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Preliminary Assessment/Site Inspection Report for Tatalina Long Range Radar Site

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Acronyms and Abbreviations

°F	degrees Fahrenheit
µg/L	micrograms per liter
1,2-DCA	1,2-dichloroethane
611 CES/CEAR	611th Civil Engineer Squadron/Assessment Management Flight, Environmental Restoration Section
611 CEOS/CEVR	611 Civil Engineer Operations Squadron/Assessment Management Flight, Environmental Restoration Section
AAC	Alaska Administrative Code
AC&W	Aircraft Control and Warning
ADCCED	Alaska Department of Commerce, Community, and Economic Development
ADEC	Alaska Department of Environmental Conservation
AFCEC	Air Force Civil Engineer Center
amsl	above mean sea level
ASL	Applied Sciences Laboratory
AST	aboveground storage tank
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CSM	conceptual site model
CSP	Contaminated Sites Program
DERA	Defense Environmental Restoration Account
DPS	direct-push system
DQO	data quality objectives
DRO	diesel-range organics
EDB	ethylene dibromide
EPA	U.S. Environmental Protection Agency
E-S	Engineering-Science
FSP	Field Sampling Plan
GAC	granular-activated carbon
GRO	gasoline-range organics
HDPE	high-density polyethylene
HSP	Health and Safety Plan
IDW	Investigation-derived waste
IRP	Installation Restoration Program
JBER	Joint Base Elmendorf-Richardson
LNAPL	light non-aqueous phase liquid
LOQ	limit of quantitation
LRRS	Long Range Radar Site
LUST	Leaking Underground Storage Tank
MAR	Minimally Attended Radar
MDL	method detection limit
mg/kg	milligrams per kilogram
mg/l	milligrams per liter
OD	outer diameter
ORP	oxidation-reduction potential

OWS	oil-water separators
PA/SI	Preliminary Assessment/Site Inspection
PID	photoionization detector
POL	petroleum, oil, and lubricants
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
QAPP	Quality Assurance Project Plan
RRO	residual-range organics
SAP	Sampling and Analysis Plan
SL	screening level
SOP	standard operating procedure
SOW	scope of work
SVOC	semi-volatile organic compound
TIC	tentatively identified compound
TO	Task Order
URS	URS Group Inc.
USAF	U.S. Air Force
USFWS	U.S. Fish and Wildlife Service
UST	underground storage tank
VOA	volatile organic analysis
VOC	volatile organic compound
WACS	White Alice Communications System
WCC	Woodward-Clyde Consultants, Inc.
WGS	World Geodetic System
WRCC	Western Regional Climate Center

Executive Summary

Preliminary Assessment/Site Inspection, Site TU/US-C613 – Removed UST 500-1, Tatalina Long Range Radar Site, Alaska

The 611th Civil Engineer Squadron/Assessment Management Flight, Environmental Restoration Section (611 CES/CEAR) at Joint Base Elmendorf-Richardson (JBER), Alaska, and the Air Force Civil Engineer Center (AFCEC) have completed this Preliminary Assessment/Site Inspection (PA/SI) to evaluate potential releases of petroleum, oil, and lubricants (POL)-related hazardous substances, pollutants, or contaminants. This summary provides an overview of the PA/SI activities, results, and conclusions for the site.

Project Setting

Historical site use and previous investigation findings suggest that the primary source of contamination at the installation is associated with past leaks or spills from fuel storage and delivery practices. Information has been located related to the removal of one underground storage tank (UST) at the installation; however, this UST was not labeled UST 500-1, nor was it associated with Building 500.

Available documentation is somewhat unclear; however, it appears the UST was used to store gasoline and was removed in October or November, 1993.

Project Objectives

The PA/SI was a limited field evaluation for which the primary objective was to evaluate the presence or absence of POL-related hazardous substances, pollutants, or contaminants. The site was evaluated for potential releases and associated soil or groundwater contamination. Secondary objectives of data collection included evaluation of the extent of contaminated soil or groundwater to support decision-making for future investigations, risk assessments, or remedial actions, as required. Accordingly, the PA/SI included the following:

- Review available historical information for the site.
- Collect soil and groundwater samples from the site.
- Submit the samples for laboratory analysis for chemicals most likely to be present based on the site history and suspected contaminant source(s).
- Compare analytical data to conservative, risk-based screening levels.

What's Been Done So Far?

This PA/SI has undergone the following evaluation steps:

1. **Site Identification:** The site was identified from previous investigations.
2. **Document Review:** Available documentation regarding the site was researched, and existing site information and previous investigation results were reviewed to assist in the development of the PA/SI Work Plan (CH2M HILL, 2012), which was approved by the Alaska Department of Environmental Conservation (ADEC) in June 2012.
3. **Visual Site Inspection:** A visual site inspection of the site was completed on August 9, 2012, prior to intrusive activities. During the site inspection, the site was examined for potential sources and signs of contamination and to confirm that the planned field sampling approach remained optimal. Available plans, reports, and drawings were reviewed and onsite personnel were interviewed to obtain site-specific background information.

4. **Soil and Groundwater Sampling:** Surface and subsurface soil, and groundwater samples were collected from three soil borings on August 10, 2012, in general accordance with the approved project WP. The samples of site soil and groundwater were collected and submitted to an offsite laboratory for analysis.
5. **Data Evaluation:** Chemical analytical results were validated and compared to risk-based screening levels.
6. **Reporting:** This PA/SI report was prepared to describe the work that was completed, and present the PA/SI results and conclusions.

What Did the Air Force Find Out?

Concentrations of benzene, ethylene dibromide (EDB), and xylenes were detected above screening levels in subsurface soil outside of the understood excavation area for the former 275-gallon UST while the samples collected from within the excavation area yielded results below screening levels. This suggests that residual petroleum-affected soil may remain outside of the original excavation area. However, groundwater samples collected from each of the three borehole locations yielded results below screening levels for all analytes besides metals.

Concentrations of several total metals did exceed soil and groundwater screening levels. Given that known site activities would not be expected to contribute to higher concentrations of these metals, it is suspected that these results may be attributable to background or naturally occurring concentrations in soil and groundwater. However, data for background metals concentrations in soil were not readily available during this PA/SI, nor collected during this study for comparison. Furthermore, the groundwater was sampled from undeveloped driven probes and was highly turbid, which may have biased high the groundwater sample results for total metals.

Based on the results, additional soil investigation of the lateral and vertical extent of benzene, m- & p-xylene, and EDB-affected soil may be required. No additional groundwater investigation appears to be warranted.

Introduction

This document provides the results of the Preliminary Assessment/Site Inspection (PA/SI), consisting of a review of existing information, site reconnaissance, and limited field sampling conducted for Site TU/US-C613 at Tatalina Long Range Radar Site (LRRS), Alaska (Figure 1-1).

The Tatalina LRRS PA/SI effort is administered by the 611 Civil Engineer Squadron/Assessment Management Flight, Environmental Restoration Section (611 CES/CEAR) located at Joint Base Elmendorf-Richardson (JBER), Alaska. This PA/SI report has been prepared in support of CH2M HILL's prime contract FA8903-08-D-8769 with the Air Force Civil Engineer Center (AFCEC), Task Order (TO) 314.

The field work was conducted in October 2011 and August 2012 in general accordance with the *Final Work Plan for Preliminary Assessments/Site Inspections for Cape Lisburne, Cape Newenham, Indian Mountain, and Tatalina Long Range Radar Stations, and King Salmon Air Station* (Work Plan) (CH2M HILL, 2012).

The following sections describe the general installation characteristics of Tatalina LRRS that apply to site TU/US-C613. Investigation and results for Site TU/US-C613 are presented in Part 2.

1.1 Project Background

The purpose of this project was to conduct a PA/SI at Site TU/US-C613 identified by AFCEC and located at Tatalina LRRS. The site is undergoing a PA/SI to evaluate releases of hazardous substances, pollutants, or contaminants and whether surface or subsurface soil or groundwater contamination is associated with the site. Secondary objectives of data collection include assessing the nature and extent of contaminated soil or groundwater (if present) to support decision making for future investigation, risk assessment, and/or remedial action. The site was initially identified in a *Final Evaluation Report, Volume II, Air Force Compliance Clean-Up Sites, Identification and Evaluation of Defense Environmental Restoration Account Eligibility for Air Force Center for Engineering and the Environment, Multiple Locations* (URS Group, Inc. [URS], 2009).

The approach for the PA/SI was described in the Work Plan (CH2M HILL, 2012). The Work Plan, which includes the Health and Safety Plan (HSP), Sampling and Analysis Plan (SAP), Field Sampling Plans (FSPs), and Quality Assurance Project Plan (QAPP), was approved by AFCEC and 611 CES/CEAR in May 2012 and the Alaska Department of Environmental Conservation (ADEC) on June 20, 2012. This Work Plan describes the data quality objectives (DQOs), sampling methodologies, and analytical program for assessing conditions at the identified site to make decisions about the need for further investigation, risk assessment, and remedial action.

The PA/SI is a limited field inspection for which the primary objective is to confirm the presence or absence of petroleum, oil, and lubricants (POL)-related hazardous substances, pollutants, or contaminants. A site with positively confirmed contamination that exceeds regulatory screening levels (SLs) may be recommended for further investigation. Decisions regarding whether a site is considered contaminated and what defines the nature and extent of contamination are made by comparing analytical data obtained from site soil and/or water sampling to SLs.

1.2 Installation History

Tatalina LRRS, located in the upper Kuskokwim River Delta and 240 miles northwest of Anchorage, is accessible only by air or water. The facility is situated on 4,968 acres at the base of Takotna Mountain on the eastern flank of the Kuskokwim Mountains in Interior Alaska (AFCEC, 1995). This area is considered part of the Kuskokwim-Tanana Lowlands (AFCEC, 1995). Tatalina LRRS is located at latitude 62°53'36.77"N and longitude 155°58'11.309"W based on the 1984 (revised 2004) World Geodetic System (WGS) datum.

The LRRS comprises four distinct areas: the Upper Camp on Takotna Mountain, the Lower Camp, the airstrip, and the barge landing site along the Kuskokwim River known as “Sterling Landing” (AFCEC, 1995). The Upper and Lower Camps are connected by a winding road and an abandoned tramway.

Following World War II, the defense of North America, including Alaska, became increasingly important. The growing presence of the Soviet Union and the perceived communist threat motivated General Dwight D. Eisenhower to initiate the major rebuilding of the Alaskan Air Command Facilities (AFCEC, 1995). One of the first goals was construction of a permanent Aircraft Control and Warning (AC&W) system.

Tatalina LRRS was one of the original 10 AC&W sites built in the 1950s in Alaska as part of an air defense communication system. Construction of the installation was completed in 1952, and the facility became operational as a ground-controlled interceptor site (AFCEC, 1995). Communications were originally provided by high-frequency radio, which was replaced by the White Alice Communications System (WACS) in 1957. The WACS was replaced in 1979 by the Alascom commercially owned and operated satellite earth terminal communications system.

As obsolete systems were upgraded and replaced with modern systems requiring fewer personnel to operate them, the number of military personnel required to operate the station were reduced. By 1977, the personnel strength was reduced from 174 to 27 (AFCEC, 1995). In 1983, the remaining military personnel were replaced by contractor personnel to maintain the Joint Surveillance System equipment. In 1985, further reduction of personnel occurred when the AN/FPS-117 Minimally Attended Radar (MAR) was activated.

The Upper Camp, located at the top of Takotna Mountain, houses radar equipment. The Lower Camp has a runway and provides support to the Upper Camp from a composite facility constructed in 1984, which provides housing and industrial operations. Tatalina LRRS is resupplied by river barge. Cargo is offloaded at Sterling Landing on the Kuskokwim River and is transported 16 miles by truck to the installation.

1.3 Report Organization

This report presents the approaches and result of the PA/SI conducted at Tatalina LRRS, and is organized into the following two parts: Part 1 addresses both the general setting and background information for Tatalina LRRS, along with the general PA/SI methodologies, and Part 2 addresses the description and inspection results.

- Part 1 presents an overview of general conditions at Tatalina LRRS and details the general process used to complete the PA/SI. Part 1 contains the following sections:
 - Section 1: Introduction
 - Section 2: Tatalina LRRS Background and Conceptual Site Model
 - Section 3: Site Inspection Approach
 - Section 4: References
 - Figure
- Part 2 presents the PA/SI results for Site TU/US-C613. The individual report contains the following information specific to the site:
 - Section 1: Site TU/US-C613 – Removed UST 500-1 (which includes the site description and history and a summary of previous investigations)
 - Section 2: Conceptual Site Model
 - Section 3: Summary of Site Evaluation Activities and Results
 - Section 4: Conclusions
 - Section 5: References
 - Figures
 - Tables

Six appendixes are provided with this PA/SI:

- Appendix A: Field Notes, Soil Boring Logs, and Groundwater Logs
- Appendix B: Photographic Log
- Appendix C: Data Quality Assessment Report
- Appendix D: Laboratory Analytical Reports
- Appendix E: Laboratory Certifications
 - ADEC Certificate of Approval for Contaminated Sites Analysis (UST-79)
 - Laboratory Certificate of Accreditation (DoD-ELAP)
- Appendix F: Responses to Comments

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Tatalina LRRS Background and Conceptual Site Model

Conceptual site models (CSMs) integrate existing information and working assumptions about the physical site conditions; the nature, occurrence, and distribution of chemicals; fate and transport processes; and the possibility of subsequent human and ecological exposure to the chemicals at, or potentially released from, a site. This section presents background information and the overall CSM for Tatalina LRRS. This overall CSM forms the underlying structure for the site-specific CSM that describes the individual PA/SI site in Part 2 of this report.

2.1 Community and Surrounding Land Use

The land surrounding the LRRS was conveyed to and is owned by several Native corporations, including MTNT Limited and Doyon Limited (Woodward-Clyde Consultants [WCC], 1988). The Sterling-Ophir Highway, which extends from the community of Takotna (located 6 miles northwest of the installation) to Sterling Landing, runs through the installation (AFCEC, 1995). This road has a 100-foot right-of-way for private and public use. The community of McGrath, population 346, is 14 miles east of Tatalina, and there is no road connection between the two (Alaska Department of Commerce, Community, and Economic Development [ADCCED], 2011).

2.2 Climate and Weather

For the period 1981 through 2010, the annual average maximum temperature was 35.7 degrees Fahrenheit (°F), and the annual average minimum temperature was 23.2°F. Annual precipitation averaged 16.31 inches of rainfall and 86.8 inches of snowfall (Western Regional Climate Center [WRCC], 2011). The months of heaviest rainfall are July and August.

2.3 Site Features and Topography

Site TU/US-C613 is assumed to be located in the Lower Camp; therefore, only the site characteristics of the Lower Camp are discussed.

Tatalina LRRS is situated within the Kuskokwim Mountains. Topography in the area of the LRRS is moderately steep. From the top of Takotna Mountain at an elevation of approximately 3,199 feet above mean sea level (amsl), the terrain descends to an elevation of approximately 1,247 feet amsl at the Lower Camp over a distance of approximately 0.9 mile. Topography is a constant, moderate slope at the Lower Camp (WCC, 1988). The runway area is moderately level, and ground elevation at the airstrip is approximately 902 feet amsl. The area is surrounded by an upland spruce/hardwood forest-type habitat.

The hydrogeology of the Lower Camp is reported to be dominated by moderately thick mixed talus and alluvial deposits composed of sand, gravel, cobbles, and boulders that have been eroded from upslope regions (AFCEC, 1995). These deposits occur at or near ground surface, are seasonally highly permeable, and receive recharge from units upslope and from precipitation infiltration. Seasonal discharge is directed downslope to local surface waters.

The unconsolidated materials at the Lower Camp, estimated at 23 feet in thickness (water gallery depth), form the gently sloping valley floor below the station. The thickness of the surface residuum that overlies bedrock is probably greater at the airstrip, approximately 1.2 miles east of the Lower Camp, because of the presence of alluvial deposits from the Tatalina River, which flows past the airstrip approximately 0.9 mile to the west.

The existence and extent of permafrost at the Lower Camp is uncertain but is reported to be mostly continuous and restricted primarily to fine-grained sediment layers ranging from within a few feet of ground surface to a maximum depth of approximately 590 feet below ground surface (bgs) and usually absent from coarse-grained

sequences (Gilbert, 1986; WCC, 1988). It is unknown whether continuous permafrost exists at other parts of the LRRS. Regionally, the area is generally underlain by a thin layer of permafrost (less than 590 feet thick) (AFCEC, 1995).

Site-specific geology is discussed in Part 2.

2.4 Surface Water and Drainage

Three unnamed creeks and Beef Steak Creek drain Tatalina LRRS. Drainage is generally directed east and south to unnamed tributaries of the Tatalina River. Drainage from the Lower Camp flows southeasterly into an unnamed tributary of the Tatalina River and ultimately into the Tatalina River, which is the receiving body south of the installation (AFCEC, 1995). Runoff from the airstrip is directed easterly for a short distance and is then discharged into the Tatalina River.

2.5 Groundwater Use

During a 1996 study, the site geology was noted to generally consist of clayey gravels and sand with a perched water table at 10 feet bgs and groundwater at 17 feet bgs. Groundwater was encountered during excavation at the interface of the overburden and the underlying bedrock (approximately 9.5 feet bgs). The groundwater was thought to be infiltrating from a localized perched water table that had been penetrated during excavation and sampling.

Tatalina LRRS has a 106,000-gallon water tank that provides potable water for site operations and fire suppression (AFCEC, 1995). Water is supplied to the installation by a water gallery constructed to 23 feet bgs in the highly permeable mixed talus and alluvial deposits of the Lower Camp area (WCC, 1992).

2.6 Subsistence Activities

Numerous communities and Native corporations in the region such as Doyon Limited and MTNT Limited engage in subsistence harvest activities (ADCCED, 2011). Generally, the harvest area used by a community includes the land and waters within a radius of 50 miles or more of the community during the summer. The harvest area may expand considerably in winter as travel conditions improve.

2.7 Ecological Setting

2.7.1 Wetlands

Wetlands are abundant in the valleys and basins associated with large river systems, including the Yukon, Kuskokwim, Porcupine, Tanana, and Koyukuk rivers. Significant wetland areas also occur on the major river deltas in Alaska. The Yukon-Kuskokwim Delta, one of the world's largest coastal deltaic formations, supports a variety of wetland types, including wet tundra, grassy sloughs, shrub swamps, ponds, and brackish marsh (U.S. Fish and Wildlife Service [USFWS], 2011)

Most regions of Alaska have a land surface that includes extensive areas of wetlands. Interior Alaska contains millions of areas of black spruce muskeg and floodplain wetlands dominated by deciduous shrubs and emergents. Shrub and herbaceous bogs are a conspicuous feature of the landscape in Southcentral and Southeast Alaska (Hall et al., 1994).

The preliminary assessment prepared by the U.S. Air Force (USAF) (USAF, 11 Environmental and Contract Planning Section, 1991) stated that no wetlands existed within a 4-mile radius of the installation, with the exception of wetlands within the Tatalina River floodplains approximately 3 miles east of the installation. The Takotna River floodplains were reported to lie approximately 4 miles to the north and west of the installation. The report further stated that extensive wetlands exist within the general area just outside the 4-mile radius.

2.7.2 Endangered and Threatened Species

The environmentally sensitive areas map and most environmentally sensitive areas map contained in the *Interior Alaska Subarea Contingency Plan for Oil and Hazardous Substance Discharges/Releases* did not identify any endangered or threatened species, nor areas of concern such as migratory bird nesting or breeding areas (Alaska Department of Environmental Conservation [ADEC], 2000).

Raptors are reported as commonly occurring in this subarea, including bald and golden eagles (protected species), osprey, and falcons (including the American peregrine falcon, which is an endangered species). These species tend to nest on cliffs, bluffs, or other steep terrain (ADEC, 2000). Feeding areas used by raptors include most habitats found in Interior Alaska. Both resident and migratory raptors are found in the Interior Alaska Subarea.

Peregrine falcons begin arriving in the Interior Alaska area in mid-April and remain in the area through September. Nesting pairs have been reported along the Yukon and Tanana rivers (Luensmann, 2010). Prime nesting areas are at any bluff or steep course along rivers. Prime feeding areas include wetlands containing waterfowl, shorebirds, and other small birds. Peregrine falcons have not been reported as nesting in the vicinity of Tatalina LRRS.

2.8 Summary of Potential Receptors and Exposure Pathways

The known source of contamination in the vicinity of presumed Site TU/US-C613 is from gasoline that leaked from a former 275-gallon UST (Tank 4) associated with the water gallery pump. The CSM for exposure at Site TU/US-C613, including past or current sources of contamination, chemical release mechanisms, transport/exposure media, potential exposure points, potential exposure routes, and potential receptors, is presented in Worksheet 10, Problem Definition, in the Work Plan.

Potential human health exposure pathways include incidental human ingestion and dermal contact with the soil. Groundwater is also considered a complete pathway. All potential ecological exposure pathways are considered complete.

Potential receptors and exposure pathways are described below.

2.8.1 Human Exposure Pathways

Potential human health exposure pathways include incidental human ingestion and dermal contact with the soil. Groundwater is also considered a complete pathway. Potential human exposure scenarios include:

- **Excavation/Construction Workers:** Potential exposure of excavation/construction workers to constituents in subsurface soil, including surface soil from 0 to 2 feet bgs, and shallow groundwater by incidental ingestion, dermal contact, and inhalation of ambient dust and vapors.
- **Current and Future Occupational Workers:** Potential exposure of current and future occupational workers to constituents in soil to 2 feet bgs by incidental ingestion, dermal contact, and inhalation of ambient dust and vapors in ambient air; and inhalation of vapors migrating from subsurface soil and groundwater to indoor air.
- **Hypothetical Future Residents:** Potential exposure of hypothetical future residents to constituents in subsurface soil, including surface soil from 0 to 2 feet bgs, by incidental ingestion, dermal contact, and inhalation of ambient dust and vapors in ambient air.

2.8.2 Ecological Exposure Pathways

The site at Tatalina LRRS consists of highly developed and disturbed land with limited ecological habitat; there is limited potential for direct exposure of ecological receptors to the primary source of the contaminants in soil at this site.

Biota of concern for Tatalina LRRS includes terrestrial flora and fauna. Terrestrial vegetation includes vegetation that is available as forage. Grasses and other plants are readily consumed by herbivorous animals. Small mammals and birds are the primary terrestrial groups that may be receptors. Small mammals are typically abundant onsite and offsite, relatively mobile, and widely distributed.

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Site Inspection Approach

This section describes the site inspection approach and methodologies used to evaluate the site. The investigation and results are presented in Part 2 of this PA/SI.

3.1 Data Quality Objectives

Historical data gathered during the records review and site reconnaissance conducted at the site in October 2011 were reviewed to develop DQOs, a preliminary CSM, and field sampling strategies. These DQOs specify the type, quality, quantity, and uses of the data needed to adequately support site decisions. The program-level DQOs were presented in Worksheet 10, Problem Definition, in the Work Plan (CH2M HILL, 2012). Worksheet 17, Sampling Design and Rationale, in the Work Plan presented the general sampling designs that were developed from these DQOs for each of the sites. These sampling designs and approaches were used to develop the DQOs and FSPs specific to the site, including target analyte selection, which are presented in Appendix D of the Work Plan.

The program-level CSMs depicting the types of releases and affected media anticipated for the site at Tatalina LRRS are described below:

- **Surface Petroleum, Oil, and Lubricants Releases** – Sites with known or potential surface releases of POLs from ASTs and/or aboveground fuel pipelines
- **Subsurface Petroleum, Oil, and Lubricants Releases** – Sites with known or potential subsurface releases of POLs from buried fuel pipelines, USTs, valve pits, sumps, or leaching wells
- **Surface Multi-chemical Releases** – Sites with known or potential surface releases of non-POL chemicals (for example, solvents, metals, pesticides, or fuels), or a potential mixture of POL and non-POL chemicals released from drums, aircraft maintenance activities, fire training, waste burning/disposal areas, transformers, or wash pads
- **Subsurface Multi-chemical Releases** – Sites with known or potential subsurface releases of non-POL chemicals (or a mixture of POL and non-POL chemicals) from oil-water separators (OWSs), septic tanks, sumps, or drains.

The above-listed types of releases and associated sampling design requirements were the primary considerations in developing site-specific FSPs in the Work Plan (CH2M HILL, 2012). The overall investigation approach for the source evaluation is summarized below:

1. Collection of samples where contamination is most likely to be present based on evaluations of site operational history, review of historical documents and maps, and the result of site reconnaissance activities.
2. Analysis of samples for target constituents associated with chemicals potentially managed or released at the site.
3. Comparison of analytical results for site inspection samples to site inspection SLs.

3.2 Preliminary Conceptual Site Model Development

Preliminary CSMs were developed for the site identified at Tatalina LRRS. The preliminary CSMs were based on the current understanding of the site history and conditions, with the understanding that the CSM could be updated as necessary based on input from the field work.

The majority of the contaminant releases at the Tatalina LRRS, and therefore the contaminants of concern, were petroleum hydrocarbons, primarily gasoline fuels. Secondary analytes include diesel-range organics (DRO), residual-range organics (RRO), volatile organic compounds (VOCs), semi-volatile organic compounds (SVOCs), and metals.

As pure products, petroleum hydrocarbons such as diesel and motor gasoline fuels are less dense than water. When released into the environment in sufficient quantities, the petroleum hydrocarbons will accumulate as a light non-aqueous phase liquid (LNAPL) at the capillary fringe of the groundwater table surface or the permafrost interface, whichever occurs first. When the soluble portion of petroleum products dissolves in groundwater, the specific gravity of the aqueous plumes is nearly the same as that for uncontaminated groundwater, and the plumes will move with the groundwater flow. The insoluble portions will typically adsorb to the soil particles or become disconnected globules in the soil pore spaces.

When a hydrocarbon release occurs on the surface of unfrozen soils, the hydrocarbon tends to spread laterally across the ground surface and then infiltrates into the soils. The extent of lateral spreading across the ground surface is a function of quantity and rate of release and the permeability of the surface. Similarly, when a hydrocarbon release occurs from a below-grade tank or pipeline, the product initially will tend to spread in response to a pressure gradient around the leak location and then will infiltrate into the soils.

The infiltrating product from a surface spill or subsurface spill tends to flow primarily vertically under the influence of gravity through larger air-filled soil pores, although capillary forces may cause some lateral spreading. If a relatively small volume of product is spilled, the product likely will be immobilized in the soil above the groundwater table or permafrost. If a sufficient quantity of product is spilled, the infiltrating product either reaches the saturated capillary fringe and displaces some water from the saturated soil pores, or encounters frozen soil. If the product reaches saturated soil, the petroleum hydrocarbons tend to migrate laterally as a mound of LNAPL free product develops near the groundwater table.

The groundwater table at a site can fluctuate (rise and fall) seasonally based on hydrologic and hydrogeologic site conditions. As the groundwater table fluctuates, the mobile free product in the vicinity of the spill encounters uncontaminated soil and tends to be smeared or trapped as immobile residual product. At some sites, the releases from several tanks or piping leaks may coalesce into a complex contiguous source area.

Gravity drainage and flow of the LNAPL to a point of immobility probably occurs relatively quickly (in a period of weeks or months) at sites caused by a discrete spill event, but may occur over a period of years at sites with long-term product leaks. Because the known spills at the sites are several years to a few decades old, it is very likely that gravity drainage and flow of the LNAPL has already reached a point of immobility.

At all release sites where LNAPL is present, a portion of the LNAPL mass in the subsurface volatilizes into the air-filled soil pores, dissolves into the soil moisture and groundwater (if present), and is adsorbed by the soil solids (primarily the organic carbon) following the phase partitioning relationships. Therefore, the LNAPL at hydrocarbon spill sites tends to act as a long-term source of dissolved-phase and vapor-phase hydrocarbons. The dissolved- and vapor-phase contaminants will tend to migrate away from the LNAPL-contaminated soil source area, but the contaminant center of mass will not move appreciably when LNAPL is present. Infiltrating precipitation that encounters vadose-zone hydrocarbon will tend to carry dissolved-phase hydrocarbon toward the water table. At the water table, the precipitation containing the dissolved hydrocarbon mixes with the groundwater and is advected downgradient. Similarly, LNAPL in the saturated zone will tend to partition directly into the groundwater and be advected downgradient. Vapor-phase hydrocarbon tends to diffuse toward the ground surface and into the atmosphere, nearby buildings, or both. At some point downgradient of the spill location, the groundwater will discharge to and mix with surface waters. Biodegradation of hydrocarbons likely will occur throughout the contaminated zone (in the vadose zone and the saturated zone) and limit the extent of migration (Geosphere and CH2M HILL, 2006).

3.3 Site Inspection Screening Levels and Target Analytes

Worksheet 15, Reference Limits and Evaluation, of the Work Plan presents the SLs for each target analyte (CH2M HILL, 2012). Decisions regarding whether a site is considered contaminated and may require further investigation are made by comparing analytical results for site inspection samples to the site inspection SLs. The site inspection SLs are based on ADEC soil and groundwater cleanup levels as listed in 18 Alaska Administrative Code (AAC) 75 (ADEC, 2008; revised April 2012) and the U.S. Environmental Protection Agency (EPA) *Regional Screening Levels*

for *Chemical Contaminants at Superfund Sites* (EPA, 2012) (EPA regional SLs). The screening approach, in which individual sample point results are compared to conservative SLs, is informative for guiding potential future investigations, but is not necessarily indicative of actual or site-specific risk.

3.3.1 Soil Screening Levels

The primary sources of the human health risk-based soil SLs are the ADEC Method Two cleanup levels for direct contact and outdoor inhalation for sites with less than 40 inches of precipitation and the ADEC Method Two cleanup levels for migration to groundwater (listed in Tables B1 and B2, respectively, of 18 AAC 75.341 [ADEC, 2008; revised April 2012]). As identified in Worksheet 15 of the Work Plan, soil SLs are based on either direct contact, outdoor inhalation, or migration to groundwater cleanup levels, whichever is more stringent. For analytes without ADEC-listed values, the soil SLs are the human health risk-based residential values listed in the EPA regional SLs (EPA, 2012). No background data of naturally occurring metals concentrations in soil at Tatalina LRRS were readily available for evaluation during this PA/SI.

3.3.2 Groundwater Screening Levels

The primary source of the groundwater SLs is the ADEC cleanup levels listed in Table C of 18 AAC 75.345 (ADEC 2008; revised April 2012). For petroleum hydrocarbons including gasoline-range organics (GRO), DRO, and RRO, the SLs are set equal to the cleanup levels in Table C. For all other compounds, SLs are derived by dividing the cleanup levels in Table C by a factor of 10. For analytes without ADEC-listed values, groundwater SLs are the tap water values listed in *Regional Screening Levels for Chemical Contaminants at Superfund Sites* (EPA, 2012). No background data of naturally occurring metals concentrations in groundwater at Tatalina LRRS were readily available for evaluation during this PA/SI.

3.3.3 Target Analyte Identification

The target analyte list depends on the types of materials and chemicals handled and/or released at or near the site. Where historical analytical results for samples collected at that particular site were available, the results for those were considered when selecting target analytes and proposed boring locations. On the basis of site histories and operational information for Tatalina LRRS, the target analytes for the surface and subsurface POL release sites were expected to be chemicals that make up one or more of the following analytical suites:

- Petroleum hydrocarbons including GRO, DRO, and RRO
- VOCs
- SVOCs
- Metals (total metals in groundwater)
- Ethylene dibromide (EDB)
- 1,2-dichloroethane (1,2-DCA)

3.4 Field Sampling Program

Appendix D of the Work Plan (CH2M HILL, 2012) contains the FSP for the site under evaluation at Tatalina LRRS. The FSP identified the target analytes and described the proposed field sampling program to complete the site inspection.

The sampling program for the site focused on the most likely locations and depths for releases of hazardous substances or petroleum products to have occurred. The program-level DQOs, detailed in Table 10-1 of the Work Plan (CH2M HILL, 2012), were used to guide the sampling program at the site. Site information acquired through research of existing information and reports (if any) was also used to determine optimum placement of sample locations. The rationale for the number and locations of samples were detailed in the FSP and Worksheet 18 of the Work Plan. The methods and procedures for completing the field investigations were summarized in the FSP and detailed in the standard operating procedures (SOPs) appended to the Work Plan (Appendix G).

General field sampling methodologies and procedures are summarized below. Site-specific methodologies used, if significantly different from the discussion below, are detailed in Part 2 of this report. The PA/SI activities were

conducted using the project Work Plan (CH2M HILL, 2012) and there were no deviations from the Work Plan. Samples were collected from the specified depth intervals listed in the site-specific FSP in Appendix D of the Work Plan: surface soil at a depth interval of 0 to 2 feet bgs, the 2 feet bgs sample at a interval of 2 to 4 feet bgs, the 5 feet bgs sample at a depth interval of 5 to 7 feet bgs, and the 10 feet bgs sample at a depth interval of 10 to 12 feet bgs.

Field records, including the field notes, soil boring logs, and groundwater sample logs, are provided in Appendix A of this report. A photographic log of the site is provided in Appendix B.

3.4.1 Utility Locates

Following USAF and ADEC approval of the Work Plan, the CH2M HILL field team and drilling subcontractor mobilized to Tatalina LRRS on August 9, 2012.

Upon arrival at the site, the field personnel marked proposed sampling locations with flags or paint and evaluated any additional access or logistics issues with respect to traffic controls, active site use, aircraft or controlled airfield zones, other controlled site access requiring an escort, or adjacent work activities.

Some sampling positions were altered slightly if warranted by the site conditions (site utilities, obstructions, vegetation, surface materials, and so on). Sampling sites were cleared by Arctec Alaska, Inc. personnel, and some sampling locations were altered following utility locates to provide maximum safe clearance prior to intrusive field work.

3.4.2 Surface Soil Sampling

In general, surface soil samples were collected in conjunction with subsurface soil sampling using the direct-push system (DPS) drilling capabilities of a Geoprobe 54LT. Surface soil samples were collected from the 0 to 2 foot bgs interval of each DPS soil core retrieved using a decontaminated stainless steel spoon. A representative soil sample was collected from the entire 0 to 2 foot bgs soil interval. Deviations are discussed in Part 2 of this report.

3.4.3 Subsurface Soil Sampling

In accordance with the Work Plan and site-specific FSP (Appendix D of the Work Plan), subsurface soil samples at the site were collected at multiple depth intervals based on site-specific rationales (CH2M HILL, 2012). A subsurface soil sample was targeted for collection within the smear zone (capillary fringe zone) where shallow groundwater was anticipated within the project scope of work. Site-specific subsurface sampling procedures, and depths investigated, are discussed in Part 2.

Proposed subsurface soil sampling locations were first cleared for any buried utilities as discussed in Section 3.4.1 above. A Geoprobe 54LT drilling rig was operated by Geotech, Inc. (drilling subcontractor) to drive a 2-inch-diameter steel macrocore sampler with a 1.75-inch-diameter, 4-foot-long, dedicated and disposable acetate liner. At the top of each sample interval, the macrocore sampler was driven into the subsurface soil. After the sampler was advanced, it was retrieved from the borehole, the acetate liner full of soil (soil core) was extracted from the macrocore sampler. The full acetate liner was then cut open so that the collected soil core was exposed and placed on a sample collection table in the orientation that it was collected.

In accordance with Appendix G, Field Standard Operating Procedures of the Work Plan, the soil core was field-screened by soil core and headspace organic vapor screening methods using a photo-ionization detector (PID) (CH2M HILL, 2012). The soil lithology and other subsurface soil conditions were then observed and logged including changes in lithology, color, moisture and density, and staining and odors, and recorded on the soil boring log as well. Field screening and lithologic observations were recorded in the soil boring logs provided in Appendix A of this report.

Following field screening and lithologic logging, subsurface soil samples were collected from each sample core. VOCs, GRO, EDB, and 1,2-DCA discrete soil samples were collected promptly following exposure of the soil core using a new, dedicated 5-gram TerraCore sampler. Soil samples were collected from the specified depth interval listed in the site-specific FSP unless otherwise determined by field screening and best field judgment. The

TerraCore sampler was driven into the soil core, filling the sampler, and then removed from the soil core. The 5-gram soil sample was then extruded into a pre-weighed and labeled 4-ounce sample container. This action was repeated five times to collect the required 25 grams of soil per sample. Methanol was immediately added to the sample container and the container lid was immediately screwed on tightly, forming a seal.

Each soil sample collected for analyses other than VOCs, GRO, EDB, and 1,2-DCA was then homogenized within the acetate liner; collected with a decontaminated, stainless steel spoon; and divided among the appropriate sample jars. Sample management and preservation techniques are discussed below in Section 3.4.7.

If sufficient soil volume for the necessary sample analyses and containers for a desired sampling interval was not obtained, or if poor soil core recovery was encountered, the drill rig was moved immediately adjacent to the initial hole and the macrocore was driven again to the desired sampling depth. The procedure described above was repeated until sufficient sample volume was obtained.

Site-specific procedures and any significant deviations from this procedure are discussed in Part 2.

The DPS drill rods, macrocores, and any tooling which contacted soil were thoroughly decontaminated between each sample location as described in Section 3.4.8 below.

3.4.4 Temporary Well Installation

To investigate the potential presence of contamination constituents in groundwater, representative groundwater samples were collected to assess whether chemicals of interest had the potential to affect local groundwater. Following collection of the deepest subsurface soil sample within the smear zone/capillary fringe zone and if shallow groundwater was present, several temporary groundwater well points were installed in accordance to the site-specific FSP (Appendix D) and field SOPs (Appendix G) in the Work Plan (CH2M HILL, 2012). Each temporary well point consisted of either a 0.5-inch-diameter, micro-laser slot steel pipe or continuous-wrap, wire-wound, steel screen advanced to approximately 2 to 5 feet below the static groundwater table. The use of micro-laser slot steel pipe or continuous-wrap, wire-wound, steel screen was selected based on the soil density and anticipated groundwater recovery of the formation at each sampling location. Typically the screens were set below the groundwater interface as approximated by examining the lithology within the soil cores. If the soil cores indicated a possibility of the presence LNAPL, then the screens were set to straddle to the water table by placing approximately 1 to 1.5 feet of screen above the groundwater interface. Site-specific procedures and any significant deviations from this procedure are discussed in Part 2. In some sampling locations, groundwater was not encountered within the predetermined maximum boring depth due to refusal or absence of groundwater. These specific borings are discussed in Part 2.

3.4.5 Groundwater Sampling

Prior to groundwater sampling, all water quality measurement instruments were calibrated daily according to manufacturer's instructions. Field water quality parameters were measured at temporary monitoring wells using a YSI 600, flow-through cell, and Hach turbidity field meter. Field water quality parameters measured included temperature, pH, turbidity, specific conductance, dissolved oxygen, temperature, and oxidation-reduction potential (ORP), which were documented in the groundwater sampling logs presented in Appendix A.

In general, most viable temporary monitoring wells were purged prior to groundwater sampling; however in poorly recovering formations, no-purge groundwater sampling methods were used as described in the Appendix G, Field Standard Operating Procedures of the Work Plan (CH2M HILL, 2012). Temporary monitoring wells were purged (if appropriate) and sampled using a variable-speed, Geopump Series II peristaltic pump, fitted with dedicated 0.25-inch outer diameter (OD) high-density polyethylene (HDPE) tubing. Prior to well purging and groundwater sampling, the depth to water and total well depth were measured using a water level indicator. The depth to water, total well depth, and known length of the well screen were used to calculate and place the sample tubing intake generally at the mid-point between the groundwater interface and the bottom of the well screen for purging and sample collection.

During purging, the water level, pumping rate, and field water quality parameters were measured after approximately each well volume was extracted. Purging stopped after three well volumes were extracted or the well purged dry. If no-purge sampling methods were used, only an initial and final set of field water quality parameters were measured. Field observations and water quality measurements during purging were recorded in the site-specific groundwater sampling forms provided in Part 2.

Immediately following collection of water quality parameters, samples for chemical analysis were collected using the peristaltic pump. Samples to be analyzed for VOCs, GRO, EDB, and 1,2-DCA were collected first, followed by SVOCs and metals. Samples were collected in the appropriate volatile organic analysis (VOA) vials and bottles, labeled, and immediately placed in a cooler with ice. Sample management is discussed in detail in Section 3.4.7 below.

3.4.6 Borehole and Temporary Well Abandonment

All soil borings and temporary wells were abandoned following the completion of soil and groundwater sampling. Temporary well casings and screens were extracted from subsurface using the Geoprobe 54LT drill rig. All open soil boreholes from soil and groundwater sampling were backfilled with hydrated bentonite and capped at the surface with native material similar to the surrounding ground surface.

3.4.7 Sample Management, Preservation, and Shipping

Soil and groundwater samples collected during the site inspection field activities were placed into the appropriate, laboratory-supplied jars or bottles, labeled in the field, and placed in ice coolers temporarily.

All samples were maintained at preservation temperature in chilled coolers throughout the field investigation. All samples were chilled in coolers by frequently rotating freshly frozen gel-ice substitute packs approximately every 4-6 hours. After conclusion of the field investigation, the samples were transported to Bethel, Alaska, via air charter along with the field crew and other field equipment. Upon arrival in Bethel, the samples were then shipped overnight via Alaska Airlines Goldstreak to Portland, Oregon, where a courier service picked up the samples for same-day delivery to the CH2M HILL Applied Sciences Laboratory (ASL) in Corvallis, Oregon. All laboratory samples were entered onto chain-of-custody forms, packaged in protective bubble-wrap, and each cooler was packed with gel ice packs before shipping.

Copies of the ADEC Certificate of Approval and approval letter for Contaminated Sites Analysis (UST-79) and the DoD-ELAP Certificate of Accreditation are provided in Appendix E.

3.4.8 Equipment Decontamination and Management of Investigation-Derived Waste

New, disposable sampling equipment and supplies were used to collect soil and groundwater samples as extensively as possible (for example, stainless steel spoons, zip-loc bags, HDPE tubing, and so on). Non-disposable sampling tools and equipment, such as drill rods and macrocore samplers, were decontaminated using brushes and a Alconox detergent wash and potable water rinse between sampling locations (for example, boreholes).

Investigation-derived waste (IDW) generated during PA/SI field sampling activities includes soil, water, and disposable solid waste. These wastes consisted of potentially contaminated soil, decontamination water, monitoring well purge water, used personal protective equipment (PPE), and used disposable sampling equipment. The general processes used to manage these wastes are described below and in Appendix B, Waste Management Plan of the Work Plan (CH2M HILL, 2012).

3.4.9 Soil Investigation-Derived Waste

Small volumes of potentially contaminated soil were generated during DPS drilling and sampling activities. In accordance with Appendix B, Waste Management Plan of the Work Plan (CH2M HILL, 2012), soil was field-screened using a PID and visual and olfactory observations. Soil derived from DPS drilling with no signs of contamination was put back into the borehole from which it originated. Excess soil requiring disposal was not generated. The Work Plan specified that heavily contaminated soil (as determined by evidence of petroleum

staining, odors, or elevated PID readings) was to be containerized and labeled pending analysis. No soil meeting these criteria was encountered during the site inspections.

3.4.10 Water Investigation-Derived Waste

IDW water was generated during groundwater sampling, well purging, and equipment decontamination. All IDW water generated was containerized in 5-gallon poly drums, appropriately labeled, and temporary stored onsite before being filtered through a granular-activated carbon (GAC) filter and deposited into the ground surface at the site on August 10, 2012.

3.4.11 Used Personal Protective Equipment and Disposable Sampling Equipment

Used PPE and spent disposable sampling equipment generated during field activities included Terracore samplers, acetate sample liners, nitrile gloves, HDPE tubing, plastic sheeting, paper towels, plastic buckets, and stainless steel spoons and bowls. These disposable materials were generated in limited quantities during the PA/SI field sampling activities. All disposable sampling equipment was decontaminated of any remaining IDW soil and groundwater and disposed as municipal solid waste.

3.5 Data Management, Review, and Evaluation Procedures

After the field evaluations were complete and analytical data were validated, the data were compiled and electronically stored in the project archives and sample database. Information maintained in the project archives and sample database includes field notes, observations, and measurements from sampling activities, analytical results from the current and previous investigations, spatial and geographical data of sample and well locations, and other data relevant to environmental evaluation at the Tatalina site.

The site evaluation procedure consisted of the following activities:

1. Compiling field records and analytical data
2. Creating figures documenting the field sampling effort
3. Comparing the compiled field records and figures to the Work Plan to identify variances from the planned investigation
4. Reviewing analytical data to identify potential issues with elevated detection limits, blank contamination, rejected samples, or other analytical data issues that might affect the usability of the sample results
5. Comparing sample results to SLs
6. Updating the CSM as appropriate based on the results of the SL comparisons and field observations

3.5.1 Data Verification, Validation, and Processing

A three-step data review process consisting of verification, validation, and usability assessment was employed in examining the collected data. This three-step data review process is described as follows:

1. Data verification is the first step in data review. Data verification confirms that the specified requirements for sampling and analysis have been performed. Activities include reviews of chains of custody, field notebooks, and laboratory data.
2. Data validation extends data verification and is used to confirm that the requirements for a specific intended use are fulfilled. Data validation is the systematic process of evaluating whether the data comply with the pre-defined requirements of the project (including method, procedural, and contractual requirements) and comparing the data with criteria based on the DQOs documented in the Work Plan. The purpose of data validation is to assess the performance associated with the analysis to determine the quality of the data. Data validation includes a determination, to the extent possible, of the reasons for any failure to meet performance requirements, and an evaluation of the effect of such failures on the usability of the data.

3. Data usability assessment is an evaluation based on the findings of data validation and verification, in the context of the overall project decisions or objectives. The assessment determines whether the project execution and resulting data meet the DQOs. Both the sampling and analytical activities must be considered, with the ultimate goal of assessing whether the final, qualified results support the decisions to be made with the data.

Worksheets 34 through 37 (Verification [Step I] Process, Validation [Steps IIa and IIb] Process, Validation [Steps IIa and IIb] Summary, and Usability Assessment) of the Work Plan (CH2M HILL, 2012) describe the process and criteria in detail.

Analytical data obtained during the project were validated by a qualified CH2M HILL chemist in accordance with specifications provided in Worksheet 36, Validation (Steps IIa and IIb) Summary. Appendix F of the Work Plan describes the data processing procedures in detail. A complete set of the processed results, as well as full documentation of the original results and how the processed results were derived, will be included in Appendixes C and D.

3.5.2 Flagging Conventions

Data flags were assigned using the QC acceptance limits and procedures defined in the Work Plan (CH2M HILL, 2012). Data flags, and the reason for each flag, were entered into an electronic database and made available to the data users. Multiple flags were routinely applied to a specific sample method, matrix or analyte combination, but there is only one final flag. The most conservative of the validation flags was ultimately applied to the data. The final flag also includes matrix and blank sample impacts.

The following categories of data flags were tracked in the database and used to calculate both contractual and analytical completeness:

- Flags caused by laboratory deviation from requirements in the Work Plan.
- Flags applied because of the nature of the sample matrix or method limitations. The database keeps track of the type of protocol violation, and contractual and analytical completeness during data validation is accomplished.

The data flags are those listed in the Work Plan and are defined as follows:

- B = The analyte was detected in the sample at a concentration less than or equal to 5 times (10 times for common laboratory contaminants) the blank concentration.
- J = The analyte was positively identified, and the quantitation is an estimation because of discrepancies in meeting certain analyte-specific QC criteria. Or, the analyte was positively identified, but the associated concentration is estimated above the method detection limit (MDL) and below the limit of quantitation (LOQ).
- R = The data were rejected because of deficiencies in meeting QC criteria and may not be used for decision making.
- U = The analyte was analyzed for, but not detected.
- UJ = The analyte was not detected; however, the result is estimated because of discrepancies in meeting certain analyte-specific QC criteria.
- NJ = The analyte is a tentatively identified compound (TIC).

In addition, the following flags, which have no QC implications and are not listed in the Work Plan, were used:

- Exclude = Data were not used in the site assessment; more appropriate data exist for this analyte.
- None = A flag was not applied. This placeholder is for calculating QC criteria issues without flagging.
- A complete set of validated data with accompanying data flags are presented in the tables provided in Part 2 of this report.

3.5.3 Holding Time

In accordance with the Worksheet 36 of the Work Plan, sample results found to be over the holding time would be flagged as estimated concentrations, with detected results flagged “J” and non-detected results flagged “UJ” (CH2M HILL, 2012).

3.5.4 Data Processing

3.5.4.1 Re-extraction and Reanalysis

The laboratories are required to report all reanalysis results to CH2M HILL. There are numerous reasons for reanalysis. Reanalysis is routinely performed to analyze dilutions, analyze laboratory duplicates, and verify surrogate recoveries. When multiple results for an analyte are reported, the value that meets the Work Plan specifications most closely is chosen for the data users. This is done as a part of the data validation process. Work Plan-specified criteria are used to choose this value. Data are marked as “exclude” only when the Work Plan dictates that a “better” value is available. For example, when one of 50 analytes in a method exceeds the calibration range during sample analysis, 49 of those results are reported from the original analytical run and the single affected result is marked “exclude.” Upon dilution and reanalysis, one diluted result is reported and the other 49 results are marked “exclude.” Therefore, after this process, all 50 analytes for this sample are made available to the project team in the project database. Reanalysis, in general, is not discussed below unless it represents a data quality issue not related to the routine reasons presented in this paragraph.

3.5.4.2 Blank Contamination and Corrective Action

When any blank is below one-half the LOQ, no corrective action by the field or the laboratory is required, according to Appendix J of the Work Plan (CH2M HILL, 2012). However, Worksheet 36 of the Work Plan specifies the action to be taken by the data validator, regardless of whether the blank contamination is below or above the LOQ.

Sample results between the MDL and the LOQ have been flagged “J” and are represented in the data tables provided in Part 2 of this report. These qualified results represent values determined at levels where the true value of the measured chemical could not be quantified with a high degree of confidence. The laboratory’s MDL levels support the Work Plan requirements. The data user may consider these qualified results as estimates when making project decisions.

3.5.4.3 Overall Assessment

The number and severity of QC check or field procedure failures presented below are minimal. Out of approximately 2,750 normal and FD data points, five data points were rejected (~0.2 percent); 13 results were qualified because of QC exceedances (~0.5 percent); and 46 results were affected by blank contamination (~1.6 percent).

3.5.5 Data Validation Overview and Conclusions

The data generated from groundwater and soil analyses for the PA/SI at Tatalina LRRS are of sufficient quality and quantity necessary for accomplishing project objectives, with the exception of the rejected data. Sample results accurately indicate the presence and/or absence of target analyte contamination at sampled locations. Samples were collected and analyzed as specified in the Work Plan (CH2M HILL, 2012).

Sample results are believed to be representative of site conditions at the time of collection. Results obtained are comparable to industry standards because collection and analytical techniques followed approved, documented procedures (except as noted in this report and reflected in qualified data points). Results were reported in industry standard units. Blank contamination occurred and is generally below the LOQ. The blank contamination was representative of normal laboratory and field procedures. In cases of elevated LOQs and MDLs, because of matrix interference and/or high target analyte concentrations, the results obtained for associated sample/analyses reflect the best achievable data for the site-specific conditions. Validation flags are not included in discussions of the sample results in Part 2 of this report but can be found in the Part 2 tables.

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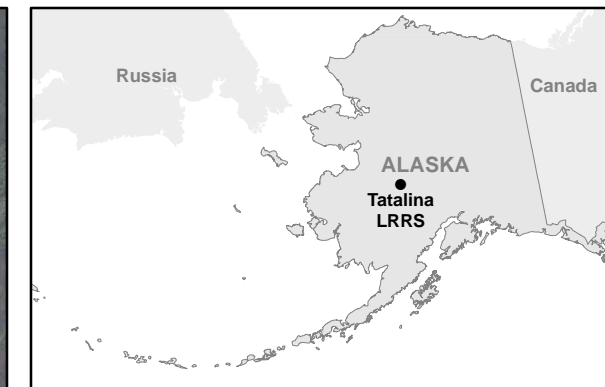
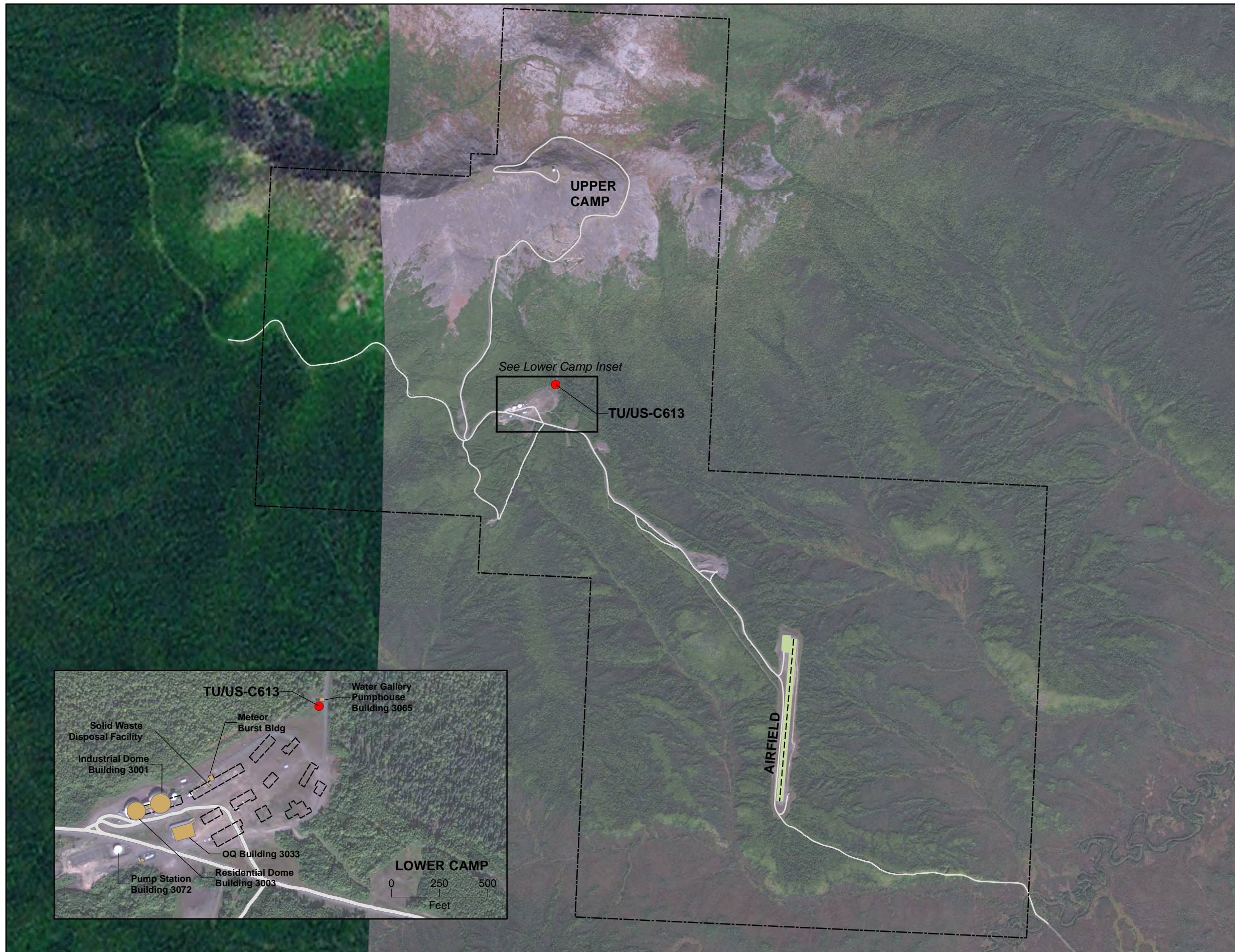
SECTION 4.0

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Figure



- Compliance Site
- Airfield Centerline
- Airfield
- Road or Parking Area
- ▭ Installation Boundary
- Permanent Structure
- ▭ Demolished Structure

- Notes:
1. LRRS = Long Range Radar Site
 2. Data are rendered in UTM Zone 5N, WGS 1984 coordinates.
 3. Data and imagery from GeoBase for Tatalina LRRS. Lower resolution imagery from i-cubed, eSat, 1999.

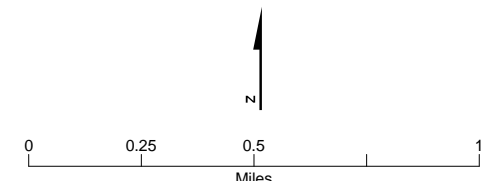
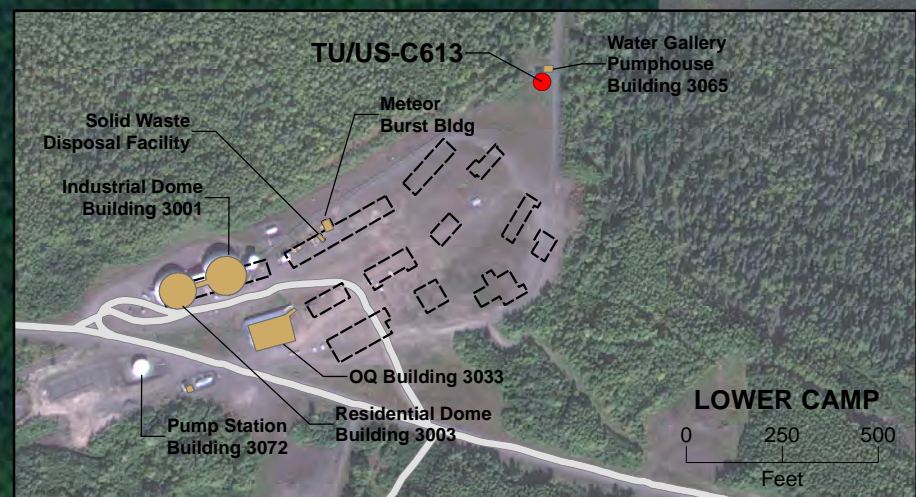


Figure 1-1
Installation Map
 PA/SI for Tatalina LRRS, Alaska

Site TU/US-C613 – Removed UST 500-1

This document provides the results of the Preliminary Assessment/Site Inspection (PA/SI) conducted at Site TU/US-C613 to assess whether there is surface, subsurface, or groundwater contamination remaining onsite from past site uses at Tatalina Long Range Radar Site (LRRS). The fieldwork was conducted in August 2012 in general accordance with the *Final Work Plan for Preliminary Assessments/Site Inspections for Cape Newenham, Cape Lisburne, Indian Mountain, and Tatalina Long Range Radar Stations, and King Salmon Air Station* (Work Plan) (CH2M HILL, 2012). The Alaska Department of Environmental Conservation (ADEC) approved this Work Plan on June 20, 2012.

1.1 Site Description and History

Historical site use and previous investigation findings suggest that the primary source of contamination at the installation is associated with past leaks or spills from fuel storage and fueling practices. Information has been located related to the removal of one underground storage tank (UST) at the installation; however, this UST was not labeled UST 500-1, nor was it associated with Building 500. Based on this limited information, Site TU/US-C613 is assumed to be located in the vicinity of the former 275-gallon gasoline UST adjacent to the water gallery pumphouse (611 Civil Engineering Operations Squadron/Assessment Management Flight, Environmental Restoration Section [611 CEOS/CEVR], 1996) and associated stockpile.

1.2 Summary of Previous Investigations

CH2M HILL was scheduled to travel to Tatalina LRRS on October 13, 2011, to conduct a site visit and visually assess Site TU/US-C613. However, on the day of travel, the Tatalina LRRS site manager informed CH2M HILL that Tatalina LRRS was fogged in and that the commercial flight that was supposed to arrive in McGrath from Anchorage had been turned back that morning because of weather conditions. The site manager indicated that inclement weather conditions would likely last for a few days. Because of the tight time constraint and fast-approaching winter weather, a site reconnaissance visit was not accomplished for the Tatalina LRRS.

Limited information regarding the site was provided in the scope of work (SOW); the final evaluation report (URS Group Inc. [URS], 2009) stated only that information was not currently available for the site. The SOW identified UST 500-1 as the site name associated with TU/US-C613. Because the location of Site TU/US-C613 is unknown, a review of records focused on information about site USTs, particularly for UST-500-1 and Building 500. Several spill/leak sites have been identified at the Lower Camp in the past, and these are discussed briefly. The information provided in this section is based on a review of the following documents:

- *Installation Restoration Program Phase I: Records Search, AAC-Northern Region* (Engineering-Science [E-S], 1985)
- *Technical Support Document for Record of Decision for Tatalina AFS* (Woodward-Clyde Consultants, Inc. [WCC], 1988)
- *Preliminary Assessment for Tatalina Long Range Radar Site* (U.S. Air Force [USAF], 1991)
- *Environmental Baseline Survey, Air Force Radar Stations, Alaska* (Air Force Civil Engineer Center [AFCEC], 1995)
- *UST Release Investigation Report, Tatalina LRRS, Alaska* (611 CEOS/CEVR, 1996)

1.2.1 1985 Phase I Records Search

Fuel was (and continues to be) delivered to the installation by barge up the Kuskokwim River and offloaded into two petroleum, oil, and lubricants (POL) tanks at Sterling Landing. At the time fuel was trucked 16 miles to bulk storage tanks at the Lower Camp, from which fuel was distributed for use to the appropriate system tanks at the

Lower Camp and at the Upper Camp (E-S, 1985). Inventory controls were used to determine whether leaks had occurred.

Several spills and leaks have been noted at the installation. The POL bulk storage area at the Lower Camp was reported to have a history of periodic losses occurring during transfer of fuel from Sterling Landing to these bulk tanks (E-S, 1985). Among the sites evaluated were four spill/leak locations (operational periods are in parentheses):

- Spill/Leak Nos. 6 and 7 at Upper Camp (1984 to 1985)
 - No. 6 – 1985: Leak resulted in 500 gallons draining into the rock.
 - No. 7 – 1980s: Earlier leak at site of No. 6 was reported as being of a larger volume.
- Spill/Leak No. 8 at Lower Camp (1950s to 1985)
 - Some spillage of diesel fuel had occurred around the truck fill stand at Sterling Landing.
- Spill/Leaks Nos. 1 through 4 at Lower Camp (1970s, 1980 to 1982)
 - No.1 – 1980: 1,000 gallons of diesel fuel overflowed Tank 3.
 - Nos. 2 and 3 – 1981 and 1982: Losses of approximately 500 gallons occurred at Tank 4.
 - No. 4 – 1970s: A hose on a diesel fuel tank located where the new composite buildings are now situated leaked, and several hundred gallons of fuel drained to the vicinity of the POL bulk storage tanks.
- Spill/Leak No. 5 at Lower Camp (1983)
 - Leakage from motor gasoline tanks near Building 3045 was noted. Leakage seeped into the soil and into some of the surface drainage systems. The area has experienced routine spillage from the motor gasoline fill stand.

Absorbents were used to recover some fuel, but the soil generally permitted rapid infiltration. In 1983, the bermed POL area was sealed to minimize fuel spill losses.

There was no reference to UST-500 or Building 500 in the records search report. There was no reference to the presence of any USTs at the installation.

1.2.2 1991 Preliminary Assessment Report

USAF conducted a preliminary assessment of Tatalina LRRS in response to a request by ADEC (USAF, 1991). The report listed the previously identified spill/leak sites but did not mention the presence of USTs or refer to Building 500 at Tatalina LRRS.

1.2.3 1995 Environmental Baseline Study

The installation has historically received and continues to receive and store small quantities of hazardous materials, including diesel fuels and gasoline. The 1995 environmental baseline study (AFCEC, 1995) summarized storage tank information for the installation. At that time, AFCEC found neither records of USTs nor records of the presence of USTs at the installation. Twelve aboveground storage tanks (ASTs) were listed; at the time (1995), no evidence of release(s) was found. The facility/building numbers associated with the ASTs were listed, but Building 500 was not listed.

The spill/leak areas identified in the 1985 records search were assigned the following Installation Restoration Program (IRP) site designations:

- Spill/Leaks Nos. 6 and 7 = SS001
- Spill/Leak No. 8 = SS002
- Spill/Leak Nos. 1 through 4 = SS003
- Spill/Leak No. 5 = SS009

1.2.4 1996 UST Release Investigation Report

The first (and only) discussion of a UST at the installation that was located in available and accessible records was in the 1996 UST release investigation report prepared by USAF (611 CEOS/CEVR, 1996).

The report stated that in October and November 1993, the 11 Civil Engineer Squadron Operations Support/Civil Engineer Squadron Operations (11 Civil Engineering Operations Squadron/Operations Office [CEOS/CEOR]) removed and closed out the 275-gallon gasoline UST associated with the water gallery pump. This description matches Tank 4, a regulated tank, identified in the ADEC UST Facility Report for Tatalina (ADEC, 2011). The owner identification number was 3065 (probably Building 3065), and the tank was identified as an asphalt-coated or bare-steel, 275-gallon UST storing gasoline. The tank was reportedly installed on May 1, 1971; the date of removal is not listed, although the tank is listed as removed from the ground (AFCEC, 2011). The 611 Civil Engineering Squadron/Assessment Management Flight, Environmental Restoration Section (611 CES/CEVR) indicated that gasoline-contaminated soil had been found. Seventy cubic yards of soil were excavated and stockpiled in containment near the onsite landfill. The UST had been buried with 2 feet of cover material, and the tank floor was an additional 5 feet deep (7 feet below ground surface [bgs]).

During the 1996 investigation, a total of four borings were placed in downgradient and upgradient locations around the former location of the UST, with one boring located in the center of the backfilled excavation. At the time, groundwater flow was assumed to be parallel with the adjacent stream. The site geology was noted to be generally clayey gravels and sand with a perched water table at 10 feet bgs and groundwater at 17 feet bgs.

The analytical results for the soil samples collected from the borings indicated that contamination was below method detection limits (MDLs) for gasoline-range organics (GRO) in all but one sample collected from 5 feet bgs at the center of the UST location (with a result of 6.8 milligrams per kilogram [mg/kg]). The ADEC Level A action level for cleanup at the time was 50 mg/kg. Most samples were below MDLs for total benzene, toluene, ethylbenzene, and xylenes (BTEX). Samples that were reported with measurable quantities of total BTEX were well below ADEC's most stringent cleanup level (Level A) of 10 parts per million (ppm). The highest reported concentration of total BTEX was 0.097 mg/kg for toluene and 0.026 mg/kg for benzene (from the same sample where GRO was recorded at 6.8 mg/kg). Lead levels did not exceed background levels. The report concluded that the boring sample results from this assessment indicated that the volume of soil contamination associated with the removed UST to be minimal.

The 70-cubic-yard contaminated soil stockpile was uncovered, and samples were collected in nine locations and then composited into three samples (three locations to each sample) to quantify the average level of contamination in the pile. Analytical results for the soil stockpile samples were below the MDL for GRO. One sample had low levels of toluene (0.06 mg/kg) and xylenes (0.049 mg/kg). The lead samples were reported to be within the natural (background) range of soil.

Samples from the UST excavated soils stockpile were reported to have traces of total BTEX in one sample (below Level A action levels). The report recommended that the stockpile be used as fill.

Water samples were collected from the cistern and were submitted for laboratory analysis for volatile organic compounds (VOCs) (using U.S. Environmental Protection Agency [EPA] Method 524.2) and lead. The water cistern samples had traces of contamination below the then-applicable regulatory limits. One sample was reported to have a lead concentration of 4.5 micrograms per liter ($\mu\text{g/L}$) (where the EPA regulatory limit was 15 parts per billion [ppb]). VOC concentrations were reported as 0.001 milligram per liter (mg/L) for dichloromethane and 0.0011 mg/L for 1,3-dichloropropane (EPA regulatory limit of 0.005 ppm).

The report recommended that final closure for the UST be applied for with ADEC.

1.2.5 1993-2000 ADEC Contaminated Sites Program Database

The ADEC Contaminated Sites Program (CSP) database was accessed to obtain information about site cleanup activities and the current regulatory status of the site. Based on a review of the information presented in the

ADEC CSP Database for Tatalina LRRS, information gaps have been identified. The CSP database refers to several reports that have not yet been located among readily accessible and available sources of information.

On November 2, 1993, UST 3065-1 was added to both the ADEC CSP database (no associated file number; Hazard ID 22875) and Leaking Underground Storage Tank (LUST) list (Source Area ID 75825) (ADEC, 2011). The CSP database identifies UST 3065-1 as a 275-gallon gasoline UST that was removed and closed out in October/November 1993. This is consistent with the information presented in the 1996 UST release investigation report (611 CEOS/CEVR, 1996). The CSP references a report received by ADEC in 1993 stating that gasoline-contaminated soil was discovered during closure of a regulated UST.

The CSP also references a Tank Closure Report for the Wellhouse UST (Building 3065) that was received in 1994. According to the CSP database, the initial assessment reported photoionization detector (PID) readings ranging from 0 to 247 ppm, with the highest readings coming from soils immediately below the UST bottom. Removal activities included pumping contents of the tank into overpacks, excavating the overburden, and removing the tank and associated piping. A mixture of approximately 200 gallons of water and 65 gallons of gasoline was pumped from the UST prior to removal. Between 65 to 70 cubic yards of soil and weathered rock were removed and temporarily stockpiled on a plastic sheet. Soils were segregated into clean and contaminated stockpiles during excavation based on PID readings. Soils with PID values greater than 5 ppm were considered to be contaminated. A contaminated soil containment cell was subsequently constructed near the landfill location, and contaminated soil was transferred to the cell. The excavation was backfilled with clean soil and graded to match surrounding ground surface.

The 275-gallon UST reportedly did not have a history of spills, leaks, or releases. The UST was removed because it had been abandoned in place and was excess to current needs. Groundwater was encountered during excavation at the interface of the overburden and the underlying bedrock (approximately 9.5 feet bgs). The groundwater was thought to be infiltrating from a localized perched water table that had been penetrated during excavation and sampling. A groundwater sample was collected and submitted for laboratory analysis for VOCS; no VOC compounds were detected. The water level in the cistern located upgradient of the UST site was measured at approximately 12.5 feet bgs. Four grab samples of soil were collected from surrounding soils during UST removal, and three confirmation soil samples were collected from the excavation. Analytical results of soil samples collected during and after removal indicated that the primary contaminants in the soil were GRO and lead. One soil sample exceeded 100 ppm GRO, and all soil samples exceeded 5 ppm lead. A CSP database entry dated December 21, 1999, referred to a UST Post-Closure Report received on December 21, 1999. This report has not been located among readily available sources of information.

ADEC File Number 2655.38.017 (Hazard ID 1904) addresses the five USTs (769-1, 769-2, 769-3, 769-5, and 769-6) at Building 3065, the Wellhouse, that were decommissioned in 1987. The first entry is dated July 21, 1993, and the database entries discuss much of the same information as is provided above. The database confirms that former UST 769-4 is the UST that was adjacent to Building 3065. The entry dated April 28, 2000, reported that ADEC issued a no further action for UST 769-4 on July 28, 1999.

SECTION 2.0

Conceptual Site Model

Historical site use and previous investigation findings suggest that the primary source of contamination at the installation is associated with past leaks or spills from fuel storage and fueling practices. Information has been located related to the removal of one UST at the installation; however, this UST was not labeled UST 500-1, nor is it associated with Building 500. Based on this limited information, Site TU/US-C613 is assumed to be located in the vicinity of the former 275-gallon gasoline UST adjacent to the water gallery pumphouse (611 CEOS/CEVR, 1996) and associated stockpile.

On the basis of site history, previous investigations, current practices, and guidance listed in Work Plan Worksheet 14, *Summary of Project Tasks*, and Worksheet 15, *Reference Limits and Evaluation*, the main target analyte for Site TU/US-C613 is GRO. Secondary analytes include diesel-range organics (DRO), residual-range organics (RRO), VOCs, semi-volatile organic compounds (SVOCs), and metals. Soils and groundwater were also sampled and analyzed for ethylene dibromide (EDB), which is a scavenger additive in leaded gasoline, and 1,2-dichloroethane (1,2-DCA), which is also a known component in leaded gasoline.

Potential human receptors are considered to be adult workers. Human health exposure pathways for adult workers include incidental ingestion of soils, dermal contact with soils, inhalation of vapor indoors and outdoors from subsurface soils and groundwater, and inhalation of dust. Groundwater is also considered a potentially complete exposure pathway to future adult workers.

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Summary of Site Evaluation Activities and Results

Site evaluation activities were performed during August 2012 in accordance with the Work Plan (CH2M HILL, 2012). Site evaluation activities involved a visual site inspection of the site as well as limited soil and groundwater sampling and analysis to evaluate the presence or absence of contamination and to improve contaminant delineation. The following subsections describe these inspection activities and associated results as well as the deviations from the Work Plan.

3.1 Visual Site Inspection

CH2M HILL was scheduled to travel to Tatalina LRRS on October 13, 2011, to conduct a site visit and visually assess Site TU/US-C613. However, on the day of travel, the Tatalina LRRS site manager informed CH2M HILL that Tatalina LRRS was fogged in and that the commercial flight that was supposed to arrive in McGrath from Anchorage had been turned back that morning because of weather conditions. The site manager indicated that inclement weather conditions would likely last for a few days. Because of the tight time constraint and fast-approaching winter weather, a site reconnaissance visit was not accomplished for the Tatalina LRRS.

CH2M HILL conducted a site inspection on August 9, 2012, prior to drilling and sampling activities described below, to document conditions at Site TU/US-C613. The location of Site TUUS-C-613 was identified as an area adjacent to and south of Building 3065/ Water Gallery Pumphouse. The location of the removed UST (Site TU/US-C613) was verified through a review of site drawings available at the installation. The former UST was located immediately south of Building 3065.

3.2 Soil Sampling and Analysis

As described in the Field Sampling Plan (FSP) for Site TU/US-C613 (Appendix D of the Work Plan [CH2M HILL, 2012]), three borings were advanced:

- TA613DP001; located approximately at the downgradient corner of the former 275-gallon UST adjacent to the water gallery pumphouse.
- TA613DP002; located immediately downgradient from the former 275-gallon UST excavation footprint.
- TA613DP003; located approximately 10 feet downgradient from the former 275-gallon UST excavation footprint.

Surface and subsurface soil samples were collected on August 10, 2012, from boreholes advanced at the three locations shown in Figure 2-1. Boreholes were advanced using a Geoprobe 54LT direct-push system (DPS) drill rig. Soil descriptions were completed on boring logs and are provided in Appendix A. Surface and subsurface soil samples were collected using a 4-foot-long, 0.5-inch-diameter steel macrocore sampler with a 1.75-inch-diameter disposable acetate liner. Surface soil samples were collected from the 0 to 2 feet bgs depth interval while subsurface soil samples were collected at multiple sample depths, as listed in Tables 2-1 and 2-2. Subsurface soil samples were collected according to the methods described in Part 1, Section 3.4.3.

Native soils generally consisted of layers of silty sands and gravels, organic silts, and clay down to 15 feet bgs. Saturated soils were encountered in all soil boring between 9 and 10 feet bgs. Soils were generally damp down to 4 feet bgs and moist down to the groundwater interface at approximately 10 feet bgs. The greatest total depth was advanced in soil borings TAC613DP001 and TAC613DP002 to a depth of 15 feet bgs. The temporary well points were pushed further than 15 feet bgs to collect groundwater samples and are discussed in Section 3.3 below.

Both surface and subsurface soil samples were analyzed for GRO, DRO, RRO, VOCs, SVOCs, EDB, 1,2-DCA, and total metals (Table 2-1). Validated soil analytical data were compared to (screened against) the screening levels (SLs) identified in Worksheet 15 of the Work Plan and Section 3.3 of Part 1 of this PA/SI report to assist in

determining if chemicals are present in site media at concentrations that may warrant further action (CH2M HILL, 2012). Analytes in exceedance of their respective SLs are shown on Figure 2-1. The complete analytical results for the surface and subsurface soil samples collected during the site evaluation are presented in Table 2-1.

3.2.1 Surface Soils

The chemicals detected in surface soil samples included petroleum hydrocarbons, VOCs, and metals. SVOCs were not detected in surface soil samples with the exception of phenanthrene, which was detected below the SL at soil boring TAC613DP003. GRO, DRO, and RRO were detected in all surface samples at concentrations that are below the SLs. Detected GRO concentrations ranged from 5.75 to 7.49 mg/kg, DRO concentrations ranged from 4.58 to 14.1 mg/kg, and RRO concentrations ranged from 7.6 to 15.8 mg/kg.

Only four VOC analytes (1,2,4-trimethylbenzene, dichlorodifluoromethane, naphthalene, and trichlorofluoromethane) were detected in surface soil (boring TAC613DP001); none of these analytes were detected above the SLs.

All metals except silver and thallium were detected in surface soil at Site TU/US-C613. Of these, arsenic, chromium, cobalt, iron, manganese, molybdenum, nickel, and selenium were detected at concentrations above their corresponding SLs. Arsenic, chromium, cobalt, iron, manganese, molybdenum, nickel, and selenium were detected at maximum concentrations of 29.7 mg/kg, 53.1 mg/kg, 17.7 mg/kg, 51,600 mg/kg, 697 mg/kg, 1.63 mg/kg, 92.7 mg/kg, and 7.3 mg/kg, respectively. Metals concentrations exceeding the SLs were detected in each soil sample collected, suggesting that the detected metals concentrations may be attributed to background or naturally occurring metals concentrations.

Further summary of the analytical results are available in Figure 2-1 and Table 2-1.

3.2.2 Subsurface Soils

The chemicals detected in subsurface soil samples included petroleum hydrocarbons, VOCs, and metals. SVOCs were not detected in subsurface soil samples. GRO, DRO, and RRO were detected below the SLs at all soil borings. Detected GRO concentrations ranged from 1.37 to 11.1 mg/kg, DRO concentrations ranged from 2.94 to 8.89 mg/kg, and RRO concentrations ranged from 6.9 to 23.2 mg/kg.

Several VOC analytes were detected in subsurface soil, three of which (EDB, benzene, and m- & p-xylene) were detected above the SLs. The SLs for EDB, benzene, and m- & p-xylene are 0.00016 mg/kg, 0.025 mg/kg, and 0.18 mg/kg, respectively. EDB was detected from 5 to 7 feet bgs and 10 to 12 feet bgs in soil borings TAC613DP002, with a maximum concentration of 0.00353 mg/kg, and TAC613DP003, with a maximum concentration of 0.000757 mg/kg. Benzene was detected in all three soil borings below the SL with the exception of soil boring TAC613DP003 where benzene was detected at 0.0301 mg/kg at 10 to 12 feet bgs. M- & p-xylene was detected above the SL at 10 to 12 feet bgs in soil boring TAC613DP002, with a maximum concentration of 0.191 mg/kg. M- & p-xylene concentrations were below the SL in TAC613DP003.

All listed analyte metals except silver and thallium were detected in the subsurface samples. Aluminum, arsenic, chromium, cobalt, iron, manganese, and selenium were detected at concentrations above their corresponding SLs in subsurface soil samples. Maximum concentrations for metals exceeding SLs are as follows: aluminum (27,300 mg/kg), arsenic (9.75 mg/kg), chromium (57.1 mg/kg), cobalt (35.5 mg/kg), iron (52,800 mg/kg), manganese (2,470 mg/kg), and selenium (7.43 mg/kg). Metals concentrations exceeding the SLs were detected in each soil boring, suggesting that the detected metals concentrations may be attributed to background or naturally occurring metals concentrations.

Further presentations of the analytical results are available in Figure 2-1 and Table 2-1.

3.3 Groundwater Sampling and Analysis

Following completion of soil sampling, installation of temporary groundwater sampling points (TAC613MW001 through TAC613MW003) was attempted at the three corresponding borehole locations (TAC613DP001 through TAC613DP003). A 0.5-inch-diameter temporary monitoring well point with a 3-foot-long, micro-laser slot steel

screen was installed at each location. An exact measurement of groundwater level was unattainable due to the diameter of the driven probe. An estimate of groundwater level was between 9 and 10 feet bgs. However, the wells were pushed to a deeper depth to attain adequate flow. The screened interval for TAC613MW001 was approximately 16 to 19 feet bgs. The screened intervals for TAC613MW002 and TAC613MW003 were approximately 13 to 16 feet bgs.

Groundwater samples were collected from all three locations on August 10, 2012. Based on soil sampling observations, poor groundwater recovery was anticipated at well point TAC613MW002 and therefore the well point was sampled according to the no-purge groundwater sampling methods described in Part 1, Section 3.4.5 of this PA/SI report. Groundwater parameters were recorded and were considered stable before collecting the groundwater sample. The groundwater sample was analyzed for GRO, DRO, RRO, VOCs, SVOCs, EDB, 1,2-DCA, and total metals (Table 2-2).

Validated groundwater analytical data were compared to (screened against) the SLs identified in Worksheet 15 of the Work Plan and Section 3.3.2 of Part 1 of this PA/SI report to assist in determining if chemicals are present in site media at concentrations that may warrant further action (CH2M HILL, 2012). Analytes exceeding SLs are shown on Figure 2-2. The complete analytical results for the groundwater samples collected during the site evaluation at Site TU/US-C613 are presented in Table 2-2.

The chemicals detected in groundwater included petroleum hydrocarbons, VOCs, and metals. GRO, DRO, and RRO were either not detected or detected below the SLs at all temporary well points. The only detected GRO concentration was 40.4 µg/L. DRO concentrations ranged from 33.4 to 71.9 µg/L and RRO concentrations ranged from 90 to 233 µg/L, respectively.

Acetone was the only VOC detected in groundwater at the site. Acetone was detected below the SL with a maximum concentration of 1.64 µg/L at TAC613MW002.

No SVOCs were detected in the groundwater samples collected at Site TU/US-C613.

All target analyte metals, except antimony, cadmium, and thallium, were detected in the groundwater sample collected at Site TU/US-C613. Of the metals detected, total aluminum, arsenic, beryllium, chromium, cobalt, iron, lead, manganese, nickel, and vanadium exceeded the SLs. Maximum concentrations for total metals exceeding SLs are as follows: aluminum (13,900 µg/L), arsenic (19.1 µg/L), beryllium (0.89 µg/L), chromium (22.7 µg/L), cobalt (13.2 µg/L), iron (20,100 µg/L), lead (11.9 µg/L), manganese (2,120 µg/L), nickel (18.5 µg/L), and vanadium (42.7 µg/L). In evaluating these unfiltered total metals results, it is important to note that these samples were collected from undeveloped driven probes and the field-measured turbidity during sampling ranged from 42 to greater than 1,000 nephelometric turbidity units. Given that known site activities are not expected to contribute to higher concentrations of the metals exceeding SLs, it is suspected that these groundwater results may be attributable to background or naturally occurring concentrations in groundwater.

Further presentations of the analytical results are available in Figure 2-2 and Table 2-2.

3.4 Deviations from the Sample Collection Plan

The PA/SI field activities were conducted utilizing the project Work Plan (CH2M HILL, 2012). Sample depths were collected from the specified depth interval listed in the site-specific FSP in Appendix D of the Work Plan..

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Conclusions

Site TU/US-C613 is the location of a former 275-gallon gasoline UST adjacent to the water gallery pumphouse at the Tatalina LRRS. As described in the FSP for Site TU/US-C613, soil borings TAC613DP001 through TAC613DP003 were advanced to determine the following:

- The absence or presence of contamination in soils at the location of the former 275-gallon UST and evaluate horizontal and vertical extent in soil, if contamination is present.
- The presence or absence of contamination in groundwater.

4.1 Surface and Subsurface Soil

Analytical results obtained during the August 2012 PA/SI activities indicate that petroleum hydrocarbons, VOCs, and metals were detected in surface and subsurface soils. Soil samples collected within the former UST location area verified the presence of DRO, GRO, and RRO at concentrations below corresponding SLs.

The data indicate concentrations of benzene in soil increase with increasing depth and distance from the location of the former UST. The greatest concentration of benzene (0.0301 mg/kg) was above the SL at 10 to 12 feet at soil boring TAC613DP003, which is the furthest downgradient soil boring from the former UST location.

Other VOC analytes were detected above SLs at soil borings TAC613DP002 and TAC613DP003, downgradient from the former UST location. The concentration of m- & p-xylene (0.191 mg/kg) at TAC613DP002 exceeded the SL at 10 to 12 feet bgs, the deepest sample location. The concentration of EDB was detected above the SL from a depth of 10 to 12 feet bgs, the deepest sample collected during this inspection.

Exceedances of the SLs for aluminum, arsenic, chromium, cobalt, iron, manganese, nickel, and selenium were detected in surface and/or subsurface soil samples. Given that known site activities would not be expected to contribute to higher concentrations of these metals, it is suspected that these results may be attributable to background or naturally occurring concentrations in soil. However, data on background metals concentrations in soil were not readily available during this PA/SI, nor collected during this study for comparison.

Based on the results, additional investigation of the lateral and vertical extent of benzene, m- & p-xylene, EDB, and metals-affected soil may be required.

4.2 Groundwater

Analytical results obtained during the August 2012 PA/SI indicate that petroleum hydrocarbons (GRO, DRO, and RRO) and one VOC (acetone) were detected in groundwater but at concentrations below their respective SLs. While results of soil sampling did yield SL exceedances of benzene, EDB, and m- and p-xylenes in subsurface soil samples collected from 5 to 7 feet and 10-12 feet bgs, it is important to note that none of these analytes were detected in groundwater samples collected from the same borehole.

Concentrations of several total metals exceeded groundwater SLs. Given that known site activities would not be expected to contribute to higher concentrations of these metals, it is suspected that these results may be attributable to background or naturally occurring concentrations in groundwater. However, data on background metals concentration in groundwater were not readily available during this PA/SI, nor collected during this study for comparison. Furthermore, the groundwater was sampled from undeveloped driven probes and was highly turbid, which may have biased high the groundwater sample results for total metals.

Based on the results obtained during this PA/SI, no additional groundwater investigation appears to be warranted.

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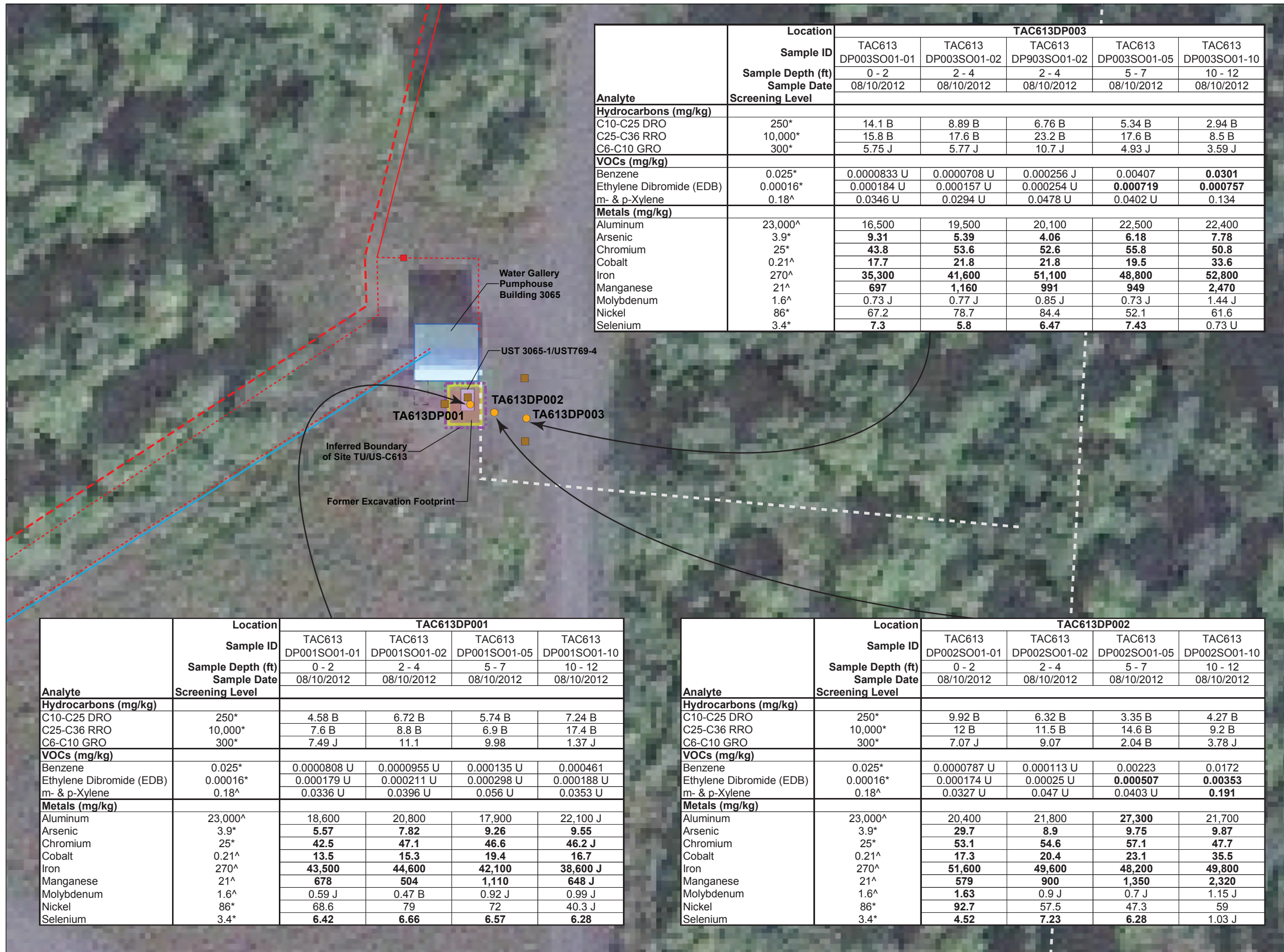
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Figures



- Sampling Location
- Previous Soil Sampling Location
- Electrical Transformer: Pad Mounted
- Water Main
- Electrical Line: Primary Overhead
- Electrical Line: Primary Underground
- Electrical Line: Service Underground
- Electrical Line: Abandoned
- ⬢ Inferred Compliance Site Boundary
- Utilidor Cover
- Filled Excavation
- Former UST Location
- Water Gallery Pumphouse

Note:
 1. LRRS = Long Range Radar Site
 2. Data are rendered in UTM Zone 5N, WGS 1984 Coordinates.
 3. Data source GeoBase for Tatalina LRRS.

* = Based on 2012 ADEC Method 2 Soil Cleanup Levels
 ^ = Based on 2012 EPA Regional Soil Screening Limits
 mg/kg = milligrams per kilogram
 Bold = The analyte exceeded noted screening level.
 B = The analyte was detected in the sample at a concentration less than or equal to five times (10 times for common laboratory contaminants) the blank concentration.
 J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
 U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
 Multiple results from the location and depth interval represent primary and duplicate samples.

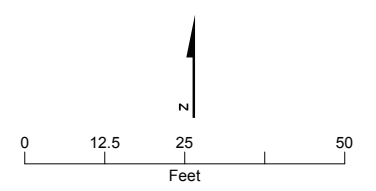
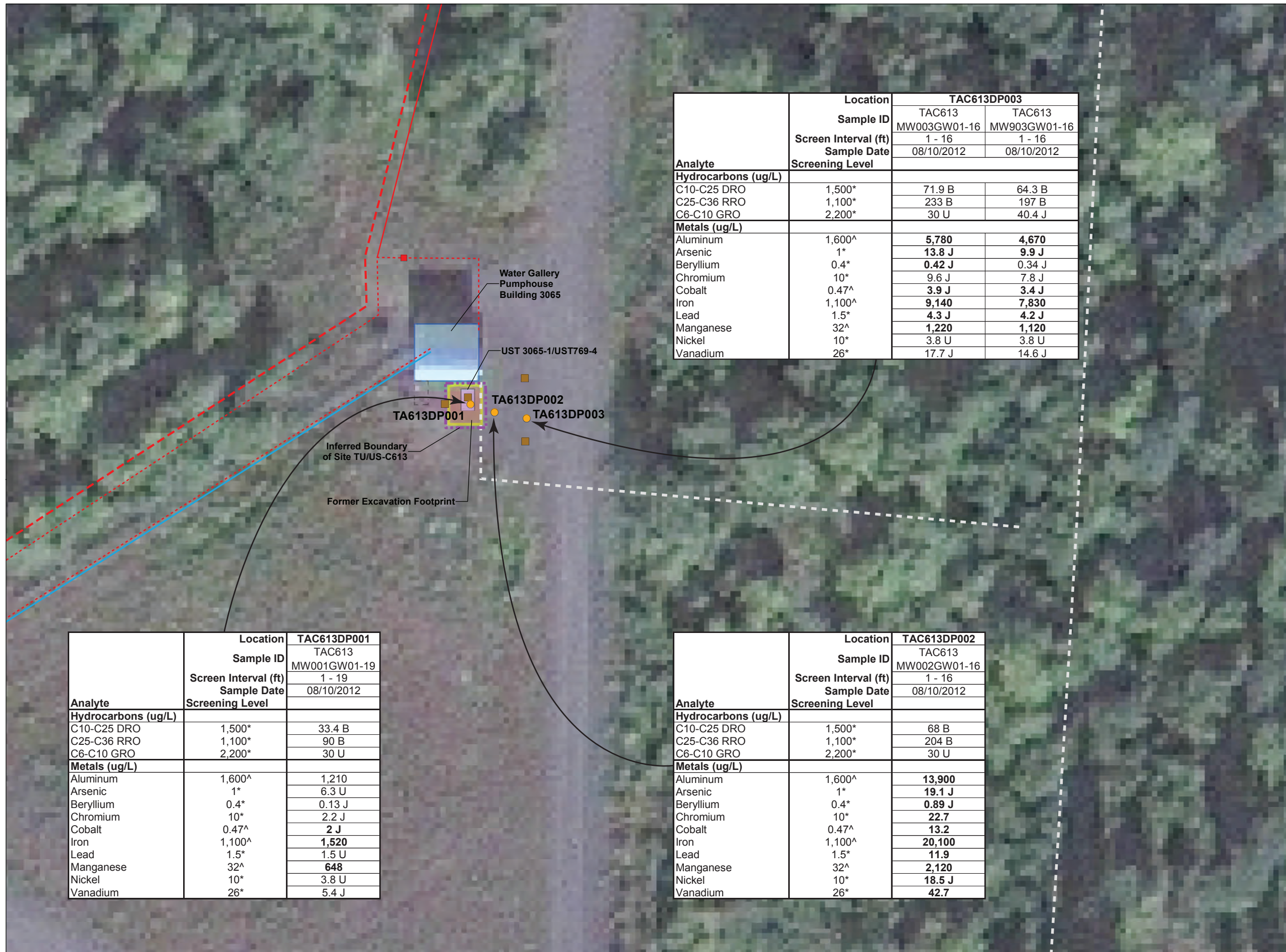


Figure 2-1
Site TU/US-C613 Screening Level Exceedances in Soil
 PA/SI for Tatalina LRRS, Alaska

Analyte	Location Sample ID Sample Depth (ft) Sample Date Screening Level	TAC613DP001			
		TAC613 DP001SO01-01	TAC613 DP001SO01-02	TAC613 DP001SO01-05	TAC613 DP001SO01-10
		0 - 2 08/10/2012	2 - 4 08/10/2012	5 - 7 08/10/2012	10 - 12 08/10/2012
Hydrocarbons (mg/kg)					
C10-C25 DRO	250*	4.58 B	6.72 B	5.74 B	7.24 B
C25-C36 RRO	10,000*	7.6 B	8.8 B	6.9 B	17.4 B
C6-C10 GRO	300*	7.49 J	11.1	9.98	1.37 J
VOCs (mg/kg)					
Benzene	0.025*	0.0000808 U	0.0000955 U	0.000135 U	0.000461
Ethylene Dibromide (EDB)	0.00016*	0.000179 U	0.000211 U	0.000298 U	0.000188 U
m- & p-Xylene	0.18^	0.0336 U	0.0396 U	0.056 U	0.0353 U
Metals (mg/kg)					
Aluminum	23,000^	18,600	20,800	17,900	22,100 J
Arsenic	3.9*	5.57	7.82	9.26	9.55
Chromium	25*	42.5	47.1	46.6	46.2 J
Cobalt	0.21^	13.5	15.3	19.4	16.7
Iron	270^	43,500	44,600	42,100	38,600 J
Manganese	21^	678	504	1,110	648 J
Molybdenum	1.6^	0.59 J	0.47 B	0.92 J	0.99 J
Nickel	86*	68.6	79	72	40.3 J
Selenium	3.4*	6.42	6.66	6.57	6.28

Analyte	Location Sample ID Sample Depth (ft) Sample Date Screening Level	TAC613DP002			
		TAC613 DP002SO01-01	TAC613 DP002SO01-02	TAC613 DP002SO01-05	TAC613 DP002SO01-10
		0 - 2 08/10/2012	2 - 4 08/10/2012	5 - 7 08/10/2012	10 - 12 08/10/2012
Hydrocarbons (mg/kg)					
C10-C25 DRO	250*	9.92 B	6.32 B	3.35 B	4.27 B
C25-C36 RRO	10,000*	12 B	11.5 B	14.6 B	9.2 B
C6-C10 GRO	300*	7.07 J	9.07	2.04 B	3.78 J
VOCs (mg/kg)					
Benzene	0.025*	0.0000787 U	0.000113 U	0.00223	0.0172
Ethylene Dibromide (EDB)	0.00016*	0.000174 U	0.00025 U	0.000507	0.00353
m- & p-Xylene	0.18^	0.0327 U	0.047 U	0.0403 U	0.191
Metals (mg/kg)					
Aluminum	23,000^	20,400	21,800	27,300	21,700
Arsenic	3.9*	29.7	8.9	9.75	9.87
Chromium	25*	53.1	54.6	57.1	47.7
Cobalt	0.21^	17.3	20.4	23.1	35.5
Iron	270^	51,600	49,600	48,200	49,800
Manganese	21^	579	900	1,350	2,320
Molybdenum	1.6^	1.63	0.9 J	0.7 J	1.15 J
Nickel	86*	92.7	57.5	47.3	59
Selenium	3.4*	4.52	7.23	6.28	1.03 J



- Sampling Location
- Electrical Transformer: Pad Mounted
- Water Main
- Electrical Line: Primary Overhead
- - - Electrical Line: Primary Underground
- - - - - Electrical Line: Service Underground
- - - - - Electrical Line: Abandoned
- ⬢ Inferred Compliance Site Boundary
- Utilidor Cover
- Filled Excavation
- Former UST Location
- Water Gallery Pumphouse

Note:
 1. LRRS = Long Range Radar Site
 2. Data are rendered in UTM Zone 5N, WGS 1984 Coordinates.
 3. Data source GeoBase for Tatalina LRRS.

* = Based on 2012 ADEC Method 2 Groundwater Cleanup Levels
 ^ = Based on 2012 EPA Tap Water Regional Screening Limits
 ug/L = micrograms per liter
 Bold = The analyte exceeded noted screening level.
 B = The analyte was detected in the sample at a concentration less than or equal to five times (10 times for common laboratory contaminants) the blank concentration.
 J = The analyte was positively identified; the associated numerical value is the approximate concentration of the analyte in the sample.
 U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
 Multiple results from the location and depth interval represent primary and duplicate samples.

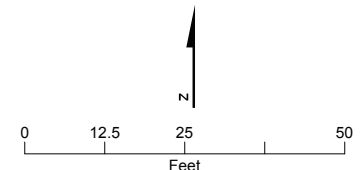


Figure 2-2
Site TU/US-C613 Screening Level Exceedances in Groundwater
 PA/SI for Tatalina LRRS, Alaska

TABLE 2-1
Summary of Chemical Results for Soil: Site TU/US-C613
PA/SI for Tatalina Long Range Radar Site

Analyte	Location Sample ID Sample Depth (ft) Sample Date Screening Level	Screening Level Source	TAC613DP001				TAC613DP002				TAC613DP003			
			TAC613DP001SO01-01	TAC613DP001SO01-02	TAC613DP001SO01-05	TAC613DP001SO01-10	TAC613DP002SO01-01	TAC613DP002SO01-02	TAC613DP002SO01-05	TAC613DP002SO01-10	TAC613DP003SO01-01	TAC613DP003SO01-02	TAC613DP003SO01-05	TAC613DP003SO01-10
			0 - 2	2 - 4	5 - 7	10 - 12	0 - 2	2 - 4	5 - 7	10 - 12	0 - 2	2 - 4	2 - 4	5 - 7
			8/10/2012	8/10/2012	8/10/2012	8/10/2012	8/10/2012	8/10/2012	8/10/2012	8/10/2012	8/10/2012	8/10/2012	8/10/2012	8/10/2012
			0	2	5	10	0							

Notes:
 NA = Not analyzed
 ND = Not detected
 B = The analyte was detected in the associated method and/or calibration blank.
 J = The analyte was positively identified: the associated numerical value is the approximate concentration of the analyte in the sample.
 R = The sample results are rejected due to serious deficiencies in the ability to analyze the sample and to meet the quality control criteria.
 The presence or absence of the analyte cannot be verified.
 U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.
 UJ = The analyte was below the reported sample quantitation limit. However, the reported value is approximate.
 mg/kg = Milligrams per Kilogram
Bold indicates the analyte was detected
 Shading indicates the result exceeded screening criteria

Screening Level Sources:
 A = 2012 ADEC Table B2 Method 2 Soil Cleanup Level (Under 40 in.) - Ingestion
 B = 2012 ADEC Table B2 Method 2 Soil Cleanup Level (Under 40 in.) - Inhalation
 C = 2012 ADEC Table B2 Method 2 Soil Cleanup Level (Under 40 in.) - Migration to Groundwater
 D = 2012 ADEC Table B1 Method 2 Soil Cleanup Level (Under 40 in.) - Direct Contact
 E = 2012 ADEC Table B1 Method 2 Soil Cleanup Level (Under 40 in.) - Outdoor Inhalation
 F = 2012 ADEC Table B1 Method 2 Soil Cleanup Level (Under 40 in.) - Migration to Groundwater
 G = 2012 EPA Soil Regional Screening Limits - Residential

TABLE 2-2
Summary of Chemical Results for Groundwater: Site TU/US-C613
PA/SI for Tatalina Long Range Radar Site

Analyte	Location Sample ID Screen Interval (ft) Sample Date Screening Level	Screening Level Source	TAC613DP001	TAC613DP002	TAC613DP003	
			TAC613MW001GW01-19	TAC613MW002GW01-16	TAC613MW003GW01-16	TAC613MW903GW01-16
			1 - 19	1 - 16	1 - 16	1 - 16
			8/10/2012	8/10/2012	8/10/2012	8/10/2012
			1	1	1	1
Hydrocarbons (µg/L)						
C10-C25 DRO	1500	A	33.4 B	68 B	71.9 B	64.3 B
C25-C36 RRO	1100	A	90 B	204 B	233 B	197 B
C6-C10 GRO	2200	A	30 U	30 U	30 U	40.4 J
VOCs (µg/L)						
1,1,1,2-Tetrachloroethane	0.05	C	0.2 U	0.2 U	0.2 U	0.2 U
1,1,1-Trichloroethane	20	B	0.2 U	0.2 U	0.2 U	0.2 U
1,1,2,2-Tetrachloroethane	0.43	B	0.2 U	0.2 U	0.2 U	0.2 U
1,1,2-Trichloroethane	0.5	B	0.2 U	0.2 U	0.2 U	0.2 U
1,1-Dichloroethane	730	B	0.2 U	0.2 U	0.2 U	0.2 U
1,1-Dichloroethene	0.7	B	0.2 U	0.2 U	0.2 U	0.2 U
1,1-Dichloropropene	--	--	0.2 U	0.2 U	0.2 U	0.2 U
1,2,3-Trichlorobenzene	0.52	C	0.2 U	0.2 U	0.2 U	0.2 U
1,2,3-Trichloropropane	0.012	B	0.2 U	0.2 U	0.2 U	0.2 U
1,2,4-Trichlorobenzene	7	B	0.2 U	0.2 U	0.2 U	0.2 U
1,2,4-Trimethylbenzene	180	B	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dibromo-3-Chloropropane	0.000032	C	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichlorobenzene	60	B	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloroethane	0.5	B	0.2 U	0.2 U	0.2 U	0.2 U
1,2-Dichloropropane	0.5	B	0.2 U	0.2 U	0.2 U	0.2 U
1,3,5-Trimethylbenzene	180	B	0.2 U	0.2 U	0.2 U	0.2 U
1,3-Dichlorobenzene	330	B	0.2 U	0.2 U	0.2 U	0.2 U
1,3-Dichloropropane	29	C	0.2 U	0.2 U	0.2 U	0.2 U
1,4-Dichlorobenzene	7.5	B	0.2 U	0.2 U	0.2 U	0.2 U
2,2-Dichloropropane	--	--	0.2 U	0.2 U	0.2 U	0.2 U
2-Butanone (MEK)	2200	B	0.5 U	0.5 U	0.5 U	0.5 U
2-Chlorotoluene	18	C	0.2 U	0.2 U	0.2 U	0.2 U
2-Hexanone	3.4	C	0.5 U	0.5 U	0.5 U	0.5 U
4-Chlorotoluene	19	C	0.2 U	0.2 U	0.2 U	0.2 U
4-Methyl-2-Pentanone (MIBK)	290	B	0.5 U	0.5 U	0.5 U	0.5 U
Acetone	3300	B	0.5 U	1.64	1.4	1.22
Benzene	0.5	B	0.2 U	0.2 U	0.2 U	0.2 U
bis(2-Chloroethoxy)methane	4.7	C	2.1 U	2.1 U	2.2 U	2.1 U
Bromobenzene	5.4	C	0.2 U	0.2 U	0.2 U	0.2 U
Bromochloromethane	8.3	C	0.2 U	0.2 U	0.2 U	0.2 U
Bromodichloromethane	1.4	B	0.2 U	0.2 U	0.2 U	0.2 U
Bromoform	11	B	0.2 U	0.2 U	0.2 U	0.2 U
Bromomethane	5.1	B	0.2 U	0.2 U	0.2 U	0.2 U
Carbon Disulfide	370	B	0.2 U	0.2 U	0.2 U	0.2 U
Carbon Tetrachloride	0.5	B	0.2 U	0.2 U	0.2 U	0.2 U
Chlorobenzene	10	B	0.2 U	0.2 U	0.2 U	0.2 U
Chloroethane	29	B	0.2 U	0.2 U	0.2 U	0.2 U
Chloroform	14	B	0.15 U	0.15 U	0.15 U	0.15 U
Chloromethane	6.6	B	0.2 U	0.2 U	0.2 U	0.2 U
cis-1,2-Dichloroethene	7	B	0.2 U	0.2 U	0.2 U	0.2 U
cis-1,3-Dichloropropene	0.85	B	0.2 U	0.2 U	0.2 U	0.2 U
Dibromochloromethane	1	B	0.2 U	0.2 U	0.2 U	0.2 U
Dibromomethane	37	B	0.2 U	0.2 U	0.2 U	0.2 U
Dichlorodifluoromethane	730	B	0.2 U	0.2 U	0.2 U	0.2 U
Ethylbenzene	70	B	0.2 U	0.2 U	0.2 U	0.2 U
Ethylene Dibromide (EDB)	0.005	B	0.006 U	0.006 U	0.006 U	0.006 U
Hexachlorobutadiene	0.73	B	0.2 U	0.2 U	0.2 U	0.2 U
Isopropylbenzene	370	B	0.2 U	0.2 U	0.2 U	0.2 U
Methyl tert-Butyl Ether (MTBE)	47	B	0.2 U	0.2 U	0.2 U	0.2 U
Methylene Chloride	0.5	B	0.2 U	0.2 U	0.2 U	0.2 U
n-Butylbenzene	37	B	0.2 U	0.2 U	0.2 U	0.2 U
n-Propylbenzene	37	B	0.2 U	0.2 U	0.2 U	0.2 U
Naphthalene	73	B	0.2 U	0.2 U	0.2 U	0.2 U

TABLE 2-2
Summary of Chemical Results for Groundwater: Site TU/US-C613
PA/SI for Tatalina Long Range Radar Site

Analyte	Location Sample ID Screen Interval (ft) Sample Date Screening Level	Screening Level Source	TAC613DP001	TAC613DP002	TAC613DP003	
			TAC613MW001GW01-19	TAC613MW002GW01-16	TAC613MW003GW01-16	TAC613MW903GW01-16
			1 - 19	1 - 16	1 - 16	1 - 16
			8/10/2012	8/10/2012	8/10/2012	8/10/2012
			1	1	1	1
p-Isopropyltoluene	--	--	0.2 U	0.2 U	0.2 U	0.2 U
sec-Butylbenzene	37	B	0.2 U	0.2 U	0.2 U	0.2 U
Styrene	10	B	0.2 U	0.2 U	0.2 U	0.2 U
tert-Butylbenzene	37	B	0.2 U	0.2 U	0.2 U	0.2 U
Tetrachloroethene (PCE)	0.5	B	0.2 U	0.2 U	0.2 U	0.2 U
Toluene	100	B	0.2 U	0.2 U	0.2 U	0.2 U
trans-1,2-Dichloroethene	10	B	0.2 U	0.2 U	0.2 U	0.2 U
trans-1,3-Dichloropropene	0.85	B	0.2 U	0.2 U	0.2 U	0.2 U
Trichloroethene (TCE)	0.5	B	0.2 U	0.2 U	0.2 U	0.2 U
Trichlorofluoromethane	1100	B	0.2 U	0.2 U	0.2 U	0.2 U
Vinyl Chloride	0.2	B	0.2 U	0.2 U	0.2 U	0.2 U
m- & p-Xylene	19	C	0.4 U	0.4 U	0.4 U	0.4 U
o-Xylene	19	C	0.2 U	0.2 U	0.2 U	0.2 U
SVOCs (µg/L)						
1,2-Diphenylhydrazine	0.0067	C	2.1 U	2.1 U	2.2 U	2.1 U
2,4,5-Trichlorophenol	370	B	2.1 U	2.1 U	2.2 U	2.1 U
2,4,6-Trichlorophenol	7.7	B	2.1 U	2.1 U	2.2 U	2.1 U
2,4-Dichlorophenol	11	B	2.1 U	2.1 U	2.2 U	2.1 U
2,4-Dimethylphenol	73	B	R	R	R	R
2,4-Dinitrophenol	7.3	B	2.1 U	2.1 U	2.2 U	2.1 U
2,4-Dinitrotoluene	0.13	B	2.1 U	2.1 U	2.2 U	2.1 U
2,6-Dinitrotoluene	0.13	B	2.1 U	2.1 U	2.2 U	2.1 U
2-Chloronaphthalene	290	B	2.1 U	2.1 U	2.2 U	2.1 U
2-Chlorophenol	18	B	2.1 U	2.1 U	2.2 U	2.1 U
2-Methylnaphthalene	15	B	2.1 U	2.1 U	2.2 U	2.1 U
2-Methylphenol	180	B	2.1 U	2.1 U	2.2 U	2.1 U
2-Nitroaniline	15	C	2.1 U	2.1 U	2.2 U	2.1 U
2-Nitrophenol	--	--	2.1 U	2.1 U	2.2 U	2.1 U
3,3-Dichlorobenzidine	0.19	B	2.1 U	2.1 U	2.2 U	2.1 U
3- & 4-Methylphenol	18	B	2.1 U	2.1 U	2.2 U	2.1 U
3-Nitroaniline	--	--	2.1 U	2.1 U	2.2 U	2.1 U
4,6-Dinitro-2-Methylphenol	0.12	C	2.1 U	2.1 U	2.2 U	2.1 U
4-Bromophenyl Phenyl Ether	--	--	2.1 U	2.1 U	2.2 U	2.1 U
4-Chloro-3-Methylphenol	110	C	2.1 U	2.1 U	2.2 U	2.1 U
4-Chloroaniline	1.6	B	2.1 U	2.1 U	2.2 U	2.1 U
4-Chlorophenyl Phenyl Ether	--	--	2.1 U	2.1 U	2.2 U	2.1 U
4-Nitroaniline	0.33	C	2.1 U	2.1 U	2.2 U	2.1 U
4-Nitrophenol	--	--	2.1 U	2.1 U	2.2 U	2.1 U
Acenaphthene	220	B	2.1 U	2.1 U	2.2 U	2.1 U
Acenaphthylene	220	B	2.1 U	2.1 U	2.2 U	2.1 U
Anthracene	1100	B	2.1 U	2.1 U	2.2 U	2.1 U
Benzo(a)anthracene	0.12	B	2.1 U	2.1 U	2.2 U	2.1 U
Benzo(a)pyrene	0.02	B	2.1 U	2.1 U	2.2 U	2.1 U
Benzo(b)fluoranthene	0.12	B	2.1 U	2.1 U	2.2 U	2.1 U
Benzo(g,h,i)perylene	110	B	2.1 U	2.1 U	2.2 U	2.1 U
Benzo(k)fluoranthene	1.2	B	2.1 U	2.1 U	2.2 U	2.1 U
Benzoic acid	15000	B	2.1 U	2.1 U	2.2 U	2.1 U
Benzyl alcohol	150	C	2.1 U	2.1 U	2.2 U	2.1 U
bis(2-Chloroethyl)ether	0.077	B	2.1 U	2.1 U	2.2 U	2.1 U
bis(2-Chloroisopropyl)ether	0.031	C	2.1 U	2.1 U	2.2 U	2.1 U
bis(2-Ethylhexyl)phthalate	0.6	B	2.1 U	2.1 U	2.2 U	2.1 U
Butyl Benzyl Phthalate	730	B	2.1 U	2.1 U	2.2 U	2.1 U
Carbazole	4.3	B	2.1 U	2.1 U	2.2 U	2.1 U
Chrysene	12	B	2.1 U	2.1 U	2.2 U	2.1 U
di-n-Butyl Phthalate	370	B	2.1 U	2.1 U	2.2 U	2.1 U
di-n-Octyl Phthalate	150	B	2.1 U	2.1 U	2.2 U	2.1 U
Dibenz(a,h)anthracene	0.012	B	2.1 U	2.1 U	2.2 U	2.1 U
Dibenzofuran	7.3	B	2.1 U	2.1 U	2.2 U	2.1 U

TABLE 2-2
Summary of Chemical Results for Groundwater: Site TU/US-C613
PA/SI for Tatalina Long Range Radar Site

Analyte	Location Sample ID Screen Interval (ft) Sample Date Screening Level	Screening Level Source	TAC613DP001	TAC613DP002	TAC613DP003	
			TAC613MW001GW01-19	TAC613MW002GW01-16	TAC613MW003GW01-16	TAC613MW903GW01-16
			1 - 19	1 - 16	1 - 16	1 - 16
			8/10/2012	8/10/2012	8/10/2012	8/10/2012
			1	1	1	1
Diethyl phthalate	2900	B	2.1 U	2.1 U	2.2 U	2.1 U
Dimethyl phthalate	37000	B	2.1 U	2.1 U	2.2 U	2.1 U
Fluoranthene	150	B	2.1 U	2.1 U	2.2 U	2.1 U
Fluorene	150	B	2.1 U	2.1 U	2.2 U	2.1 U
Hexachlorobenzene	0.1	B	2.1 U	2.1 U	2.2 U	2.1 U
Hexachloroethane	4	B	2.1 U	2.1 U	2.2 U	2.1 U
Indeno(1,2,3-cd)pyrene	0.12	B	2.1 U	2.1 U	2.2 U	2.1 U
Isophorone	90	B	2.1 U	2.1 U	2.2 U	2.1 U
N-Nitrosodimethylamine (NDMA)	0.0017	B	2.1 U	2.1 U	2.2 U	2.1 U
N-Nitrosodiphenylamine	17	B	2.1 U	2.1 U	2.2 U	2.1 U
N-Nitrosodipropylamine	0.012	B	2.1 U	2.1 U	2.2 U	2.1 U
Nitrobenzene	1.8	B	2.1 U	2.1 U	2.2 U	2.1 U
Pentachlorophenol	0.1	B	2.1 U	2.1 U	2.2 U	2.1 U
Phenanthrene	1100	B	2.1 U	2.1 U	2.2 U	2.1 U
Phenol	1100	B	2.1 U	2.1 U	2.2 U	2.1 U
Pyrene	110	B	2.1 U	2.1 U	2.2 U	2.1 U
Total Metals (µg/L)		--				
Aluminum	1600	C	1210	13900	5780	4670
Antimony	0.6	B	3.5 U	3.5 U	3.5 U	3.5 U
Arsenic	1	B	6.3 U	19.1 J	13.8 J	9.9 J
Barium	200	B	15.8 J	114	55.5	46.9
Beryllium	0.4	B	0.13 J	0.89 J	0.42 J	0.34 J
Cadmium	0.5	B	0.24 U	0.24 U	0.24 U	0.24 U
Calcium	--	--	28800	25000	19400	18000
Chromium	10	B	2.2 J	22.7	9.6 J	7.8 J
Cobalt	0.47	C	2 J	13.2	3.9 J	3.4 J
Copper	100	B	1.6 U	22.3	7.4 J	5.5 J
Iron	1100	C	1520	20100	9140	7830
Lead	1.5	B	1.5 U	11.9	4.3 J	4.2 J
Magnesium	--	--	7130	8690	5380	4890
Manganese	32	C	648	2120	1220	1120
Molybdenum	7.8	C	1.8 J	2.3 J	2.3 J	1.9 J
Nickel	10	B	3.8 U	18.5 J	3.8 U	3.8 U
Potassium	--	--	831	1980	1190	1030
Selenium	5	B	10.5 U	10.5 U	10.5 U	10.5 U
Silver	10	B	0.8 U	1.1 B	0.8 U	0.8 U
Sodium	--	--	4030	3340	3370	2700 B
Thallium	0.2	B	3.4 U	3.4 U	3.4 U	3.4 U
Vanadium	26	B	5.4 J	42.7	17.7 J	14.6 J
Zinc	500	B	5.4 J	55	35.4	35.1

Notes:

NA = Not analyzed

ND = Not detected

B = The analyte was detected in the associated method and/or calibration blank.

J = The analyte was positively identified: the associated numerical value is the approximate concentration of the analyte in the sample.

R = The sample results are rejected due to serious deficiencies in the ability to analyze the sample and to meet the quality control criteria.

The presence or absence of the analyte cannot be verified.

U = The analyte was analyzed for, but was not detected above the reported sample quantitation limit.

UJ = The analyte was below the reported sample quantitation limit. However, the reported value is approximate.

µg/L = Micrograms per Liter

Bold indicates the analyte was detected

Shading indicates the result exceeded screening criteria

Screening Level Sources:

A = 2012 ADEC Table C Groundwater Cleanup Levels

B = 1/10th 2012 ADEC Table C Groundwater Cleanup Levels

C = 1/10th 2012 EPA Tapwater Regional Screening Limits

