to x100 scale, and allow approximately 10 minutes to platinize the electrode. Remove the probe and rinse with tap water.

1.1.2 YSI Model 3000 T-L-C Meter

The YSI T-L-C Meter measures temperature, water level or depth, conductivity, and temperature compensated conductivity for water quality parameters. By convention, the conductivity of a solution is referenced to 25°C. In both temperature compensated conductivity ranges, the reading is automatically corrected to 25°C.

1.1.2.1 Calibration

Always calibrate the instrument according to the manufacturer's instructions taking into account the guidelines provided in this section. The meter must be calibrated before the start of each work day and checked periodically throughout the work day. Refer to Attachment 5 for part identification on the YSI Model 3000 T-L-C Conductivity Meter. Consult the instruction manual for further details.

Reagent-grade potassium chloride (KCl) is universally used for the standardization of specific conductance equipment. Standard solutions are made up at 0.001 molar (M), 0.01M, 0.1M, or 1M KCl. A concentration of 0.01M is typically used because its specific conductance is closest to most natural samples.

The electrodes are calibrated by reading the specific conductance of standard KCL solutions. The following guidelines should be used in conjunction with the manufacturer's instructions:

The YSI T-L-C Meter is calibrated at the factory. There are no user adjustments inside the instrument. Monitor the instruments calibration using a standard solution. Rinse the probe with the solution to remove any contamination. Immerse the probe in the standard solution and set the function switch to one of the temperature compensated ranges, depending on the range of the standard solution. Compare the reading with the standard solution value to determine the instruments accuracy. Note the instruments reading and associated temperature. If the readings indicate that the instrument is out of calibration, notify the Montgomery Watson warehouse manager and return the instrument to the factory for recalibration. The percent error calculated can be used to as a correction factor to improve the accuracy of measurement of the sample being tested. Use the following formula to calculate the corrected conductivity value if necessary:

1.1.1.2 Operation

1. To measure temperature, set the function switch to °C. Completely submerge the probe in sample to be measured and allow sufficient time for temperature of the probe and the sample

to equilibrate, approximately 40 to 60 seconds. Read the displayed value after the reading has stabilized and note in field logbook and data form.

2. To measure conductivity, set the function switch to 2 m_/cm. Completely submerge the probe and allow sufficient time for it to reach equilibrium with the sample, approximately 10 to 20 seconds. If the overrange signal is displayed (1.__), then the conductivity of the sample is greater than 1.99 m_/cm. Reset the function switch to 20 m_/cm. If the overrange signal is still displayed, the conductivity is greater than 19.99 m_/cm and cannot be measured without dilution. Observe the displayed value after the reading is stable. Note measurement in the field logbook and appropriate data form.
3. To measure temperature compensated conductivity, set the function switch to 2 m_/cm TC to 25°C. Follow step 2 but reset the function switch to 20 m_/cm TC to 25°C if the overrange signal is still displayed. Observe the displayed value after the reading is stable. Note measurement in the field logbook and appropriate data form.
4. To measure water level or depth, switch the function key to any of the conductivity modes. Lower the probe into the well or borehole and observe the display panel. When the value displayed rises the electrode is measuring the conductivity of the water. Raise the probe slowly out of the water until the displayed value goes back to approximately zero. Lower the probe very slowly until the reading rises suddenly. Observe the cable mark at the well reference point and note measurement in the field logbook and appropriate data form.

1.1.1.3 Maintenance

1. **Battery Replacement.** When BAT appears in the upper left corner of the display panel, approximately 8 hours of use remains. To replace batteries, six heavy-duty "C" batteries are necessary. Uncoil about one foot of the probe cable. Unscrew counterclockwise direction the screw located on the face of the instrument. Remove the electronics and probe reel assemblies from the housing, and disconnect the probe connector (located on the back of the electronics assembly) by turning its sleeve counterclockwise. Remove the probe reel from the electronics assembly. Remove the nine screws located on the back of the electronics assembly and separate the front and back halves. Install the batteries into the holders located on the circuit board. Remove, dry, and replace the desiccant container. Reassemble.
2. **Desiccant Replacement.** When the case is opened for any reason, the interior will have the same relative humidity as the surrounding air. If resealed and later operated at a lower temperature, internal condensation might occur. The desiccant prevents this condition from happening. Periodically remove the desiccant container for drying or replacement if necessary.
3. **Seal Replacement.** To insure watertight integrity, the o-rings should be replaced annually. Disassemble and assemble the instrument as described in Step 1.
4. **Cleaning.** Clean and decontaminate the instrument at the end of each project. Use a solution of liquid detergent and water. Rinse the instrument with clean water. Do not clean the instrument while it is disassembled. Use a bathroom cleaner to clean the probe. Use isopropyl alcohol if a stronger cleaning solution is required. Rinse the probe several times with distilled or deionized water.

5. **Replatinizing the Probe.** If cleaning the probe does not restore the probe's performance, or if flaking or other defects in the platinum black coating are apparent, replatinizing is necessary. A YSI Model 3045 Platinizing Instrument and solution are necessary for this procedure. If the probe requires replatinizing while in the field, notify the warehouse manager of the situation and return the instrument to the warehouse. A backup or alternate meter should be used at this point.
6. **Storage.** Store the conductivity probe in deionized water to reduce the frequency of replatinizing. If the probes have been stored dry, it is necessary to soak them in deionized water for 24 hours prior to use.

1.5 LAMOTTE MODEL 2008 TURBIDITY METER

The LaMotte Model 2008 portable turbidity meter measures the amount of light scattered at right angles from a beam of light passing through the test sample. Turbidity readings are the measure of the interaction of light with suspended solid particles in the sample. Test results are read directly in Nephelometric Turbidity Units (NTUs) on the LCD digital readout. Nephelometry refers to the measurement of light scattering in the direction perpendicular to its propagation. The sample to be analyzed is placed in an optically selected sample tube. The sample tube is inserted in a light tight compartment. When the instrument is turned on, light passing through the turbid sample will be scattered and only the light that is scattered at right angles to the light source is detected by the dual photocells and registered by the meter. The display panel will register the appropriate NTU value on the calibrated scale. Two ranges are available; 0-20 and 0-200 NTUs. The low range (0-20 NTU) is used for monitoring drinking water quality, while the high range (0-200 NTU) may be used for a wide range of monitoring applications.

1.5.1 Calibration

The turbidimeter is pre-calibrated in LaMotte laboratories, and a simple standardization is the only step required prior to testing. Two standards are supplied with each Model 2008 turbidimeter for standardization.

Always calibrate the instrument according to the manufacturer's instructions taking into account the guidelines provided in this section. The meter must be calibrated before the start of each work day and checked periodically throughout the work day. Refer to Attachment 6 for parts identification on the LaMotte Model 2008 Turbidity Meter. Consult the instruction manual for further details.

1.5.2 Operation

1. Collect a sample of the liquid to be measured and set aside to allow the sample time to equilibrate to ambient temperature and allow any entrained gasses to escape. Keep dust or other airborne contaminants from contact with the sample.
2. Rinse the sample tube with the liquid sample and shake the excess liquid out. Fill the sample tube to its neck, taking care to pour the sample gently down the side to avoid creating any bubbles.

3. Cap the sample tube. While holding the sample tube by the cap only, wipe the outside surface with a clean, lint-free, absorbent wipe until the tube is dry and smudge-free. Set the sample tube aside on a clean surface that will not contaminate or scratch the bottom of the tube.
4. Select the appropriate range, and insert a sample tube containing the standard with a value close to that of your sample. Make sure the tube is seated at the bottom of the chamber. Cap the chamber. The green LED on the front panel must be illuminated, indicating that the lamp is on. Adjust the STANDARDIZE control so that the display reads the known value of the standard.
5. Remove the standard and insert the sample tube. Make sure the tube is seated on the bottom and cap the chamber. The reading should stabilize within 15 seconds. Document the measurement in the field logbook and the appropriate data form. Remove the sample tube from the chamber and cap. The lamp is only illuminated when the instrument is in the measurement mode and a sample tube is seated in the bottom of the chamber. Removing the sample tube between measurements will enhance the battery and lamp life.
6. Periodically verify the stability of the readings by inserting the standard and adjusting if necessary.

1.5.3 Maintenance

1. Keep the instrument clean and dry, especially the sample chamber. Keep the sample chamber capped except while inserting or removing the sample tube. While holding the instrument upside down, clean the sample chamber with compressed gas used for cleaning lenses.
2. If the lamp burns out, return the instrument to the LaMotte Service Laboratory where the lamp can be replaced and the instrument can be recalibrated. To test the stability of the lamp, insert a clean, dry, empty sample tube into the chamber. The actual value under these conditions is unpredictable but should be stable. As long as the display is stable the lamp is useable.
3. Do not charge the instrument's battery until the battery low indicator is visible on the display panel. Recharging from the fully discharged condition (Bat low indicator visible) to the fully charged condition (red LED extinguished) should take 4 to 5 hours. If it takes notably less time to charge, it is a sign of diminished battery capacity. A small indicator will appear in a corner of the front panel when the batteries are nearly exhausted. At the end of the useful charge, the readings will become unstable; they will appear to drift. Recharging the battery is necessary.
4. While in the measurement mode, with the sample chamber empty and capped the instrument should read, if functioning properly and the standardization correctly, between -0.10 and -0.40 NTUs. This reading is a convenient check on the functionality and accuracy of the Model 2008 turbidity meter.
5. The accuracy and repeatability of the measurements is a function of the condition of the standards, technique, and the quality of the glassware. Standards will remain stable indefinitely as long as they are not exposed to excessively hot or cold environments; keep

standards between 10°C and 40°C. Once the seal is broken on the standard, the standard is only good for nine months thereafter. When transferring standard to a sample tube, make sure the sample tube is absolutely clean. Rinse the inside of the sample tube with standard prior to transferring the standard. Always transfer the standards in a dust-free environment and promptly cap the containers.

6. Glassware must be clean and defect-free. Scratches and/or abrasions will permanently affect the accuracy of the readings. To limit the variability in measurements due to the imperfect geometry of the glassware, use the same glassware and always orient the sample tube in the chamber the same way.
7. The readings made on any one type of turbidimeter may not agree with a reading for the same sample from a different type of turbidimeter. There will be an affixed and determinable relationship between the two readings, but the numerical values may not correspond.

1.6 HANNA MODEL HI 8043 DISSOLVED OXYGEN METER

The Hanna Model HI 8043 Dissolved Oxygen Meter comes with a polarographic type probe, incorporating a thermistor for automatic temperature compensation. The tip of the probe consists of a cell enclosed by a selective membrane in a protective PVC holder containing the electrolyte and electrodes. The temperature thermistor is lodged inside the electrode body just above the sensor. The oxygen that diffuses through the membrane is reduced at the cathode when an external voltage is applied between the electrodes. The current produced is directly proportional to the amount of oxygen passing through the membrane and the electrolyte.

1.6.1 Calibration

Always calibrate the instrument according to the manufacturer's instructions taking into account the guidelines provided in this section. The meter must be calibrated before the start of each work day and checked periodically throughout the work day. Refer to Attachment 7 for part identification on the Hanna Model HI 8043 Dissolved Oxygen Meter. Consult the instruction manual for further details.

1. The instrument is shipped factory calibrated. However, the calibration should be verified periodically and when the anode is completely reduced, the electrolyte or membrane is changed, the electrodes are cleaned, and after excessive use in aggressive solutions.
2. The probe must be polarized prior to use to maintain stable measurements with the same recurring degree of accuracy. When measurements are taken with a non-polarized probe, the oxygen level revealed is both that of the surrounding solution which penetrates into the probe as well as that which is already present in the electrolyte solution. In order to polarize the probe, the function switch should be in the STB mode and the probe covered with the protective cap filled with electrolyte solution for 6 hours.
3. The thermometer should be calibrated at least every 3 months. Immerse the probe and switch the instrument to °C. Agitate the water for at least 10 minutes until thermal equilibrium between the probe and water is achieved. Check the temperature of the water using a

thermometer with an accuracy of at least 0.1°C and adjust the °C trimmer until the display reads the thermometer temperature.

4. **Zero Calibration.** Switch the function switch to the O₂ position. Uncap the probe and immerse in zero calibration solution. Wait 5 minutes and do not stir as this will introduce more oxygen into the solution. The readings must be stable before proceeding. If the probe has not sufficiently polarized, the read-out will continue to fluctuate. In this case, switch back to STB position and wait for a few hours for complete polarization before proceeding. Once the readings are stable, use a small screwdriver to turn the Zero Calibration screw until the display reads zero. If the zero point is passed, "1" will appear on the display. If you cannot get a zero reading the probe is probably defective and the membrane, electrode, and electrolyte solution should be checked. Rinse the probe with tap water after the zero calibration has been completed.
5. **Slope Calibration.** For an accurate calibration, the probe should be immersed with water in a air tight container. If an open container is used for calibration, the margin of error is approximately 0.1 ppm. Switch the instrument to °C, wait for readings to stabilize and note temperature of water in the field logbook and data form. Refer to Attachment 8 for the corresponding dissolved oxygen reading at displayed temperature. Switch the instrument to O₂ and adjust the slope trimmer until the correct reading is displayed. If the calibration is performed above sea level, a correction should be made for the difference in altitude according to Attachment 9.
6. The calibration will remain constant for a period of about 20 hours from the time the electrode is activated. After this time, the surface of the anode is completely reduced and cleaning is necessary to reactivate the whole surface. To clean the anode, unscrew the PVC membrane holder from the probe. Drain the electrolyte solution. Wipe the surface of the dark-grey coil, the silver anode, with a cotton wad and a slightly abrasive cleaning paste. Thoroughly rinse with distilled water. To clean gold cathode, wipe it lightly using a piece of filter paper making sure not to scratch the surface.

1.1.2 Operation

1. Remove the instrument from the packing material and examine carefully to make sure that no damage has occurred during shipment. If noticeable damage is evident, immediately notify shipper and contact the Montgomery Watson warehouse manager.
2. Remove the protective cap before taking measurements. Switch the instrument to "O₂". Immerse the probe in the sample and agitate the probe. Allow several minutes for thermal equilibrium to occur between the probe and the sample. Note the reading in the field logbook and the data form.
3. If the sample contains significant salinity, the read-out values must be corrected, taking into account the lower degree of oxygen solubility present in such conditions. Use manufacturer's table to determine the corresponding quantity to be subtracted for every mg/l of salt present in the sample.

1.1.3 Maintenance

1. **Battery Replacement.** When the battery is low, the "V" symbol will appear on the display. To replace the battery, remove the protective cover on the back side of the instrument. If the battery is replaced immediately, the instrument can be used for measurements after approximately half an hour. If the instrument has remained without a battery for more than 1 minute, allow at least 6 hours for the probe to polarize.
2. After each use, wash the electrode with distilled water or remove any trace organic compounds, bacteria, etc. Wipe with slightly dampened cotton; do not use abrasive materials for cleaning.
3. If the membrane is damaged, replace it with a new membrane. Fill the membrane up with HI Solution. Delicately tap the side of the holder to remove any bubbles trapped inside. Screw the holder onto the electrode body very slowly, keeping the holder in an upright position.
4. Always store the probe with the cap in place, filled with electrolyte.

1.7 SOLINST WATER LEVEL METER

1.7.1 Operation

1. Upon receipt of meter check set the switch to "on" position. To check the circuit submerge the electrode (probe) in tap water. This completes the circuit and activates the buzzer. Depress the test button to test the battery and circuitry.
2. The zero measurement on the Model 101 meter is at the tip of the inner electrode, visible near the center of the probe. The zero measurement on the Model 102 meter is at the base of the outer body electrode.
3. To adjust the sensitivity, remove the face plate on the reel. Located on the top of the circuit board is a small adjustable potentiometer screw. If the alarm continues after removal from water, the sensitivity should be reduced by turning the screw clockwise. If no alarm is heard and the battery is functioning, the sensitivity should be increased by rotating the screw counterclockwise.

1.7.2 Maintenance

1. After the depth of water has been recorded the cable should be carefully rewound onto the reel, the probe wiped dry and replaced into the probe holder.
2. Decontaminate the probe, cable, and reel between each use.
3. Always store and ship the meter in the padded carrying case.
4. To replace the battery, remove the face plate on the reel by unscrewing the three faceplate screws and carefully lifting off to the side to avoid damaging the wiring. Replace the 9-V battery making sure the polarity is correct. Replace the faceplate.

1.8 SOLINST MODEL 121 INTERFACE METER

The following is summarized from the manufacturer's manual. For additional information concerning the Solinst Model 121 Interface Meter, consult the instruction manual.

1.8.1 Operation

1. Turn main switch to the "on" position. Also twist probe to the "on" position. A flashing light on the face plate indicates that the probe is in the "on" position but the main switch is not "on". A continuous buzz indicates that the main switch is "on", but the probe is "off."
2. Lower probe slowly until lights and audible tone are on. Raise and lower the probe gently to determine the exact upper level of the nonconductive floating product. Note level from marked tape. If no floating product exists, one single light will come on.
3. Continue to lower the probe until only one light is on. Shake the probe slightly at this point to clear any residual product from the conductivity sensor. Raise the probe slowly until both lights and the audible tone are on to determine the product/water interface. Read level directly from the tape.
4. Repeat steps 2 and 3 to confirm readings.
5. To determine if there are any sinking product is present in the well, continue lowering the probe to the bottom of the well. If both lights and buzzer come on, determine the top of the layer by reading directly from the tape.
6. Notes: One light indicates a conductive liquid (i.e., water).
Both lights plus the audible tone indicates a non-conductive liquid (i.e., product).
A flashing light indicates that the probe switch is "on".
A continuous buzzer indicates that the main switch is "on" but the probe switch is "off."

1.8.2 Maintenance

1. After each use, the tape should be wiped, and carefully rewound onto the reel. The probe should be cleaned with a cleaner, rinsed with a hexane and distilled water mixture, wiped and returned to the holder. Make sure both switches are turned off.
2. To replace the battery in the reel, remove the three screw in the faceplate and carefully lift to one side, to prevent damage to the wiring. Replace the heavy duty 9-V alkaline or lithium type battery, noting the proper polarity. Replace the faceplate and three screws being careful to keep all wires within the hub.
3. To replace the probe battery, remove the three screws (phillips type) at the top of the probe. Gently pull the probe body apart to expose the battery holder. Remove and replace the battery with a 9-V lithium or heavy duty alkaline battery. Ensure correct polarity when replacing the battery. Check the three wire connections between the battery holder and the probe body to ensure a tight connection. Push the probe body back together and replace the phillips screws.

1.9 HNU MODEL PI 101 PORTABLE PHOTOIONIZATION ANALYZER

The detector uses an ultraviolet light source to ionize individual molecules that have an ionization potential less than or equal to that rated for the ultraviolet light source. Ambient air is drawn into the chamber with the aid of a small fan. Gaseous contaminants are ionized as they emerge from the column, and the ions are then attracted to an oppositely charged electrode, causing a current and finally an electric signal that is proportional to the number of ions.

In addition to the detailed method included with this SOP, the instruction manual for the Portable Model PI 101 Photoionization Analyzer will be available to all field personnel and should be consulted for additional information.

Limitations - Does not detect methane. Does not detect a compound if the probe used has a lower energy level than the compound's ionization potential. Response may change when gases are mixed. Other voltage sources such as power lines may interfere with the measurements. Readings can only be reported relative to the calibration standard used. Response is affected by high humidity. During cold weather, condensation may form on the UV light source window, resulting in erroneous results. Total concentrations are relative to the calibration gas used. Therefore, contaminant concentrations cannot be identified. Also, while the instrument scale reads 0 to 2,000 ppm, response is linear to the calibration gas. Greater concentrations may be "read" at a higher or lower level than the true value. Wind speeds of greater than 3 miles an hour may affect fan speed and readings, depending on the position of the probe relative to wind direction.

1.9.1 Calibration

1. Connect the sampling hose to the regulator on the calibration canister and the probe extension (Attachment 10).
2. Set function switch to the ppm range noted on the calibration gas canister. Turn on the regulator by rotating knob clockwise. Allow the meter to function for approximately 5 to 10 seconds. Take a reading.
3. Adjust the SPAN until the concentration listed on the span gas canister is indicated on the scale plate. Continue this calibration procedure until the SPAN reaches the following limits:

<u>PROBE</u>	<u>Initial Span Setting</u>	<u>Maximum Span Setting</u>
9.25 eV	5.0	1.0
10.2 eV	9.8	8.5
11.7 eV	5.0	2.0

If these limits are exceeded, the instrument must be returned for maintenance and recalibration.

Calibration events will be documented in a logbook which accompanies the instrument. Documentation will include the date inspected, person responsible for calibrating the instrument, the instrument number, calibration results, calibration gas information (source, type, concentration).

1.9.2 Operation

1. Unpack the instrument carefully. Unclamp the fasteners on the instrument cover from the main readout assembly. Remove the inner lid from the instrument cover by pulling out the two one quarter turn fasteners. Remove the probe, handle, and cable from the instrument cover. Attach the handle and probe extension to the probe.
2. Connect the probe cable plug to the 12 pin keyed socket on the main readout assembly panel. Carefully match the alignment slot in the plug to the connector key on the readout panel. Screw down the probe connector clockwise until a distinct snap and lock is felt.
3. Check the condition of the battery by turning the function switch to the BATT position. The indicator reads within or beyond the green zone on the scale plate. If the indicator is below the green arc, or if the red low battery indicator light (LED) comes on, the battery must be charged prior to use.
4. Zero the instrument by turning the function switch to the STANDBY position and rotate the ZERO ADJUSTMENT until the meter reads zero. Wait 15 to 20 seconds to confirm that the zero adjustment is stable. Readjust until the meter reads zero.
5. Set the SPAN at the appropriate setting for the probe being used (5.0 for 9.5 eV probe, 9.8 for 10.2 EV probe, and 5.0 for 11.7 eV probe).
6. Set function switch to the desired ppm range. Check the UV lamp source by checking for a violet glow at the sample inlet of the probe. (Do not look directly at the glow as it could damage the eye).
7. Listen for the fan operation to verify fan function.
8. Check instrument with an organic point source such as a "magic marker," before survey to verify instrument function.
9. Instrument is should now be operational. HNu readings will be recorded in the field logbook and on the appropriate field data sheet.

1.9.3 Maintenance

1. Perform routine calibration daily; prior to each use and at the end of each day.
2. Factory calibrate yearly, when malfunctioning, when the span setting exceeds the maximum span setting for the probe in use, and after the UV light source has been replaced.
3. Clean the main readout assembly after each use. Thoroughly decontaminate the instrument at the completion of the project.
4. Clean the UV light source window every month or as use and site conditions dictate.
5. Turn function switch to the OFF position, and disconnect the probe from the main readout assembly.
6. Remove the exhaust screw located near the base of the probe. Grasp the end cap in one hand and the probe shell in the other. Separate the end cap and lamp housing.

7. Loosen the screws on the top of the end cap, and separate the end cap and the ion chamber from the lamp and lamp housing, taking care that the lamp does not fall out of the lamp housing.
8. Tilt the lamp housing with one hand over the opening so that the lamp slides out of the housing into your hand.
9. The lamp window may now be cleaned using lens paper with HNu cleaning compound on all lamps except the 11.7 eV. Clean the 11.7 eV lamp with a freon or chlorinated organic solvent. Do not use HNu cleaner, water, or water miscible solvents (i.e., acetone and methanol).
10. Following cleaning, reassemble by first sliding the lamp back into the lamp housing. Place the ion chamber on top of the housing, making sure the contacts are properly aligned.
11. Place the end cap on top of the ion chamber, and replace the two screws. Tighten the screws only enough to seal the O-ring. Do not overtighten.
12. Line up the pins on the base of the lamp housing with pins inside the probe shell, and slide the housing assembly into the shell.
13. Replace the exhaust screw.
14. Clean the ionization chamber monthly.
15. Turn function switch to the OFF position, and disconnect the probe from the main readout assembly.
16. Remove the exhaust screw located near the base of the probe. Grasp the end cap in one hand and the probe shell in the other. Separate the end cap and lamp housing.
17. Loosen the screws on the top of the end cap, and separate the end cap and the ion chamber from the lamp and lamp housing, taking care that the lamp does not fall out of the lamp housing.
18. Clean the ion chamber with methanol using a Q-tip. Allow the chamber to dry for approximately 30 minutes.
19. Place the ion chamber on top of the housing, making sure the contacts are properly aligned.
20. Place the end cap on top of the ion chamber, and replace the two screws. Tighten the screws only enough to seal the O-ring. Do not overtighten.
21. Line up the pins on the base of the lamp housing with pins inside the probe shell, and slide the housing assembly into the shell.
22. Replace the exhaust screw
23. Recharge the battery when the indicator on the meter reads below the green zone when the function switch is turned to the BATT position or if the low battery indicator light is on.
24. Care should be taken when sampling over solids and liquids so that it is not drawn into the instrument.

1.10 MSA MODEL 360 CARBON MONOXIDE, COMBUSTIBLE GAS, AND OXYGEN INDICATOR

Ambient air monitoring at hazardous waste sites is a common safety practice. Activity at a site may cause disturbances that release hazardous vapors into the ambient air. These releases can be detected by commercially available portable air monitoring devices that register real-time data. This data can be used to establish the existence of hazards such as oxygen deficient or explosive atmospheres. Personnel protective levels may be based on these readings.

The combustible gas sensor of the Model 360 is designed to measure combustible gas or vapor content in air. It will not indicate the combustible gas content in an inert gas background, furnace stack, or in other atmospheres with less than 10 percent oxygen. Further, these instruments should not be used where the oxygen concentrations exceeds that of fresh air (oxygen enriched atmospheres) because the extra oxygen makes any combustible mix easier to ignite and, thus, more dangerous.

Combustible gases will burn or explode only when the fuel/air mixtures are within certain proportions. The minimum concentration of a particular combustible gas in air which will burn and continue to burn when ignited is defined as the lower explosive limit (LEL). The maximum concentration that can be ignited is defined as the upper explosive limit (UEL).

A small pump pulls the atmospheric sample through a filter and pushes it through the flow indicator and the manifold blocks in which the toxic gas, combustible gas and oxygen sensors are mounted. The flow is then exhausted to the side of the case. The approximate flow rate is 1.5 liters/minute.

It is very important that every work area be appraised by someone trained in hazard control to make sure that the correct instrument is chosen and to determine whether other instruments are necessary to access the hazard. Evacuate all personnel from the area if the instrument the alarm indicates the possibility of a hazardous condition.

1.10.1 Calibration

1. To establish a zero background reading, the explosimeter should be prepared for operation in an area known to be free of combustible gases and vapors. A flush of fresh air should be passed through the instrument to zero the meter needle.
2. Prior to each day's usage, sensitivity must be tested on a known concentration of each of the gases for which the instrument is calibrated. The indication must be equal to or higher than the actual concentration.
3. Calibration should be checked and adjusted in fresh air at the elevation where the instrument is to be used.
4. Attach the flow control to the 0.75% pentane/15% oxygen calibration gas tank to the instrument. Within 30 seconds, the LEL readout should stabilize and indicate between 47

and 55%. If the indication is not in the correct range, remove the right end of the indicator and adjust the LEL SPAN control to obtain 50%.

5. Verify the oxygen reading; it should be between 13 and 17%.
6. Attach the instrument to the 300 ppm carbon monoxide calibration gas tank. After approximately two minutes, the TOX readout should stabilize and indicate between 275 and 325 ppm. If the indication is not in the correct range, remove the right end of the indicator and adjust the TOX SPAN control to obtain 300 ppm.

1.10.2 Operation

1. Remove the carrying handle by loosening both knurled screws and spreading the handle beyond the collars. Lift the handle from the screw shafts. Remove the left side of the case (the end with the threaded inlet fitting) by removing the four mounting screws. Allowing left side to remain attached to the top panel (via tubing and charge jack wires) slowly slide the top panel from the case until the plastic connectors for the battery and speaker are accessible. Disconnect these connectors.
2. Slide the top panel completely off the remainder of the case. Open the protective bag containing the oxygen sensor and install the O-ring onto the threaded end of the sensor. Firmly screw the sensor into the manifold by hand so as to compress the O-ring and thereby prevent sample flow leakage.
3. Push the connectors onto the two terminals at the top of the sensor (gray to positive and yellow to negative).
4. Remove toxic sensor manifold from chassis by removing the two screws from the back chassis. Remove the plastic cap and packaging material and discard. Make sure the sintered metal disc is in place in the manifold. Firmly screw the sensor onto the manifold by hand so as to compress the O-ring and thereby prevent sample flow leakage.
5. Reinstall the flowblock onto the chassis and connect the mating electrical connectors. Reassemble the case by sliding the top panel back into position and reconnect the speaker and battery pack.
6. Place the case side in position and install the lid hinge pins into each side. Install the mounting screws.
7. Turn the FUNCTION control to the HORN OFF position; the HORN OFF indicator will light and the descriptor %LEL will show in the readout. Set the readout to zero by adjusting the LEL ZERO control. This step must be done within 30 seconds of turning the instrument on to prevent the possibility of activating the off-scale, LEL latching alarm.
8. Press the SELECT button firmly to obtain %OXY on the readout; then set the readout to 20.8% by adjusting the OXY CALIBRATE control.
9. Press the SELECT button firmly to obtain PPM TOX on the readout; then set the readout to zero by adjusting TOX ZERO control.
10. Press the RESET button.

11. Turn the FUNCTION control to MANUAL for continuous readout of any one gas or to SCAN for automatic scanning of the three gas readings.
12. Check the flow system and sample line for leaks by placing a finger over the sample inlet fitting or the end of the sample line. Observe that the FLOW indicator float drops, indicating no flow.

1.10.3 Maintenance

1. After each days of use the battery should be charged for a minimum of 14 hours. The descriptor BATT will appear in the readout when the battery voltage is too low. In addition, when operating in the ON position, the audible alarm activates when the battery voltage drops to a low level, indicating that recharging is necessary. Always recharge instrument in a non-hazardous location to prevent the potential ignition of combustible atmospheres. Do not operate the instrument while the battery is being charged. For optimum battery service, once a month the battery should be charged for 16 hours, run for 8 hours and then fully charged for 24 to 36 hours.
2. When the rechargeable, 4.0-volt lead-acid battery pack no longer responds to recharging or no longer holds a charge, replace the pack by loosening the knurled screws holding the handle and remove the handle. Looking at the front panel of the instrument, remove the right (audible alarm side) panel by unscrewing the four side panel screws. Gently pull the side panel loose and tilt the instruments to help slide out the battery case. Disconnect the molded nylon plug from the battery case. Do not disconnect the alarm speaker. Install the new battery by reversing the above steps.
3. Care should be taken when sampling over solids and liquids so that it is not drawn into the instrument. The sample inlet filter should be examined each time the instrument is recharged. If the filter element appears to be coated with dust or dirt, it should be washed, dried and reinserted or a new element substituted. Make sure that the inlet seal O-ring in the inlet filter cap is properly seated. If the O-ring is damaged or missing, the O-ring must be replaced before using the instrument.

1.10.4 Troubleshooting Guidelines

Consult the manufacturer's instruction manual for details.

1.11 LUDLUM MODEL 44-9 GM ALPHA-BETA-GAMMA (PANCAKE) DETECTOR

Radiation or radioactivity is the property of the nucleus of an atom to spontaneously emit energy in the form of high-energy electromagnetic waves or particles. Types of radiation that are of concern are alpha and beta particles, and gamma and X-radiation.

Stable atoms of an element are composed of a dense nucleus containing an equal number of protons and neutrons. Surrounding the nucleus are clouds or orbits of electrons. The number of electrons in the atom of an element equals the number of protons. The number of neutrons in the atom can vary and, if it does, the atom is known as an isotope. Most isotopes are radioactive;

they are unstable and tend to transform into an atom of a different element called a "daughter" by releasing a particle (either alpha or beta particles) or by emission of gamma and X-rays. The type of energy released and the rate of this release (decay rate or half life) is particular to each isotope. An isotope can be identified by determining the type of energy released by measuring the decay rate.

Radiation detectors operate on the principle that radiation causes ionization in the detection media. The ions produced are counted electronically, and a relationship is established between the number of ionizing events and the quantity of radiation present.

1.11.1 Descriptions of Controls and Functions

1. **Range Multiplier Selector Switch.** A six position switch marked OFF, X1000, X100, X10, X1, X0.1. Moving the range selector switch to one of the range multiplier positions provides the operator with an overall range of 0-2000 mR/hr. Multiply the scale reading by the multiplier for determining the actual scale reading.
2. **AUDIO ON-OFF Toggle Switch.** In the ON position, the switch energizes the unimorph speaker, located on the left side of the instrument. The frequency of the clicks is relative to the rate of incoming pulses. The higher the rate, the higher the audio frequency. The audio should be turned OFF when not required to reduce battery drain.
3. **Fast-Slow Toggle Switch.** Provides meter response. Selecting the fast, "F", position of the toggle switch provides 90 percent of final meter reading of four seconds. In slow, "S", position, 90 percent of final meter reading takes 22 seconds. Set on "F" for fast response and large meter deviation. The "S" position should be used for slow response and damped meter deviation.
4. **RES Button.** When depressed provides a rapid means to drive the meter to zero.
5. **BAT check.** When depressed, provides a visual means of checking the battery charge status. The instrument must be turned on to do this check.
6. **Range Calibration Adjustment.** Recessed potentiometers located under the calibration cover, on the right side of the front panel. These adjustment controls allow individual calibration for each range multiplier.

1.11.2 Calibration

1. **Detector Operating Point.** Remove the instrument housing and adjust the R4 for 900 volts. Measure high voltage with a voltmeter with a minimum of 1000 megohm input resistance. Replace the instrument housing.
2. **Range Calibration.** Turn the instrument range multiplier switch to the appropriate range. Expose the detector to a calibrated gamma field and adjust the respective range potentiometer for proper reading. Repeat this procedure for the other scales.

1.11.3 Operation

1. Turn the instrument range switch to X1000. Depress the BAT switch. The meter should deflect to the battery check position of the meter scale. If the meter does not respond, recheck to be certain that the batteries have proper polarity.
2. Expose the internal detector to a radiation check source. The speaker should click with the audio switch in the ON position.
3. Utilizing the external detector, move the range switch to the lower scales until a meter reading is indicated. The toggle switch labeled F-S should have fast response in "F" position, slow response in "S" position.
4. Press the RES switch. The meter should zero.

1.11.4 Maintenance

1. Recalibration should be completed after any maintenance or adjustment of any kind has been performed on the instrument. The geiger counter will be factory calibrated every 6 months.
2. The batteries will be removed and the battery contacts cleaned of any corrosion at least every three months. If the instrument has been exposed to a very dusty or corrosive atmosphere, more frequent battery servicing will be used.
3. Replace batteries, two standard "D" size, when the BAT check indicates low battery charge status.

1.12 DRAEGER HAND PUMPS AND DIRECT-READ COLORIMETRIC INDICATOR TUBES

The colorimetric tube and pump measure the concentrations of specific inorganic or organic vapors and of gases that cause a discoloration which is proportional to the amount of material present. The detector tubes are specific for individual compounds, or groups of compounds, and require specific sampling techniques. This information is supplied with the tubes; it details the required sample volume, the proper tube preparation and insertion in to pump, and the applicability and limitations of the individual tube. A known volume of air is drawn through a reagent using a pump. The compound reacts with the indicator chemical in the tube, producing a stain whose length or color change is proportional to the compound's concentration.

Some of the limitations are the measured concentration of the same compound may vary among different manufacturer's tubes. Many similar chemicals interfere. The tubes provide limited accuracy and is dependent on the operator's judgement. Readings are affected by high humidity.

1.12.1 Operation

1. Do not use an opened tube.

2. Complete a pump check at the beginning of each operational day. Check the pump for leaks before and after use by placing a tube into the suction inlet of the pump and completely depressing the bellows. The bellows should not completely extend in fewer than 30 minutes.
3. Refrigerate the tubes prior to use to help maintain the shelf life. Always check expiration date on the tubes prior to use. Break off both tips of the Draeger tube in the break-off eyelet located on the front pump plate.
4. Tightly insert the tube into the pump head with the arrow pointing toward the pump head. If multiple tubes are used (i.e., vinyl chloride), join the tubes with the rubber tube provided, then insert the tube into the pump head.
5. Fully compress the bellows and allow the bellows to re-extend until the chain is taut. Repeat as often as specified in the tube operating instructions.
6. Evaluate the tube according to instructions.

1.12.2 Maintenance

1. Each unit on return from the field should be visually examined for surface dirt, deformities, cracks, and cuts.
2. The pump integrity will be checked in the following manner:
 - Block the inlet with an unopened tube.
 - Fully compress; then release the pump bellows. If the bellows do not completely fill (limit chain slack) in 30 minutes, the unit is operating properly. If the unit does not pass the leak test, proceed as follows:
 - Remove the pump plate
 - Unscrew the valve with the special wrench provided
 - Clean the valve in water and dry
 - Replace the disc if it is sticky, brittle, hard or cracked
 - Reassemble and retest
5. Calibrate the pump volume at least quarterly.

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SOP 14

Field Documentation



MWH
MONTGOMERY WATSON HARZA

STANDARD OPERATING PROCEDURES

SOP-14: FIELD DOCUMENTATION

1.0 INTRODUCTION

This guideline is a general reference for the required documentation to be completed by company personnel during field investigations. Documentation in the form of field logbooks, reports, and forms should be completed for every activity in the field. Records should be maintained on a daily basis as the work progresses. All field documentation should be accurate and legible because it is part of the client's product and may potentially serve as a legal document.

2.0 DEFINITIONS

None.

3.0 RESPONSIBILITIES

All field team members are responsible for recording daily activities. A general breakdown of responsibilities should occur as follows. An in-depth description of the documentation mentioned below is given in later sections.

Field Team Leader (FTL): The FTL is responsible for completing the FTL logbook; Daily Quality Control Reports (DQCRs); documentation concerning supervision of team members; duplication and distribution of applicable records.

Rig Geologist/Sampling Team: The Rig Geologist/Sampling Team is responsible for completing the drilling logbook; lithologic logs; well construction diagrams; sampling documentation such as sample labels, sample register, and chain-of-custody (COC) forms.

Water Sampling/Development Team: The Water Sampling/Development Team is responsible for completing the water sampling/development logbook; groundwater sampling/development logs, sampling documentation such as sample labels, sample register, and chain-of-custody (COC) forms.

Aquifer Data Collection Team: The Aquifer Data Collection Team is responsible for completing the aquifer logs (e.g., slug tests, step-drawdown tests, pump tests), water level records, data organization/tracking (e.g., downloading of data from data loggers).

4.0 FIELD DOCUMENTATION GUIDELINES

Field documentation serves as the primary foundation for all field data collected that will be used to evaluate the project site. All field documentation should be accurate, legible and written in indelible ink. Absolutely no pencils or erasures are to be used. Mistakes written in the field books, logs, or on forms that need to be deleted should be crossed out with one line, initialed, and dated. Skipped pages or blank sections at the end of a page should be crossed out with an "X" covering the entire page or blank section; "No Further Entries," initials, and date should be

written by the person making the correction. The responsible field team member should write his/her signature, date, and time after the day's last entry. To further assist in the organization of the field books, logs, or forms, it is important to write the date on top of each page and the significant activity description (e.g., boring or well number). Each project job number should have its own field book. In addition, all original field documentation should be submitted to the project files.

The descriptions of field data/documentation given below serve as an outline; individual projects will vary in documentation needs.

4.1 FIELD LOGBOOKS

The field logbook is a bound, weatherproof book with numbered pages that serves primarily as a daily log of the activities carried out during the investigation. All entries should be made in indelible ink. A field logbook should be completed for each operation undertaken during the investigation, such as field team leader notes, drilling, groundwater sampling/development, and site visitors. The logbook should serve as a diary of the events of the day.

Field activities will vary from project to project; however, the concept and general information that should be recorded will remain similar. A detailed description of three basic logbooks in which field activities should be documented is given below. These field logbooks include the FTL logbook, rig geologist/sampling team logbook, and groundwater sampling/development logbook. The following sections describe the minimum information that should be recorded in each of these logbooks.

FTL Logbook

The field team leader's responsibilities include the general supervision, support, assistance, and coordination of the various field investigation activities. As a result, a large portion of the FTL's day is spent rotating between operations in a supervisory mode. Records of the FTL's activities as well as a summary of the field team's activities should be maintained in a logbook. The FTL's logbook will be used to fill out daily quality control reports (DQCRs), and as such should contain all information required in these reports (refer to Section 3.3). Items to be documented include:

- Record of tailgate meetings
- Personnel and subcontractors on job site and time spent on the site
- Field operations and personnel assigned to these activities
- Site visitors
- Log of FTL's activities: time spent supervising each operation and summary of daily operations as provided by field team members
- Problems encountered and related corrective actions
- Deviations from the sampling plan

- Records of communications: discussions of job-related activities with the client, subcontractor, field team members, and project manager
- Information on addresses and contacts
- Record of invoices signed and other billing information
- Field observations

Rig Geologist/Sampling Team Logbook

The rig geologist or sampling team leader is responsible for recording the following information:

- Health and Safety Activities
 - Calibration records for health and safety equipment (type of PID, calibration gas used and associated readings, noise dosimeters, etc.)
 - Personnel contamination prevention and decontamination procedures
 - Record of daily tailgate safety meetings
- Weather
- Calibration of field equipment
- Equipment decontamination procedures
- Personnel and subcontractors on job site and time spent on the site
- Site name and well or soil boring number
- Drilling activities
 - Sample location (sketch)
 - Drilling method and equipment used
 - Borehole diameter
 - Drill cuttings disposal/containerization (number of drums, roll off-bins, etc.)
 - Type and amount of drilling fluids used (mud, water, etc.)
 - Depth and time at which first groundwater was encountered, depth to water at completion of drilling, and the stabilized depth to water. The absence of water in the boring should also be noted.
 - Total drilling depth of well or soil boring
 - Type and amount of materials used for well installation
 - Well construction details [depth of grout (mixture, weight), bentonite seal, filter pack, etc. [include type and amount used, calculate estimated amount that should be used]
 - Type and amount of material used to backfill soil borings
 - Time and date of drilling, completion, and backfilling
 - Name of drilling company, driller, and helpers

- Sampling
 - Date and time of sample collection
 - Sample interval
 - Number of samples collected
 - Analyses to be performed on collected samples
- Disposal of contaminated wastes (PPE, paper towels, visqueen, etc.)
- Field observations
- Problems encountered and corrective action taken
- Deviations from the sampling plan
- Site visitors

Groundwater Sampling/Development Logbook

The groundwater sampling and development team members are responsible for recording the following information.

- Health and Safety Activities
 - Calibration records for health and safety equipment (i.e. type of PID, calibration gas used and readings, noise dosimeters etc.)
 - Personnel contamination prevention and decontamination procedures
 - Record of daily tailgate safety meetings
- Weather
- Calibration of field equipment
- Equipment decontamination procedures
- Personnel and subcontractors on job site and time spent on the site
- Equipment decontamination procedures
- Disposal of contaminated wastes (PPE, paper towels, visqueen, etc.)
- Site name, well number
- Water levels and product levels [time and datum that water levels are measured (i.e. top of casing)]. Purging of the well (include calculations, well volumes) with the following information:
 - Measured field parameters (temperature, pH, conductivity, odor, color, cloudiness, etc.)
 - Amount of water purged
 - Purge method: indicate bailer/pump, diameter and length of bailer, material that the bailer is composed of, type of pump, new nylon rope, etc.
- Purge water disposal/containment (Baker tank/ drums, number used, identification, etc.)

- PID readings from inside of well, purged water, and breathing zone
- Background PID readings
- Well sampling
 - Number of samples collected and type of containers used
 - Date and time of sample collection
 - Type of analyses
 - QA/QC samples collected; names given to blind samples
- Field observations
- Problems encountered and corrective actions taken
- Deviations from the sampling plan
- Site visitors

4.2 TAILGATE SAFETY MEETINGS

Tailgate safety meetings are held at the beginning of each day before the initiation of work. All personnel, subcontractors, and others who will be on the job site are required to attend. The meetings are usually conducted by the FTL, on-site safety officer, or other qualified team member. The topics discussed at the meeting should include the following:

- Protective clothing and equipment
- Chemical hazards
- Physical hazards
- Special equipment
- Emergency procedures
- Emergency phone numbers
- Directions to the hospital

All site personnel are required to sign the tailgate safety meeting form. The original form should be kept on site, and a copy should be sent to the home office.

4.3 DAILY QUALITY CONTROL REPORT

The preparation of DQCRs is the responsibility of the field team leader. DQCRs are completed on a daily basis and should summarize the events of the day and supplement the information that is already recorded in the field logbook. DQCRs should be completed regardless of the duration of the field effort. Depending on the client, copies of the report should be distributed to the Montgomery Watson Project Manager, Montgomery Watson Project Geologist, Client Project Manager (depending on the project), field office file, and home office file. Information recorded in this report should include the following.

- Date and Weather Information. Date, daily temperatures, wind speed and direction, humidity.
- Montgomery Watson Personnel and Time Spent on Site
- Subcontractors and Time Spent on Site
- Special Equipment on Site. PID, Smeal Water Sampling Rig, Hollow-Stem Auger Rig, pH meter, conductivity meter, etc.
- Work and Sampling Performed. Personnel performing specific site activities, a summary of samples collected, and a thorough explanation of the work completed.
- Quality Control Activities. Activities such as decontamination procedures, QA/QC samples taken, calibration of field equipment, etc.
- Health and Safety Levels and Activities. Field parameter measurements, including calibration of equipment. Includes daily tailgate safety meetings, level of protection used, etc.
- Problems Encountered/Corrective Actions Taken. Any technical difficulties, for example problems encountered during drilling or equipment breakdowns. Any problems that could potentially affect the quality of the samples should be included.
- Special Notes. Any information that does not fit under the categories listed above, but is important to record. Information that would be useful for future sampling such as base contacts made, visitors on site, etc.
- Next Day's Expectations
- Signature of Individual Completing the Report.

4.4 BORING LOGS

The preparation of drill logs is the responsibility of the field team members assigned to the drill rig. A detailed description of well logging is provided in the SOP for that subject. Several examples of drilling logs are given in the attachments. The exact format is dependent upon the job and the client; however, the following basic information should be recorded on the log regardless of the format.

- Project and site name
- Name of driller and drilling company
- Well/soil boring ID and location (sketch)
- Drilling and backfilling dates and times
- Reference elevation for all depth measurements
- Total depth of completed soil boring/well
- Depth of grouting, sealing, and grout mixes
- Signature of the logger.

- Description of unconsolidated materials
 - Geologic lithology description
 - Descriptive Unified Soil Classifications System (USCS) classification
 - USCS symbol
- Color (use appropriate soil color chart)
- Penetration resistance (consistency or density)
- Moisture content
- Grain size information
- Miscellaneous information (odor, fractures, visible contamination, etc.)
- Description of consolidated materials
 - Geologic rock description
 - Rock type
 - Relative hardness
 - Density
 - Texture
 - Color (use appropriate rock color charts)
 - Weathering
 - Bedding
 - Structures (fractures, joints, bedding, etc.)
 - Miscellaneous information (presence of odor, visible contamination, etc.)
- Stratigraphic/lithologic changes; depths at which changes occur
- Depth intervals at which sampling was attempted and amount of sample recovered
- Blow counts
- Depth intervals from which samples are retained
- Analyses to be performed on collected samples
- Depth at which first groundwater was encountered, depth to water at completion of drilling, and the stabilized depth to water. The absence of water in the boring should also be noted.
- Loss and depth of drilling fluids, rate of loss, and total volume of loss
- Use of drilling fluids
- Drilling and sampling problems
- PID readings

4.5 WELL CONSTRUCTION DIAGRAMS

The preparation of well construction diagrams are also the responsibility of field team members assigned to the drilling operations. This topic is further discussed in the SOP for Well Installation. The exact format of the diagram is dependent on the job and the client; however, the following basic information should be recorded and/or illustrated on the diagram regardless of the format.

- Project and site name
- Well identification number
- Name of driller and drilling company
- Depth and type of well casing
- Description of well screen and blank
- Borehole diameter
- Any sealing off of water-bearing strata
- Static water level upon completion of the well and after development
- Drilling and installation dates
- Type and amount of annulus materials used; depth measurements of annulus materials
- Other construction details (filter pack type and interval, location of centralizers, etc.)
- Surface elevation and reference elevation of all depth measurements

4.6 GROUNDWATER SAMPLING/DEVELOPMENT LOGS

The groundwater sampling/development log should be used any time that a well is developed or sampled. The following information should be recorded on the log.

- Project name and site
- Well identification number
- The date and time of sampling/development
- The water level and reference elevation
- Volume of water to be purged
- Pertinent well construction information (total depth, well diameter, etc.)
- Measurement of field parameters such as pH, turbidity, conductivity, and temperature, as well as the times at which the readings were taken.
- Type of purging and sampling equipment used
- Type of samples collected
- Sampler's initials

4.7 AQUIFER TESTING LOGS

The aquifer testing team is responsible for setting up, collecting, tracking, and organizing data. The information listed below is a partial listing of required information. Refer to the Aquifer Testing SOP for more details and the various book references as related to your project site.

- Well number/identification (data logger identification)
- Data logger information/parameter setup
- Water level (include date, time, and measurement reference (such as top of casing))
- Type of aquifer test (slug, step-drawdown, pump test, etc.)
- Slug test (include length and diameter of slug for volume calculations)
- Start time of test
- Duration of test
- Pump tests (include disposal/containment of water information)
- Field observations and problems
- Tester's name

4.8 DOCUMENTATION OF SAMPLING ACTIVITIES

Documentation to be made during sampling activities includes sample labels, sample seals, Chain-of-Custody Records, and sample register.

4.8.1 Sample Labels

A sample label should be affixed to all soil and water sample containers, and completed with the following information written in indelible ink. Required information on sample labels may vary from job to job; however, the following should be included at a minimum.

- Sample number
- Type of sample (grab or composite)
- Type of preservative, if applicable
- Date and time of collection
- Project location
- Analyte(s)
- Initials of sampling personnel

4.8.2 Custody Seals

Custody seals consist of security tape with the initials of the sampler and the date placed over the lid of each cooler containing samples. The tape should be placed such that the seal must be broken to gain access to the contents. Custody seals should not be placed directly onto the volatile organic compound (VOC) sample bottles. Custody seals should be placed on coolers prior to the sampling team's release to a second or third party (e.g., shipment to the laboratory).

4.8.3 Chain-of-Custody Records

Chain-of-custody procedures allow for the tracing of possession and handling of individual samples from the time of field collection through to laboratory analysis. Documentation of

custody is accomplished through a chain-of-custody record that lists each sample and the individuals responsible for sample collection, shipment, and receipt. A sample is considered in custody if it is:

- In a person's possession.
- In view after being in physical possession.
- Locked or sealed so that no one can tamper with it after it has been in an individual's physical custody.
- In a secured area, restricted to authorized personnel.

A COC record is used to record the samples taken and the analyses requested. Information recorded includes time and date of sample collection, sample number, and the type of sample, the sampler's signature, the required analysis, and the type of containers and preservatives used. A copy of the COC record should be retained by the sampler prior to release to a second or third party. Shipping receipts should be signed and filed as evidence of custody transfer between field sampler(s), courier, and laboratory.

The COC Record will be properly signed and the date of collection and shipment recorded, along with the sample site identifications and requested analyses for each sample.

4.8.4 Sample Register

The sample register is a field record book with prenumbered pages. A full description of each sample is recorded in the book. The information included in the sample register should include the following:

- Sample number (identification)
- Duplicate and split sample numbers (identification)
- Location of sample
- Client
- Project number
- Collection method
- Number and size of bottles for each analysis
- Destination of the sample
- Type of analysis
- Date and time of collection
- Name of sampler

Other observations may be included as the situation dictates for a thorough record that could be used to reconstruct the events concerning that sample. All information should be recorded in indelible ink.

5.0 REFERENCES

None.

SOP 15

Site Logbook



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STANDARD OPERATING PROCEDURES

SOP-15: SITE LOGBOOK

1.0 INTRODUCTION

This guideline describes the process for keeping a site logbook. The site logbook is a controlled document that records all major on-site activities during a Remedial Investigation/Feasibility Study (RI/FS). At a minimum, the following activities/events should be recorded in the site logbook:

- Arrival/departure of site visitors
- Arrival/departure of equipment
- Sample pickup (chain-of-custody form numbers, carrier, time)
- Sampling activities/sample logsheet numbers
- Start or completion of borehole/trench/monitoring well installation or sampling activities
- Health and safety issues

The site logbook is initiated at the start of the first on-site activity (e.g., initial reconnaissance survey). Entries are made for every day that on-site activities take place which involve RI/FS contractor personnel. One current site logbook is maintained per site.

The site logbook becomes part of the permanent site file maintained in the RI contractor's office. Because information contained in the site logbook may be admitted as evidence in cost recovery or other legal proceedings, it is critical that this document be properly maintained.

2.0 DEFINITIONS

Site Logbook - The logbook is a bound notebook with consecutively numbered pages that cannot be removed. Upon entry of data, the logbook requires signature by the responsible site leader.

3.0 RESPONSIBILITIES

Log books are issued to the field team by the field team leader (FTL). It is the responsibility of this person (or designee) to keep the site logbook current while in his possession and to return it to the Project Manager or turn it over to another field team. Following the completion of all fieldwork, the site logbook is returned to the Project Manager for inclusion in the permanent site files.

4.0 GUIDELINES

The cover of each site logbook contains the following information:

- Project name
- Montgomery Watson project number
- Project manager's name

- Sequential book number
- Start date
- End date

Daily entries into the logbook may contain a variety of information. At the beginning of each day the following information must be recorded:

- Date
- Start time
- Weather
- All field personnel present
- Any visitors present

During the day, a summary of all site activities and level of personal protection should be recorded in the logbook. The information need not duplicate that recorded in other field notebooks (e.g., sample logbook, site geologist's notebook, health and safety officer's notebook, etc.), but should summarize the contents of these other notebooks and refer to the page locations in these notebooks for detailed information.

The sample logsheet for each sample collected should be referenced. If measurements are made at any location, the measurements and equipment used must either be recorded in the site logbook or reference must be made to the notebook and page number(s) on which they are recorded. All entries should be made in black pen. No erasures are permitted. If an incorrect entry is made, the data should be crossed out with a single strike mark, and initialed and dated. At the completion of entries by any individual, the logbook must be signed. It must also be signed by the FTL or responsible site leader at the end of each day.

5.0 REFERENCES

None.

SOP 28

HydroPunch



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STANDARD OPERATING PROCEDURES

SOP-28: HYDROPUNCH

1.0 INTRODUCTION

This SOP provides an overview of the methods and procedures to collect groundwater samples using a HydroPunch sampler. HydroPunch is a patented method for collecting groundwater samples at precise depths from water-bearing zones in unconsolidated soils without the drilling, installation, and development of monitoring wells. HydroPunch sampling also can be used to collect samples of non-aqueous phase liquids (NAPL). The HydroPunch sampler is hammered or hydraulically advanced through the subsurface to the desired water bearing zone from which the sample is to be collected. The groundwater or NAPL sample is allowed to enter the sampler and the sample is retrieved. The installation and sampling procedures are discussed in Section 4.0 of this SOP.

Two types of HydroPunch samplers can be used. The HydroPunch I sampler is removed intact from the subsurface to retrieve the sample. HydroPunch II allows an unlimited sample volume to be collected using a bailer; however, an expendable drive point must be left in the ground. Because the HydroPunch II can collect an unlimited sample volume, it is considered the preferable sampling method. In the event that regulations do not permit sampling equipment to be abandoned in the subsurface, the HydroPunch I should be considered.

2.0 DEFINITIONS

Bailer: A cylindrical tool designed to remove solid or liquid material from a well or borehole. A valve at the bottom of the bailer retains the material. The three types of bailers include the flat-valve, the dart-valve, and the sand pump with rod plunger.

Blow Count: The cumulative number of impacts of a 140-pound hammer dropped from a height of 30 inches applied to a sample spoon that is being driven into subsurface soils or rock. Blow counts are typically tallied for intervals of 6 inches.

Borehole: The hole created by drilling or pushing an object through the subsurface.

Cone Penetrometer: An instrument that identifies underground conditions by measuring the differences in the resistance and other physical parameters of the strata. The cone penetrometer consists of a conical point attached to a drive rod of smaller diameter which is advanced by a drill rig.

Drive Point: The conical tip of the HydroPunch sampler that penetrates the subsurface as the sampler is advanced.

Non-Aqueous Phase Liquid (NAPL): Petroleum liquid that is immiscible with water and floats atop the water column.

Tremie Pipe: A device, usually a small-diameter pipe, that carries grouting materials to the bottom of the borehole and that allows pressure grouting from the bottom up without introduction of appreciable air pockets.

3.0 RESPONSIBILITIES

Project Manager: Selects site-specific HydroPunch installation, sampling, and analysis program with input from the site hydrogeologist and field team leader. Oversees and prepares subcontracts.

Site Hydrogeologist: Selects site-specific installation options, such as sampling depth. Helps prepare technical provisions of drilling subcontracts.

Field Team Leader: Implements HydroPunch installation and sampling program.

Drilling Rig Geologist: Supervises and/or performs HydroPunch point installation and sampling.

4.0 HYDROPUNCH OPERATION

This section describes the basic operation, installation and sample collection of HydroPunch samplers, as well as borehole abandonment. The HydroPunch done is not intended to be used to assess the depth and extent of permeable zones; some knowledge of the site lithologies from soil samples is necessary prior to HydroPunch sampling.

4.1 BASIC OPERATION OF HYDROPUNCH SAMPLERS

The HydroPunch II sampler consists of a cylindrical, stainless steel sample body with a length of 5 feet and a diameter of 2 inches. A disposable, cylindrical filter screen, inlet valve, and expendable conical drive point are fitted within the sample body so that these internal parts can telescope from the sample body. The screen and internal parts are sealed from the exterior by an O-ring seal at the base of the drive point when the HydroPunch is in the closed position. The sampler is driven to the desired sampling depth in the water bearing zone. The body of the sampler is pulled back approximately 4 feet. When the sample body is retracted, the drive point and attached screen remain at the original depth and are exposed to the formation, allowing the water to pass through the exposed screen and enter the sampler body. The screen, consisting of either stainless steel or polyethylene, filters soil particles from the sample. A bailer can be lowered from the surface into the sampler body to collect the groundwater sample. The HydroPunch I is slightly longer and narrower than the HydroPunch II. For HydroPunch I, the sampler is retracted 18 inches to expose the inlet screen. When the sample chamber has been filled, the entire sampling unit is removed from the subsurface. The groundwater sample is held in the sample body by two Teflon check valve in the sample body.

4.2 INSTALLATION OF THE HYDROPUNCH SAMPLER

Prior to installation, the internal and external parts of the HydroPunch are to be decontaminated in accordance with SOP-31.

The HydroPunch sampler can be installed using either a cone penetrometer testing (CPT) rig or a conventional drill rig. Using a CPT rig, the HydroPunch sampler is attached to the CPT push rods and driven from the surface to depth using the rig's hydraulic ram. CPT procedures are presented in SOP-11. Using a drill rig, the HydroPunch sampler can be attached to standard soil sampling drill rods and either driven to depth using a standard 140-pound hammer or hydraulically driven through the bottom of a borehole drilled into the water bearing zone. As a general rule, without damaging the sampler, the HydroPunch sampler can be driven into formations using the hammer method if blow counts do not exceed 30 per 6 inches. The HydroPunch should be driven at least 5 feet below the top of the water bearing zone to allow sufficient pressure to fill the sample chamber, which is higher than the intake screen. Care should be taken to not retract the sample body prior to reaching the desired sampling depth. When the desired depth is reached, the HydroPunch is retracted either 18 inches (HydroPunch I) or 4 feet (HydroPunch II) (as described in Section 4.1) to expose the inlet screen to the water bearing zone.

4.3 SAMPLE COLLECTION

With the HydroPunch II, a groundwater sample can be retrieved from the sample body in site using a 1-inch O.D. sample bailer. The sample bailer is to be decontaminated prior to use in accordance with SOP 3. The sample volume that may be collected using HydroPunch II is theoretically unlimited, but practical experience indicates that the intake screen will tend to silt up over time and the diminishing productivity of the HydroPunch II point sometimes precludes collecting large sample volumes. NAPL sampling may be conducted with HydroPunch II by the sample method described above using the hydrocarbon bailer supplied by the HydroPunch vendor. The hydrocarbon bailer permits sampling of the NAPL layer with minimal disturbance and mixing, and allows for a more accurate estimation of NAPL layer thickness. With the HydroPunch I, the groundwater sample is collected by removing the entire sampler from the subsurface. The sample is retained in the sample chamber by two check valves. Upon retrieval, the upper check valve is replaced with a Teflon stop cock valve. The sampler is turned upside down, the stop cock is opened, and the sample is decanted into the sample container. The HydroPunch I sampler will yield 500 ml of sample volume.

4.4 BOREHOLE ABANDONMENT

Following sample collection and removal of the HydroPunch from the subsurface, the borehole should be backfilled to the surface in accordance with local regulations, which generally require grouting the entire length of the borehole to the surface. For HydroPunch points advanced from the ground surface, the small diameter of the borehole will likely require using a tremie pipe during backfilling to prevent bridging of the backfill material.

5.0 REFERENCES

QED Groundwater Specialists. Groundwater Express Equipment Catalog. 1992.

SOP 30

*Field Analytical Procedures (pH,
Conductivity, Temperature, Organic
Vapor, Water Levels, and Turbidity*



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STANDARD OPERATING PROCEDURE

SOP-30: FIELD ANALYTICAL PROCEDURES (pH, CONDUCTIVITY, TEMPERATURE, ORGANIC VAPOR, WATER LEVELS, AND TURBIDITY)

1.0 INTRODUCTION

This guideline is a general reference for the proper equipment and techniques for groundwater sampling. The purpose of these procedures is to enable the user to collect representative and defensible groundwater samples and to facilitate planning of the field sampling effort. These techniques should be followed whenever applicable, although site-specific conditions or project-specific plans may require adjustments in methodology. SOP-1 presents information regarding development and sampling equipment decontamination for soil drilling operations. SOP-5 contains information regarding groundwater sampling and field measurements.

To be valid, a groundwater sample must be representative of the particular zone of the water being sampled. The physical, chemical, and bacteriological integrity of the sample must be maintained from the time of collection to the time of analysis in order to minimize changes in water quality parameters. Acceptable equipment for withdrawing samples from completed wells include bailers and various types of pumps. The primary considerations in obtaining a representative sample of the groundwater are to avoid collecting stagnant (standing) water in the well, to avoid physically or chemically altering the water due to improper sampling techniques, sample handling, or transport, and to document that proper sampling procedures have been followed.

This guideline describes suggested well evacuation methods, sample collection and handling, field measurement, decontamination, and documentation procedures. Examples of sampling and chain-of-custody (COC) forms are attached.

2.0 DEFINITIONS

Annular Space: The space between casing or well screen and the wall of the drilled hole, or between drill pipe and casing, or between two separate strings of casing. Also called annulus.

Aquifer: A geologic formation, group of formations, or part of a formation that is capable of yielding a significant amount of water to a well or spring.

Bailer: A long narrow tubular device with an open top and a check valve at the bottom that is used to remove water from a well during purging or sampling. Bailers may be made of Teflon, polyvinyl chloride (PVC), or stainless steel. Disposable bailers are available and are made of polycarbonate.

Bladder Pump: A pump consisting of flexible bladder usually made of Teflon contained within a rigid cylindrical body (commonly made of PVC). The lower end of the bladder is connected through a check valve to the intake port, while the upper end is connected to a sampling line that leads to the ground surface. A second line, the gas line, leads from the ground surface to the

annular space between the bladder and the outer body of the pump. After filling, under hydrostatic pressure, application of gas pressure causes the bladder to collapse, closing the check valve and forcing the sample to ground surface through the sample line. Gas pressure is often provided by a compressed air tank, and commercial models generally include a control box that automatically switches the gas pressure off and on at appropriate intervals.

Centrifugal Pump: A pump that moves a liquid by accelerating it radially outward in an impeller to a surrounding spiral-shaped casing.

Chain of Custody: Method for documenting the history and possession of a sample from the time of its collection through its analysis and data reporting to its final disposition.

Check Valve: Ball and spring valves on core barrels, bailers, and sampling devices that are used to allow water to flow in one direction only.

Conductivity (electrical): A measure of the quantity of electricity transferred across a unit area, per unit potential gradient, per unit time. It is the reciprocal of resistivity.

Datum: An arbitrary surface (or plane) used in the measurement of heads (i.e., National Geodetic Vertical Datum [NGVD], commonly referred to as mean sea level [msl]).

Decontamination: A variety of processes used to clean equipment that contacted formation material or groundwater that is known to be or suspected of being contaminated.

Downgradient: In the direction of decreasing hydrostatic head.

Drawdown: The lowering of the potentiometric or piezometric surface in a well and aquifer due to the discharge of water from the well.

Electric Submersible Pump: A pump that consists of a rotor contained within a chamber and driven by an electric motor. The entire device is lowered into the well with the electrical cable and discharge tubing attached. A portable power source and control box remain at the surface. Electrical submersible pumps used for groundwater sampling are constructed of inert materials such as stainless steel, and are well sealed to prevent sample contamination by lubricants.

Filter Pack: Sand or gravel that is generally uniform, clean, and well rounded that is placed in the annulus of the well between the borehole wall and the well screen to prevent formation material from entering through the well screen and to stabilize the adjacent formation.

Headspace: The empty volume in a sample container between the water level and the cap.

HydroPunch: An in situ groundwater sampling system in which a hollow steel rod is driven into the saturated zone and a groundwater sample is collected.

In Situ: In the natural or original position; in place.

Monitoring Well: A well that is constructed by one of a variety of techniques for the purpose of extracting groundwater for physical, chemical, or biological testing, or for measuring water levels.

Packer: A transient or dedicated device placed in a well or borehole that isolates or seals a portion of the well, well annulus, or borehole at a specific level.

Peristaltic Pump: A low-volume suction pump. The compression of a flexible tube by a rotor results in the development of suction.

pH: A measure of the acidity or alkalinity of a solution, numerically equal to 7 for neutral solutions, increasing with increasing alkalinity and decreasing with increasing acidity. (Original designation for potential of hydrogen.)

Piezometer: An instrument used to measure head at a point in the subsurface; a nonpumping well, generally of small diameter, that is used to measure the elevation of the water table or potentiometric surface.

Preservative: An additive (usually an acid or a base) used to protect a sample against decay or spoilage, or to extend the holding time for a sample.

Static Water Level: The elevation of the top of a column of water in a monitoring well or piezometer that is not influenced by pumping or conditions related to well installation, hydrologic testing, or nearby pumpage.

Turbidity: Cloudiness in water due to suspended and colloidal organic and inorganic material.

Upgradient: In the direction of increasing static head.

3.0 RESPONSIBILITIES

Project Manager: Selects site-specific water sampling methods, locations for monitoring well installations, monitoring wells to be sampled and analytes to be analyzed with input from the field team leader (FTL) or Superintendent and project geologist. Responsible for project quality control and field audits.

Field Team Leader or Superintendent: Implements water sampling program. Supervises project geologist/hydrogeologist and sampling technician. Insures that proper chain-of-custody procedures are observed and that samples are sampled, transported, packaged, and shipped in a correct and timely manner.

Project Geologist/Hydrogeologist: Insures proper collection, documentation, and storage of groundwater samples prior to shipment to the laboratory. Assists in packaging and shipment of samples.

Field Sampling Technician: Assists the project geologist/hydrogeologist in the completion of tasks and is responsible for the proper use, decontamination, and maintenance of groundwater sampling equipment.

4.0 FIELD ANALYTICAL PROCEDURES

During the well development process, the pH, specific conductance, water temperature, and turbidity (in accordance with American Society for Testing Materials [ASTM] D-1889) will be periodically measured and recorded on a log sheet. The following sections briefly outline the procedures for measuring these parameters. This SOP is not intended to be all inclusive, but is intended to provide general guidance regarding these procedures. Specific SOPs have applicable measurements for the type of field activity and SAPs will contain any deviations or amendments to these procedures. All field instruments shall be calibrated according to manufacturer's instructions. All field instruments will be calibrated prior to use. Calibration information shall be recorded in the field logbook. Detailed information regarding maintenance and servicing is available in the operation manual for each meter used. Servicing and maintenance information will be recorded in the field logbook. SOP 16 contains specific procedures for field measurements and guidelines on sampling equipment procedures for field measurements.

4.1 pH

Purge the well until pH, temperature, and specific conductance are at equilibrium. Equilibrium is established as follows: pH variation is less than 0.2 pH units, temperature variation is less than 0.5 degrees Celsius, and less than 10 percent variation in specific conductance. Equilibrium will be established by three consecutive readings, where on casing volume is pumped between each reading.

4.2 CONDUCTIVITY

Purge the well until pH, temperature, and specific conductance are at equilibrium. Equilibrium is established as follows: pH variation is less than 0.2 pH units, temperature variation is less than 0.5 degrees Celsius, and less than 10 percent variation in specific conductance. Equilibrium will be established by three consecutive readings, where on casing volume is pumped between each reading.

4.3 TEMPERATURE

Purge the well until pH, temperature, and specific conductance are at equilibrium. Equilibrium is established as follows: pH variation is less than 0.2 pH units, temperature variation is less than 0.5 degrees Celsius, and less than 10 percent variation in specific conductance. Equilibrium will be established by three consecutive readings, where on casing volume is pumped between each reading.

4.4 ORGANIC VAPOR

An organic vapor analyzer (photoionization detector [PID] or flame ionization detector [FID]) will be used to field-screen soil to determine if VOCs are present. Field screening will be performed by placing the detector within an inch of recently excavated or exposed in-place soil. The highest concentration detected will be recorded on the field notebook. Additional soil will be excavated if the concentration detected by an OVA is above background. Confirmation samples will be collected if the concentration is at background or below detection. Soil conditions, tank and line conditions, and the presence of petroleum odors and stained soils, as well as field screening results, will be used as additional information for decision-making.

OVA's will be used only as field screening tools, since they have the following limitations:

- OVA's measure the concentration of total organic vapors and serve as a general indicator of the level of contamination in soil.
- OVA's are not compound-specific and can detect the presence of a wide range of volatile organic compounds, many of which are not regulated under the IEPA UST regulations (e.g., the PID detects ammonia compounds and the FID detects methane).
- Moisture and cold temperatures can cause inaccurate meter readings during field screening.

If more accurate field-screening data are required, a headspace sample can be collected by placing soil material (in-place or recently excavated soil) into a sample jar or "ziplock"-type plastic bag. The container is partially filled (50 to 75 percent), leaving an excess space or "headspace" above the soil. The bag is sealed or the top of the sample jar is covered with aluminum foil and sealed with the lid. The sample is heated by placing it in the sun or near a heat source. The seal is broken or the foil is pierced with the detector probe to determine the concentration of the organic compounds which have volatilized from the soil and into the container headspace. The highest concentration detected is recorded on the field log.

4.5 WATER LEVELS

Water level measurement procedures are described in detail in SOP 6-Monitoring Well Design, Construction, and Installation.

4.6 TURBIDITY

The well will be considered adequately developed when the measured parameters are stabilized, the necessary quantity of water removed, and the water is visibly clear of sand and sediments. During well development, a turbidity of 5 nephelometric turbidity units (NTUs) will be the goal for water clarity. In the event that the 5 NTU goal cannot be reached in 4 hours in the development process, variation in specific capacity values will be used to determine if well development is adequate. Four consecutive specific capacity readings with 10 percent of each other will indicate adequate well development. If the specific capacity and the measured parameters listed above are stabilized (no more than 10 percent variance between three

consecutive readings) and the proper amount of water is withdrawn, but the turbidity exceeds 5 NTUs, then an additional amount of water equal to two standing water volumes will be removed, at which point the well will be considered fully developed.

5.0 REFERENCES

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SOP 35

Investigation Derived Waste Management



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STANDARD OPERATING PROCEDURES

SOP-35: INVESTIGATION DERIVED WASTE MANAGEMENT

1.0 INTRODUCTION

The purpose of this Standard Operating Procedure (SOP) is to describe the policy, organization, functional activities, and investigation-derived waste (IDW) management control to be implemented for field investigation activities. The plan should be used as a guideline for future waste management. More detailed, site-specific information should be presented in the Sampling and Analysis Plans (SAPs) prepared for individual investigations conducted at each site. The objective of the plan is to describe the procedures required to manage IDW. In addition, the SOP establishes the sampling and analytical procedures to be followed to manage the IDW as required by CERCLA, Superfund Amendments and Reauthorization Act (SARA), and Resource Conservation and Recovery Act (RCRA) guidance. Detailed information presented in this SOP addresses the following:

- Typical types of IDW that will be generated and managed during investigation activities at the three OUs
- Typical specific activities expected to be conducted that may generate IDW.
- Specific waste parameters or characteristics that need to be quantified to ensure safe and effective management of IDW
- Methods of obtaining necessary data to assess IDW, such as sampling and analysis procedures
- Options for disposal of IDW
- Applicable or relevant and appropriate requirements (ARARs) to be considered during the implementation of the SOP

1.1 PLAN ORGANIZATION

The organization of the SOP is designed to facilitate the decision-making process, presenting a logical approach to be used in determining the proper handling and treatment or disposal of IDW. Section 2.0 presents information on the types, typical volumes, and containment of wastes generated during field investigations as well as the field activities that are expected to generate IDW at the three OUs. Section 3.0 outlines the intermediate handling and management of waste soils, liquid wastes, personal protective equipment, and disposable equipment. Record-keeping practices, containerization, storage, characterization, and sampling and analysis protocols for the IDW also included in Section 3.0. Section 4.0 details the disposal options available for the IDW. Section 5.0 discusses ARARs to be considered for implementation of the SOP during the field investigations.

2.0 GENERATION OF INVESTIGATION-DERIVED WASTES

During field programs, a variety of potentially contaminated IDWs will be generated. Potential field activities include drilling, trenching or test pits, groundwater sampling, surface water sampling, aquifer testing, soil-gas surveys, geophysical surveys, and location surveys. The National Contingency Plan (NCP), codified in 40 Code of Federal Regulations (CFR) 300, requires that the handling of IDW attains all the ARARs to the extent practicable considering the urgency of the situation.

2.1 TYPES OF IDW

IDW generated during field activities may include the following media and waste types:

- Soil
- Drilling mud
- Groundwater
- Decontamination fluids
- Personal protective equipment (PPE)
- Disposable equipment

The above wastes may or may not be considered hazardous for the purposes of handling and disposal. Section 3.6 details how the wastes will be characterized prior to determining the appropriate disposal option. In addition to the IDW listed above, refuse may be generated during field activities. This could include, for example, packaging materials and broken or cut-off well screening and casing. Typically, this refuse can be treated as nonhazardous material and disposed of as appropriate, such as in an on-base industrial dumpster.

2.2 IDW GENERATION ACTIVITIES

The various activities conducted during field investigations will result in the generation of IDW. Field activities may include soil-gas and geophysical surveys; drilling of soil borings; trenching or test pits; monitoring well installation and development; aquifer testing; collection of soil surface water and groundwater samples; and location surveys. The IDW generated during these activities could potentially be contaminated with various hazardous substances. Estimated volumes of IDW generated from various field activities are presented in the sections that follow. As part of the preplanning procedures prior to the initiation of any field effort, the individual contractors should perform site-specific calculations of the total volumes of IDW expected to be generated based on the anticipated activities as part of their project planning.

An effort should be made to reduce the amount of IDW generated during field activities because the quantity of IDW will affect the overall cost of the remedial action and potentially increase liability or exposure. IDW can be minimized through proper planning of all activities that generate IDW. The sampling equipment and method of decontamination should be selected with consideration to the volume of IDW that will be generated. Whenever possible, the number of activities conducted at a site should be reduced.

2.2.1 Soil-Gas and Geophysical Surveys

Soil-gas and geophysical surveys are conducted to identify and locate anomalies, potential "hot spots," and source areas. These activities potentially generate a small volume of decontamination fluid and PPE.

2.2.2 Drilling

Two drilling techniques are typically used for soil boring or monitoring well installation at the hollow-stem auger (HSA) or mud rotary. The preferred method is HSA drilling; however, problems have been encountered using this drilling method for installation of deeper monitoring wells or large diameter extraction wells. To collect shallow soil samples using HSA, a borehole will typically be drilled using an 8.25-inch outside-diameter (OD) auger to collect soil samples. A minimum of 0.37 cubic feet (cu. ft.) (2.8 gallons) of soil cuttings per linear foot of borehole will be generated. A 25-foot soil boring would therefore generate a minimum of 9.3 cu. ft. (70 gallons) of soil cuttings (filling approximately one and one-half 55-gallon drums). Additional quantities of soil should be expected when using the HSA due to reworking of the soil during removal from the borehole, known as the "fluff" factor, and due to slough created during drilling, especially if poorly consolidated materials are encountered. An estimated 30 percent increase in soil-cutting volumes will be generated due to the "fluff" factor. Table 2-1 shows the relationship between the diameter of borehole and the potential volume of soil cuttings generated from drilling using HSA. The installation of larger diameter soil borings will generate proportionally larger quantities of soil.

The volume of drilling mud generated from the mud rotary drilling method is difficult to estimate because many variables are involved. Mud rotary drilling includes the addition of a drilling fluid, water, to remove the pieces of formation that were broken by the drill bit. The water and soil are together referred to as drilling mud. Typically, the drilling mud is separated to remove sand and gravel, and the liquid mud is recycled through the system. The solids (sand and gravel) are deposited in a bin or drum. When the borehole is completed, the mud is flushed out of the borehole and deposited in a tank. The volume of drilling mud generated depends on the stratigraphy encountered, fluid losses during drilling, and solids added to the mud.

Drilling by both HSA and mud rotary could also potentially generate large volumes of PPE and decontamination fluid. These volumes are difficult to estimate because they depend on many site-specific factors.

2.2.3 Hand Augering, Surface Soil Sampling Activities

Typically, hand augering is conducted using a 3.25-inch inside-diameter (ID) auger. Surface soil sampling is usually completed using hand-held sampling tools. Due to small diameter and limited drilling depth, a small volume of soil cuttings is estimated to be generated during these activities, and a small volume of PPE would also be generated.

2.2.4 Trenches or Test Pits

Trenches or test pits may be excavated at sites. Following the soil sampling and visual observations of the pit, the excavated soil will generally be placed back into the test pit. Depending on specific site conditions, the need may arise to remove the excavated soil from the area of contamination (AOC). This could potentially generate large volumes of soil to be treated and/or disposed. Decontamination of the excavation and sampling equipment could potentially generate large volumes of decontamination fluid. PPE will also be generated.

2.2.5 Location Surveys

Following the completion of sampling activities, the coordinates and elevations of all sampling points, including soil borings, monitoring wells, soil-gas points, and geophysical survey grids, will be surveyed. Small volumes of PPE could potentially be generated.

2.2.6 Monitoring Well Development, Groundwater Sampling, and Aquifer Testing

The volume of groundwater generated through monitoring well development, groundwater sampling, and aquifer testing is dependent upon a number of variables, including well diameter, length of the screened interval, saturated thickness of the well, porosity of the material used as filter packing, duration and rate of pumping. PPE and decontamination fluid would also be generated as a result of these activities, but the volume is dependent on the type and duration of the activity.

Complete well development requires the removal of at least three times the amount of source water used during drilling and construction of the well plus a minimum of three times the volume of standing groundwater within the well. For example, during the development of a 4-inch-ID well with 30 feet of standing water, a minimum of 58 gallons of groundwater plus three times the amount of the source water used during drilling and construction of the well would be generated. An additional 58 gallons of groundwater would be generated while purging the well prior to groundwater sampling.

Aquifer pump testing will generate much larger volumes of groundwater than well purging. Typical volumes cannot be estimated because they depend on the well construction and the duration of the test.

In general, purge water should be segregated by well and containerized in Department of Transportation (DOT)-approved, 55-gallon drums. If the on-installation treatment system is approved as a disposal mechanism, an option is to cut costs by consolidating purge water in on-installation Baker tanks for temporary storage prior to discharge to the treatment system.

2.2.7 Surface Water Sampling

Surface water sampling may be conducted to determine the constituents of the surface water at the site. This activity could potentially generate a small volume of decontamination fluid and PPE.

2.2.8 Decontamination Fluid

The volume of IDW generated as decontamination fluid will be dependent upon a number of site-specific factors, and therefore, will vary in quantity. Site-specific factors include the number and type of field activities per site and the total number of sites being investigated. Decontamination fluid can vary from a few gallons a day for decontamination of instruments to several hundred gallons a day for decontamination of large field equipment such as drill rigs.

2.2.9 PPE and Disposable Equipment

The volume of IDW generated as PPE and disposable equipment will be dependent upon a number of site-specific factors and therefore, will vary in quantity. Site-specific factors include the U.S. Environmental Protection Agency (USEPA) health and safety work level (Level D versus Levels C or B), number and type of field activities per site, number of people working on site, total number of sites being investigated, and the amount of disposable equipment that is required. PPE waste volumes generated per day will typically account for one-half of a 55-gallon drum for a crew of four.

2.3 IDW CONTAINMENT

IDW generated during field activities will be contained at the site of generation or at a designated central location. DOT-approved, 55-gallon drums for the handling of hazardous waste (DOT, USEPA-approved DOT-17-H) should be used for the containment of some of the IDW including PPE, and disposable sampling equipment. Roll-off boxes and Baker tanks may be used to contain soil and liquid wastes, respectively. However, DOT-approved, 55-gallon drums may be used to containerize soil and liquid wastes if preferred. The number of each type of container required at each site should be estimated before field work commences.

Soil cuttings and/or drilling mud will either be contained in DOT-approved, 55-gallon drums or placed in roll-off boxes located in the general area of sites being investigated. If soil cuttings are determined to be potentially hazardous while in the field (i.e., HNU readings above designated levels or visible staining), soil cuttings should be segregated by site or boring, containerized in DOT-approved 55-gallon drums lined with polyethylene, and immediately secured with lids. Each drum or roll-off box will be labeled as discussed in Section 3.4. Drums or roll-off boxes will be stored at the site of generation or transported from the AOC following drilling and stored at a central location as instructed by the base environmental coordinator. Drums or roll-off boxes will be held until adequate characterization of the site or the contained soil or drilling mud is completed (Section 3.6.1).

Liquid wastes will either be stored within the AOC or transported to a central location. Liquid wastes generated during field investigation activities include fluids generated during well installation, development, purging and sampling, aquifer testing, surface water sampling, and decontamination of equipment. The base may consolidate liquid wastes in on-installation Baker tanks if the liquids are generated from wells located in areas where previous investigations have shown no contamination or contaminants at levels that would not adversely affect the existing on-installation groundwater treatment facility. If liquid wastes are determined to be potentially hazardous while in the field (i.e., HNU readings above designated levels) or if previous investigations have indicated contamination at that location, DOT-approved, 55-gallon drums lined with polyethylene will be used for containment until the liquid can be characterized (see Section 3.6). Liquid wastes may also be stored in 55-gallon drums if drums are more convenient than Baker Tanks. Each drum will be labeled as discussed in Section 3.4. Drums will be stored at the site of generation or transported from the AOC and stored at a central location as instructed by the base environmental coordinator. Liquid wastes will be stored pending IDW characterization (Section 3.6).

Depending upon the suspected contaminants present, decontamination fluid generated at each site may be segregated by site and containerized in DOT-approved, 55-gallon drums or stored with other liquid wastes generated at the same site. The decontamination fluid will be stored within the AOC or a designated central location as instructed by the base environmental coordinator. Decontamination fluid will be held until adequate characterization is complete (Section 3.6.2). However, if the on-installation treatment system is approved as a disposal mechanism, decontamination fluid may be transported to Baker tanks for temporary storage and eventual disposal into the system.

PPE and disposable equipment produced through field activities will be segregated by site, double-bagged in plastic bags, secured and labeled using a wire tag. The bags will then be placed in DOT-approved, 55-gallon drums and labeled as discussed in Section 3.4. Partially filled drums will be secured with lids at the completion of field activities or at the end of the work day. PPE and disposable equipment will be held at the site of generation or a designated central location as instructed by the base environmental coordinator. PPE and disposable equipment will be held until adequate characterization of the site or of the containerized PPE and disposable equipment is completed (Section 3.6).

3.0 IDW HANDLING AND MANAGEMENT OPTIONS

This section discusses the proper IDW management procedures to be followed in record-keeping practices, requirements for compliance with storage time limitations, and characterization of IDW. The protocols established for sampling and analysis of contaminated IDW, if required, are also presented in this section.

Following the field activities, including proper labeling and temporary storage of IDW as appropriate, the first task will be to characterize the IDW generated. Proper characterization is required to determine if disposal is necessary and, if so, the appropriate disposal options. These options include both on-installation and off-installation disposal or treatment and are discussed in detail in Section 4.0. Initially, the IDW will be characterized based on a review of analytical

data generated from environmental samples collected during field activities. This data will be compared to the background data collected during the OU 3 remedial investigation. Based on this comparison, the characteristics of the IDW will be inferred. In some cases, testing containerized IDW may be required to further define disposal options. The management of investigation-derived wastes including containerization and required analyses are presented in Sections 3.1, 3.2, and 3.3 for soil, liquids wastes, and PPE, respectively. The methods for accurately characterizing IDW are presented in Section 3.6.

Initially, soil and liquid IDW will be characterized based on the background data. To identify potential contamination, analytical results should be compared to the 95% Upper Tolerance Level for the background samples.

Proper IDW management requires that the following steps be completed:

- Characterize the waste generated
- Determine the quantity of waste that is hazardous
- Evaluate available on-installation and off-installation disposal/treatment methods
- Identify ARARs of concern
- Select a disposal option
- If off-installation disposal or treatment is required or selected, schedule testing and transport of wastes

The investigation team members will conduct the field activities that generate the IDW (Section 2.2), place the IDW in appropriate containers (Section 2.3), and complete record-keeping responsibilities (Section 3.4). Once the waste has been adequately characterized, the investigation team will also arrange for the appropriate treatment or disposal of the IDW. Analytical results of environmental samples and recommended disposal options for IDW will be summarized in a technical memorandum submitted to the Remedial Project Managers (RPMs) and the USACE by the investigation team. The RPM and USACE approval will be required prior to proceeding with the recommended disposal options. The technical memorandum will document the status of containerized IDW with the following information:

- A complete list of containers stored at each site of generation or at the central area
- Unique identification of each container
- Contents of each container
- Analytical results of the environmental samples
- Volume of potentially contaminated material
- Potential contaminant(s) of concern
- Site maps showing the location of each container at the site
- Recommended treatment and/or disposal options for each container

If off-installation treatment and disposal of containerized IDW is required, the investigation team would be responsible for sampling containerized IDW, if required, for further characterization or disposal. The investigation team should provide documentation to the USACE. Handling and

managing the off-installation treatment and disposal of IDW after the containers have been characterized for off-installation removal would also be required. Additional tasks that would be performed include, but may not be limited to, preparing manifests, tracking containers, tracking 90-day storage limits, arranging the transport of containers, and arranging the ultimate disposal to a RCRA-permitted off-installation treatment, storage, and disposal facility (TSDF).

3.1 CHARACTERIZATION AND MANAGEMENT OF INVESTIGATION DERIVED SOILS AND DRILLING MUD

The containerization of, and proposed analyses for, investigation-derived soils and/or drilling mud generated during field investigations are described in the following sections. Figure 3-1 presents the step by step process that will be followed for characterization of the soils and drilling mud.

3.1.1 Containerization

Investigation-derived soils and/or drilling mud generated during field activities will be containerized on-site within individual AOCs. Details for containerization of investigation-derived soils and/or drilling mud are presented in Section 2.3 of this document, but in general the IDW soils will be contained in either bins or 55-gallon drums. Possible exceptions to leaving IDW soil and/or drilling mud at the AOC would include areas with a high degree of public access or sites where leaving the IDW on site would result in increased risks to human health and/or the environment. In such cases, the IDW may be moved to a secured central location. The base environmental coordinator will instruct the field team where to store contained IDW.

3.1.2 Analyses

Any available information from previous investigations should be reviewed along with background samples and analytical results of environmental soil samples collected on site within the AOC to determine the potential contaminants of concern and probable characteristics of containerized IDW. If environmental samples are determined to be nonhazardous (see Figure 3-1), investigation-derived soil and/or drilling mud will be disposed as described for nonhazardous soils in Section 4.0.

If the IDW is characterized as nonhazardous at any level of the characterization process, it will be disposed as described for nonhazardous soils (Section 4.0). If analyses show contaminant concentrations of the soil samples collected within the AOC to be above background concentrations (Table 3-1), results will be compared to Total Threshold Limit Concentrations (TTLC), 10 times the Soluble Threshold Limit Concentration (STLC), and 20 times the Toxic Characteristic Leaching Procedure (TCLP) regulatory limits. At this point, if soil samples are determined to be hazardous (under RCRA or California Code of Regulations [CCR] Title 26), the collection of composite samples from IDW containers for analysis may be necessary. Specific sampling and analysis methods are described in detail in Section 3.7. The samples will be analyzed by STLC or TCLP procedures to determine if the IDW is hazardous, and to evaluate

potential land disposal restrictions (LDRs). If the containerized composite samples are again determined to be hazardous, options for disposal need to be considered (Section 4.0).

If no environmental samples were taken during the waste generation, composite samples should be collected from IDW containers. The samples will be analyzed by STLC or TCLP procedures. If the containerized composite samples are determined to be hazardous, disposal options need to be considered (Section 4.0). Additional sampling and testing of IDW may be initiated as appropriate based on the intended method of disposal (Section 4.0) and standards determined by individual TDU or TSDF locations.

3.2 CHARACTERIZATION AND MANAGEMENT OF INVESTIGATION DERIVED LIQUID WASTES

The containerization of, and proposed analyses for, investigation-derived liquid wastes generated during field investigations at the site are described in the following sections. Figure 3-2 presents the step by step process that will be followed for characterization of the liquid IDW.

3.2.1 Containerization

Liquid wastes generated during field activities may include fluids generated during well installation, well purging and sampling, aquifer testing, and the decontamination of drilling and sampling equipment. These investigation-derived liquid wastes will be containerized and may be segregated by source or by site, dependent upon the anticipated contamination and volume of liquids generated. The segregated liquids will remain within the AOC or will be transported to a central location, pending determination of IDW status with respect to RCRA and other pertinent ARARs as well as the disposal methodologies available. Details for containerization of investigation-derived liquid wastes are presented in Section 2.3 of this document, but in general, liquid waste will be contained in either Baker Tanks or 55-gallon drums. Possible exceptions to leaving IDW liquid wastes at the AOC will include public access considerations or if leaving the IDW on site will create increased risks to human health and/or the environment. In such cases, the IDW may be moved to a secured central location. The base environmental coordinator will instruct field team members where to store contained IDW.

3.2.2 Analyses

Information from previous studies, background data, and analytical results of environmental samples collected at each site will be reviewed to determine contaminants of concern and the characteristics of the containerized IDW (Figure 3-2). If aqueous samples are determined to be nonhazardous (analytical concentrations are below the 95% Upper Tolerance Level for background samples), the liquid wastes will be disposed as described for nonhazardous liquids in Section 4.0.

If contaminant concentrations in the aqueous samples collected within a given AOC are above background concentrations, results will then be compared to STLC and TCLP regulatory limits. At this point, if the samples are determined to be hazardous (under RCRA and/or CCR Title 22),

the containerized IDW liquid should be sampled according to the procedures described in Section 3.7, and the analytical results should be compared to the STLC and TCLP regulatory limits. If analytical results of the containerized IDW liquid determine the liquid to be nonhazardous (Figure 3-2), the liquid will be disposed of as nonhazardous liquid IDW. However, if samples of the containerized waste are determined to be hazardous, the options for disposal may be considered as discussed in Section 4.0.

If no environmental samples were taken during waste generation, composite samples should be collected from IDW containers. The sample results should be compared to the STLC and TCLP regulatory limits to determine if the waste should be disposed as hazardous or nonhazardous liquid IDW.

If the activities that generated the liquid wastes were associated with one of the OUs with a treatment system that is able to handle the types and concentrations of compounds detected, the liquid waste may be discharged to the system for treatment and eventual discharge to the groundwater recharge basin. If the treatment system is unable to handle the IDW, or if an on-installation treatment system is not available, required sampling and testing of IDW should be initiated as appropriate for the intended method of disposal and standards determined by individual off-installation TDU, TSDF, or POTW locations.

3.3 CHARACTERIZATION AND MANAGEMENT OF DISPOSABLE PPE AND DISPOSABLE EQUIPMENT

The following sections present various options that are available for the management of investigation-derived disposable PPE and disposable equipment. These options are intended to be considered following a review of all available information concerning the environmental samples collected within the AOC where the PPE and/or disposable equipment was generated.

3.3.1 Decontaminated Equipment

If disposable PPE and disposable equipment are decontaminated following use and are therefore designated as nonhazardous waste, the IDW will be placed in plastic bags and disposed of in an on-installation industrial dumpster. A second option is to remove the IDW to an off-installation Subtitle D landfill. Further details for disposal options of decontaminated disposable PPE and disposable equipment are presented in Section 4.0.

3.3.2 Potentially Contaminated Equipment

If disposable PPE and disposable equipment are not decontaminated following use, they may represent potentially hazardous waste. Disposable PPE and disposable equipment will be containerized and segregated by individual site (e.g., by boring or site number) and stored within the AOC, pending determination of RCRA status and disposal. Possible exceptions to leaving the IDW at the AOC include public access considerations or the potential for increased risks to human health and the environment.

Following a review of pertinent information concerning the site of generation, including analytical results and regulatory provisions, the disposal options for the PPE and disposable equipment will be assessed. If the results of environmental samples collected during field sampling activities are determined to be nonhazardous, the disposable PPE and disposable equipment will be disposed as nonhazardous IDW. Further details for disposal options of nonhazardous disposable PPE and disposable equipment are presented in Section 4.0.

If the results of environmental samples from the AOC are determined to be hazardous, the containers will be disposed of as hazardous IDW. Disposal options for hazardous IDW are presented in Section 4.0.

3.4 CONTAINER LABELING AND RECORD KEEPING

Container labeling and record-keeping requirements include: (1) proper labeling of containers as waste pending receipt of analytical test results (proper labeling includes information such as source site number, boring or well number, and permissible storage period); and (2) date(s) of waste generation and type of IDW stored in the container. Drum labels will be placed on the side of the drum, not on the lid, to reduce breakdown of the label by environmental conditions and to prevent the possibility of interchanging labels if lids are reused. Plastic bags used to contain disposable PPE and disposable equipment will be identified with a drum label wrapped around a piece of wire to produce a wire tag that will be used to seal the bag. An example of a container label to be used for identifying containerized IDW is shown on Figure 3-3.

IDW containers should be tracked using a form similar to that shown on Figure 3-4. The form should be completed once each container is filled. Information recorded should include site name, location identification, storage location, contents, source, dates of operation, and capacity of container. The quantity (volume) of material in each container should be measured and recorded on the IDW container data sheet prior to sealing the container.

In addition to complying with the above requirements, as appropriate, the contractor will notify the engineer-in-charge (EIC) and provide the USACE with an inventory of wastes generated, including source, media, storage location, analytical results, and final treatment or disposal. Storage locations for containerized wastes will be designated by the base environmental coordinator. Hazardous waste manifests and material safety data sheets will be completed by Montgomery Watson or the generator as appropriate. All manifests will be signed by the generator (Installation).

Entries will be made by the EIC in a field log book during the waste management activities. The quantities of wastes generated at each site, visual observations of the wastes, odor characteristics, and HNu readings should be included in the field log book.

3.5 STORAGE TIME LIMITS

Several storage and disposal requirements are subject to time limits that begin when the IDW is generated. These include: (1) removal of waste from the site (unless wastes will be stored on site

within the AOC); (2) notification of the USACE by the contractor following initial characterization of the IDW; and (3) final treatment or disposal of the IDW.

Within 60 days of waste generation, the investigation team should provide a memorandum to the USACE documenting the initial characterization of the IDW. Sixty days is required to receive analytical results from the laboratory, review the data, interpret the data, and prepare the memorandum. The memorandum will assist the USACE in RI/FS planning and compliance with environmental regulations. Documentation should contain information on quantity of waste, type (soil, water, etc.), site, source (borehole, monitoring well, etc.), contaminants detected, and concentrations. This information will be used to make an initial classification of waste (potentially hazardous, designated, or nonhazardous). The memorandum should include proposed actions to be taken concerning additional sampling and disposal.

As discussed in Section 3.6, if IDW is characterized to be potentially hazardous, additional sampling of IDW containers will be required to determine if the IDW is hazardous. If the material is defined as RCRA hazardous waste, RCRA regulations (40 CFR 262.34) requires the waste to be transported off site in 90 days. In addition, RCRA regulations (40 CFR 262.34) require that, unless IDW will be stored within the AOC, IDW will be transported to the designated storage area within 3 days. If additional sampling is performed, it is likely that the 90-day limit on RCRA waste will be exceeded. CERCLA-derived wastes may be stored at an area longer than 90 days as long as the storage area complies with RCRA substantive storage requirements (the administrative process for obtaining a permit is not required). The intent of the waste management program will be to dispose of IDW as soon as is practicable. Factors that may influence the length of time of storage include laboratory turnaround time, duration of investigations at the site, storage area volume limitations, time requirements to arrange for off-site disposal, and the degree of risk that the IDW poses to human health and the environment. If IDW is generated that is deemed by the USACE, regulatory agencies, or the contractor to present a high degree of risk by storing the IDW, arrangements will be made for immediate transfer or disposal.

3.6 IDW CONTAINER SAMPLING AND ANALYSIS METHODS

Analytical samples collected during field activities will be analyzed and the results compared to background and regulatory limits before IDW container sampling occurs. Data collection efforts completed during the field investigation should be sufficient for determining whether IDW is potentially hazardous. The basic objective of IDW sampling is to produce a set of samples representative of the contained IDW media under investigation and suitable for subsequent analysis, if required. Containerized soil and liquid wastes can be returned to the source at any time during the investigation, contingent upon compliance with ARARs. ARARs are discussed in Section 5.0. PPE and disposable equipment found to be potentially hazardous will be disposed as hazardous materials. The methods, techniques, and analyses used for testing hazardous field-generated wastes that will be disposed of off-installation to a RCRA-permitted facility or Class I disposal facility are presented in the following sections.

The sampling technique chosen for sampling activities will, in part, be dependent upon the physical state of the IDW media to be sampled. The physical state of the IDW will affect most

aspects of the sampling effort. The sampling technique will vary according to whether the sample is liquid, solid, or multiphasic. The generation of decontamination fluids through IDW sampling should be minimized and should be a factor considered in the final choice of sampling technique. The decontamination fluids will be minimized through selection of appropriate technique to sample the media in question and ease of cleaning. Care should be exercised to avoid the use of sampling devices plated with chrome or other materials that might contaminate the sample.

If IDW is characterized to be potentially hazardous after review of analytical data generated during field activities, IDW container sampling will be conducted. Testing is required prior to on- or off-installation treatment, storage, or disposal of contaminated material. However, IDW container testing is not required if the IDW is determined to be nonhazardous. Criteria for testing protocol are presented in Sections 3.1 through 3.3. The description of sampling techniques for containerized media is divided into two sections, which address soil and drilling mud, and containerized liquids.

3.6.1 Containerized Soil and Drilling Mud Sampling

Available options for sampling devices suitable for soil and drilling mud sampling include scoops, thin-walled tube samplers, hand augers, core samplers, and sampling triers. The presence of rocks, debris, or other sampling-specific considerations will dictate the most suitable sampling method. The sampling technique will also vary according to whether the solid is hard or soft, powdery or clay-like (USEPA, 1986).

If the soil or drilling mud is stored in bins, one composite sample should be collected from each bin. If the IDW is stored in drums, one composite sample should be collected from the cuttings from each boring or from each site.

3.6.2 Containerized Liquid Waste Sampling

Beakers, glass tubes, extended bottle samplers, and Composite Liquid Waste Samplers (COLIWASA) are devices that may potentially be used to sample containerized liquid media. Site-specific conditions may necessitate a variety of sampling options. Site-specific conditions will include the homogeneity or heterogeneity of the liquid to be sampled and stratification and the physical nature of the liquid such as viscosity. Sampling techniques will be chosen based on properties of the liquid medium and ease of decontamination of sampling equipment. Surface water samples from drums can also be readily collected by merely submerging a sample bottle.

If the liquid waste is stored in Baker Tanks, one composite sample should be collected from each Baker Tank. If the liquid waste is stored in drums, one composite sample should be collected from the drums for each sampling event.

4.0 DISPOSAL OPTIONS FOR IDW

Disposal alternatives for IDW include: (1) on-installation land disposal, (2) off-installation land disposal, (3) on-installation treatment, (4) off-installation treatment, and (5) on-installation storage and disposal within the AOC. Choosing one of these alternatives is dependent upon the type of IDW; concentrations of contaminants as determined by sampling and analysis (see Section 3.7); and federal, state, or local regulations and ARARs (discussed in Section 5.0). The disposal option should be determined prior to site investigation activities to assess the site investigation costs and minimize on-site waste storage. Specific IDW disposal options are presented in the following sections and are shown in Table 4-1 and on Figures 4-1 through 4-3.

Ultimately, the PPE and disposable equipment will be transported to dumpsters for disposal at either a sanitary landfill, a TDU, or a RCRA-permitted TSDf as discussed in this section.

4.1 ON-INSTALLATION LAND DISPOSAL FOR NONHAZARDOUS WASTES

A significant amount of the solid waste generated during any field program will be considered nonhazardous. There are no RCRA ARARs concerning the disposal of nonhazardous solid wastes; therefore, nonhazardous solid wastes (as determined by environmental samples) may be disposed at an appropriate location on base. PPE and disposable equipment will be stored in dumpsters but will not be disposed on the base.

A significant fraction of solid waste generated during field investigations will be investigation-derived soil and drilling mud. Disposal options for soils found to be nonhazardous may include spreading around the source areas (such as spreading around borings), or transporting to a designated area on base. Soil disposal around the boring or source area within the AOC may not be feasible due to public access considerations, the location of the AOC (such as borings in or adjacent to roads or other developed areas), or more stringent, non-RCRA ARARs. If it is not feasible to spread the soil around the source area, the soil must be sent to a designated location on the site selected by the USACE, or sent to a suitable Subtitle D landfill or an off-installation TDU or TSDf.

Investigation-derived liquids that are determined to be nonhazardous would have the same on-installation disposal options as soils. However, disposal of liquids by pouring them around the source area may not be prudent due to the potential to mobilize contaminants by infiltration of water or due to public access considerations. Nonhazardous liquid wastes may also be disposed by surface discharge to a groundwater recharge basin. If it is determined that the environmental samples are nonhazardous but treatment and disposal is controlled by more stringent, non-RCRA ARARs, alternate methods of disposal would be required.

Nonhazardous trash and decontaminated PPE and disposable equipment generated during field activities can be disposed in an on-installation industrial dumpster for disposal after characterization.

On-site disposal can significantly decrease the volumes of wastes that must be transported and/or treated, thus decreasing costs of the field program. Any on-base disposal should be coordinated with the appropriate base agencies.

4.2 OFF-INSTALLATION LAND DISPOSAL

One potential alternative for IDW disposal is at an off-installation TDU or TSD municipal landfill. The waste that is disposed at off-installation facilities may include soil, drilling mud, liquid wastes, PPE, or disposable equipment. Once waste is characterized, as discussed in Section 3.6, the appropriate "Class" of disposal unit (as defined in Title 26 of the CCR) must be selected. Class I facilities may accept hazardous, designated, and nonhazardous wastes; Class II facilities may accept designated wastes; and Class III facilities accept nonhazardous solid wastes. Selection of a particular disposal unit (hazardous or nonhazardous) is dependent on the waste type, contaminant concentration, facility acceptance criteria, geographic location, and cost.

The disposal facility should be selected prior to the instigation of the site activities. The disposal facility must be contacted prior to arriving at the TSD facility with waste to ensure acceptance of the waste by the landfill operator and to check that the facility's requirements have not changed. The contractor should obtain verification that the disposal facility is in compliance with all operational permits prior to receiving wastes from the site. Additional sampling and testing of the IDW required by the disposal facility should be initiated prior to disposal. The generator must either obtain an EPA identification number and manifest form for IDW, or prepare a bill of lading for RCRA nonhazardous IDW prior to transporting.

4.3 ON-INSTALLATION TREATMENT

On-installation treatment will be considered, as appropriate, to minimize the volume of liquid and solid waste to be sent to off-installation facilities and to reduce costs. Liquid wastes including surface water, groundwater, and decontamination fluids may be transported to an on-installation groundwater treatment system for treatment as appropriate. The treated liquids would then be discharged along with treated groundwater from the treatment system. Currently, treated water from the treatment system is discharged into the arroyo. Future discharge alternatives may include discharge to the former sewage treatment plant percolation ponds or reinjection to groundwater. Care must be taken that contaminated liquids sent to the existing treatment system do not contain contaminants that the system is not capable of removing or that will disrupt the operation of the system. On-installation treatment of contaminated solid would entail establishing centralized treatment units in compliance with applicable regulatory requirements.

4.4 OFF-INSTALLATION TREATMENT

Treatment of IDW (including soil, liquid wastes, PPE, and disposable equipment) may be required for hazardous waste that does not meet the requirements for land disposal facilities. Landfills may specify treatment to certain levels prior to acceptance of wastes. In some cases, off-installation treatment may be more cost-effective than off-installation land disposal or on-installation treatment.

4.5 DISPOSAL OF HAZARDOUS WASTES WITHIN THE AOC

In some cases, IDW may be left on site within the AOC even if waste is considered hazardous. The decision to implement this option depends on the waste characteristics, media type, and degree of threat posed by the waste to human health and the environment. If IDW consists of hazardous soils that pose no immediate threat to human health and the environment, it may be left on site within the delineated AOC unit if approved by the site RPMs. Generally, the return of soil cuttings and/or drilling mud to the location from which they were taken will comply with ARARs based on the implication that the site will be further evaluated and treated during subsequent activities at the site. If this option is selected, the following actions must be taken:

- Delineate the AOC using markers such as flagging or fencing.
- Determine locations close to the soil source, such as a boring or test pit, in the AOC for waste burial or spreading.
- Place the hazardous IDW soil in pits and cover the pits with surficial soil to prevent dispersion.

Following waste disposal at the site, the containers used to contain the soil will be decontaminated and reconditioned for further use. IDW should not be disposed within the AOC if the following conditions apply:

- IDW is hazardous water or other aqueous liquid.
- IDW is hazardous soil that may pose a substantial risk to human health and the environment if left on site.
- IDW is PPE or disposable equipment.

5.0 COMPLIANCE WITH ARARS

The NCP requires that handling of IDW meet all ARARs to the extent practicable considering the urgency of the situation. Applicable requirements are standards or criteria promulgated under federal or state law that specifically address a hazardous substance, pollutant containment, remedial action, location, or other circumstance at a project site (USEPA, 1988a). Relevant and appropriate requirements are standards or criteria promulgated under federal or state laws that are suited to a particular site because they address site scenarios sufficiently similar to those on which the regulations are based. Identification of ARARs first dictates the determination of whether a given requirement is applicable; then, if it is not applicable, a determination of whether it is both relevant and appropriate. This evaluation compares a number of site-specific factors with those addressed in the statutory or regulatory requirements. Factors considered include the hazardous substance present at the site, physical site features, or the type of remedial action.

A given requirement might be relevant, but not appropriate, for the project site; therefore, such a requirement would not be an ARAR for the site. When a requirement is deemed both relevant

and appropriate in a given case, this requirement must be complied with to the same degree as if it were applicable.

To-be-considered (TBC) criteria are nonpromulgated advisories or guidance issued by federal or state government that are not legally binding and do not have the status of potential ARARs. In many circumstances, TBC criteria will be reviewed along with ARARs in determining an IDW level that is sufficiently protective of human health and the environment.

There are several different types of ARARs, including chemical-specific, action-specific, and location-specific ARARs. Chemical-specific ARARs are usually health- or risk-based numerical values or methodologies applied to site-specific conditions. These values establish the acceptance concentration of a chemical substance that may be found in or discharged to the ambient environment. Action-specific ARARs are technology- or activity-based requirements or limitations on actions taken with respect to hazardous substances. Location-specific ARARs are restrictions placed on the concentration of hazardous substances or the conduct of activities solely because they occur in special locations.

Environmental laws and regulations that are potential ARARs for IDW at CERCLA sites include RCRA, including LDRs, the Toxic Substances Control Act (TSCA), the Clean Water Act (CWA), the Safe Drinking Water Act (SDWA), and existing state ARARs.

5.1 RESOURCE CONSERVATION AND RECOVERY ACT

RCRA was passed by Congress in 1976 to meet three goals: (1) The protection of human health and the environment; (2) the reduction of waste and the conservation of energy and natural resources; and (3) the reduction or elimination of the generation of hazardous waste as expeditiously as possible. The Hazardous and Solid Waste Amendments (HSWA) of 1984 significantly expanded the scope of RCRA by adding new corrective action requirements, land disposal restrictions, and technical requirements (USEPA, 1988b).

RCRA is the most important federal ARAR for IDW generation and management, because it specifically regulates all aspects of transportation, treatment, storage, and disposal of hazardous wastes. The determination of whether a waste is or is not hazardous may be made on the basis of knowledge of the IDW and associated suspected or known contamination, rather than by direct testing (USEPA, 1991). RCRA has ten discrete sections (subtitles) that address specific waste management activities. Two of these subtitles and their implementing regulations may be ARARs for IDW handling: Subtitle C (Hazardous Waste Management) and Subtitle D (Solid Waste Management).

Under RCRA Subtitle C, wastes are defined as hazardous on the basis of their source or method of generation ("listed" wastes) or their chemical constituents or characteristics ("characteristic" wastes). For example, xylene is a listed waste, and based on the "contained-in-interpretation" (USEPA, 1986) soil or groundwater contaminated with this waste would also be considered hazardous. Characteristic hazardous wastes include those wastes that have (1) extremely high or low pH, (2) high reactivity, (3) ignitability, or (4) toxicity as measured by a leaching procedure such as TCLP, or other criteria, as listed in 40 CFR 261.

One of the most significant provisions of RCRA, with respect to the disposal of IDW, is the provision for LDRs, which are defined by RCRA Section 3004. LDRs limit the types of wastes that may be disposed to land (such as landfills and surface impoundments). An important consideration in evaluating the applicability or relevance and appropriateness of LDRs is whether land disposal of RCRA-hazardous IDW has occurred. The AOC can be used to determine whether or not LDRs are applicable; however, the AOC concept applies only to contaminated soil or sediments from the site. Contaminated PPE, disposable equipment, or decontamination fluid that may be generated by investigation activities at the site are not included in the LDR approach to AOCs. Based on the delineation of an AOC, LDRs do not occur when hazardous IDW is:

- Stored in a container within the AOC and then returned to its source
- Moved within the AOC unit, as defined for a specific site
- Capped in place
- Treated “*in situ*”
- Processed within the AOC to improve structural stability
- Left in place, moved, or stored within a single AOC unit

However, LDRs do occur when hazardous IDW is:

- Composed of wastes from different AOCs which have been consolidated into one AOC
- Moved outside of an AOC for treatment and storage and returned to the same or a different AOC
- Excavated from an AOC, removed to a separate unit such as a tank, surface impoundment, or incinerator that is within the AOC, and then redeposited into the AOC

LDRs prohibit the storage of hazardous waste beyond specified time limits, unless the purpose of storage is to accumulate sufficient quantities of waste to promote proper disposal, treatment, or recovery. However, storage of IDW until a final disposal option is selected in a record of decision (ROD) may be considered allowable storage under the LDR storage prohibition. Conditions under which such storage occurs should comply with substantive regulations pertaining to storage of hazardous waste in containers (such as the provision of secondary containment for drums containing liquid wastes). The USEPA does not require that administrative requirements such as permits or ARARs be met, as long as substantive issues are addressed (USEPA, 1988b).

All LDRs must be followed to the extent practicable if hazardous IDW cannot be held within the delineated AOC. For example, if leaving hazardous IDW within the AOC would significantly increase risks to human health and the environment through fire, explosion, or toxicity, or other hazard, the IDW should be disposed of at an off-installation RCRA Subtitle C TSDF.

Hazardous decontamination fluids, PPE, and disposable equipment will be containerized and ultimately disposed off installation, unless a properly permitted TSDF is available on the installation for such disposal. IDW storage practices are described in Section 2.3, IDW

management options are discussed in Section 3.0, and disposal options are discussed in Section 4.0. Once hazardous wastes are taken outside the AOC, such wastes are subject to both the substantive and administrative requirements of RCRA.

Nonhazardous PPE or disposable equipment will be disposed of in facilities such as municipal landfills (RCRA Subtitle D). Nonhazardous IDW, such as soil cuttings, drilling mud, or sediment will be disposed of within the AOC if all other ARARs are met.

5.2 TOXIC SUBSTANCES CONTROL ACT

The TSCA was passed by Congress in 1976. This act establishes new requirements and authorities for identifying and controlling toxic chemical hazards to human health and the environment. Regulations associated with this act affect the handling and disposal of wastes containing polychlorinated biphenyls (PCBs) and asbestos. The potential impacts of these regulations on IDWs are noted below:

- Nonhazardous IDW containing PCBs or asbestos at concentrations greater than specified limits must be disposed of at facilities regulated under the TSCA (see 40 CFR 761.60). Options include incineration or disposal at TSCA chemical waste facilities.
- PCB-contaminated material such as IDW, with concentrations less than 50 parts per million (ppm), is not generally regulated under TSCA and may be disposed of in acceptable Subtitle D landfills. However, the PCB action level for the State of California is 5 ppm.

5.3 CLEAN WATER ACT

The CWA of 1977 addresses site-specific pollutant discharge limitations and performance standards for specific industries to protect surface water quality. The CWA also regulates criteria for selecting POTWs and sets Ambient Water Quality Criteria (AWQC). During field investigations, the most likely situation where the CWA will be applicable involves the indirect discharge of IDW water, regulated under CWA, to a POTW for treatment and disposal (USEPA, 1991). Prior to discharge of IDW waters to POTWs, the contractor will ensure that POTW/CWA standards are met.

5.4 STATE REQUIREMENTS

Other states have specific regulations for waste management. These regulations for waste management. These regulations will be addressed in site specific SAPs.

California regulations are provided here as an example. California Hazardous Waste Regulations - Title 26 (Toxics) of the CCR may contain ARARs for IDW management decisions. Title 26 regulations promulgate TLCs and STLCs as potential ARARs for the handling and disposal of IDW. Hazardous wastes (characteristic or listed) defined in Title 26 would be treated in the same manner as RCRA hazardous wastes.

The State Water Resources Control Board regulates and promulgates applicable water quality objectives that are potential ARARs for IDW soil and water handling. ARAR waivers may be available for state requirements specifically aimed at CERCLA sites or for state ARARs that are inconsistently applied (CERCLA section 121[d][4][E] and 40 CFR 300.430[f][1][ii][C][5]). Nonhazardous IDW which contain trace levels of contaminants will not be disposed of on site in a manner which may impact groundwater quality. Disposal of California restricted, nonhazardous wastes will be performed in accordance with Title 26.

6.0 REFERENCES

U.S. Environmental Protection Agency (USEPA), 1984. Waste Analysis Plans. Prepared by the Office of Solid Waste, October 1984.

USEPA, 1986. Test Methods for Evaluating Solid Waste, Third Edition SW-846. Prepared by the Office of Solid Waste and Emergency Response, November 1986.

USEPA, 1988a. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA, Interim Final. Prepared by the Office of Emergency and Remedial Response, October 1988.

USEPA, 1988b. CERCLA Compliance with Other Laws Manual, Draft Guidance. Prepared by the Office of Emergency and Remedial Response, August 1988.

USEPA, 1990. CERCLA Compliance with the RCRA Toxicity Characteristics (TC) Rule: Part II. Prepared by the Office of Solid Waste and Emergency Response, October 1990.

USEPA, 1991. Management of Investigation-Derived Wastes During Site Inspections. Prepared by the Office of Emergency and Remedial Response, Publication 9345.3-02FS, May 1991.

APPENDIX C

Field Forms



MWH
MONTGOMERY WATSON HARZA



MWH
MONTGOMERY WATSON HARZA

TAILGATE SAFETY MEETING FORM

Project Number:
1850805.010102

Date: _____ Time: _____ Job Number: _____
Client: United States Army Engineer District - Alaska Site-Specific Location: Gambell, Alaska

Safety Topics Presented

Protective Clothing/
Equipment: _____

Chemical Hazards: _____

Physical Hazards: _____

Special Equipment: _____

Other: _____

Emergency Procedure: _____

Hospital: Norton Sound Regional Hospital, Nome Phone: (907) 443-3311 (or 3353)
Providence Hospital, Anchorage (907) 562-2221

Hospital Address Air service from Gambell to hospital for serious injuries
And Route: 911/Medevac - Lifeguard Alaska 800-478-5433

ATTENDEES

NAME PRINTED

SIGNATURE

_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

Meeting Conducted By: _____

Project Safety Officer: Name Printed Signature
Bonnie McLean Project Manager: Gary Busse

USACOE

ACCIDENT REPORTING

Important Things to Remember

- All incidents are reportable (mishap that caused or could have caused injury or damage)
- Incidents classified as accidents are recordable (incidents that result in medical treatment, lost time, or >\$2K damage)
- Ensure casualty treated
- IMMEDIATELY notify SAAO. If AE/DAE/RE/OE is not available then you will contact Chief, CONOPS (753-2768)
- After notification IMMEDIATELY prepare and submit 265-R to SAAO Safety Officer (all incidents) within 24 hours. If Safety Officer is not available then FAX the former to District Safety Office on Fort Richardson (753-2591)
- Prepare and submit ENG FORM 3394 to SAAO within 48 hours (only if incident = accident)
- Use as much detail as possible when describing incident
- Submit ORIGINAL copy of ENG FORM 3394 to SAAO Safety Officer
- If you are not sure, ask the Safety Officer

POD AND HED
IMMEDIATE REPORT OF
ACCIDENT

SOHO USE ONLY	
Date Recd':	_____
Time Recd':	_____

TO: _____ FROM: _____ DATE: _____
(COE OFFICE)

1. Name of Person Reporting: _____ Phone No.: _____
(Print)

2. Location of Accident: _____

3. Date and Time of Accident: _____

4. 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. Contrator & 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. Description 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: _____

1. ACCIDENT CLASSIFICATION				
PERSONNEL CLASSIFICATION <input type="checkbox"/> CIVILIAN <input type="checkbox"/> MILITARY <input type="checkbox"/> CONTRACTOR <input type="checkbox"/> PUBLIC	INJURY/ILLNESS/FATAL <input type="checkbox"/> <input type="checkbox"/> FATAL <input type="checkbox"/> OTHER	PROPERTY DAMAGE <input type="checkbox"/> FIRE INVOLVED <input type="checkbox"/> OTHER <input type="checkbox"/> FIRE INVOLVED <input type="checkbox"/> OTHER	MOTOR VEHICLE INVOLVED <input type="checkbox"/> <input type="checkbox"/>	DIVING <input type="checkbox"/> <input type="checkbox"/>

2. PERSONAL DATA				
a. Name (Last, First, MI)	b. AGE	c. SEX <input type="checkbox"/> MALE <input type="checkbox"/> FEMALE	d. SOCIAL SECURITY NUMBER	e. GRADE
f. JOB SERIES/TITLE	g. DUTY STATUS AT TIME OF ACCIDENT <input type="checkbox"/> ON DUTY <input type="checkbox"/> TDY <input type="checkbox"/> OFF DUTY		h. EMPLOYMENT STATUS AT TIME OF ACCIDENT <input type="checkbox"/> ARMY ACTIVE <input type="checkbox"/> ARMY RESERVE <input type="checkbox"/> VOLUNTEER <input type="checkbox"/> PERMANENT <input type="checkbox"/> FOREIGN NATIONAL <input type="checkbox"/> SEASONAL <input type="checkbox"/> TEMPORARY <input type="checkbox"/> STUDENT <input type="checkbox"/> OTHER (Specify)	

3. GENERAL INFORMATION			
a. DATE OF ACCIDENT <i>(month/day/year)</i>	b. TIME OF ACCIDENT <i>(Military time)</i> hrs	c. EXACT LOCATION OF ACCIDENT	d. CONTRACTOR'S NAME (1) PRIME: (2) SUBCONTRACTOR:
e. CONTRACT NUMBER <input type="checkbox"/> CIVIL WORKS <input type="checkbox"/> MILITARY <input type="checkbox"/> OTHER (Specify)		f. TYPE OF CONTRACT <input type="checkbox"/> CONSTRUCTION <input type="checkbox"/> SERVICE <input type="checkbox"/> A/E <input type="checkbox"/> DREDGE <input type="checkbox"/> OTHER (Specify)	g. HAZARDOUS/TOXIC WASTE ACTIVITY <input type="checkbox"/> SUPERFUND <input type="checkbox"/> DERP <input type="checkbox"/> IRP <input type="checkbox"/> OTHER (Specify)

4. CONSTRUCTION ACTIVITIES ONLY <i>(Fill in line and corresponding code number in box from list - see help menu)</i>	
a. CONSTRUCTION ACTIVITY (CODE) #	b. TYPE OF CONSTRUCTION EQUIPMENT (CODE) #

INJURY/ILLNESS INFORMATION <i>(Include name on line and corresponding code number in box for items a, f & g - see help menu)</i>			
a. SEVERITY OF ILLNESS/INJURY (CODE) #	b. ESTIMATED DAYS LOST (CODE) #	c. ESTIMATED DAYS HOSPITALIZED (CODE) #	d. ESTIMATED DAYS RESTRICTED DUTY (CODE) #

a. BODY PART AFFECTED (CODE) # PRIMARY _____ SECONDARY _____	b. TYPE AND SOURCE OF INJURY/ILLNESS TYPE _____ (CODE) # SOURCE _____ (CODE) #
f. NATURE OF ILLNESS / INJURY (CODE) #	

6. PUBLIC FATALITY <i>(Fill in line and correspondence code number in box - see help menu)</i>	
a. ACTIVITY AT TIME OF ACCIDENT (CODE) #	b. PERSONAL FLOATATION DEVICE USED? <input type="checkbox"/> YES <input type="checkbox"/> NO <input type="checkbox"/> N/A

7. MOTOR VEHICLE ACCIDENT			
a. TYPE OF VEHICLE <input type="checkbox"/> PICKUP/VAN <input type="checkbox"/> AUTOMOBILE <input type="checkbox"/> TRUCK <input type="checkbox"/> OTHER (Specify)	b. TYPE OF COLLISION <input type="checkbox"/> SIDE SWIPE <input type="checkbox"/> HEAD ON <input type="checkbox"/> REAR END <input type="checkbox"/> BROADSIDE <input type="checkbox"/> ROLL OVER <input type="checkbox"/> BACKING <input type="checkbox"/> OTHER (Specify)	c. SEAT BELTS	USED NOT USED NOT AVAILABLE (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 <i>(Fill in line and correspondence code number in box from list - see help menu)</i>	
a. TYPE OF VESSEL/FLOATING PLANT (CODE) #	b. TYPE OF COLLISION/MISHAP (CODE) #

ACCIDENT DESCRIPTION *(Use additional paper, if necessary)*

See attached page.

11. CAUSAL FACTORS) (Read Instruction Before Completing)						
a. (Explain YES answers in item 13)		YES	NO			
DESIGN: Was design of facility, workplace or equipment a factor?		<input type="checkbox"/>	<input type="checkbox"/>	a. (CONTINUED) 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	YES	NO
INSPECTION/MAINTENANCE: Were inspection & maintenance procedures a factor?		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
PERSON'S PHYSICAL CONDITION: In your opinion, was the physical condition of the person a factor?		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
OPERATING PROCEDURES: Were operating procedures a factor?		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
JOB PRACTICES: Were any job safety/health practices not followed when the accident occurred?		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
HUMAN FACTORS: Did any human factors such as, size or strength of person, etc., contribute to accident?		<input type="checkbox"/>	<input type="checkbox"/>		<input type="checkbox"/>	<input type="checkbox"/>
ENVIRONMENTAL FACTORS: Did heat, cold, dust, sun, glare, etc., contribute to the accident?		<input type="checkbox"/>	<input type="checkbox"/>	b. WAS A WRITTEN JOB/ACTIVITY HAZARD ANALYSIS COMPLETED FOR TASK BEING PERFORMED AT TIME OF ACCIDENT? <input type="checkbox"/> YES <i>(If yes, attach a copy.)</i> <input type="checkbox"/> NO		

12. TRAINING		
a. WAS PERSON TRAINED TO PERFORM ACTIVITY/TASK? <input type="checkbox"/> YES <input type="checkbox"/> NO	b. TYPE OF TRAINING. <input type="checkbox"/> CLASSROOM <input type="checkbox"/> ON JOB	c. DATE OF MOST RECENT FORMAL TRAINING. (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	See attached page.
b. INDIRECT CAUSE(S)	See attached page.

14. ACTION(S) TAKEN, ANTICIPATED OR RECOMMENDED TO ELIMINATE CAUSES.
DESCRIBE FULLY:
See attached page.

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 CORPS _____ CONTRACTOR _____	d. DATE (Mo/Da/Yr)	e. ORGANIZATION IDENTIFIER (Div, Br, Sect)	f. OFFICE SYMBOL		

16. MANAGEMENT REVIEW (1st)		
a. <input type="checkbox"/> CONCUR b. <input type="checkbox"/> NON CONCUR c. COMMENTS		
SIGNATURE	TITLE	DATE

17. MANAGEMENT REVIEW (2nd - Chief Operations, Construction, Engineering, etc.)		
a. <input type="checkbox"/> CONCUR b. <input type="checkbox"/> NON CONCUR c. COMMENTS		
SIGNATURE	TITLE	DATE

18. SAFETY AND OCCUPATIONAL HEALTH OFFICE REVIEW		
a. <input type="checkbox"/> CONCUR b. <input type="checkbox"/> NON CONCUR c. ADDITIONAL ACTIONS/COMMENTS		
SIGNATURE	TITLE	DATE

19. COMMAND APPROVAL	
COMMENTS	
COMMANDER SIGNATURE	DATE

10.

ACCIDENT DESCRIPTION (Continuation)

1a.

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 discretion 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.

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: O-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-0810/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 | 14. ELECTRICAL |
| 2. SITE PREPARATION | 15. SCAFFOLDING/ACCESS |
| 3. EXCAVATION/TRENCHING | 16. MECHANICAL |
| 4. GRADING (EARTHWORK) | 17. PAINTING |
| 5. PIPING/UTILITIES | 18. EQUIPMENT/MAINTENANCE |
| 6. FOUNDATION | 19. TUNNELING |
| 7. FORMING | 20. WAREHOUSING/STORAGE |
| 8. CONCRETE PLACEMENT | 21. PAVING |
| 9. STEEL ERECTION | 22. FENCING |
| 10. ROOFING | 23. SIGNING |
| 11. FRAMING | 24. LANDSCAPING/IRRIGATION |
| 12. MASONRY | 25. INSULATION |
| 13. CARPENTRY | 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 | 13. DUMP TRUCK (OFF HIGHWAY) |
| 2. DRAGLINE | 14. TRUCK (OTHER) |
| 3. CRANE (ON VESSEL/BARGE) | 15. FORKLIFT |
| 4. CRANE (TRACKED) | 16. BACKHOE |
| 5. CRANE (RUBBER TIRE) | 17. FRONT-END LOADER |
| 6. CRANE (VEHICLE MOUNTED) | 18. PILE DRIVER |
| 7. CRANE (TOWER) | 19. TRACTOR (UTILITY) |
| 8. SHOVEL | 20. MANLIFT |
| 9. SCRAPER | 21. DOZER |
| 10. PUMP TRUCK (CONCRETE) | 22. DRILL RIG |
| 11. TRUCK (CONCRETE/TRANSIT MIXER) | 23. COMPACTOR/VIBRATORY ROLLER |
| 12. DUMP TRUCK (HIGHWAY) | 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 | PERMANENT PARTIAL DISABILITY |
| LWD | LOST WORKDAY CASE INVOLVING DAYS AWAY FROM WORK |
| NLW | RECORDABLE CASE WITHOUT LOST WORKDAYS |
| RFA | RECORDABLE FIRST AID CASE |
| NRI | NON-RECORDABLE INJURY |

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
HEAD, EXTERNAL	H1	EYE 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 which occurred during a single work day or shift.

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
	TO	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 repeated exposures to conditions of the work environment over a long period of me. 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, OCCUPATIONAL		DA	ARTHRITIS, BURSTITIS
	DB	BACK STRAIN, BACK SPRAIN	
	DC	CEREBRAL VASCULAR CONDITION: STROKE	
	DD	ENDEMIC DISEASE (OTHER THAN CODE TYPES R&S)	
	DE	EFFECT OF ENVIRONMENTAL 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	
	D8	DISABILITY, OTHER	

GENERAL NATURE CATEGORY	CODE	NATURE OF INJURY NAME
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 sliwer 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
	FELL, SLIPPED, TRIPPED
0210	FELL ON SAME LEVEL
0220	FELL ON DIFFERENT LEVEL
0230	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

CODE	SOURCE OF INJURY NAME
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)
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—FLAMMABLE
0730	PLASTIC
0740	WATER
0750	MEDICINE
0800	INANIMATE OBJECT
0810	BOX, BARREL, ETC.
0820	PAPER
0830	METAL ITEM, MINERAL
0831	NEEDLE
0840	GLASS
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)

CODE	SOURCE OF INJURY NAME
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 | 9. Swimming/designated area |
| 2. Boating—powered | 10. Swimming/other area |
| 3. Boating—unpowered | 11. Underwater activities (skin diving, scuba, etc.) |
| 4. Water skiing | 12. Wading |
| 5. Fishing from boat | 13. Attempted rescue |
| 6. Fishing from bank dock or pier | 14. Hunting from boat |
| 7. Fishing while wading | 15. Other |
| 8. Swimming/supervised area | |

NON-WATER RELATED RECREATION

- | | |
|------------------------------------------|---------------------------------------------------------|
| 16. Hiking and walking | 23. Sports/summer (baseball, football, etc.) |
| 17. Climbing (general) | 24. Sports/winter (skiing, sledding, snowmobiling etc.) |
| 18. Camping/picnicking authorized area | 25. Cycling (bicycle, motorcycle, scooter) |
| 19. Camping/picnicking unauthorized area | 26. Gliding |
| 20. Guided tours | 27. Parachuting |
| 21. Hunting | 28. Other non-water related |
| 22. Playground equipment | |

OTHER ACTIVITIES

- | | |
|----------------------------------------------------|----------------------------------|
| 29. Unlawful acts (fights, riots, vandalism, etc.) | 33. Sleeping |
| 30. Food preparation/serving | 34. Pedestrian struck by vehicle |
| 31. Food consumption | 35. Pedestrian other acts |
| 32. Housekeeping | 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 | 7. DREDGE/DIPPER |
| 2. SAIL BOAT | 8. DREDGE/CLAMSHELL BUCKET |
| 3. MOTOR BOAT | 9. DREDGE/PIPE LINE |
| 4. BARGE | 10. DREDGE/DUST PAN |
| 5. DREDGE/HOPPER | 11. TUG BOAT |
| 6. DREDGE/SIDE CASTING | 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 | 7. HAULAGE UNIT |
| 2. UPPER GUIDE WALL | 8. BREAKING TOW |
| 3. UPPER LOCK GATES | 9. TOW BREAKING UP |
| 4. LOCK WALL | 10. SWEEP DOWN ON DAM |
| 5. LOWER LOCK GATES | 11. BUOY/DOLPHIN/CELL |
| 6. LOWER GUIDE WALL | 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, by-products 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, judgement, 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 management 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.

APPENDIX D

Posters



MWH
MONTGOMERY WATSON HARZA

Alaska Department of Environmental Conservation

Discharge Notification and Reporting Requirements

AS 46.03.755 and 18 AAC 75.300-.307

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 discharges 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
Juneau: (907) 465-5200

Fairbanks: (907) 451-2360
Soldotna: (907) 262-5210

*Regulated UST facilities are defined at 18 AAC 78.005 and do not include heating oil tanks.

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**

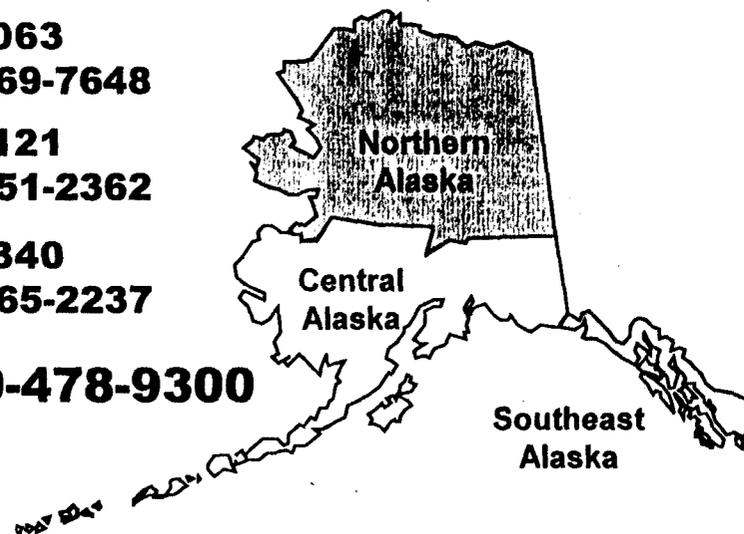
Northern Area Response Team: Fairbanks

**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

JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Provisions of the Act include the following:

Employers

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm to employees. Employers must comply with occupational safety and health standards issued under the Act.

Employees

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

Inspection

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

Complaint

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides that employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act.

Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discriminatory action.

Citation

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

Proposed Penalty

The Act provides for mandatory civil penalties against employers of up to \$7,000 for each serious violation and for optional penalties of up to \$7,000 for each nonserious violation. Penalties of up to \$7,000 per day may be proposed for failure to correct violations within the proposed time period and for each day the violation continues beyond the prescribed abatement date. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to \$70,000 for each such violation. A minimum penalty of \$5,000 may be imposed for each willful violation. A violation of posting requirements can bring a penalty of up to \$7,000.

There are also provisions for criminal penalties. Any willful violation resulting in the death of any employee, upon conviction, is punishable by a fine of up to \$250,000 (or \$500,000 if the employer is a corporation), or by imprisonment for up to six months, or both. A second conviction of an employer doubles the possible term of imprisonment. Falsifying records, reports, or applications is punishable by a fine of \$10,000 or up to six months in jail or both.

Voluntary Activity

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

OSHA has published Safety and Health Program Management Guidelines to assist employers in establishing or perfecting programs to prevent or control employee exposure to workplace hazards. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving safety and health problems or can refer you to other sources for help such as training.

Consultation

Free assistance in identifying and correcting hazards and in improving safety and health management is available to employers, without citation or penalty, through OSHA-supported programs in each State. These programs are usually administered by the State Labor or Health department or a State university.

Posting Instructions

Employers in States operating OSHA approved State Plans should obtain and post the State's equivalent poster.

Under provisions of Title 29, Code of Federal Regulations, Part 1903.2(a)(1) employers must post this notice (or facsimile) in a conspicuous place where notices to employees are customarily posted.

More Information

Additional information and copies of the Act, OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta, GA	(404) 562-2300
Boston, MA	(617) 565-9860
Chicago, IL	(312) 353-2220
Dallas, TX	(214) 767-4731
Denver, CO	(303) 844-1600
Kansas City, MO	(816) 426-5861
New York, NY	(212) 337-2378
Philadelphia, PA	(215) 596-1201
San Francisco, CA	(415) 975-4310
Seattle, WA	(206) 553-5930


Alexis M. Herman, Secretary of Labor

U.S. Department of Labor
Occupational Safety and Health Administration

Washington, DC
1997 (Reprinted)
OSHA 2203



U.S. Department of Labor

Log and Summary of Occupational Injuries and Illnesses

For Calendar Year 19 _____ Page _____ of _____

NOTE This form is required by Public Law 91-596 and must be kept in the establishment for 5 years. Failure to maintain and post can result in the issuance of citations and assessment of penalties. (See posting requirements on the other side of form.)

RECORDABLE CASES You are required to record information about every occupational death, every nonfatal occupational illness, and those nonfatal occupational injuries which involve one or more of the following: loss of consciousness; application of work or motion; transfer to another job; or medical treatment (other than first aid). (See definitions on the other side of form.)

Company Name _____
 Establishment Name _____
 Establishment Address _____
 Form Approved _____

Case or File Number	Date of Injury or Onset of Illness	Employee's Name	Occupation	Department	Description of Injury or Illness	Extent and Outcome of INJURY						Type, Extent of, and Outcome of ILLNESS											
						Fatalities		Nonfatal Injuries				Type of Illness							Fatalities		Nonfatal Illnesses		
						Injury Related	Injury Not Related	Injuries With Lost Workdays	Injuries Without Lost Workdays	CHECK Only One Column for Each Illness (See other side of form for terminology or permanent transfers.)	Illness Related	Illness Not Related	Illnesses With Lost Workdays	Illnesses Without Lost Workdays									
Enter DATE of death	Enter a CHECK if injury involves day, away from work, or day of restricted work activity, or both.	Enter a CHECK if injury involves days away from work.	Enter number of DAYS of restricted work activity.	Enter number of DAYS away from work.	Enter a CHECK if no entry was made in columns 1 or 2 but the injury is recordable as defined above.	Enter DATE of death	Enter a CHECK if illness involves days away from work, or days of restricted work activity, or both.	Enter a CHECK if illness involves days away from work.	Enter number of DAYS of restricted work activity.	Enter number of DAYS away from work.	Enter number of DAYS of restricted work activity.	Enter number of DAYS away from work.	Enter a CHECK if no entry was made in columns 6 or 7.										
(A)	(B)	(C)	(D)	(E)	(F)	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)					
PREVIOUS PAGE TOTALS																							
TOTALS (Enter these on other side of form.)																							

INJURIES

ILLNESSES

**REVIEW
COMMENTS**

**PROJECT: Supplemental Remedial Investigation DOCUMENT: Draft Workplan
LOCATION: Gambell, Saint Lawrence Island, Alaska**

Alaska Dept. of Environmental Conservation		DATE: 8/31/01 REVIEWER: Jeff Brownlee (ADEC) PHONE: (907) 269-3053	Action taken on comment by:		
Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE	MWH RESPONSE	USAED RESPONSE

1	General	Please include a section discussing the Applicable and Relevant or Appropriate Requirements (ARARs) and cleanup levels that apply to this work. The 1999 work was using method 2 as a cleanup goal.		ARARs section added, with Methods 1 and 2 cleanup levels proposed.	
2	Section 2.7, 2.8 Page 2-5, 2-6	Please change the text in the last sentence of the second paragraph in each of these sections to read "Additionally, soil samples will be collected from the midpoint or highest screening level of all borings.		Text added.	
3	Section 2.9, 2.10, 2.11, 2.12	Please add an additional boring to each of these sites. One boring is not statistically significant and could miss an area of contamination.		An additional boring is added to each of these sites (Sites 25B, 26, 27, and 28). Both soil borings from Site 12 (2 each) and the southernmost boring at Site 16 are deleted. Site 27 is redefined – it now consists of two former drum storage areas, located adjacent to and north of Site 7.	The SOW was modified to add five (5) discretionary soil borings based on field conditions.
4	Figures 2-4, 2-5, 2-8	Please clarify if any investigation of anomalies is planned for these areas of concern.		None planned under this investigation.	
5	Table 2-2	Please add PCBs to the borehole samples at site 7. Text states that transformers were supposedly buried at this location. This would be a good candidate for subsurface anomaly investigation.		No further PCB sampling planned under this SOW. PCBs were sampled for in 1994 and are no longer considered a contaminant of concern.	The SOW was modified to add PCB lab analysis for samples collected at Site 7 and redefined Site 27 (former drum storage area).
6	Section 6.0	Please reference the SOP for IDW in App. A		Reference added.	
7	Appendix A	Please include a SOP for well point installation and development. What is the procedure if refusal occurs during advancement of the well point?		SOP added to Appendix and language added to the text of Section 3 describing what happens in case of refusal: well point will be abandoned.	
8	General	The Technical Engineering Centers' photos show a large drum storage area north of site 25A. Please clarify if there has been any sampling in this area or community concern expressed		MWH is not aware of any sampling performed in this area. No community concern was expressed for the area north of Site 25A, however, there was a	The large drum storage areas shown in the TEC

**REVIEW
COMMENTS**

**PROJECT: Supplemental Remedial Investigation DOCUMENT: Draft Workplan
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Alaska Dept. of Environmental Conservation		DATE: 8/31/01 REVIEWER: Jeff Brownlee (ADEC) PHONE: (907) 269-3053	Action taken on comment by:		
Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE	MWH RESPONSE	USAED RESPONSE

		about contamination in this area.		concern about Site 25A.	report (north of Site 7) will be sampled as redefined Site 27.
9	General	A well written workplan. It appears good effort was made to address community concerns and new evidence of possible contamination found in the Technical Engineering Centers' aerial photos.		Noted. Thanks!	

**REVIEW
COMMENTS**

**PROJECT: Supplemental Remedial Investigation DOCUMENT: Draft Workplan
LOCATION: Gambell, Saint Lawrence Island, Alaska**

U.S. ARMY CORPS OF ENGINEERS		REVIEWER: Lisa K. Geist (CEPOA-EN-EE-A) PHONE: (907) 753-5742	Action taken on comment by:		
Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE	MWH RESPONSE	USAED RESPONSE

1.	Page 1-3 Section 1.4	Update the reference for Oil Spill Consultants Report to Final Remedial Action Report.....February 2001		Reference updated.	
2.	Page 1-5	Update Oil Spill Report reference.		Reference updated.	
3.	Page 1-5, 1 st pp	Confirmation samples only indicated that some contamination may still be present, characterization of the levels as high may be misleading. Also, the documented concentrations may not exceed levels permitted by ADEC depending on the methodology used to develop final cleanup levels. Also, since the methodology used to collect the confirmation samples is suspect, change the last sentence to reflect that concentrations of contaminants may exceed generic ADEC Method 2 cleanup levels.		Text corrected. ARARs section added per Jeff Brownlee's first comment, with ADEC Methods 1 and 2 cleanup levels proposed.	
4.	Page 1-5, 2 nd pp	If sample locations within existing sites (e.g. Site 6, 7 and 25) were selected based on review of the HTSA, those features should be listed here, or within Section 2.		Text added.	
5.	Section 2.1	Please clarify that the confirmation sampling will also include speciation of Chromium.		Text clarified.	
6.	Section 2.1	It would be more clear to state that Site 4A <i>formerly</i> contained transformers and two Quonset huts. Also, additional language should be added to explain that a removal action occurred in 1999, thus the confirmation samples were collected.		Text corrected and language added.	
7.	Section 2.2	It is incorrect to say "Currently, the site consists of burned timbers, a standing steel pole, stained soil, and debris." Stained soil was excavated, and miscellaneous debris was removed during the 1999 removal action by Oil Spill Consultants. I don't know if the steel pole or burned timbers still remain.		Text corrected.	
8.	Section 2.3 Figure 2-4	Do any of the proposed soil borings correspond to features identified the 2000 TEC report (e.g. "1980 - depressions")? If possible, provide graphic showing overlay on aerial		Figure updated to show air photo overlain by drawing, with details added.	

**REVIEW
COMMENTS**

**PROJECT: Supplemental Remedial Investigation DOCUMENT: Draft Workplan
LOCATION: Gambell, Saint Lawrence Island, Alaska**

U.S. ARMY CORPS OF ENGINEERS		REVIEWER: Lisa K. Geist (CEPOA-EN-EE-A) PHONE: (907) 753-5742	Action taken on comment by:		
Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE	MWH RESPONSE	USAED RESPONSE

		photography, including previous sampling locations, inferred landfill boundary from geophysical work, 2000 anomalies, and TEC features.			
9.	Section 2.4 Figure 2-5	Soil borings and well points should also be targeted based on the features identified by TEC. If possible, provide graphic overlay of Site 7 with aerial photography, previous sampling locations, TEC features, and locations of geophysical anomalies (incl. 2000 work). The 2 proposed soil borings on the north edge of Site 7 should correlate with 1955 drum feature identified by TEC.		Figure updated to show air photo overlain by drawing, with details added. The "1955 drum feature identified by TEC" is now a redefined Site 27. The two proposed soil borings on the north edge of Site 7 were moved to correlate with the 1955 drum storage area at the new Site 27 (one additional boring was added – total of three soil borings).	
10.	Section 2.4	In addition, at least one soil boring from Site 7 and/or Site 6 should be re-positioned such that any topographic "low areas" are covered. Refer to areas of possible "drainage" identified by Morgan Apatiki, and field reconnaissance.		Borings from Site 7 moved to redefined Site 27.	
11.	Section 2.5	Barrels of asphalt were also removed from Site 8 during the 1999 Oil Spill Consultants fieldwork. The confirmation sample appears to have been taken near the area where these drums were formerly located (as shown on Figure 2-6), and not to confirm surface debris removal as implied by the text.		Text corrected.	
12.	Section 2.6	The final Oil Spill Consultants Report does not contain a Table 6A, however, Table 8 does refer to sample 99-GAM-011-SL as being part of Site 8. However, this table is inconsistent with Figures 3 and 4 as well as the accompanying text in the Oil Spill Report. Therefore, Table 8 is most likely incorrect in referring to sample 011 as being part of Site 8. Please revise the workplan accordingly. A third grid should be added to cover the former location of sample 99-GAM-011-SL. A third triangular grid is already shown on Figure 2-7, which conflicts with the text of section 2.6.		Test revised.	
13.	Section 2.6 Figure 2-7	Provide graphical overlay of "disturbed areas" identified by TEC near Site 12. Will second soil boring be located in the field – it is not shown on the figure. Also, "disturbed areas"		Both soil borings deleted from Site 12.	

**REVIEW
COMMENTS**

**PROJECT: Supplemental Remedial Investigation DOCUMENT: Draft Workplan
LOCATION: Gambell, Saint Lawrence Island, Alaska**

U.S. ARMY CORPS OF ENGINEERS		REVIEWER: Lisa K. Geist (CEPOA-EN-EE-A) PHONE: (907) 753-5742	Action taken on comment by:		
Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE	MWH RESPONSE	USAED RESPONSE

		shown in TEC report appear to be located east of Site 12. These areas were identified based on 1980 aerial photography and may not be related to military use of the area. Recommend only installing 1 soil boring at Site 12, based on reported prior use of the Site for landfill activities.			
14.	Section 2.7	The proposed soil borings should be located to somewhat coincide with features identified in the TEC report, or possible "drainage" areas identified by Morgan Apatiki.		The southernmost soil boring was moved to Site 25B.	
15.	Section 2.8	The proposed soil borings may be adjusted in the field based on observations of "drainage" areas. However, the targeted locations identified on Figure 2-9 appear appropriate. If necessary, an additional soil boring could be added in this area by moving one from another site.		Noted.	
16.	Section 2.11 Figure 2-11	The identified sample location on Fig 2-11 does not correspond with the textual description of a suspected trench. Please move the proposed Site 27 and associated sampling location east. The highlighted area on Fig 2-11 corresponds to an area of "vegetation" identified from 1948 aerial photography.		Figure corrected.	
17.	Section 2	The area identified on Figure 2-9 as Site 24 (J) should also be sampled, based on the presence of multiple pits and trenches identified by TEC. Perhaps move 1 proposed soil boring from Site 12 or elsewhere.	W	No response required.	The SOW was modified to add five (5) discretionary soil borings.
18.	Section 3.2.1	Please clarify when the site reconnaissance will occur (e.g. prior to implementation of the sampling program).		Text added.	
19.	Section 8.0	Update the Oil Spill Consultants Report reference.		Reference updated.	
20.	Table 4-2	The ADEC Method II cleanup levels based primarily on migration to groundwater fall between the listed MDL and MRL for several analytes. These include: benzene, 1,1,2-trichloroethane, 1,1-dichloroethene, 1,2-dichloroethane, 1,2-dichloropropane, carbon tetrachloride, tetrachloroethene, and trichloroethene. The Method II cleanup levels for several		Table 4-2 revised due to change in laboratory (from CAS to ARI). ADEC Method 2 migration to groundwater, under 40-inch zone levels will be compared to ARI's MRLs and MDLs. In cases where cleanup levels are between the MRL and MDL, results will be	

**REVIEW
COMMENTS**

**PROJECT: Supplemental Remedial Investigation DOCUMENT: Draft Workplan
LOCATION: Gambell, Saint Lawrence Island, Alaska**

U.S. ARMY CORPS OF ENGINEERS		REVIEWER: Lisa K. Geist (CEPOA-EN-EE-A) PHONE: (907) 753-5742	Action taken on comment by:		
Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE	MWH RESPONSE	USAED RESPONSE
		other analytes are below the stated MDL. These include: antimony, methylene chloride, and vinyl chloride.		qualified as estimated values.	

**REVIEW
COMMENTS**

**PROJECT: Supplemental Remedial Investigation DOCUMENT: Draft Workplan
LOCATION: Gambell, Saint Lawrence Island, Alaska**

		REVIEWER: Ron Scrudato and Jeff Chiarenzelli PHONE: (315) 312-2883 DATE: August 14, 2001	Action taken on comment by:		
Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE	MWH AMERICAS RESPONSE	USAED RESPONSE

1.		It is well know that ordnance was used and disposed at various locations within the Gambell area, yet there is no indication that ordnance-related chemicals are included in the list of analytes in this or previous investigations. We believe this represents a major flaw in the proposed work plan and severely compromises the effective evaluation of the contamination resulting from the military occupation at Gambell.		Beyond the SOW; Alaska District will address this comment.	The Corps Engineering and Support Center, Huntsville has been conducting a separate investigation for ordnance at the Gambell Site. This investigation has been ongoing for two field seasons and is near completion. Even though no soil sampling was conducted under the Engineering Evaluation/Cost Analysis (EE/CA), it is highly unlikely that any buried munitions would have ruptured and contaminated the soil. The items in question are not fused and fired items and this was not an impact area where soil contamination may be encountered.
2.		It is recommended that all samples collected from sites that have not been previously evaluated be sampled and analyzed for the entire potential range of organic and inorganic contaminants known or likely to have been introduced to the Gambell area as a result of military occupation.		Beyond the SOW; Alaska District will address this comment.	The suite of analyses includes DRO/GRO/RRO, TAL metals, and VOCs. At selected areas, Sites 7 and 27, PCBs were also added. These compounds are the primary chemicals of concern for the Gambell area, based on the results of the Phase I and II investigations.
3.		Rather than arbitrarily selecting midpoint sampling in proposed bore holes, it is recommended bore hole samples be screened for organic substances using a PID and based on field screening, samples be collected from sample sections with positive PID responses for more detailed laboratory analysis.		Text added to describe that samples will be collected from locations within each borehole with the highest PID screening results.	

**REVIEW
COMMENTS**

**PROJECT: Supplemental Remedial Investigation DOCUMENT: Draft Workplan
LOCATION: Gambell, Saint Lawrence Island, Alaska**

		REVIEWER: Ron Scrudato and Jeff Chiarenzelli PHONE: (315) 312-2883 DATE: August 14, 2001	Action taken on comment by:		
Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE	MWH AMERICAS RESPONSE	USAED RESPONSE

4.		Were all the former sites that were evaluated and are now designated as "no further action" (NFA) sites evaluated for the presence of ordnance-related chemicals? If not, it is recommended that these NFA sites be re-classified until they are re-evaluated for the presence of these chemicals.		Beyond the SOW; Alaska District will address this comment.	The ordnance EE/CA has investigated all of the sites that were reported to have had munitions buried or disposed at. Only two sites had any evidence of OE items. These were small arms residue at the radar site and Site D (demo pit south of the lake). The radar site had some small arms casings remaining from the burn destruction of the radar building. Site D had small arms residue resulting from the destruction of small arms residue here. There would be no reason to conduct ordnance related chemical sampling at a site where ordnance presence cannot be confirmed from an earlier investigation targeted at finding ordnance.
5.		Clarification is requested on the site characterization and designation involving the remedial actions performed by Oil Spill Consultants in 1999. How were the sites selected and how were the areas designated for excavation determined? Is the report included in Section 1.4 of this report referencing Oil Spill Consultants available for review and was the company responsible for site characterization and selection of the proposed remedy?		See Oil Spill Consultants SOW, work plans, reports, and other documents. Justification of work performed by Oil Spill Consultants is beyond the SOW for this work plan.	Sites addressed during the Oil Spill Consultants 1999 removal action were initially investigated during the Phase I and II remedial investigations conducted by Montgomery Watson. A debris inventory identified eligible materials for building debris/ debris removal, and associated contaminated soils were also removed.
6.		It is suggested trenching be considered to investigate and evaluate pits and trenches. This would provide a far more effective evaluation of the extent of contamination or burial		Beyond the SOW; Alaska District will address this comment.	The goal of the Supplemental Investigation is to determine the presence or absence of chemical

**REVIEW
COMMENTS**

**PROJECT: Supplemental Remedial Investigation DOCUMENT: Draft Workplan
LOCATION: Gambell, Saint Lawrence Island, Alaska**

		REVIEWER: Ron Scrudato and Jeff Chiarenzelli PHONE: (315) 312-2883 DATE: August 14, 2001	Action taken on comment by:		
Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE	MWH AMERICAS RESPONSE	USAED RESPONSE

		in linear features than bore holes proposed in the work plan.			contamination in areas based on new information from the community and other recent reports (i.e. the historical aerial photo analysis). If significant chemical contamination is identified, the exact source may be addressed through future actions.
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**REVIEW
COMMENTS**

**PROJECT: Supplemental Remedial Investigation DOCUMENT: Draft Workplan
LOCATION: Gambell, Saint Lawrence Island, Alaska**

Sivuqaq, Inc.		DATE: August 30, 2001 REVIEWER: Morgan Apatiki, Community Liason PHONE: (907) 985-5826	Action taken on comment by:		
Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE	MWH AMERICAS RESPONSE	USAED RESPONSE

1.	Sec 1.1, page 1-1, Para. 1	Referring to the word "some", stating some sites. The word <u>some</u> related to unknown version. The locals want the complete collection of data requiring the PCB Analysis to correspond with Identifying and Clarifying the description of contaminating compound. Specifically, the nature and extent of contamination since some of the buried military debris are now under the building facilities. The people are aware of other sites recommended for no further action. They are asking is the wipe-sampling has been completed over the burial sites. They are anticipating to get information from the soil boring sampling at or near the burial sites and looking forward for the results of exposure environmental protocol.		Beyond the SOW; Alaska District will address this comment.	Analysis for PCBs was added to the SOW for samples collected at Site 7 and the redefined Site 27. The objective of this investigation is to determine if chemical contamination exists at depth.
2.	Para. 2	There is new information about undetected sites being located. Also information on surfaced debris by construction at the High school area, previously unreported. We are concerned if the surfaced debris may have any contamination or asbestos.		Beyond the SOW; Alaska District will address this comment.	Noted. The Supplemental Investigation is designed to fill data gaps and the discretionary soil borings will be used to determine the nature and extent of possible contamination.
3.	Sec. 1.4.2, Page 1-4, Para 2	There are reports of possible high-level contamination of lead and chemical on areas 1A and 2 from the eye-witness perspective. (Figure 2-1).		Beyond the SOW; Alaska District will address this comment.	Noted. These areas were previously investigated. No elevated levels of contamination were detected at Site 1A. Elevated levels of metals were detected at Site 2 during the Phase I investigation. However, upon further investigation during Phase II, it was determined that the elevated detection of lead in 1994 was from an isolated location.

**REVIEW
COMMENTS**

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LOCATION: Gambell, Saint Lawrence Island, Alaska**

Sivuqaq, Inc.		DATE: August 30, 2001 REVIEWER: Morgan Apatiki, Community Liason PHONE: (907) 985-5826	Action taken on comment by:		
Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE	MWH AMERICAS RESPONSE	USAED RESPONSE

4.	2.2 - S4a Page 2-2	During the 1997 and 1999 cleanup, the local laborers reported smelling intense fumes at sites 4a and 4b.		Noted. Sites 4A and 4B are addressed in this work plan.	
5.	2.2 - S4b Page 2-2	From the eye-witness perspective, the cause of the fire start from the tower and burned down. The heat was so intense that near-by barrels of fuel were burst and contents ignited. That was where the DRO originated from. The local people use the streams for water which are flowing down from the contaminated areas. It is recommended that these streams mentioned be tested for compatibility.		Noted. Sample collection from streams is beyond the SOW; Alaska District will address this comment.	Oil Spill Consultants removed contaminated soils (e.g. a source area) from Site 4B in 1999. However, additional confirmation samples will be collected during this field effort to determine the nature and extent of any remaining contamination. The Corps will re-evaluate these results to determine if further action is required.
6.	2.3 - S6 Page 2-2	There are reports of human waste landfill contained in 55 gallon barrels just West of site 6 and East from housings built in 1995. This area of landfill was detected and confirmed by the Golder Associates, Inc.		Noted.	
7.	2.4 - S7	The site for the proposed kindergarten school facility is designated in this area. It is now under feasibility study. Eye-witness reports state that this area was where a massive oil-spill took place. Recommended that a coordinator be assigned with Kawerak which is funding the project.		Noted. Alaska District will address this comment.	The Corps will continue to coordinate with all stakeholders and provide information to the community.
8.	2.4 - S7 Fig. 2-5	From traditional knowledge and natural terrain, the ground water flows West down to the former old housing and South to the farthest small pond beyond the end of Troutman lake.		Noted.	The natural flow of groundwater within the Village of Gambell is presumed to be from the south to north. However, local flow patterns on top of permafrost may follow

**REVIEW
COMMENTS**

**PROJECT: Supplemental Remedial Investigation DOCUMENT: Draft Workplan
LOCATION: Gambell, Saint Lawrence Island, Alaska**

Sivuqaq, Inc.		DATE: August 30, 2001 REVIEWER: Morgan Apatiki, Community Liason PHONE: (907) 985-5826	Action taken on comment by:		
Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE	MWH AMERICAS RESPONSE	USAED RESPONSE

					migration pathways such as sewer lines or other underground features.
9.	General info.	There are reports of DRO, GRO and RRO drainages being encountered by the construction workers, indicated in area 25A, area 7 and just East of the former old housing area. A sketch of the layout of the report has been sent via FAX to the Alaska District.		Noted.	These areas will be investigated during the supplemental investigation.

**REVIEW
COMMENTS**

**PROJECT: Supplemental Remedial Investigation DOCUMENT: Draft Workplan
LOCATION: Gambell, Saint Lawrence Island, Alaska**

Savoonga Native Corporation		DATE: August 27, 2001 REVIEWER: George Noongwook, Community Liason PHONE: (907) 984-6414	Action taken on comment by:		
Item No.	Drawing Sht. No., Spec. Para.	COMMENTS	REVIEW CONFERENCE	MWH AMERICAS RESPONSE	USAED RESPONSE

1.	Sec 1.4.2 Investigation History Para 1	Arsenic, barium, cadmium, etc. were also detected; however, the elevated concentrations of metals reported by URS were not substantiated during subsequent investigations. Please explain why they were not substantiated.		Subsequent investigations failed to reproduce the analytical results reported by URS, even though appropriate sample locations, collection techniques, and analytical methods were used.	
2.	Sec 2.1 Site 4A Quonset Huts Para 1	In 1999, Oil Spill Consultants reported DRO in soil at concentrations of up to 1,310 mg/kg. The referred locations were collected from the outskirts of the two Quonset hut frames (removed). Please explain why the samples have elevated levels of DRO.		The source of the DRO and the reason for its presence in soil at the outskirts of the Quonset hut frames are unknown.	
3.	Sec 2.2 Site 4B Para 1	Analysis of the soil samples collected showed elevated of metals, DRO and dioxins. It was apparent that only 24 inch of soil was removed and excavated soil confirmed DRO and dioxin levels of 13,900 mg/kg and 1,846 part per trillion (ppt), respectively. Where did the DRO Originate from and will the sampling protocol determine if There are remaining DRO and dioxins at this location? What was the cause of the fire that burned the buildings at this site?		See Morgan Apatiki's comment number 5. Remaining DRO levels will be determined by the proposed sampling and analysis; however, dioxin analysis is beyond the SOW (per instructions from Lisa Geist following a personal communication with Jeff Brownlee of ADEC).	
4.	Sec 2.3 Site 6 Military Landfill Para 3	To determine the nature and extent of soil contamination, three boreholes will be drilled to the permafrost. The timing of the boreholes is critical because the permafrost Level of the ground will differ depending on the season. For example during the early summer, the permafrost will be closer to the surface than when compared to late fall in October. Therefore, we would recommend that borehole depth be determined in feet below ground surface before boring.		This work is planned for September 2001, when permafrost depth is expected to be deeper than other times of the year. Text has been added to clarify that boreholes will be advanced to 12 feet below ground surface unless permafrost is encountered at less than 12 feet bgs. The equipment proposed for drilling the boreholes cannot penetrate permafrost.	
5.	Fig 2-5 Site 7	This figure does not show the groundwater flow direction. The legend denotes that there is.		Figure corrected.	
6.	General	On November 3, 2000 RAB Meeting, NALEMP Program involving local community members to recommend buried debris cleanup actions to be taken by DoD under SPIP were asked when the NALEMP removal program was beginning.		Alaska District will address this comment.	It remains uncertain when a NALEMP removal program might begin. Further

**REVIEW
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		In Site 25A-Gambell South Housing Area, this area was noted to have stained soils during installation of water mains. If the area were found to contain contaminated soil, would it qualify under NALEMP removal action?			updates will be provided to the community in the future. If soil contamination if determined to be of military origin, and poses a significant risk to human health and the environment, projects may be eligible for cleanup under the FUDS or NALEMP programs.
7.	General	Morgan Apatiki suggested that air and water quality testing be done in an around the high school area. Pam Miller further suggested that it would be possible to test for volatile organics if there were spills of solvents and chemicals. Conceivably, NALEMP Program can address this concern. We want to reassure that our children are protected from any possible contaminants, which may have been buried in this area. Contractors reported to have encountered buried debris during construction of the high school there.		Beyond the SOW; Alaska District will address this comment.	Volatile organic compounds will be analyzed for at Sites 6, 7, and the discretionary soil borings.
8.	General	The need for documentation of contaminants encountered during construction of residential homes and water mains was brought up by Jeff Brownlee at the November 3, 2000 RAB Meeting. Conceivably, SPIP program can be used to Document some of these concerns brought up by the Community.		Noted.	The objective of the current investigation is to resolve data gaps associated with these new areas of concern.