Final

Haines Fuel Terminal PFAS Remedial Investigation Work Plan
Haines, Alaska

U.S. Army Garrison Alaska

HQAES Nos.:
2199A.1001 (HFT Administrative Area Surficial Area)
2199A.1015 (HFT Bulk Fuel Storage Area, Including Fire Foam Building)
2199A.1019 (Site Wide Groundwater)

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ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
°F	degrees Fahrenheit
µg/L	micrograms per liter
AAC	Alaska Administrative Code
ACM	asbestos containing material
ADEC	Alaska Department of Environmental Conservation
AOI	area of interest
AOPI	area of potential interest
APP	Accident Prevention Plan
Arcadis	Arcadis U.S., Inc.
AST	aboveground storage tank
bgs	below ground surface
BRA	Baseline Risk Assessment
Brice	Brice Environmental Services Corporation
Bristol	Bristol Environmental Remediation Services, LLC
BTEX	benzene, toluene, ethylbenzene, and xylenes
CDQR	Chemical Data Quality Review
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CoC	chain-of-custody
COPC	contaminant of potential concern
COPEC	contaminant of potential ecological concern
CSM	conceptual site model
cy	cubic yard
DERP	Defense Environmental Restoration Program
DoD	Department of Defense
DPW	Directorate of Public Works
DQCR	Daily Quality Control Report
DQO	data quality objective
DRO	diesel range organics
ELAP	Environmental Laboratory Accreditation Program
EPA	U.S. Environmental Protection Agency
FD	field duplicate
FRB	field reagent blank
GAC	granular activated carbon
GIS	geographic information system
gpm	gallons per minute
GPS	Global Positioning System
GRO	gasoline range organics
HDPE	high-density polyethylene

ACRONYMS AND ABBREVIATIONS (CONTINUED)

HFPO-DA	hexafluoropropylene oxide-dimer acid
HFT	Haines Fuel Terminal
HQAES	Headquarters Army Environmental System
HVE	high vacuum extraction
IDW	investigation-derived waste
LBP	lead-based paint
LOD	limit of detection
MED	Manual for Electronic Deliverables
mg/kg	milligrams per kilogram
mL	milliliter
MS	matrix spike
MSD	matrix spike duplicate
N/A	not applicable
NAD83	North American Datum of 1983
NAVD88	North American Vertical Datum of 1988
NCP	National Oil and Hazardous Substances Contingency Plan
ng/L	nanogram per liter
NGS	National Geodetic Survey
North Wind	North Wind, Inc.
NPDL	Northern Pacific Division Laboratory
NSRS	National Spatial Reference System
ORC	oxygen-releasing compound
OSD	Office of the Assistant Secretary of Defense
PA/SI	Preliminary Assessment/Site Inspection
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PFAS	per- and polyfluoroalkyl substances
PFBA	perfluorobutanoic acid
PFBS	perfluorobutane sulfonic acid
PFHxA	perfluorohexanoic acid
PFHxS	perfluorohexane sulfonate
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctane sulfonic acid
PFPrA	perfluoropropanoic acid
PM	Project Manager
POL	petroleum, oil, and lubricants
PRG	preliminary remediation goal

ACRONYMS AND ABBREVIATIONS (CONTINUED)

PSL	project screening level
PVC	polyvinyl chloride
QA	quality assurance
QC	quality control
RCRA	Resource Conservation and Recovery Act
RfD	reference dose
RI	Remedial Investigation
RRO	residual range organics
RSL	Regional Screening Level
SEDD	Staged Electronic Data Deliverable
SFO	oral cancer slope factor
SOP	standard operating procedure
TAH	total aromatic hydrocarbon
TFSI	bis(trifluoromethylsulfonyl)amine
THQ	target hazard quotient
TMB	trimethylbenzene
TR	target cancer risk
UCL	upper confidence level
UFP-QAPP	Uniform Federal Policy-Quality Assurance Project Plan
USACE	U.S. Army Corps of Engineers
UST	underground storage tank
UVOST	ultraviolet optical screening tool
VOC	volatile organic compounds

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1.0 INTRODUCTION

Brice Environmental Services Corporation (Brice) has been contracted by the U.S. Army Corps of Engineers (USACE), Alaska District, to complete a remedial investigation (RI) for per- and polyfluoroalkyl substances (PFAS) at the former Haines Fuel Terminal (HFT) near Haines, Alaska (Figure 1). The project is being performed under Contract W911KB22D0019, Task Order W911KB23F0122 (USACE 2023).

This RI Work Plan describes the approach to evaluate PFAS contamination at HFT and includes the following sections:

- Section 1 – Introduction
- Section 2 – Site Background and Physical Setting
- Section 3 – Previous Investigation Summary
- Section 4 – Remedial Investigation Approach
- Section 5 – Records and Reporting
- Section 6 – References

This Work Plan is intended for use in conjunction with the project *Uniform Federal Policy-Quality Assurance Project Plan* (UFP-QAPP), the *Risk Assessment Work Plan,* and the *Accident Prevention Plan* (APP)*,* which are included as Appendices A, B, and C, respectively.

1.1 Project Overview and Objectives

This Work Plan presents the proposed PFAS RI approach for the HFT site. The HFT site is further subdivided into the former Administrative Area, former Tank Farm Area, and former Fuel Terminal Dock Area (Figure 2). The proposed RI is follow-on work to a Preliminary Assessment and Site Inspection (PA/SI), which identified PFAS contamination in soil and groundwater at the site (Arcadis U.S., Inc. [Arcadis] 2023). The objectives of this RI are to characterize the nature and extent of PFAS contamination present in soil and groundwater to ensure there are no remaining data gaps, and to evaluate the human health and ecological risk.

During the PA/SI seven areas of potential interest (AOPIs) were identified at the HFT site and were investigated during the SI. Of the seven, three are carried forward as areas of interest (AOIs) to be further investigated during this RI. These include the former Firehouse Office, Shop, and Garage 1212; former Fire Pump Building 1208; and former Fire Hose Building 1203 located in the former Administrative Area. The former Hose Cart Building 1209 is retained as an AOPI as additional sampling is necessary to support the PA/SI findings and rule it out as a potential source area. The former Tank Farm Fire Foam System (including former Fire Foam Building 1231) located in the former Tank Farm Area is retained as an AOPI for additional groundwater sampling to confirm that PFAS concentrations are less than project screening levels (PSLs). The two AOPIs identified in the PA/SI at the former Fuel Terminal Dock Area (former Marine Dock Fire Hose Building 1236 and former Dockmaster Building 1234) do not require further investigation. During the SI soil results were less than PSLs and PFAS was not detected in groundwater, therefore these locations are no longer considered AOPIs. The PFAS AOIs and AOPIs associated with the HFT site are identified on Figure 2.

A Baseline Risk Assessment (BRA) will be developed to evaluate cumulative risk at the site for all contaminants exceeding risk-based screening levels, including results from the 2015-2017 RI (Bristol Environmental Remediation Services, LLC [Bristol] and North Wind, Inc. [North Wind] 2020). The results

of the BRA will be used to support risk management decisions to determine whether further action is appropriate or if established site remedies are protective of human health and the environment.

To meet these objectives, the RI will be completed using a data-driven phased approach with two mobilizations. With this approach, the findings and analytical results from the first mobilization will be used to make decisions on sampling locations for the second mobilization. This Work Plan outlines the general approach and methods for the entire investigation as well as proposed sample locations for the first mobilization. Sample locations for the second mobilization will be presented in a separate Work Plan Addendum. Table 1-1 summarizes the definable features of work for the first and second mobilizations. All activities are further discussed in Section 4 (Remedial Investigation Approach).

Table 1-1 Planned Activities for Each Mobilization

MOBILIZATION	ACTIVITY
1	Install 10 groundwater monitoring wells within the former Administrative Area in the Emergent Beach Perched Aquifer. Collect discrete soil samples (surface, subsurface, and water table) from each boring during well installation.
	Collect groundwater samples from the 10 new wells and 20 existing wells located throughout the HFT.
	Collect 3 surface water samples and 3 sediment samples from a seep discharging from the Emergent Beach Perched Aquifer into Tanani Bay.
Data Evaluation	Evaluate data obtained from the first mobilization to determine sample locations for the second mobilization. Prepare a Work Plan Addendum to guide field activities.
2	Complete up to 10 additional soil borings to evaluate surface and subsurface soil. Collect 3 discrete soil samples (surface, subsurface, and water table) from each boring.
	Complete up to 4 of the new borings as monitoring wells and collect groundwater samples.

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

In addition to the planned activities, there is an optional task to complete sediment characterization sampling for metals adjacent to the Fuel Terminal Dock. If this site characterization work does occur a Site Inspection Work Plan will be prepared to guide sampling.

1.2 Project Site and Source Area Tracking Numbers

The HFT source area is tracked by the U.S. Army in the Headquarters Army Environmental System (HQAES) for funding purposes. The source area is also tracked in the Alaska Department of Environmental Conservation (ADEC) Contaminated Sites database, which is maintained by the ADEC Project Manager (PM) assigned to the site. The current ADEC and HQAES tracking numbers and source area description are presented in Table 1-2.

Table 1-2 Crosswalk Table for Source Area Tracking Numbers

HQAES SITE DESIGNATION	ADEC HAZARD ID[1]	ADEC FILE ID[1]	SITE NAME	INVESTIGATION PHASE
2199A.1001 (HFT Administrative Area Surficial Area) 2199A.1015 (HFT Bulk Fuel Storage Area, Including Fire Foam Building) 2199A.1019 (Site Wide Groundwater)	591	1508.38.002	U.S. Army Haines POL Terminal	RI

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
[1] Available from the ADEC Contaminated Sites Database at https://dec.alaska.gov/Applications/SPAR/PublicMVC/CSP/SiteReport/591

1.3 Regulatory Framework

The PFAS RI will be conducted in accordance with the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), as amended by the Superfund Amendments and Reauthorization Act; the Defense Environmental Restoration Program (DERP); the Resource Conservation and Recovery Act (RCRA); National Oil and Hazardous Substances Contingency Plan (NCP) requirements; U.S. Environmental Protection Agency (EPA) regulation and guidance; and all other applicable federal, state, and local regulations.

The PFAS data collected during the RI will be compared to the PSLs, which are the EPA Regional Screening Levels (RSLs) established in November 2023, as defined in the August 2023 Office of the Assistant Secretary of Defense (OSD) Memorandum, *Investigating PFAS within the Department of Defense Cleanup Program* (Department of Defense [DoD] 2023) and the DoD's PFAS 101 webpage *Regional Screening Levels Used in DoD Cleanups* (https://www.acq.osd.mil/eie/eer/ecc/pfas/pfas101/rsl.html; DoD 2024). Updates to EPA RSLs that occur prior to reporting will be incorporated into the PSLs and toxicity levels under the direction of DoD and as appropriate, any differences from this Work Plan will be summarized as part of the report. Updates to PFAS-related RSLs are maintained at https://www.acq.osd.mil/eie/eer/ecc/pfas/tf/policies.html. Although DoD recognizes that EPA has published RSLs for lithium bis(trifluoromethylsulfonyl)amine (TFSI) and perfluoropropanoic acid (PFPrA) there are currently no EPA-approved analytical methods for these analytes. These analytes are not associated with fire-fighting foam and are not considered contaminants of potential concern (COPCs) at the site.

The PSLs used for this project are the most conservative residential scenarios for soil and tap water. Worksheet 15 of the UFP-QAPP (Appendix A) details the PSLs and laboratory-specific quantitation limits for soil and groundwater in Tables 15-1 and 15-2. The residential scenario is considered for the evaluation of unlimited use and unrestricted exposure. Future residential use of the property is not a reasonably anticipated scenario because the vast majority of the property is zoned heavy industrial.

The results from the previous investigations and new data collected during the RI will be used to complete a BRA to evaluate risks to human health and the environment due to potential exposures of human and ecological receptors to PFAS compounds. The comparison criteria for identifying COPCs for soil will be based on the EPA RSLs for residential soil (target cancer risk [TR] of $1x10^{-6}$, target hazard quotient [THQ] of 0.1; EPA 2023). Groundwater results will be compared to the EPA tap water RSL (TR $1x10^{-6}$, THQ 0.1) to identify COPCs in groundwater. The ecological risk assessment will be comprised of an ecological scoping evaluation and screening for contaminants of potential ecological concern (COPECs) will not be included.

Seeps from the Emergent Beach Perched Aquifer discharge into Tanani Bay, groundwater upgradient in this perched aquifer has been found to have perfluorooctane sulfonic acid (PFOS) and perfluorohexane sulfonate (PFHxS) at concentrations greater than PSLs. During low tide up to three co-located surface water and sediment samples will be collected from seeps to confirm the presence or absence of PFAS compounds in this media and will assess if the groundwater to surface water pathway is complete.

During the RI phase, the non-carcinogenic reference doses (RfDs) for PFOS, perfluorooctanoic acid (PFOA), perfluorobutanoic acid (PFBA), perfluorobutane sulfonic acid (PFBS), perfluorononanoic acid (PFNA), perfluorohexanoic acid (PFHxA), PFHxS, and hexafluoropropylene oxide-dimer acid (HFPO-DA) and the oral cancer slope factor (SFO) for PFOA of 0.07 (milligram per kilogram [mg/kg]-day)$^{-1}$ will be used to conduct site-specific risk assessments in accordance with *Risk Assessment Guidance for Superfund Volume I, Part A* (EPA 1989). These eight PFAS compounds (PFOS, PFOA, PFBA, PFBS, PFNA, PFHxA, PFHxS, and HFPO-DA) have established toxicity values that the DoD can use to perform a BRA to determine whether remedial action is needed under CERCLA. Note that HFPO-DA is not considered a COPC at this site because it was not used commercially until 2009, after the fuel terminal had ceased operation. Site-specific risk assessment results will depend on the levels of PFAS, as well as non-PFAS COPCs, found at each site and will be used to determine if any necessary remedial actions are required in accordance with CERCLA, DERP, and the NCP. A BRA Work Plan is provided in Appendix B and provides additional details.

The laboratories and analytical methods were selected to confirm COPCs have sufficient limits of detection (LODs) to meet the EPA RSLs for soil and groundwater. Any analytes that do not have sufficient sensitivity to meet the criteria are highlighted in the UFP-QAPP Worksheet 15 tables (Appendix A), and any impacts to decision making will be discussed in the RI Report.

For the purpose of this RI Work Plan, previous results are discussed in reference to the PSLs and/or preliminary remediation goals (PRGs), which are ADEC cleanup levels in effect at the time of the investigation and referenced in the associated document; however, the historical results are also compared to the current PSLs to guide proposed investigation activities. All historical data and data collected during this project will be compared to the current PSLs as described above and used to justify conclusions and recommendations for the site.

1.4 Project Organization and Responsibilities

The principal points of contact for each organization associated with this Work Plan are presented in UFP-QAPP Worksheet 1 and 2 in Appendix A. An updated project organizational chart, key personnel, and personnel contact information are presented in UFP-QAPP Worksheets 3 and 5 in Appendix A, and updated qualifications are presented in UFP-QAPP Worksheets 4, 7, and 8 in Appendix A. Communication pathways among the key personnel are described on Worksheet 6.

2.0 SITE BACKGROUND AND PHYSICAL SETTING

The following sections present the site background and physical setting of the former HFT based on previous investigations.

2.1 Haines Fuel Terminal Background

The HFT is located in southeastern Alaska at Tanani Point, approximately 2.9 miles north of the city of Haines (Figure 1). HFT is comprised of about 203 acres and was constructed in 1954 at the southern end of the Haines-Fairbanks Pipeline to provide facilities for tanker dockage, bulk fuel storage, and fuel pumping to deliver fuel to Fort Wainwright and Eielson Air Force Base near Fairbanks, Alaska. HFT was an active fuel storage and pumping facility from 1955 until 1971, when the use of the pipeline was discontinued (Bristol and North Wind 2020). Following termination of pipeline operations, HFT was used for fuel storage from 1971 through 1988. When in operation, HFT had a tank farm with 13 aboveground storage tanks (ASTs) with a combined fuel storage capacity of 380,000 barrels. The tank farm and associated infrastructure plus a fuel dock were located on the northern portion of HFT, while a smaller administrative area with housing, warehouses/garages, a maintenance building, a firehouse, and other related buildings was located on the southern end of HFT.

Most site infrastructure was removed beginning in the early 2000s. The 13 ASTs were removed between 2001 and 2003. All buildings except Building 1204 (a dormitory used by the Alaska National Guard) were removed in 2005, and the majority of underground fuel piping was removed during pipeline investigation activities in 2015 and 2016. HFT is currently unoccupied and is heavily vegetated. The HFT property is owned by the U.S. Army; however, the State of Alaska owns the Lutak Road right-of-way, which divides HFT into two non-contiguous areas. Most of HFT is located west of Lutak Road. The western area is fenced along its perimeter and is currently zoned heavy industrial. The narrow strip of land east of Lutak Road is unfenced and has been zoned for a multitude of uses that includes future residential scenarios (Bristol and North Wind 2020).

2.2 Physical Characteristics

2.2.1 Climate

HFT is located in the maritime climate zone and has relatively mild winters and summers. The average snowfall is 164 inches per year with an average annual precipitation of 63 inches per year. The average July high is around 65 degrees Fahrenheit (°F), and the average January low is 18°F (National Oceanic and Atmospheric Administration 2023).

2.2.2 Geology

HFT is situated on the Chilkat block of the Coastal Granite Plutonic Complex, in southeastern Alaska. The regional geology is controlled by the active plate boundary of the northern Pacific Basin (Redman et al. 1984). Major strike-slip right-later faults with near-horizontal displacement have caused large- and small-scale displacement (Peapple et al. 1999). The linear river valleys and marine inlets in the HFT region are controlled by these major faults (Bristol and North Wind 2020). The oldest rocks in the HFT area are Early Cretaceous metabasalt of the Chilkat block. Exposed bedrock near the HFT consists of metamorphic and hornblende diorite igneous rocks. The surficial deposits of the region predominantly consist of glacial and glacial-marine sediments. The till at the HFT has an abundance of gravel and cobbles, but also includes

sand and silt with variable clay content. The gravel and cobble-size material reflects the local bedrock. The glacial till is generally poorly sorted, unstratified, and compact. Previous glaciation has scoured earlier sediments and the underlying bedrock. The HFT also contains colluvium and artificial fill (Bristol and North Wind 2020).

A bedrock ridge composed of diorite is evident in the subsurface extending from Tanani Point to the area near the HFT fuel dock. A bedrock low, or trough, is present to the west of the bedrock ridge. The trough is either the result of glacial scour or from faulting. Several channels have been eroded through the bedrock ridge before the deposition of surficial sediments following the most recent glacial advance. These channels may offer preferential pathways for groundwater flow (Bristol and North Wind 2020).

2.2.3 Surface Water

No permanent freshwater surface water features are present within HFT (Bristol and North Wind 2020). The former Tank Farm Area is drained by a series of manmade ditches that discharge to the ocean. Drainage in the former Administrative Area occurs as sheet flow following surface topography to the southeast before infiltrating into soil or discharging to Tanani Bay. Vegetation in the former Administrative Area has increased since the facilities were decommissioned, reducing the potential for significant surface run-off. HFT is surrounded to the northeast, east, and southeast by the Lutak and Chilkoot Inlets. Several groundwater seeps are present along the coastline in the intertidal zone, including southeast of the site at Tanani Beach.

2.2.4 Groundwater

Due to its diverse geologic and depositional history, seven distinct aquifers have been identified at HFT: the fractured granite-diorite bedrock aquifer, Northern Aquifer, discontinuous sands and gravels overlying bedrock aquifer, the deep artesian (confined) aquifer, the Emergent Beach Perched Aquifer, the Marine Varve Aquifer, and the perched upper colluvium aquifer. Besides the fractured granite-diorite bedrock aquifer, these aquifers generally have very limited productivity because they are composed of fine-grained sediments and/or have limited spatial extent. Consequently, nearly all residents near the HFT obtain their domestic water from wells drilled into the underlying bedrock (Bristol and North Wind 2020). The Alaska Well Log Tracking System indicates that two wells within 4 miles of the HFT are completed in the discontinuous sand and gravel layer that occasionally directly overlies bedrock. Refer to Figure 3 for a depiction of the perched water and aquifers. Residents do not use the perched aquifers as a drinking water source.

2.2.4.1 Fractured Granite-Diorite Bedrock Aquifer

The fractured granite-diorite aquifer is present throughout the site and is divided into the southern and northern portions of the Tank Farm Area. In the southern portion the bedrock surface is nearly 60 feet below mean sea level and the reduction in pressures during pumping would likely cause saltwater intrusion. In the northern portion of the former Tank Farm Area, bedrock was found to be much shallower. The bedrock aquifer in the northern portion of the Tank Farm Area could be a potential source of groundwater for domestic use. No evidence of any groundwater contamination has ever been found in monitoring wells that penetrate into bedrock or within water discharged by seeps along Lutak Inlet that flow from bedrock fractures (Bristol and North Wind 2020).

2.2.4.2 Northern Aquifer

The flow system in the northern portion of the former Tank Farm Area is an unconfined aquifer that appears to be perched on the bedrock surface. The clay confining unit is absent in much of this area. Flow direction is typically east-northeast, flowing directly down the bedrock surface.

The average sustainable pump rate for monitoring wells constructed and sampled within the Northern Aquifer is 0.08 gallons per minute (gpm) with a drawdown of 0.48 feet. A well completed in this aquifer pumping at that rate could have the potential to produce a total of approximately 115 gallons of water per day (Bristol and North Wind 2020). Based on the low yield from this shallow unconfined aquifer it is unlikely to be used as a future drinking water source.

2.2.4.3 Discontinuous Sands and Gravels Overlying Bedrock Aquifer

Monitoring well and sample boreholes occasionally have encountered gravels and/or sands directly above the bedrock surface. Typically, these deposits are very thin and appear to be a discontinuous veneer over low spots in the bedrock surface. It is not clear if the sands and gravels may provide preferential pathways for groundwater migration or if they are truly discontinuous deposits filling minor low spots on a previously eroded surface. The deposits are found in a small percentage of boreholes and are too thin (generally less than 2 feet) to alone provide a sufficient volume of water to be used as groundwater source in the HFT area. Monitoring wells constructed with their screened interval through these materials also have a portion of their screens into the underlying bedrock. For this reason, it is prudent to consider these discontinuous sands and gravels as a small vertical extension of the underlying bedrock aquifer (Bristol and North Wind 2020). Some portions of the discontinuous sands and gravels overlying bedrock aquifer are also within the deep artesian (confined) aquifer (monitoring wells AP-145, AP-146, and AP-151). Velocity and directional flow probes installed in wells AP-128, AP-145, AP-146, and AP-151 (all completed within the deep sand and gravel/bedrock aquifer) showed a strong correlation to tidal changes with the flow velocity increasing and the groundwater elevation decreasing during outgoing tides.

Tidal changes in monitoring wells do not necessarily indicate saltwater intrusion but rather the motion of fresh water in response to pressure changes associated with sea level rise. A salinity study conducted in 1998 indicated that there is currently no saltwater intrusion at the site; however, the reduction of pressures by over pumping within the aquifers located below sea level could very easily result in saltwater intrusion of the strata below sea level (Bristol and North Wind 2020). The Alaska Well Log Tracking System indicates that two wells within 4 miles of the HFT are completed in the gravel layer that occasionally directly overlies bedrock. In the former Administrative Area the discontinuous sands and gravels overlying bedrock aquifer would be found well below sea level and, similar to the fractured granite-diorite aquifer, has the potential for saltwater intrusion.

2.2.4.4 Deep Artesian (Confined) Aquifer

An aquifer with artesian pressure underlies the deep water-deposited clays of the southern portion of the HFT, including the former Administrative Area. The artesian conditions appear to be present in a thin, approximately 5-foot-thick zone of well sorted sand present between the bedrock and the overlying clay confining unit. This layer is potentially discontinuous. The direction of groundwater flow within the deep artesian aquifer is toward the southeast. Some wells completed within this zone have true artesian flow with groundwater flowing at the ground surface (Bristol and North Wind 2020).

Previous studies have indicated that the likely source of recharge to the artesian aquifer is through the north-south trending fault located near the west edge of the HFT. Core holes at the Tank 107 basin encountered diorite except for the western most core hole, which penetrated into the metabasalt bedrock. This indicates that the fault lies directly below the Tank 107 basin. The southern end of the fault is found where Mink Creek crosses Lutak Road. The fault is not visible at the surface, as it is covered by surficial sediments. The fault likely serves as a vertical preferential pathway for the movement of groundwater into the geologic strata below the clay confining unit (Bristol and North Wind 2020).

The highest groundwater elevation and flow rate within the confined artesian aquifer at the former Administration Area is at monitoring well AP-145. The hydraulic head at other deep wells, while artesian, is slightly lower. Within the western and central portions of the former Administrative Area, the bedrock surface is nearly 60 feet below mean sea level; however, the depth to bedrock is shallower in the eastern portion of the former Administrative Area, and the Emergent Beach Perched Aquifer directly overlies the bedrock aquifer in this area. The discharge from the deep artesian system to Lutak Inlet evidently occurs below the clay unit at a point and depth well below the low-tide line. The hydraulic head gradient of the artesian aquifer system is approximately 0.09 feet/foot. The natural flow rate from the artesian wells is approximately 0.4 gpm. A well completed in this aquifer flowing at that rate could produce approximately 500 gallons of water per day. Monitoring wells AP-116, AP-120, AP-124, AP-133, AP-145, and AP-151 have or have had artesian flow (Bristol and North Wind 2020).

Contaminants have not been detected in the deep artesian (confined) aquifer likely due to the overlying clay unit that is up to 80 feet thick. Although artesian in nature this aquifer is very thin and may be susceptible to saltwater intrusion during pumping if a drinking water well was installed in this aquifer, particularly in the former Administrative Area.

2.2.4.5 Emergent Beach Perched Aquifer

The uppermost aquifer in the southern portion of the HFT is the Emergent Beach Perched Aquifer, which consists of upper deposits composed of gravely sand deposited in a beach environment and lower deposits composed of sandy calcareous gravels deposited in a beach or fluvial environment. These deposits range from approximately 10 to 20 feet thick within the former Administrative Area and become thinner to the north. Over most of the former Administrative Area, the Emergent Beach Perched Aquifer overlies a marine clay confining layer that is blue-gray in color and up to 80 feet thick. The general groundwater flow direction in the perched aquifer is toward the south-southeast; however, the surface of the underlying clay appears to have minor channels eroded in it that also influences the direction of groundwater flow. The clay unit serves as the perching layer for the groundwater found in the beach deposits and separates that groundwater from the deeper artesian aquifer.

The average sustainable pump rate for the 2-inch diameter monitoring wells constructed and sampled within the Emergent Beach Perched Aquifer is 0.07 gpm with a drawdown of 0.33 feet. A well completed in this aquifer pumping at that rate could produce a total of approximately 100 gallons of water per day (Bristol and North Wind 2020). Based on the low yield from this shallow unconfined aquifer it is unlikely to be used as a future drinking water source.

2.2.4.6 Marine Varve Aquifer

The aquifer present below the center of the former Tank Farm Area is mostly within varved sediments that fill a bedrock low. A bedrock ridge extends from an area near the HFT fuel dock to Tanani Point. The area directly west of the ridge, in a topographically uphill direction, overlays a bedrock low. The bedrock low is cut perpendicularly east to west by a low bedrock divide that extends from approximately the center

of Tank 106 to an area 150-feet north of the former Manifold Building. The bedrock low bounded by the bedrock ridge on the east, the bedrock divide on the north, the structural fault on the west, and the thick layer of confining clays to the south has been referred to as the paleobasin in previous HFT studies. The bedrock ridge is cut by a paleochannel or bedrock gulley (filled with surficial sediments) that drains groundwater from the paleobasin to the east and toward Lutak Inlet (Bristol and North Wind 2020). The paleochannel is depicted in Figure 3.

The average sustainable pump rate for monitoring wells constructed and sampled within the Marine Varve Aquifer is 0.05 gpm with a drawdown of 0.8 feet. A well completed in this aquifer pumping at that rate could have the potential to produce a total of approximately 70 gallons of water per day (Bristol and North Wind 2020). Based on the low yield from this shallow unconfined aquifer it is unlikely to be used as a future drinking water source. The groundwater flow direction is generally to the east-northeast, with the exception of local variation near the former Manifold Building.

2.2.4.7 Perched Upper Colluvium Aquifer

Groundwater is present within the colluvium above the clay member in the western portion of the former Tank Farm Area. The water-bearing colluvium is underlain by clay that is quite hard and often dry. Penetration of the underlying dry clay was extremely difficult in the Tank 101, 103, and 104 areas. The sand beds beneath the former tanks are also saturated in these basins, as they overlay the clay stratigraphic member.

Flow direction within the colluvium is typically in the local downhill direction. There appears to be a number of very small groundwater seeps where water within the colluvium may come to the surface and be incorporated into the local surface water. The area below Tank Basin 103 is especially boggy with seeps and surface water present.

The average sustainable pump rate for monitoring wells constructed and sampled within the perched upper colluvium aquifer is 0.08 gpm with a drawdown of 0.15 feet. A well completed in this aquifer pumping at that rate could produce a total of approximately 115 gallons of water per day. It should be noted that with this perched water aquifer, the total volume of water present may not support pumping for extended times (Bristol and North Wind 2020). Based on the low yield from this shallow unconfined aquifer it is unlikely to be used as a future drinking water source.

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3.0 PREVIOUS INVESTIGATION SUMMARY

This section presents a summary of previous investigations conducted at the HFT site. Many site investigations and treatability studies or interim actions have been conducted by numerous contractors over the past 20+ years at HFT. These activities were typically governed by individual work plans, with the results documented in numerous task-specific reports. Some examples of these reports include:

- Geologic and hydrogeologic investigations
- Source area evaluations
- Removal actions
- Soil gas surveys
- Well drilling
- Tracer tests
- Permeable sparging trench system operations

These reports were compiled into a comprehensive summary presented in the *Former Haines Fuel Terminal Data Gap Analysis Report* (North Wind 2014). Additional investigation to address identified data gaps was conducted as part of an RI completed from 2015-2017 (Bristol and North Wind 2020). The COPCs that these investigations and evaluations focused on were primarily petroleum, oil, and lubricants (POL)-related compounds, the exception being the Lutak Burn Pit (Bristol and North Wind 2020). In 2022 a PFAS PA/SI was carried out and identified PFAS at concentrations greater than the current PSLs within the former Administrative Area (Figure 4) and PFAS detections at concentrations less than the current PSLs at the former Bulk Fuel Storage Area (Figure 5).

Based on the previous investigations several areas are known to have soil or groundwater contamination exceeding applicable PRGs primarily for POLs (North Wind 2014; Bristol and North Wind 2020). These areas include:

- Tank 100 through Tank 110 and Tank 112
- Exit Pipeline Tank 102 through Tank 105
- Main Pipeline near Paleochannel
- Tank Farm Burn Pit
- Lutak Burn Pit
- Mainline Pump House Building 1200
- POL Laboratory Building 1206
- Utility Building 1207
- Fire Pump Building 1208
- Fire Foam Building 1231
- Manifold Building 1232
- Tank 100 Pump House Building 1237
- Tank 100 Valve and valve piping
- Source Area upgradient of AP-104

Based on the PA/SI, this RI will focus on the following locations (Arcadis 2023):

- **Fire Foam Building 1231** – Retained as an AOPI, the purpose of sampling is to confirm the PA/SI findings. If PA/SI findings are supported this site will no longer be an AOPI, if results indicate PFAS is present in groundwater at concentrations greater than the PSLs the site will become an AOI.

- **Firehouse Office, Shop, and Garage Building 1212** – This site is an AOI because PA/SI results found PFAS at concentrations greater than the PSLs in groundwater.
- **Hose Cart Building 1209** – Retained as an AOPI, additional sampling required to support the PA/SI findings and rule out as a potential source area.
- **Fire Pump Building 1208** – This site is an AOI because PA/SI results found PFOS at estimated concentrations greater than the PSL in groundwater.
- **Fire Hose Building 1203** – This site is an AOI because PA/SI results found PFOS at estimated concentrations greater than the PSL in groundwater.

3.1 Previous Investigations

Contaminant investigation and remedial work at the HFT has been ongoing since 1985. PFAS was first assessed during the 2015-2017 RI work. The summaries in this section focus primarily on the former Administrative Area and former Tank Farm Area where PFAS was identified during the PA/SI.

3.1.1 1985 Bulk Fuel Storage Area POL Sampling

In 1985 tank basins and berms were recontoured and basin liners were installed by a contractor. During the work activities, workers complained of a petroleum smell in the soil and a petroleum taste was experienced by some workers. The tank areas considered by the workers to be most noticeably contaminated were tank basins 101 through 103 and tank basins 105 through 107. It was reported that in areas of higher contamination the soil had an oily appearance and when soil encountered water it formed an oily sheen. Samples were collected from soil within the tank containment basis. Tank 101 results for ethylbenzene (84.5 mg/kg), toluene (183 mg/kg), and total xylenes (592 mg/kg) exceeded PRGs at the time, and a composite sample from Tank 102, Tank 106, and a soil pit had total xylenes (192.9 mg/kg) in exceedance of PRGs (North Wind 2014).

3.1.2 1990 Underground Storage Tank Removal

Four underground storage tanks (USTs) were removed at the former Administration Area in 1990 (North Wind 2014). They were:

- Tank 900, used to contain gasoline, near Garage/Shop/Warehouse Building 1202 with a capacity of 2,000 gallons.
- Tank 901, used to contain heating oil, near the former Utility Building 1207 with a capacity of 1,000 gallons.
- Tank 902, used to contain gasoline, near the former Fire Pump Building 1208 with a capacity of 100 gallons.
- Tank 903, used to contain gasoline, near the former Truck Fill Stand Building 1217 with a capacity of 1,000 gallons.

Petroleum-contaminated soil was discovered while excavating the USTs 900, 901 and 903. The contaminated soils that were removed were stockpiled north of the former Quarters Area in the former pipe lay down area (North Wind 2014; Bristol and North Wind 2020). The contaminated soil was transported to Juneau and treated with a soil burner during the 1999 Pipeline and Soil Stockpile Removal Action. All samples collected from the footprint of the soil storage area were below regulatory levels (North Wind 2014).

3.1.3 1992 Fuel Terminal Site Investigation

As part of the 1992 Fuel Terminal Site Investigation, borings AP-005 through AP-038 were completed throughout the former Administrative Area and Bulk Fuel Storage Area (Bristol and North Wind 2020). The following borings were completed as monitoring wells: AP-006, -007, -009, -011, -013, -014, -015, -016, -017, -018, -019, -020, -022, -023, -027, -029, -030, -032, and -034 (North Wind 2014). Soil samples were collected from borings and groundwater samples were collected from monitoring wells. Data is available for select borings and monitoring wells.

Borings found to have exceedances of PRGs were the following (North Wind 2014; Bristol and North Wind 2020):

- AP-006 – Former POL Laboratory Building 1206 – diesel range organics (DRO) at 3,800 mg/kg
- AP-009 – Valve Boxes – 2-methylnaphthalene at 1.7 mg/kg and naphthalene at 0.37 mg/kg
- AP-028 – Tank 106 – DRO at 8,500 mg/kg
- AP-032 – Tank 108 – 1,2,4-trimethylbenzene (TMB) at 0.63 mg/kg

Borings with soil detections less than PRGs included AP-022 (Tank 103), AP-024 (Tank 104), AP-027 (Tank 105), and AP-031 (Tank 108). Non-detect soil results were associated with soil borings AP-020 (Tank 110/112) and AP-023 (Tank 104). Tetrachloroethene (PCE) was identified in soil at concentrations greater than the PRGs in the former Drum Storage Area; however, this area is located east of the former Administrative Area (North Wind 2014; Bristol and North Wind 2020). Further information regarding PCE at the former Drum Storage Area is provided in Section 3.1.8.

Monitoring wells with exceedances of PRGs were the following (North Wind 2014; Bristol and North Wind 2020):

- **AP-007** – Former Utility Building 1207 – DRO at 1,700 micrograms per liter (µg/L) and 1,2,4-TMB at 160 µg/L
- **AP-009** – Valve Boxes – 1,2,4-TMB at 17 µg/L
- **AP-014** – Tanani Burn Pit – DRO at 3,500 µg/L, benzene at 95 µg/L, ethylbenzene at 340 µg/L, total xylenes at 2,150 µg/L, and 1,2,4-TMB at 490 µg/L
- **AP-034** – Manifold Building 1232 – DRO at 4,200 µg/L, benzene at 770 µg/L, ethylbenzene at 300 µg/L, total xylenes at 360 µg/L, naphthalene at 120 µg/L, and 1,2,4-TMB at 220 µg/L

Monitoring wells with detections (but no PSL exceedances) included AP-011 (Drum Storage Area), AP-013 (Drum Storage Area), AP-020 (Tank 110/112), AP-027 (Tank 105), and AP-30 (Tank 107; North Wind 2014; Bristol and North Wind 2020).

3.1.4 1996 Groundwater Treatment System Oxygen-Release Compounds

In October 1996, a groundwater treatment system, using oxygen-releasing compounds (ORCs), was installed as a treatability study across the Paleochannel Area. Its goal was to determine if enhanced bioremediation could be used to slow or stop the offsite migration of petroleum products in the groundwater. The results were inconclusive (Bristol and North Wind 2020).

3.1.5 1996 Offsite Migration Investigation

The 1996 Offsite Migration Investigation focused on the former Tank Farm Area. Groundwater was sampled for limited analytes and minimal soil samples were collected. Groundwater was sampled for gasoline range organics (GRO) and benzene, toluene, ethylbenzene, and xylenes (BTEX) compounds and

exceedances were found for GRO at Tank 110; GRO and benzene at Tank 101, 103, 104, 105, 106, 107, 109, 111, and 112; and GRO, benzene, and toluene at Tank 108. Soil samples were collected from Tank 104 through Tank 109; Tank 104 soil had exceedances for GRO and DRO, Tank 107 exceedances for DRO, and Tank 108 and Tank 109 had benzene exceedances. During the investigation tank sludge was observed outside of several of the tank manway entrances. The monitoring well AP-104 (AP-104 Source Area) was sampled during the investigation and was found to have groundwater exceedances for GRO and benzene.

While onsite for the investigation, an attempt was made to conduct a geophysical survey of the Goo Pit to delineate the extent of buried metallic debris. Overhead high voltage power lines disrupted the survey equipment (EM-34 Geophysical Surveillance Surveyor) and the results were inconclusive, but appeared to identify several metallic anomalies in the area. In the fall of 1996, an attempt was made to cap the Goo Pit, but stopped when drums were uncovered. It had been reported that asphaltic materials were buried by the Alaska Department of Transportation and Public Facilities during the paving of Lutak Road. The Goo Pit area is located east of the former Administrative Area and was further investigated in 2015 during the RI (Bristol and Northwind 2020).

3.1.6 1997 Vacuum Extraction System

The high vacuum extraction (HVE) system was constructed between October and December 1997, becoming operational in 1998. The system was installed at the perimeter of the former Tank 100 area with the purpose of reducing the occurrence of free product fuel found in the area. The HVE system was expanded in the fall of 1999 but was eventually deactivated in December 2000 due to decreasing fuel recovery rates. At its highest the system extracted 2 gallons per day and by its shutdown recovery had decreased to approximately 0.03 gallons per day. The system extracted approximately 225 gallons of fuel from the subsurface and reduced contamination concentrations in groundwater migrating offsite (Bristol and North Wind 2020).

3.1.7 1997 Lutak Burn Pit Removal Action

Approximately 1,800 cubic yards (cy) of soil was removed from the Burn Pit area and transported to a contaminated soil stockpile north of Buildings 1213 and 1214. The soil was heavily contaminated with GRO, DRO, residual range organics (RRO), and BTEX compounds. The excavation reached a depth of 24 feet below ground surface (bgs) and bedrock was exposed in the southern portion of the excavation. Due to limits of the excavator the excavation could not proceed beyond 24 feet bgs, and soil contaminated with GRO and DRO was left in place in a portion of the excavation. The soil left in place was covered with a liner and large boulders. The stockpiled soil was eventually transported to Juneau and treated with a soil burner during the 1999 Pipeline and Soil Stockpile Removal Action. Confirmation sampling conducted under the former stockpile ensured all POL-contaminated soil was removed from the stockpile area (Bristol and North Wind 2020).

3.1.1 1998 Tank 107 Release Investigation

Soil borings were advanced in 11 locations; 8 locations were within the containment basin with 3 additional borings located topographically downgradient of the containment basin. Monitoring wells were completed at 9 of the boring locations. Significant soil contamination was discovered during the release investigation and free product was observed on the piezometric surface in several monitoring wells (North Wind 2014).

3.1.2 1998 Tank 104 ORC Treatability Study

Prior to the treatability study six soil borings were advanced in the Tank 104 area; exceedances against the PRGs were found for GRO and DRO. GRO had a maximum detection of 8,300 mg/kg at 4 to 6 feet bgs and DRO had a maximum detection of 358 mg/kg at 4 to 5 feet bgs. In addition, there were detections for ethylbenzene, toluene, and total xylenes (North Wind 2014). The ORC treatability study was conducted near Tank 104 and within the paleochannel. The study was terminated due to ineffectiveness (Bristol and North Wind 2020).

3.1.3 1999 Pipeline and Soil Stockpile Removal

During the fall of 1999, the fuel pipelines from the dock to the Manifold Building were removed. Eleven confirmation soil samples were collected and analyzed for GRO, DRO, BTEX, and polycyclic aromatic hydrocarbons (PAHs). The analytes 2-methylnaphthalene and naphthalene exceeded PRGs, and there were detections for DRO, toluene, ethylbenzene, total xylenes, and fluorine. The soil samples with the 2-methylnaphthalene and naphthalene exceedances were downgradient of the Tank 109 containment basin drain which was believed to be the source and not from a leak associated with the pipeline. During the removal, a 12-foot-long section of 10-inch diameter pipe was lost into Lutak Inlet and a 28-foot-long section of 16-inch diameter pipe was abandoned in place at the dock facility; 150 gallons of methanol was recovered from the abandoned pipeline. Methanol was used during deactivation of the pipeline for cleaning and flushing (Bristol and North Wind 2020).

In addition to the pipeline removal, soil generated during the UST removal and Lutak Burn Pit excavation was shipped offsite to Juneau for thermal treatment (Bristol and North Wind 2020).

3.1.4 2001 Permeable Air Sparge Trench Treatability Study

A 420-foot-long permeable air sparging trench system was installed across in the Paleochannel in October 2001. Two additional augmentation trenches were added to the system in May 2003 to improve the overall effectiveness. The system used in-situ horizontal air sparging wells placed in a gravel fill trench to remove contaminants from groundwater entering the trench and to enhance aerobic biodegradation of petroleum-affected groundwater and soils downgradient of the injection wells (North Wind 2014). The system was operated until 2014 (Bristol and North Wind 2020).

3.1.5 2001 Bulk Tank Removal

Tank 100 and Tank 107 were removed from the HFT site (North Wind 2012, 2014).

3.1.6 2002 Groundwater Tracer Study

Groundwater fluorescent tracer dyes (i.e., Fluorescein and Eosine) were initially introduced into specific areas of the HFT in 2002. The purpose was for continued monitoring of the movement of these dyes related to the fate and transport of subsurface contamination (Bristol and North Wind 2020).

3.1.7 2003 Free Product Removal

Free product fuel was skimmed from monitoring wells AP-525 and AP-526, approximately 30 gallons of fuel was removed (Bristol and North Wind 2020).

3.1.8 2003 Drum Storage Area Passive Soil Gas Survey

A passive soil gas survey was completed in May 2003 and used 100 individual screening modules installed in a grid with 30-foot spacing. The screening boreholes were advanced with a 42-inch long, 3/4-inch diameter drill bit on a rotary hammer drill. The modules were allowed to equilibrate for 16 days before removal (Bristol and North Wind 2020). The purpose was to gather PCE data to demonstrate that the PCE contamination observed in 1992 had attenuated. The highest total mass concentrations for PCE coincided with the earlier sampling data (North Wind 2014). The former Drum Storage Area is located east of the former Administrative Area.

3.1.9 2003 Bulk Tank Removal

Tanks 101 through 106 and Tanks 108 through 112 were removed from the HFT site (North Wind 2012; Bristol and North Wind 2020).

3.1.10 2004 Tanani Point Burn Pit Removal Action

In August 2004 57 cy of POL-contaminated soil was removed from the Tanani Point Burn Pit; soil was removed to the underlying bedrock surface. In addition, a steel containment tray that served as the bottom of the Burn Pit was excavated. Soil samples were collected from the walls of the excavation and results were below PRGs for GRO, DRO, and BTEX compounds. The contaminated soil from the Burn Pit was placed within the footprint of the former Tank 100 area and stockpiled. In 2007 the soil was treated using Pentononic and System ET-20 microbes. The treated soil was sampled in 2008 for GRO, DRO, RRO, BTEX, PAHs, and lead and results were below the alternative PRGs. The soil remained within the Tank 100 footprint and was eventually covered by soil placed as part of the 2009 Source Reduction Excavation (Briston and North Wind 2020).

3.1.11 2004-2005 Building Demolition

Buildings at the HFT site were surveyed for hazardous materials such as asbestos containing materials (ACM), and lead-based paint (LBP); before their demolition ACM and LBP were abated, manifested, and transported offsite to a permitted landfill for disposal. All buildings, except Building 1204, were demolished by 2005 (North Wind 2014).

3.1.12 2005 Class V Underground Injection Control Assessment

As many as nine dry wells may exist at the HFT. Two wells are associated with the former Mainline Pump House Building 1200, one well with the former Garage/Shop/Warehouse Building 1202, two wells with the former POL Laboratory Building 1206, two wells with the former Utility Building 1207, and two wells with the former Cold Storage Building 1210. Four dry wells were investigated in 2005, one of the Mainline Pump House wells, the Garage/Shop/Warehouse Building 1202 well, and the two wells of the former Utility Building 1207. A fifth dry well was assessed in 2007 in association with the Mainline Pump House Building 1200. Results found contamination was present at the dry wells associated with the former Mainline Pump House Building 1200 and the northwest dry well associated with the former Utility Building 1207 (North Wind 2014). At Building 1200, DRO and 1,2,5-trimethylbenzene concentrations were greater than the ADEC migration to groundwater cleanup levels (PRGs at the time) but did not exceed the current EPA residential RSLs (EPA 2023). At Building 1207, DRO and 1,2,4-trimethylbenzene concentrations were greater than the ADEC migration to groundwater cleanup levels (PRGs at the time) but did not exceed the current EPA residential RSLs (EPA 2023).

3.1.13 2008 – 2009 Free Product Skimming

In October 2008, 24 free product recovery wells were installed (North Wind 2012). Wells installed near the former Manifold Building were equipped with passive skimmers and removed approximately 50 gallons of product (Bristol and North Wind 2020).

3.1.14 2009 Source Reduction Excavation

Soil was excavated from the vicinity of monitoring well AP-173, soil boring AP-524, former Tank 100 Pump House, the Paleochannel Area, Tank Farm Burn Pit, Tank 100 dewatering valve, and buildings associated with the former Administrative Area with the purpose of removing the most heavily contaminated soil. Due to excavation activities monitoring wells AP-0173, AP-0516, AP-018, and NW-03 were removed and replaced (North Wind 2012). The Tank 100 excavation began adjacent to the former transfer piping that connected the Tank 100 Pump House to Tank 100 near the location of monitoring well NW-03. The excavation progressed easterly through the area of the former Burn Pit and stopped along the eastern edge near the air supply lines for the sparge system. The depth of the excavation ranged from 2 feet to 18 feet bgs, and a total of 2,060 cy was removed and treated from the area of Tank 100. This soil was placed within two treatment cells at the former Tank 100 Burn Pit location. Excavation floor and sidewall samples found that the remaining soil was less than PRGs except for elevated levels of 1,2,4-TMB (Bristol and North Wind 2020).

The AP-173 excavation started at the northeast limit of the contamination directly above the onsite seep and continued laterally and in depth until all soil with a photoionization detector measurement greater than 300 parts per million was excavated. Approximately 600 cy of contaminated soil was removed and transported to a treatment cell located directly south of Tank 100. Post excavation sampling of the floor and sidewalls indicated the remaining soil was less than PRGs. This removal action did not significantly reduce contaminant concentrations in groundwater, indicating that groundwater may be moving from contamination known to exist within the Tank 107 basin (North Wind 2014).

Soil excavated from the former Administrative Area came from the former Utility Building 1207, the Fire Pump Building 1208, and the 4-Unit Radiator Building 2011. A total of 480 cy was excavated, and the soil was placed into Treatment Cell #3 located northeast of these three buildings.

The soil placed into treatment cells was treated with System ET-20 microbes and Pentononic during 2009 and 2010. Sampling conducted in 2010 indicated that the soil within the treatment cells containing material from Tank 100 and AP-173 reached applicable alternate PRGs in place at the time except for 1,2,4-TMB. The treatment cell liners were removed, and the treated soil was left in place at the cell location. Sampling of Treatment Cell #3 found DRO met the PRGs in place at the time (Bristol and North Wind 2020). In 2011 the treated soil was spread, both in the former Administrative Area and former Tank 100 area and graded to nearly level surface.

3.1.15 2010 Groundwater and Surface Water Sampling

Groundwater and surface water sampling activities were conducted in 2010, groundwater sampling occurred in May and October. Surface water sampling occurred at the onsite seep, culvert seep, and at Tanani Beach Seep #1 and #3. The Northern Tank Farm Area was found to have groundwater exceedances for GRO, 1,2,4-TMB, and 1,3,5-TMB; and surface water exceeded for total aromatic hydrocarbons (TAH) water quality standard of 10 µg/L (ADEC 2022b). The Paleochannel Area had groundwater exceedances for GRO, DRO, benzene, 1,2,4-TMB, and 1,3,5-TMB; there were no surface water exceedances. The Paleobasin Area had groundwater exceedances for benzene, total xylenes, 1,2,4-TMB, and 1,3,5-TMB;

there were no surface water exceedances. The former Administrative Area was found to have groundwater exceedances of 1,2,4-TMB; and there were no surface water exceedances (North Wind 2012).

3.1.16 2014 Data Gap Analysis

A data gap analysis was performed to evaluate and compile data from previously conducted individual investigations and remedial actions at the former HFT to determine which individual site features required additional characterization activities. Soil and groundwater data were compared to the PRGs specific to the HFT as identified in the *ADEC Alternative Cleanup Level Memorandum*, dated 16 April 2001 (North Wind 2014). The alternative cleanup levels were subsequently rescinded in December 2016 by ADEC, as a result, cleanup levels default to the most stringent exposure pathway values from 18 AAC 75.341 Tables B1 and B2 for soil and groundwater cleanup levels identified in 18 AAC 75.345 Table C.

3.1.17 2015 – 2017 RI

The 2015-2017 RI was meant to determine the nature and extent of 39 features that were found to require some degree of additional data collection based on the 2014 Data Gap Analysis. The report for the 2015-2017 RI efforts was finalized in June 2020. Former UST and potential dry wells were investigated in conjunction with the adjacent building. The RI results were compared to PRGs for soil and groundwater. The RI included 16 polychlorinated biphenyl (PCB) soil composite samples, 26 surface soil samples, 40 passive soil gas screening ports, 1,120 ultraviolet optical screening tool (UVOST) probes, 267 soil borings, 354 subsurface soil samples, installation of 14 monitoring wells, 25 surface water samples, and 119 groundwater samples. Soil and groundwater samples were analyzed for a range of contaminants, selected analysis was specific to each site based on known contaminants of concern or COPCs. Analysis included GRO, DRO, RRO, volatile organic compounds (VOCs), PAHs, semi-volatile organic compounds, 1,2-dibromoethane, pesticides, PCBs, PFAS, metals (including mercury), glycols, and dioxins/furans. Results were used to complete a risk evaluation and establish site-specific alternative PRGs for the former Administration Area and Fuel Handling Area (Bristol and North Wind 2020).

Based on results the following sites required no further action: Valve Box #1, septic system drain field, 3-Unit Radiator Building 1201, Shop, Garage, Warehouse Building 1202, Cold Storage Building 1210, Incinerator Building 1216, Truck Fill Stand Building 1217, Potential Administration Area Landfill, Lutak Beach Debris Area, Tank Basin 111, Tanani Burn Pit, Drum Storage Area, and North and South Equipment Laydown Yards. Below is a summary of sites that were investigated and found to require further evaluation (Bristol and North Wind 2020):

3.1.17.1 Former Tank Farm Area PFAS Results

- **Lutak Burn Pit:** Soil was sampled for PFOS and PFOA, results were non-detect at 12 to 13 feet bgs.
- **Fire Foam Building 1231:** UVOST confirmed that there was no hydrocarbon contamination present in the soil. Four soil samples were collected at HFT near the former Fire Foam Building 1231 and analyzed for PFOS and PFOA. PFOS was detected in two of three soil samples at concentrations of 0.0029 mg/kg and 0.0055 mg/kg, above the PRG. PFOA was not detected at concentrations greater than the LOD in any of the soil samples. Soil samples were not analyzed for PFBS, PFNA, and PFHxS; and groundwater was not assessed. Figure 5 details sample locations and results.

3.1.18 2022 PFAS PA/SI

The PFAS PA/SI assessed groundwater and soil for PFOS, PFOA, PFBS, PFNA, and PFHxS at seven identified AOPIs across the HFT. The AOPIs associated with the former Administrative Area are the former Firehouse Office, Shop, and Garage Building 1212; Fire Pump Building 1208; Hose Cart Building 1209; and Fire Hose Building 1203. The AOPI associated with the former Tank Farm Area is the former Tank Farm Fire Foam System (including former Fire Foam Building 1231). The AOPIs associated with the former Fuel Terminal Dock Area are the former Marine Dock Fire Hose Building 1236 and Dockmaster Building 1234. Results were compared to the PFOS, PFOA, PFBS, PFNA, and PFHxS PSLs to determine if further investigation was warranted. Refer to Figures 4 and 5 for PA/SI results. Sample results generated as part of the PA/SI found that PFAS compounds were present at the following locations at concentrations greater than the PSLs (Arcadis 2023):

- **Firehouse Office, Shop, and Garage Building 1212:** PFOS (43 and 270 nanograms per liter [ng/L]) and PFHxS (45 ng/L) were detected in groundwater at concentrations greater than the PSLs of 4 ng/L for PFOS and 39 ng/L for PFHxS. The remaining analytes were non-detect in groundwater. All soil results were non-detect for PFOS, PFOA, PFBS, PFNA, and PFHxS.
- **Fire Pump Building 1208:** PFOS (43 ng/L) was detected in groundwater at concentrations greater than the PSL of 4 ng/L, and PFHxS was detected at a concentration less than the PSL; all other analytes were non-detect in groundwater. All soil results were non-detect for PFOS, PFOA, PFBS, PFNA, and PFHxS.
- **Fire Hose Building 1203:** PFOS (87 ng/L) was detected in groundwater at concentrations greater than the PSL of 4 ng/L and PFHxS was detected at a concentration less than the PSL; all other analytes were non-detect in groundwater. In soil, PFOS was detected at a concentration less than the PSL and the remaining analytes were non-detect.

Locations where PFAS compounds were detected at concentrations less than the PSLs include (Arcadis 2023):

- **Dockmaster Building 1234:** PFOS (0.00056 mg/kg) was detected in soil at a concentration less than the PSL of 0.013 mg/kg. All groundwater results were non-detect for PFOS, PFOA, PFBS, PFNA, and PFHxS.
- **Fire Foam Building 1231:** PFOS (2.9 ng/L) and PFHxS (3.0 ng/L, 3.1 ng/L, and 7.1 ng/L) were detected in groundwater at concentrations less than the PSLs of 4 ng/L and 39 ng/L, respectively. The groundwater sampling locations are downgradient of the Fire Foam Building 1231, Tank Farm Burn Pit, Lutak Burn Pit, and associated ASTs of the HFT Tank Farm Fire Foam System. In soil PFOS (0.00083 mg/kg, 0.00055 mg/kg, and 0.0010 mg/kg) was detected at concentrations less than the PSL of 0.013 mg/kg. No other analytes were detected in groundwater and soil samples.

Locations that were non-detect for PFAS in soil and groundwater included the former Hose Cart Building 1209 and Marine Dock Fire Hose Building 1236 (Arcadis 2023).

3.2 Past PFAS Result Comparison to Current Screening Levels

PFAS data has previously been collected at the HFT APOIs and AOIs in 2015, 2016, and 2022. Refer to Sections 3.1.17 and 3.1.18 for additional summary of field efforts and results. Since the collection of the previous PFAS data the screening criteria has been revised resulting in lower RSLs (EPA 2023). The DoD directive instructs those sites screened against the older, less stringent, levels must be reconsidered against the new RSLs (DoD 2024). Refer to Section 1.3 for additional details regarding PSLs as well as Worksheet 15 of the UFP-QAPP. Previous soil and groundwater PFAS results are compared to current PSLs in Appendix H.

Comparison of previous soil results to current PSLs shows that all non-detection LODs are less than the PSLs, there are no soil data concerns. Comparison of previous groundwater results to current PSLs show that there are two monitoring wells that were non-detect with LODs greater than the PSLs. Monitoring well AP-114 had non-detect results with LODs greater than the PSLs for PFOA and PFNA. This monitoring well is associated with the Fire Hose Building 1203. Monitoring well AP-207, associated with the former Tank Farm Area, had a non-detect result with a LOD greater than the PSL for PFOS. Monitoring well AP-114 (Figure 6) and AP-207 (Figure 7) are proposed for sampling during the RI field efforts covered as part of this Work Plan.

3.3 Conceptual Site Model

The details from the site background and physical setting in Section 2 and the previous investigation results in Sections 3.1 were used to develop the current conceptual site model (CSM) as presented in Worksheet 10 of Appendix A. The current CSM was used to guide development of the RI approach discussed in Section 4.

4.0 REMEDIAL INVESTIGATION APPROACH

This section presents the PFAS RI approach for activities planned in 2024, including utility locates and the excavation permit process, coordination of site access, drilling and soil sampling, monitoring well installation, groundwater sampling, surveying, and managing investigation-derived waste (IDW). Detailed field activity techniques and procedures are presented in established standard operating procedures (SOPs) found in Appendix D. All SOPs and field forms referenced in this section are presented in the UFP-QAPP and listed in Worksheet 21 in Appendix A.

This section also describes the sampling design and rationale developed to meet the data quality objectives (DQOs). Additional details regarding the DQOs are presented in Worksheet 11, and additional details associated with the sampling design and rationale are presented in Worksheet 17 of the UFP-QAPP (Appendix A). Sampling locations and methods are summarized in Worksheet 18 (Appendix A).

All sampling will be performed in accordance with this Work Plan. Personnel will follow the APP (Appendix C) and wear appropriate personal protective equipment. PFAS sampling procedures will be followed as detailed in BE-SOP-34 (Field Sampling Protocol for PFAS) to ensure the quality and integrity of the samples. Samples will be collected into containers provided by the laboratory, and samples will be managed as required by the sample method. Pace Analytical South Carolina and Pace National in Mount Juliet, Tennessee are accredited by the DoD Environmental Laboratory Accreditation Program (ELAP) and approved by the ADEC Contaminated Sites Program; Laboratory certificates are provided in Appendix F. Refer to Worksheet 19/30 and Worksheet 26/27 in the UFP-QAPP (Appendix A) for additional details regarding sample containers and sample management. Disposable sampling items will be used, when possible, and non-disposable sampling items will be decontaminated as detailed in BE-SOP-14 (Equipment Decontamination) and any fluids generated as part of this process will be managed as IDW.

The results of the 2024 RI activities will be reviewed to determine if any data gaps exist and if additional investigation may be required. Any supplemental activities will be described in a separate Work Plan Addendum and/or updates to the UFP-QAPP, and the field work would be planned for later in 2024.

4.1 Utility Locates, Excavation Permit, and Site Access Approval

Prior to any intrusive activities, all appropriate permits and site access approvals will be obtained. An excavation permit will be obtained from the Fort Wainwright Directorate of Public Works (DPW), if required. To initiate the excavation permit process, a work order number from DPW will be requested. Once a work order number is obtained, the Alaska Digline will be notified as described in BE-SOP-25 (Underground Utilities). All appropriate signatures will be obtained to complete the dig permit and the field crew will carry a copy of the signed permit during drilling activities. If an excavation permit is not required by DPW, the Alaska Digline will be notified. Utility services include cable television, telephone, natural gas, electricity, fuel pipelines, sewer, and water. Locations will be identified with wood stakes, colored pin flags, and/or high visibility paint.

4.2 Mobilization

Two mobilization efforts are anticipated, the first mobilization will occur in early Summer 2024 and the second mobilization will occur later in the field season following data review from the first mobilization. Worksheet 14/16 of the UFP-QAPP (Appendix A) provides the project schedule. Field activities will be supported by Brice personnel and equipment, mobilized from either Anchorage or Fairbanks; personnel will stay in Haines until the completion of field activities for each mobilization. Mobilization of equipment

for drilling activities is expected to occur in early Summer 2024 (following Work Plan approval). The equipment will include a Geoprobe 6620DT drill rig, sampling equipment, and other materials and supplies to support the field effort. This equipment may be temporarily stored onsite during the duration of the field effort.

4.3 Drilling and Surface and Subsurface Soil Sampling

This section presents the procedures and approach for drilling and subsurface soil sampling at the HFT site. All SOPs referenced in this section are listed in the UFP-QAPP (Appendix A) and are found in Appendix D. Field forms are provided in Appendix E. If water needs to be added downhole during drilling activities only water that has been verified as PFAS-free will be used.

4.3.1 Soil Borings and Surface and Subsurface Soil Sampling Approach

Soil borings and subsurface soil sampling will be completed to delineate soil contamination identified in previous investigations, confirm past sample events findings, and investigate a potentially identified source area(s). The suspected source area is the former Firehouse Office, Shop, and Garage Building 1212. The former Hose Cart Building 1209 and Fire Pump Building 1208 area could also be a potential source area, along with the former Fire Hose Building 1203, due to downgradient monitoring wells AP-114 and AP-009 having previously exceeded the groundwater PSLs. Proposed boring locations for the first mobilization, located in the former Administrative Area, are presented in Figure 6.

The locations of the soil borings have been identified to meet the DQOs identified in Worksheet 11 of the UFP-QAPP, including delineation of contamination identified in previous investigations, confirmation sampling, and identification of a source area(s). The boring locations may be modified based onsite features. Ten boring locations are proposed for the first mobilization, and following completion of the soil boring, 10 monitoring wells will be installed (as detailed in Section 4.4). The three monitoring wells located along Lutak Road, downgradient from the former Administration Area and adjacent to the beach, will be completed as temporary monitoring wells with the option to make them permanent. Three soil samples will be collected from each soil boring from the surface, subsurface and water table for a total of 30 primary soil samples. The sampling approach for each objective will be as follows:

- Delineation of contamination based on data from previous investigations (three samples per boring, eight borings):
  - **Boring locations (eight soil borings):**
    - One boring northwest of the former Firehouse Office, Shop, and Garage Building 1212 to establish clean upgradient boundary.
    - One boring northeast of the former Firehouse Office, Shop, and Garage Building 1212 to establish a clean boundary.
    - One boring northwest of the former Garage, Shop and Warehouse Building 1202 and upgradient of AP-114, which had PFAS detections at concentrations greater than the PSLs.
    - One boring northeast of the former Garage, Shop, and Warehouse Building 1202 and upgradient of AP-009, which had PFAS detections at concentrations greater than the PSLs.
    - One boring northwest of the former Main Line Pump House Building 1200 and downgradient of AP-148, which had PFAS detections at concentrations greater than the PSLs.

        - Three borings south of Lutak Road, southeast and downgradient of AP009 and AP-114, which both had PFAS detections at concentrations greater than the PSLs.
    - **Sampling approach:** Three soil samples will be collected from each boring: one soil sample from the surface soil (0 to 2 feet bgs), one from subsurface soil (2 to 15 feet bgs) within the vadose zone dependent upon soil conditions (e.g., change in soil horizon, perched water lens, confining layer), and one at the groundwater interface.
- Confirmation sampling confirming PFAS absence or presence at potential source areas (three samples per boring, two borings)
    - **Boring locations:**
        - One boring southeast of former Hose Cart Building 1209 and northwest of former Fire Pump Building 1208 confirming the absence or presence of PFAS.
        - One boring southeast of the former Fire Hose Building 1203 confirming the presence of PFAS at concentrations less than the PSLs.
    - **Sampling approach:** Three soil samples will be collected from each boring: one soil sample from the surface soil (0 to 2 feet bgs), one from a subsurface soil (2 to 15 feet bgs) within the vadose zone dependent upon soil conditions (e.g., change in soil horizon, perched water lens, confining layer), and one at the groundwater interface.

4.3.2 Borehole Drilling Procedures

A Geoprobe drill rig will advance soil borings into the ground using direct push technology, which provides a continuous soil core and minimizes the IDW generated. Each boring will be drilled to a minimum depth of 5 feet below the water table. Soil boring locations will be marked with survey lath, survey whiskers, or pin flags as appropriate. Drilling activities will be recorded on boring logs and performed in accordance with BE-SOP-05 (Drilling and Soil Logging).

4.3.3 Borehole Logging

All borings will be logged in the field, and any observations regarding drilling conditions, staining, odors, debris, soil descriptions, and the depth to the groundwater interface at the time of drilling will be recorded on a boring log. Soil descriptions will be documented using the Unified Soil Classification System. Observations will be recorded on boring logs and activities will be completed as described in BE-SOP-05 (Drilling and Soil Logging).

4.3.4 Soil Sampling

Soil samples will be collected from each boring as described in Section 4.3.1 into containers provided by the laboratory and managed as appropriate to the sample method requirements. A clean stainless-steel spoon or other appropriate sampling device will be used to collect the soil sample. Refer to Worksheet 19/30 for sample containers and sample storage (Appendix A). Field screening and laboratory soil sample collection procedures will be performed according to the DoD *Environmental Field Sampling Handbook* (2013) and procedures outlined in SOPs BE-SOP-06 (Soil Sampling) and BE-SOP-34 (Field Sampling Protocol for PFAS). All samples collected will be recorded on a soil sample tracking form.

Soil samples will be submitted for analysis by Draft Method 1633 for PFAS to Pace Analytical South Carolina. Samples will be managed as detailed in Section 5 and Worksheet 18 of the UFP-QAPP (Appendix A). Worksheet 15 details the laboratory limits in Table 15-1 for Draft Method 1633, along with additional worksheets found in the UFP-QAPP (Appendix A) detailing the laboratory and equipment

capabilities. Method 1633 was finalized in January 2024; the final version of the method will be used if the selected laboratory receives method accreditation.

Field quality assurance (QA) and quality control (QC) samples (e.g., field duplicate [FD], matrix spike [MS]/matrix spike duplicate [MSD], field reagent blank [FRB]) will be collected as described in Section 4.8. The collection of equipment blanks is not anticipated for boring soil sampling activities as all samples will be collected using new, disposable equipment (e.g., disposable polyvinyl chloride [PVC] liners, stainless-steel spoons). All soil cuttings will be containerized and managed as further described in Section 4.10.

4.4 Well Installation, Development, and Groundwater Sampling

This section presents the approach and procedures for monitoring well installation, development, and groundwater sampling. All SOPs referenced in this section are listed in the UFP-QAPP (Appendix A) and can be found in Appendix D of this Work Plan. Field forms are provided in Appendix E. If water needs to be added downhole during well installation, development, or groundwater sampling activities only water that has been verified as PFAS-free will be used.

4.4.1 Monitoring Well Installation and Groundwater Sampling Approach

Monitoring wells will be installed to characterize the nature and extent of groundwater contamination and to evaluate groundwater flow directions. All wells will be completed as permanent installations, except for three monitoring wells installed south of Lutak Road. Temporary monitoring wells are proposed at the locations south of Lutak Road due to the potential for tidal inundation and/or storm surge damage and potential right-of-way issues; however, these wells may be completed as permanent monitoring wells during the second mobilization after further assessment of these potential issues, review of the analytical results from the first mobilization, and in consultation with stakeholders. Figure 6 details the proposed monitoring well installation locations that will be used for the first mobilization. Locations of wells for the second mobilization will be proposed following assessment of the first mobilization results. The first mobilization locations include:

- Four wells in presumed upgradient, downgradient and cross-gradient directions from the former Firehouse Office, Shop, and Garage Building 1212 and AP-148
- One well for confirmation of PFAS presence or absence in the former Hose Cart Building 1209 and former Fire Pump Building 1208 area
- Four wells in presumed upgradient and downgradient directions of AP-114 and AP-009
- One well for confirmation of PFAS presence or absence at the former Fire Hose Building 1203

The well locations may be modified based onsite conditions to ensure the full characterization of the nature and extent of contamination at the site.

Up to 20 existing monitoring wells across the HFT site will be sampled during the first mobilization. A total of 13 existing monitoring wells are planned for the former Administrative Area and 3 existing monitoring wells for the former Tank Farm Area, as shown on Figures 6 and 7.

4.4.2 Permanent Monitoring Well Installation and Development

Soil borings to be completed as permanent monitoring wells will be advanced to at least 5 feet below the water table (typically between 12 and 24 feet bgs within the Emergent Beach Perched Aquifer). Permanent monitoring wells will be constructed using 10-foot-long, 2.0-inch inside diameter Geoprobe 20/40 pre-pack 0.01-inch slotted well screens and Schedule 40 PVC casings. Next, 10/20 sand

will be placed in the annulus from the base to 1 foot above the screened interval, and a 2-foot bentonite seal will be placed above the sand pack and hydrated with water. Finally, 10/20 sand will be placed above the bentonite seal to approximately 1-foot bgs.

Monitoring wells will be completed as stickups, except for the monitoring wells south of Lutak Road. Monitoring wells south of Lutak Road will be completed as flush-mounts because of public accessibility and site use. Well design and installation will be performed according to the EPA *Design and Installation of Monitoring Wells* (EPA 2018) as detailed in BE-SOP-22 (Monitoring Well Installation, Development, and Decommissioning). Well construction will be recorded on a well completion form.

No sooner than 24 hours following installation, permanent wells will be developed to remove fine-grained material from the filter pack and to facilitate natural groundwater movement from the formation through the well screen. Well development procedures will include cycles of surging and purging to dislodge and remove particles and will follow procedures found in BE-SOP-22 (Monitoring Well Installation, Development, and Decommissioning). Details of development activities will be recorded on a well development form. Groundwater sampling will be conducted after development is complete and after groundwater parameters stabilize, in accordance with BE-SOP-09 (Groundwater Sample Collection) and DoD *Environmental Field Sampling Handbook* (DoD 2013).

4.4.3 Temporary Monitoring Well Installation

Temporary wells may be installed at locations where a permanent well is not suitable (e.g., south of Lutak Road adjacent to the shoreline where storm and/or tidal impacts could occur). To maximize the data quality, temporary wells will be installed similar to permanent wells. Soil borings will be advanced to at least 5 feet below the water table. Temporary wells will be installed using a Geoprobe DT37 sampling system. These wells will be constructed using 10-foot-long, 2.0-inch inside diameter 0.01-inch slotted conventional well screens and Schedule 40 PVC casing. Prepacked filter pack screens will be used to ensure a consist layer of 20/40 silica sand filter around the screen. Additional 10/20 silica sand will be placed in any of the remaining annulus area and 2 feet above the screened interval. Bentonite clay will be placed and hydrated above the sand pack to eliminate any influence in the sample data from surface water. A temporary protective cap may be placed over the well casing if potential for damage from adjacent activities is suspected. Well construction will be recorded on a well completion form.

No sooner than 24 hours following installation, temporary wells will be developed to remove fine-grained material from the filter pack and to facilitate natural groundwater movement from the formation through the well screen. Well development procedures will include cycles of surging and purging to dislodge and remove particles and will follow procedures found in BE-SOP-22 (Monitoring Well Installation, Development, and Decommissioning). Details of development activities will be recorded on a well development form. Groundwater sampling will be conducted after development is complete and after groundwater parameters stabilize, in accordance with BE-SOP-09 (Groundwater Sample Collection), DoD *Environmental Field Sampling Handbook* (DoD 2013), and Section 4.4.4 below.

After sampling and survey activities are completed, the temporary wells will be decommissioned. Decommissioning of the wells will be accomplished by removing the PVC screen and riser completely by hand and sealing the borehole with bentonite chips. Native soil will be used for the top 2 feet of each boring for restoration to existing conditions.

4.4.4 Groundwater Sampling

Groundwater samples will be collected from newly installed permanent wells immediately following well development, once parameters stabilize as described in Section 10.0 of the EPA *Low Stress (low-flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells* (EPA 2017). If parameter stabilization is not achieved, sampling will not be initiated until a minimum of 24 hours following development. Groundwater samples will be collected from temporary wells after stabilization is achieved and turbidity is reduced to at least 50 nephelometric turbidity units. Additionally, 20 existing monitoring wells across the HFT site (Figures 6 and Figure 7) will be sampled when parameters stabilize as described in Section 10.0 of the EPA *Low Stress (low-flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells* (EPA 2017).

Sample collection will follow EPA low-flow sampling procedures (EPA 2017) and be performed in accordance with BE-SOP-09 (Groundwater Sample Collection) and BE-SOP-34 (Field Sampling Protocol for PFAS). Equipment requiring calibration, including the YSI and turbidity meter, will be calibrated in accordance with manufacturer requirements and BE-SOP-20 (Water Quality Measurements). Submersible pumps (Proactive Stainless-Steel Hurricane or similar) or peristaltic pumps will be used to sample permanent and temporary wells. Submersible pumps will be decontaminated after each use (BE-SOP-14 [Equipment Decontamination]). New high-density polyethylene (HDPE) tubing will be used to purge and collect groundwater samples at each well. If a measurable free product is encountered, a groundwater sample will not be collected unless the free product can be removed and does not recharge while purging the well. Recharge of free product can visually be determined by monitoring purge water for heavy sheen and pure product. Groundwater parameter measurements and sampling observations will be recorded on groundwater sampling forms.

Due to the potential for tidal influence, the three new temporary wells and the three existing monitoring wells located south and east of Lutak Road (AP-192, AP-536, and AP-605) will be sampled between 1 hour before and 2 hours after low tide.

Groundwater samples will be submitted for analysis by Draft Method 1633 for PFAS to Pace Analytical South Carolina. Method 1633 was finalized in January 2024; the final version of the method will be used if the selected laboratory receives method accreditation. Samples will be managed as detailed in Section 5 and Worksheet 18 of the UFP-QAPP (Appendix A). Worksheet 15 details the laboratory limits in Table 15-2 for Draft Method 1633, along with additional worksheets found in the UFP-QAPP (Appendix A) detailing the laboratory and equipment capabilities. Field QA and QC samples (e.g., FD, MS/MSD, EB, FRB) will be collected as described in Section 4.7. Equipment blanks associated with the reusable submersible pumps will be collected along with the groundwater samples as detailed in Section 4.8. Purge water will be containerized and managed as detailed in Section 4.10.

4.4.5 Water Level Measurements

Groundwater levels will be measured from the top of the PVC well casing, to the nearest 0.01-foot, prior to groundwater sampling for calculation of groundwater elevations and groundwater contouring. The measurements will be recorded from a point on the north side of each well, or at another location marked on the individual well. Water levels used for contouring should be completed by the same person using the same water level indicator for consistency. Due to the potential for tidal influence, the water level measurements from the wells in the former Administrative Area will be taken in as narrow of a time frame as possible (1 to 2 hours).

4.5 Surface Water and Sediment Sampling

Up to three surface water samples and three sediment samples will be collected during the first mobilization from co-located locations within the identified seep area of the Emergent Beach Perched Aquifer into Tanani Bay (Figure 6). Seeps will be identified during low tide; the seep area is typically exposed when there is a low tide of -2 feet or lower. The correct tide window will be identified using published tide charts. If the Tanani Point seep area (Figure 6) is wider than 20 feet in any dimension, surface water and sediment samples will be collected at two locations, otherwise a single location will be sampled. The third sample point is reserved for any other unknown seeps that are observed west of Tanani Point. Seep areas observed downgradient of monitoring wells where previous PFAS results exceeded PSLs (AP-009, AP-114, and AP-148) will be prioritized. All SOPs referenced in this section are listed in the UFP-QAPP (Appendix A) and are found in Appendix D of this Work Plan. Field forms are provided in Appendix E. Both surface water and sediment samples will be submitted to Pace Analytical South Carolina for PFAS analysis using Draft Method 1633. Field QA and QC samples (e.g., FD, MS/MSD, and field blanks) will be collected as described in Section 4.8.

4.5.1 Surface Water Sampling Procedure

The surface water samples will be collected in accordance with BES-SOP-10 (Surface Water Sampling) and the DoD *Environmental Field Sampling Handbook* (DoD 2013a) from up three beach seep locations. Sample containers will be directly filled from the seep by slightly submerging the sample container just below the water surface at a slight angle. Sample locations will be surveyed during the low-tide window in order to get accurate locations.

4.5.2 Sediment Sampling Procedure

The sediment sampling locations will be co-located with the surface water seep locations and will be collected in accordance with BES-SOP-07 (Sediment Sampling Collection) and the DoD *Environmental Field Sampling Handbook* (DoD 2013a). Sediment samples will be collected during low tide. A stainless-steel scoop will be used to collect the sediment, the sediment will be homogenized prior to placing into the laboratory-provided container. If necessary, water will be decanted from the homogenization container prior to transferring into the sample container. Sediment sample locations will be surveyed during the low-tide window in order to get accurate locations.

4.6 Decontamination

Non-disposable sampling and drilling items will be decontaminated as detailed in BE-SOP-14 (Equipment Decontamination) and BE-SOP-34 (Field Sampling Protocol for PFAS). Potable water for decontamination will be sourced locally in Haines. During the first mobilization a sample will be collected from this water source and analyzed for PFAS. While awaiting this result, the locally sourced potable water will only be used for the washing portion of the decontamination process. Until the PFAS results are available from the potable water source, all three rinses will be conducted using deionized water. The deionized water will be procured in Anchorage, analyzed for PFAS, and confirmed to be PFAS-free prior to mobilization. If the analytical results confirm that the local potable water source is PFAS-free, only the final rinse will be conducted with deionized water.

4.7 Sample Management and Shipment

All samples will be stored as appropriate to the Draft PFAS Method 1633, all media will be stored and shipped so that a temperature of 0 to 6 degrees Celsius (°C) is maintained. The sample hold time will not exceed 28 days for water and 90 days for soil from time of collection to extraction. When samples are ready to ship, they will be labeled, packaged, and shipped as detailed in BE-SOP-03 (Labeling, Packaging, and Shipping Samples). Samples will be shipped to Pace Analytical South Carolina for 1633 analysis. Samples that are considered IDW will be shipped to Pace National in Mount Juliet, Tennessee. There are no FedEx operations in Haines so coolers will be transported by Alaska Seaplanes to Juneau where a courier hired by Brice will pick up and drop off the coolers at the FedEx facility in Juneau for overnight delivery to either South Carolina or Tennessee depending on the coolers sample contents. A chain-of-custody (CoC) form will be completed for every sample shipment and requirements are detailed in Section 5.1.5 and BE-SOP-2 (Sample Chain-of-Custody). Samples will be submitted for standard turnaround time for the first mobilization. Sample management and laboratory details are available in Worksheets 19/30 and 26/27.

4.8 Field Quality Assurance and Quality Control

This section describes the field QA and QC procedures that will be implemented for this investigation. These site-specific procedures are consistent with the details presented in Worksheet 20 of the UFP-QAPP (Appendix A).

FD samples will be collected at the minimum frequency of 10% (1 for every 10 project samples) for each target analyte. FDs will be collected from locations exhibiting light to moderate contamination, and (when practical) FD samples will be collected each sampling day to evaluate sample collection techniques on a daily basis. Duplicate samples will be collected simultaneously or in immediate succession, using identical techniques, and treated in an identical manner during storage, transportation, and analysis. Additional sample volume will be collected for MS/MSD samples at the minimum frequency of 5% (1 for every shipment [not to exceed 20 samples]) to be analyzed in every extraction batch for all methods and analytes, per DoD *Quality Systems Manual* version 5.4 requirements (DoD 2021).

Equipment blank samples will be collected at the minimum frequency of 10% to evaluate the submersible pump and the soil probe/hand auger/trowel decontamination process for potential cross-contamination. No other equipment blanks for this investigation are anticipated. FRBs will be collected at a frequency of at least one per sampling event. An FRB is a sample of PFAS-free water supplied by the laboratory poured in ambient air conditions (e.g., above borehole, by sampling exhaust), collected in a sample container, and transported to the laboratory for analysis.

4.9 Survey

Following completion of the field investigation, Brice will perform horizontal and vertical surveys of the soil borings, surface soil sample locations, permanent and/or temporary monitoring wells, as well as any other relevant features. Brice will perform the survey of the surface water and sediment sample locations during the low-tide event while the locations are accessible. The surveys will be conducted in accordance with the Engineering Manual 1110-1-1005 (USACE 2007), and the results will be provided in accordance with the requirements set forth in the *Manual for Electronic Deliverables* (MED; USACE 2017).

Feature elevations and positions will be surveyed using a Trimble Geo7X centimeter edition Global Positioning System (GPS), installed with Trimble Terrasync version 5.60 software. Static GPS data will be collected, then post-processed in the office relative to up to three GPS base stations within the National

Geodetic Survey (NGS) Continuously Operating Reference Station system, using Trimble Pathfinder Office version 5.90. GPS occupation duration will vary based onsite conditions and feature accuracy requirements, to achieve the specific horizontal and vertical accuracies outlined in Table 4-3 of the MED (USACE 2017).

Monitoring well vertical accuracy for permanent wells is the only requirement for which the Trimble 7X is unsuitable. These elevations will be measured with third order differential leveling techniques, using either a Nikon AE-7C automatic level or Trimble Dini digital level. Level loops will close within tolerance of MED Table 4-3 accuracy requirements. The elevations will be constrained to existing survey control monuments, which are published in either the NGS control database or USACE USMART control database. If no suitable control exists nearby, new monuments will be installed and surveyed.

If new monuments are established, a control survey will be conducted to establish position and elevation. The survey will be conducted using static GPS, with Trimble R10 receivers. Values for the primary monument will be established by collecting GPS static data with an occupation of at least 2 hours in duration. The raw data will be submitted to the NGS Online Positioning User System. The resulting solution will be tied to the National Spatial Reference System (NSRS), satisfying MED requirement 4.3.1 (USACE 2017). The NSRS is based on the most current realization of the North American Datum of 1983 (NAD83). Thus, the solution will be obtained in the most current realization of NAD83, which is *NAD83(2011 [Epoch 2010.0000])*.

Any additional monuments needing to be established onsite will be constrained to the primary monument and measured using multiple R10 receivers and relative static surveying techniques. Static survey measurements will be adjusted using the least-squares method in Trimble Business Center software, version 5.2 or higher. The positional and vertical accuracies of the survey network adjustment will be reported at the 95% statistical confidence level. The accuracy of the adjusted survey measurements and resulting coordinates will be described in the static adjustment report and point derivation report and included in the Supplemental Data folder associated with the project report. Compliance with the horizontal accuracy requirements, as listed in Table 4-3 of the MED, will be indicated in the deliverable.

Per the performance of work statement, horizontal survey data will be reported in Alaska State Plane Coordinates, Zone 1, in meters. Vertical data will be provided using the North American Vertical Datum of 1988 (NAVD88), in meters. Spatial data will be provided in Excel format in a survey data table, as an appendix within the report. The remainder of the survey deliverable (including survey field notes, sketches, and raw survey data) will be provided as Supplemental Data in accordance with the MED (USACE 2017).

4.10 Investigation-Derived Waste Management

IDW will include soil from drilling and sampling activities and purge water from monitoring well development and sampling activities. In addition, general non-hazardous refuse (such as disposable tubing, nitrile gloves, and plastic boring liners) will be generated. All IDW will be managed according to the procedures outlined in BE-SOP-79 (Waste Management), and all IDW generated (except for general non-hazardous refuse) will be recorded on an IDW tracking form. A summary of the IDW sampling results and final disposition of all waste streams will be provided as part of the RI Report.

The IDW management strategies are summarized below for soil, water, and non-hazardous solid waste.

4.10.1 Investigation-Derived Soil

Since drilling activities will be conducted using direct push technology, a minimal amount of soil cuttings is anticipated (approximately one 5-gallon bucket per boring). All soil cuttings will be containerized, and the buckets will be appropriately labeled and stored temporarily onsite until laboratory results are obtained.

PFAS laboratory results generated as part of soil investigation efforts will be used to characterize the soil for disposal. In addition, a composite sample will be collected and analyzed for GRO, DRO, VOCs and PAHs due to the known presence of fuel contamination at the HFT site. The samples will be collected into a laboratory-provided container. Analytical results will be provided to U.S. Ecology, who will arrange, transport, and oversee the final disposal of the soil based on RCRA determination, if needed. PFAS are not RCRA-regulated compounds, but RCRA-regulated VOCs may be present in the IDW soil and will be evaluated to determine if the soil concentrations exceed the RCRA toxicity limits.

4.10.2 Investigation-Derived Water

Purge water from monitoring well development and sampling, along with decontamination fluids, will be containerized in 15-gallon polyethylene drums or other suitable containers. The purge water containers will be labeled and placed within secondary containment. The water will be consolidated into an appropriate-sized container unless the water contains free product or heavy sheen. Water will be treated with a 15-gallon granular activated carbon (GAC) container; for each mobilization, the GAC brought to site will be new. A 15-gallon GAC container holds approximately 55 pounds of GAC. The GAC will be hydrated prior to use to reduce air space.

Most of the purge water will be generated during the first mobilization when sampling the existing monitoring wells and development and sampling of new permanent and temporary monitoring wells. During the second mobilization four monitoring wells will be developed and sampled. The PFAS analytes historically found in groundwater are PFOS (highest concentration of 270 ng/L) and PFHxS (highest concentration of 45 ng/L), both detected in monitoring well AP-148 near the former Firehouse Office, Shop, and Garage Building 1212 (USACE 2023). Additionally, purge and decontamination water generated may include co-mingled petroleum analytes.

GAC is a proven technology for the filtration of PFAS and petroleum contaminants in water and can effectively be used to meet the PSLs. Using a volume of water to be treated with a safety factor (1,400 gallons of IDW water) and calculating GAC usage based on the highest PFOS contaminant level from the PFAS PA/SI, breakthrough would occur after approximately 70,000 gallons. Appendix G provides the GAC breakthrough calculations. The 15-gallon GAC container is capable of treating the volume of IDW water to be generated from field activities; however, as a conservative measure a new 15-gallon GAC container will be used during the second mobilization.

IDW water will be treated using the 15-gallon GAC container with 10-micron prefilter and 12-volt pump. Water will be pumped through the prefilter and then through the GAC at a rate not to exceed 2 gallons per minute to allow sufficient residence time for the GAC to fully absorb any PFAS present. The prefilter will remove suspended sediment from the water since high sediment can result in channeling and impact contact of the water with the GAC. The prefilter will be changed as necessary and disposed of with the soil cuttings and used GAC. If high sediment is encountered additional filters will be added in series. The 2-gallon per minute flow rate will allow the appropriate contact time for the water with the GAC. Flow rate will be periodically checked throughout the treatment process to ensure the rate is maintained. IDW water will be treated with GAC and discharged directly to the ground surface in the area of the former

Firehouse Office, Shop, and Garage Building 1212, next to monitoring well AP-148 where known groundwater contamination is present. The treated water will be discharged in a manner that allows the water to infiltrate the ground fully and not run across the ground surface. At the conclusion, IDW water treatment activities during the first mobilization and post-GAC treatment water sample will be collected and analyzed for PFAS, GRO, DRO, VOCs, and semi-volatile organic compounds (SVOCs). The IDW water results will be compared to the PSLs in Table 15-4 of the UFP-QAPP (Appendix A).

4.10.3 Final Disposal of IDW Soil and Used Granular Activated Carbon

Final disposal of IDW soil and used GAC will be arranged by U.S. Ecology (part of Republic Services) whose focus is proper waste disposal transportation and disposal and includes experience in PFAS waste. Selected disposal, and potential treatment for used GAC, will be in compliance with the OSD *Interim Guidance on Destruction of Materials Containing PFAS in the United States* (DoD 2023a). Options identified by the OSD guidance include:

- Carbon reactivation units with environmental permits (for used GAC only)
- Hazardous waste landfills with environmental permits
- Solid waste landfills with environmental permits that have composite liners, and gas and leachate collection and treatment systems

U.S. Ecology will communicate selected disposal to the Brice PM who will confirm that the final disposal (or treatment in the case of used GAC) meets the OSD guidance. Manifests will include all appropriate information for the transporters and the treatment, storage, and disposal facility. Copies of manifests will be provided to the USACE PM to review prior to the waste shipment. Currently, the majority of PFAS waste is disposed of outside of Alaska. It is anticipated that PFAS waste generated as part of this project will be disposed of through a RCRA Subtitle D or Subtitle C landfill.

Final disposal location will be dependent on RCRA determination. Prior to transporting the ADEC Approval to Transport form will be completed and signed by ADEC in accordance with 18 AAC 75.325(i)(1). Copies of the ADEC Approval to Transport form, Waste Manifest, waste characterization analytical results, and other documentation will be retained and included in the RI Report.

4.10.4 Non-Hazardous Solid Waste

Non-hazardous solid waste such as nitrile sampling gloves, paper towels, tubing, and soil boring liners will be collected and disposed of at the Haines Community Waste Solutions Landfill.

4.11 Site Restoration and Demobilization

Site restoration will be completed after the investigation activities are completed. All location markings will be removed (e.g., pin flags, survey lath, etc.), and disturbed areas will be restored to match the existing grade. All equipment, supplies, and waste will be cleaned up and removed from the site.

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5.0 RECORDS AND REPORTING

5.1 Field Documentation

Brice personnel will keep accurate written records of field activities. The information will be documented either on a field form or in a logbook. Field forms will be used for documenting common field activities. The field forms and logbooks will be maintained as part of the permanent record for the site and will be available for review during systems audits or at any other time for QC checks. Documentation requirements are discussed further in Worksheet 29 of the UFP-QAPP (Appendix A).

5.1.1 Field Forms

Several field forms have been developed to document field activities. Field forms that may be used are included in Appendix E and are listed below.

- Boring log
- Well completion log
- Well development form
- Groundwater sample form
- Field instrument calibration forms
- CoC form
- IDW tracking forms

5.1.2 Logbooks

For field activities that are not covered on field forms, logbooks will be used for documentation. The logbooks will be completed as described in BE-SOP-01 (Logbook Documentation and Field Notes) and will generally contain the following information:

- Project name/site ID/client
- Sequential logbook page numbers
- Name of author, and full name and affiliations of onsite personnel (including site visitors)
- Weather, site conditions, and other salient observations
- Daily objectives
- Time and location of activities
- Field observations and comments
- Deviations from the Work Plan
- Site sketches, as necessary, with reference to north direction
- Health and safety comments
- Conversations with the U.S. Army representatives
- Field instrument calibration/maintenance documentation

5.1.3 Photographs and Videos

When photographs or videos are taken for visual documentation of a site or procedure, they will be numbered to correspond to the field logbook entries. If possible, a reference point (building, sign, etc.) will be included to assist in verifying the location of the photograph and provide an approximate scale. The name of the photographer, date, time, site location, site description, and the direction in which the

photograph is taken (if applicable) will be entered sequentially in the logbook as photos are taken. All photos will also display a time and date stamp.

5.1.4 Daily Quality Control Reports for Field Work

A daily quality control report (DQCR) will be prepared for each day that work is performed in the field, including mobilization and demobilization efforts. The DQCR will include (but not limited to) a description of the work that is performed each day, including field sampling, health and safety, operating equipment, and any potential issues or delays. The DQCR will also include photos of daily activities.

5.1.5 Chain-of-Custody Forms

A CoC form will be completed and will accompany every sample and shipment of samples to the laboratory to establish the documentation necessary to trace sample possession from time of collection. The CoC will be completed in accordance with BE-SOP-02 (Sample Chain-of-Custody), and will contain the following information:

- Project name and Program Manager's name
- Location ID
- Sample number
- Signature of collector, sampler, or recorder
- Date and time of collection
- Sample matrix (e.g., soil or groundwater)
- Preservative, if any (e.g., hydrochloric acid)
- Analyses requested
- Northern Pacific Division Laboratory (NPDL) Work Order Number: 24-033
- Signature blocks for release and acceptance of samples
- Signatures of persons involved in chain of possession and inclusive dates of possession
- Any comments to identify special conditions or requests

The original CoC forms will be sent with the samples and copies will be retained for the project files. A copy of the CoC form will be sent by the laboratory to USACE within 24 hours of sample receipt to receipt.cooler@usace.army.mil. The laboratory portion of each form must be completed by personnel at the analytical laboratory and will contain the following information:

- Name of person receiving the samples
- Laboratory sample number
- Date of sample receipt
- Sample condition and temperature

5.1.6 Sample Labels and Identification

Sample labels are required for and will be affixed to each sample collected in accordance with BE-SOP-03 (Labeling, Packaging, and Shipping Samples). Site- and time-dependent information will be included on the waterproof labels using indelible ink. Each label will contain the following information:

- Sample with an ID number
- Sample matrix
- Method of analysis
- Project name

- Name of sampler
- Date and time of collection
- Place of collection (i.e., location ID)
- Preservation method
- Turnaround time

5.1.6.1 Sample Identification

For the purposes of sample tracking, each sample submitted to the analytical laboratory will be given a unique, alphanumeric sample ID code corresponding to the sample numbering system as detailed in Worksheet 26/27 of the UFP-QAPP (Appendix A).

5.1.6.2 Location Identification

Each sample ID will have a unique location ID (i.e., place of collection), which will be included on the sample label, sample collection form, and CoC form. Worksheet 18 of the UFP-QAPP provides a list of the location IDs (Appendix A). The general format for location IDs is listed below.

- Soil samples (note that temporary soil boring location IDs will be used until permanent IDs are assigned by the USACE):
  - Year – "24" for 2024
  - Site Code – "HFT" for Haines Fuel Terminal
  - Sample Type – "SB" for soil boring
  - Location Number – Unique, sequential number starting at "01"
- Groundwater samples from new monitoring wells (note that for permanent wells, field-assigned monitoring well location IDs will be used until permanent IDs are assigned by the USACE after installation. The field-assigned IDs will be used for all temporary wells):
  - Year – "24" for 2024
  - Site Code – HFT for Haines Fuel Terminal
  - Sample Type – "MW" for monitoring well
    – "TW" for temporary monitoring well
  - Well Number – Unique, sequential number starting at "01"
- Existing monitoring wells:
  - Assigned well ID
- Surface water and sediment samples:
  - Year – "24" for 2024
  - Site Code – "HFT" for Haines Fuel Terminal
  - Sample Type – "TBS" for Tanani Bay Sample
  - Location Number – Unique sequential number starting at "01"

As examples, the location ID for the soil sample collected at the first borehole for the HFT site would be designated "24HFT-SB01"; and a groundwater sample collected from the same site from the second temporary monitoring well installed would be designated "24HFT-TW02."

Sample forms will be used to document sample collection activities, which are included in Appendix E. Logbooks will be used to document field activities that are not covered on field forms.

5.2 Waste Disposal Documentation

Waste transportation and disposal will result in the generation of the documentation, detailed in BE-SOP-79 (Waste Management), and will include:

- Copies of profiles and associated characterization data
- Transporter-signed manifest as well as the fully executed manifests, and copies of the following: Land Disposal Restriction notifications and certifications, bills of lading, and weight tickets
- Designated offsite facility waste receipts and certificates of disposal or destruction

Copies of all waste transportation and disposal documentation will be provided to USACE electronically, it will be the responsibility of the government (USACE and the Army) to maintain these records and documents. Brice will also maintain copies of waste documentation as part of the project archive file, refer to Worksheet 29 of the UFP-QAPP (Appendix A).

5.3 RI Report

Findings of the investigation will be presented in the HFT RI Report. The report will evaluate and document the findings of the investigations, describe the nature and extent of contamination, present results from the human health and ecological risk assessment, and provide recommendations of remediation goals based on the risk assessment. The report will incorporate historical information and valid data from past investigations, along with results from the current RI, to justify the conclusions and recommendations.

The report will generally be organized as follows:

- Executive Summary
- Introduction
- Site Background and Previous Investigation Results
- Summary of Physical Characteristics
- RI Investigation Procedures
- Nature and Extent of Contamination
- Contaminant Fate and Transport
- Risk Assessment Summary
- Summary and Conclusions
- References
- Appendix A – Sample Summary and Results Tables
- Appendix B – Chemical Data Quality Review (CDQR)
- Appendix C – Photograph Log
- Appendix D – Soil Boring/Well Logs
- Appendix E – Well Development and Groundwater Sampling Forms
- Appendix F – Field Notes
- Appendix G – Survey Data
- Appendix I – Conceptual Site Model
- Appendix J – Baseline Risk Assessment

A Draft version of the RI Work Plan and RI Report (and all subsequent versions of the documents) will be submitted electronically to the USACE project team and ADEC for review (including electronic delivery of the laboratory files). After comments are received, resolved, and incorporated into the document, a redline Draft-Final report will be submitted via email for approval. Following approval of the redline

Draft-Final document, the Final document will be provided electronically to the project team. The Final submittal will include all supplemental information and native files on a CD or DVD as appropriate.

5.3.1 Chemical Data Quality Review

Brice will perform a data review of all chemical data and document the findings in a CDQR that will accompany the RI Report. The review and associated ADEC Laboratory Data Review Checklists will be completed for each data package in accordance with the data review process described in Worksheets 35, 36, and 37 in the UFP-QAPP (Appendix A) and will be submitted with the laboratory data deliverables in the Draft and Final RI Report. A discussion regarding the data quality and usability for project purposes will be included in the body of the report.

5.3.2 Laboratory Electronic Data Format

Staged Electronic Data Deliverable (SEDD) Version 5.2 Stage 2A and Level 4 PDF laboratory reports will be submitted for each laboratory data package and will conform to the MED (USACE 2017). Hard copies will be made available upon request.

The laboratory data will also be provided in a separate deliverable specifically for use by USACE in geographic information system (GIS) applications (poaChemistryDataforGIS table). This deliverable will combine key chemistry data fields with geospatial fields in accordance with Section 4.1.3 of the MED (USACE 2017).

Field water quality parameters from groundwater samples will be summarized separately in an electronic format (Excel spreadsheet). The parameters will include depth to water, drawdown, temperature, conductivity, dissolved oxygen, pH, oxidation-reduction potential, turbidity, and well stabilization.

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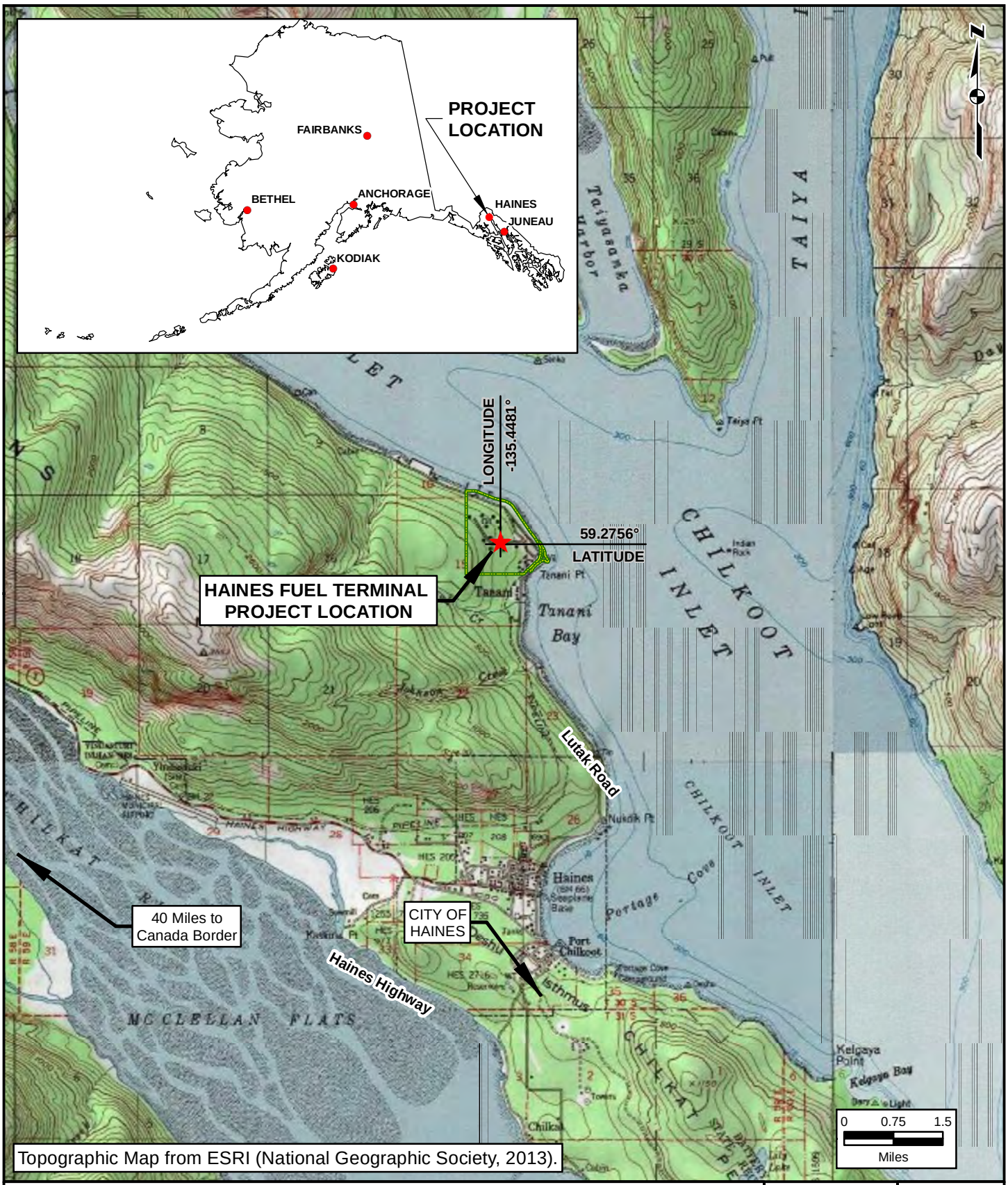
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FIGURES

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1 INCH



Topographic Map from ESRI (National Geographic Society, 2013).

HAINES FUEL TERMINAL PFAS REMEDIAL INVESTIGATION
WORK PLAN - HAINES, ALASKA
U.S. ARMY GARRISON ALASKA

LOCATION AND VICINITY MAP

DATE: 10/16/2024

PROJECT No.: 450202

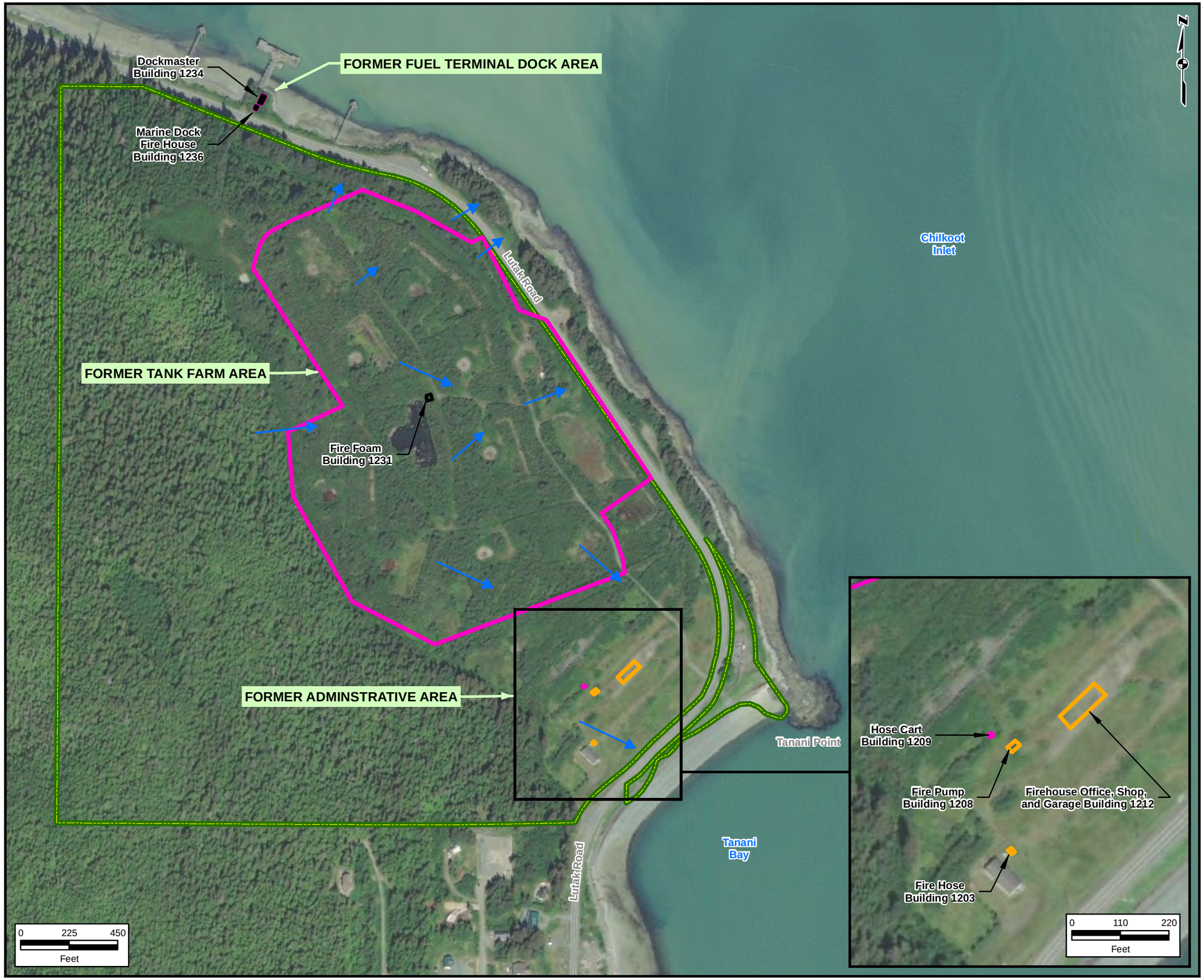
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FIGURE: **1**

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HAINES FUEL TERMINAL PFAS REMEDIAL INVESTIGATION WORK PLAN - HAINES, ALASKA

U.S. ARMY GARRISON ALASKA

SITE MAP AND AOI AND AOPI LOCATIONS

Legend:

- Groundwater Flow Direction
- Former Building
- AOI
- AOPI
- Installation Boundary

Acronyms and Abbreviations:

AOI - area of interest
AOPI - area of potential interest
PFAS - per- and polyfluoroalkyl substances

Note:

1. Coordinate Systems: Horizontal - World Geodetic System of 1984 (WGS84), Universal Transverse Mercator (UTM), Zone 8N

Sources:

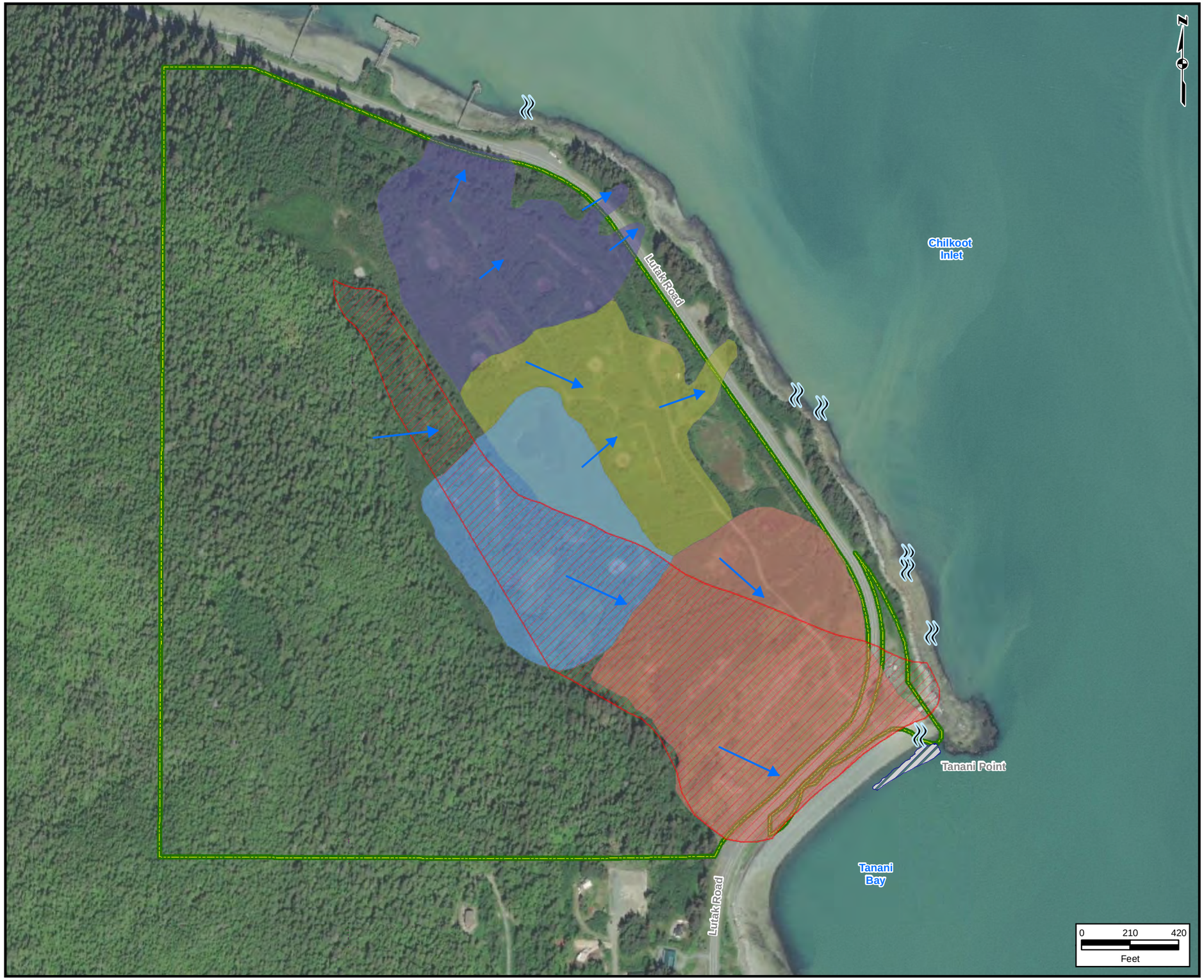
1. Groundwater flow direction reported by Bristol and North Wind, Inc. 2020
2. Aerial imagery obtained from ESRI ArcGIS Online

PROJECT No.:	DATE:	FIGURE:
450202	10/16/2024	2
P.M.: G.R.	DRAWN: C.B.	

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HAINES FUEL TERMINAL PFAS REMEDIAL INVESTIGATION WORK PLAN - HAINES, ALASKA

U.S. ARMY GARRISON ALASKA

PERCHED WATER AND AQUIFER SUMMARY

Legend:

- Groundwater Flow Direction
- Seep
- Seep Area
- Deep Artesian Aquifer
- Colluvium Perched Water
- Emergent Beach Perched Water
- Northern Aquifer
- Marine Varve Aquifer
- Installation Boundary

Acronyms and Abbreviations:

AOPI - area of potential interest

PFAS - per- and polyfluoroalkyl substances

Note:

1. Coordinate Systems: Horizontal - World Geodetic System of 1984 (WGS84), Universal Transverse Mercator (UTM), Zone 8N

Sources:

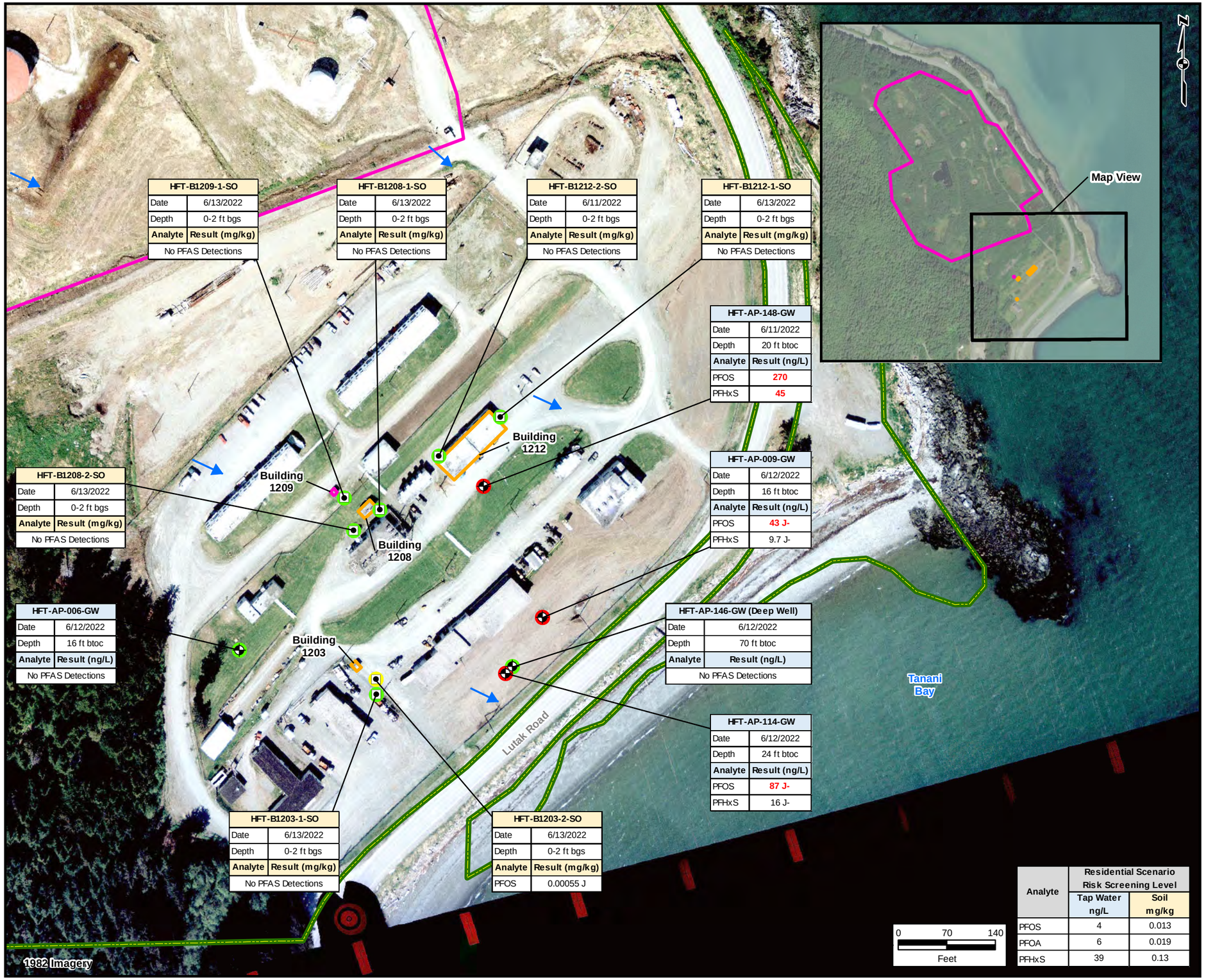
1. Groundwater flow directions, aquifers, and seep locations reported by Bristol and North Wind, Inc. 2020
2. Aerial imagery obtained from ESRI ArcGIS Online

PROJECT No.: 450202	DATE: 10/16/2024	FIGURE: 3
P.M.: G.R.	DRAWN: C.B.	

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1 INCH



Analyte	Residential Scenario Risk Screening Level	
	Tap Water ng/L	Soil mg/kg
PFOS	4	0.013
PFOA	6	0.019
PFHxS	39	0.13

HAINES FUEL TERMINAL PFAS REMEDIAL INVESTIGATION
WORK PLAN - HAINES, ALASKA

U.S. ARMY GARRISON ALASKA

FORMER ADMINISTRATIVE AREA HISTORICAL PFAS RESULTS

Legend:

- Existing Monitoring Well
- 2022 Surface Soil Sample
- PFAS Exceeds PSL
- PFAS Detected Below PSL
- No PFAS Detections
- Groundwater Flow Direction
- AOPI
- AOI
- Installation Boundary

Acronyms and Abbreviations:

AOI - area of interest
AOPI - area of potential interest
EPA - Environmental Protection Agency
ft bgs - feet below ground surface
ft btoc - feet below top of casing
J/J-/J+ - result is an estimated value based on a QC discrepancy and/or is less than the LOQ. Where possible, direction of bias (+/-) is indicated
LOQ - limit of quantitation
mg/kg - milligrams per kilogram
ng/L - nanograms per liter
PFHxS - perfluorohexane sulfonate
PFAS - per- and polyfluoroalkyl substances
PFOS - perfluorooctane sulfonate
PSL - project screening level
QC - quality control
RSL - regional screening level

Notes:

1. Results shown in **red** equal or exceed residential scenario risk screening levels.
2. The PSLs are the EPA RSLs for residential soil and tap water (November 2023), as directed by the Department of Defense's PFAS 101 web page, (https://www.acq.osd.mil/eie/eer/ecc/pfas/pfas101/rsl.html).
3. Coordinate Systems: Horizontal - World Geodetic System of 1984 (WGS84), Universal Transverse Mercator (UTM), Zone 8N.

Sources:

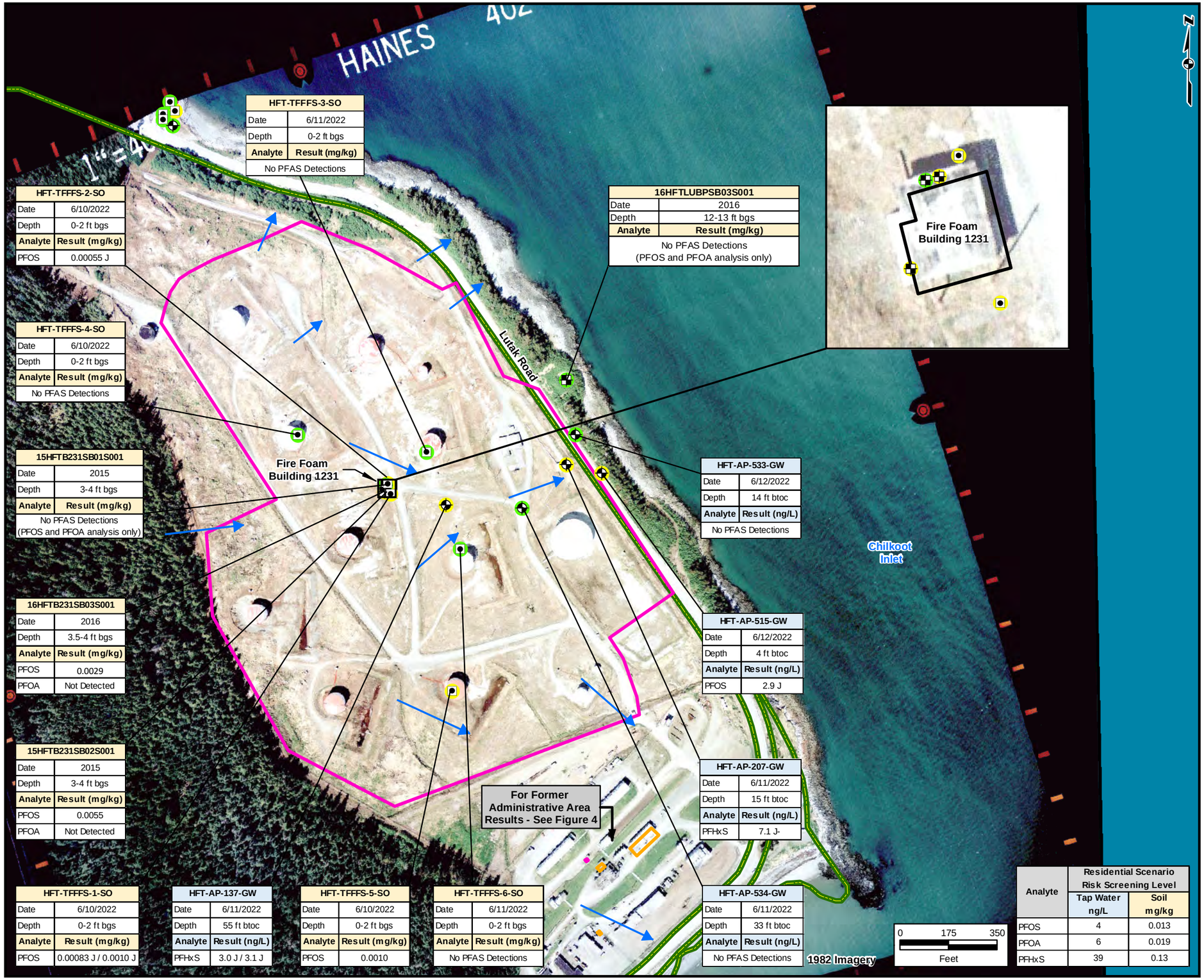
1. Groundwater flow direction reported by Bristol and North Wind, Inc. 2020
2. 1982 Imagery source: Bristol and North Wind, Inc. 2020. Final

PROJECT No.: 450202	DATE: 10/16/2024	FIGURE: 4
P.M.: G.R.	DRAWN: C.B.	

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HFT-TFFFS-3-SO	
Date	6/11/2022
Depth	0-2 ft bgs
Analyte	**Result (mg/kg)**
No PFAS Detections	

HFT-TFFFS-2-SO	
Date	6/10/2022
Depth	0-2 ft bgs
Analyte	**Result (mg/kg)**
PFOS	0.00055 J

16HFTLUBPSB03S001	
Date	2016
Depth	12-13 ft bgs
Analyte	**Result (mg/kg)**
No PFAS Detections (PFOS and PFOA analysis only)	

HFT-TFFFS-4-SO	
Date	6/10/2022
Depth	0-2 ft bgs
Analyte	**Result (mg/kg)**
No PFAS Detections	

15HFTB231SB01S001	
Date	2015
Depth	3-4 ft bgs
Analyte	**Result (mg/kg)**
No PFAS Detections (PFOS and PFOA analysis only)	

HFT-AP-533-GW	
Date	6/12/2022
Depth	14 ft btoc
Analyte	**Result (ng/L)**
No PFAS Detections	

16HFTB231SB03S001	
Date	2016
Depth	3.5-4 ft bgs
Analyte	**Result (mg/kg)**
PFOS	0.0029
PFOA	Not Detected

HFT-AP-515-GW	
Date	6/12/2022
Depth	4 ft btoc
Analyte	**Result (ng/L)**
PFOS	2.9 J

15HFTB231SB02S001	
Date	2015
Depth	3-4 ft bgs
Analyte	**Result (mg/kg)**
PFOS	0.0055
PFOA	Not Detected

HFT-AP-207-GW	
Date	6/11/2022
Depth	15 ft btoc
Analyte	**Result (ng/L)**
PFHxS	7.1 J-

HFT-TFFFS-1-SO	
Date	6/10/2022
Depth	0-2 ft bgs
Analyte	**Result (mg/kg)**
PFOS	0.00083 J / 0.0010 J

HFT-AP-137-GW	
Date	6/11/2022
Depth	55 ft btoc
Analyte	**Result (ng/L)**
PFHxS	3.0 J / 3.1 J

HFT-TFFFS-5-SO	
Date	6/10/2022
Depth	0-2 ft bgs
Analyte	**Result (mg/kg)**
PFOS	0.0010

HFT-TFFFS-6-SO	
Date	6/11/2022
Depth	0-2 ft bgs
Analyte	**Result (mg/kg)**
No PFAS Detections	

HFT-AP-534-GW	
Date	6/11/2022
Depth	33 ft btoc
Analyte	**Result (ng/L)**
No PFAS Detections	

Analyte	Residential Scenario Risk Screening Level	
	Tap Water ng/L	Soil mg/kg
PFOS	4	0.013
PFOA	6	0.019
PFHxS	39	0.13

HAINES FUEL TERMINAL PFAS REMEDIAL INVESTIGATION WORK PLAN - HAINES, ALASKA

U.S. ARMY GARRISON ALASKA

FORMER TANK FARM AREA HISTORICAL PFAS RESULTS

Legend:

- Existing Monitoring Well
- 2022 Surface Soil Sample
- 2015 / 2016 Soil Boring
- PFAS Detected Below PSL
- No PFAS Detections
- Groundwater Flow Direction
- Former Building
- AOI
- AOPI
- Installation Boundary

Acronyms and Abbreviations:

AOI - area of interest
AOPI - area of potential interest
EPA - Environmental Protection Agency
ft bgs - feet below ground surface
ft btoc - feet below top of casing
J/J-/J+ - result is an estimated value based on a QC discrepancy and/or is less than the LOQ. Where possible, direction of bias (+/-) is indicated
LOQ - limit of quantitation
mg/kg - milligrams per kilogram
ng/L - nanograms per liter
PFHxS - perfluorohexane sulfonate
PFAS - per- and polyfluoroalkyl substances
PFOA - perfluorooctanoic acid
PFOS - perfluorooctane sulfonate
PSL - project screening level
QC - quality control
RSL - regional screening level

Notes:

1. Results shown in **red** equal or exceed residential scenario risk screening levels.
2. The PSLs are the EPA RSLs for residential soil and tap water (November 2023), as directed by the Department of Defense's PFAS 101 webpage, (https://www.acq.osd.mil/eie/eer/ecc/pfas/pfas101/rsl.html).
3. Coordinate Systems: Horizontal - World Geodetic System of 1984 (WGS84), Universal Transverse Mercator (UTM), Zone 8N.

Sources:

1. Groundwater flow direction reported by Bristol and North Wind, Inc. 2020
2. 1982 Imagery source: Bristol and North Wind, Inc. 2020. Final

PROJECT No.: 450202	DATE: 10/16/2024	FIGURE: 5
P.M.: G.R.	DRAWN: C.B.	

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HAINES FUEL TERMINAL PFAS REMEDIAL INVESTIGATION
WORK PLAN - HAINES, ALASKA

U.S. ARMY GARRISON ALASKA

FORMER ADMINISTRATIVE AREA PROPOSED SAMPLING LOCATIONS

Legend:

- Proposed Soil Boring and Permanent Monitoring Well Location
- Proposed Soil Boring and Temporary Monitoring Well Location
- Existing Monitoring Well Proposed for Sampling
- Existing Monitoring Well not Proposed for Sampling
- Proposed Co-Located Surface Water and Sediment Sample Locations
- 2022 Surface Soil Sample
- PFAS Exceeds PSL
- PFAS Detected Below PSL
- No PFAS Detections
- Groundwater Flow Direction
- Seep
- Seep Area at Low Tide
- AOPI
- Former Administrative Area Building
- Installation Boundary

Acronyms and Abbreviations:
AOPI - area of potential interest
PFAS - per- and polyfluoroalkyl substances
PSL - project screening level

Note:
1. Surface water and sediment sample locations are approximate. See Section 4.5 of the Work Plan for sample location rationale.
2. Coordinate Systems: Horizontal - World Geodetic System of 1984 (WGS84), Universal Transverse Mercator (UTM), Zone 8N

Sources:
1. Groundwater flow direction reported by Bristol and North Wind, Inc. 2020
2. Aerial imagery obtained from ESRI ArcGIS Online

PROJECT No.: 450202	DATE: 10/16/2024	FIGURE: 6
P.M.: G.R.	DRAWN: C.B.	

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1 INCH



HAINES FUEL TERMINAL PFAS REMEDIAL INVESTIGATION
WORK PLAN - HAINES, ALASKA

U.S. ARMY GARRISON ALASKA

FORMER TANK FARM AREA
PROPOSED SAMPLING LOCATIONS

Legend:

- Existing Monitoring Well Proposed for Sampling
- Existing Monitoring Well not Proposed for Sampling
- 2015 / 2016 Soil Boring
- 2022 Surface Soil Sample
- PFAS Detected Below PSL
- No PFAS Detections
- Groundwater Flow Direction
- Former Building
- AOPI
- Installation Boundary

Acronyms and Abbreviations:

AOPI - area of potential interest
PFAS - per- and polyfluoroalkyl substances
PSL - project screening level

Note:

1. Coordinate Systems: Horizontal - World Geodetic System of 1984 (WGS84), Universal Transverse Mercator (UTM), Zone 8N

Sources:

1. Groundwater flow direction reported by Bristol and North Wind, Inc. 2020
2. Aerial imagery obtained from ESRI ArcGIS Online

PROJECT No.:	DATE:	FIGURE:
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APPENDIX A
UNIFORM FEDERAL POLICY FOR QUALITY ASSURANCE PROJECT PLAN

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ATTACHMENTS

Attachment A-1 Conceptual Site Models

ACRONYMS AND ABBREVIATIONS

°C	degrees Celsius
>	greater than
≥	greater than or equal to
<	less than
≤	less than or equal to
±	plus or minus
%	percent
%R	percent recovery
µg/kg	micrograms per kilogram
AAC	Alaska Administrative Code
ADEC	Alaska Department of Environmental Conservation
AED	automated external defibrillator
AFFF	aqueous film-forming foam
amu	atomic mass unit
AOI	area of interest
AOPI	area of potential interest
APP	Accident Prevention Plan
Arcadis	Arcadis U.S., Inc.
bgs	below ground surface
Brice	Brice Environmental Services Corporation
Bristol	Bristol Environmental Remediation Services, LLC
CASRN	Chemical Abstracts Service Registry Number
CB	calibration blank
CCV	continuing calibration verification
CDQR	Chemical Data Quality Report
CEP	Certified Environmental Professional
CL	control limit
CoC	chain-of-custody
COPC	contaminant of potential concern
COR	Contracting Officer's Representative
CPR	cardiopulmonary resuscitation
CSM	conceptual site model
DL	detection limit
DMC	deuterated monitoring compound
DoD	Department of Defense
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DPW	Directorate of Public Works
DQI	data quality indicator

DQO	data quality objectives
DRO	diesel range organics
DV	daily value
EB	equipment blank
EDD	electronic data deliverable
EIS	extracted internal standards
ELAP	Environmental Laboratory Accreditation Program
EPA	U.S. Environmental Protection Agency
EQEDD	EQuIS electronic data deliverable
EQuIS	Environmental Quality Information System
ESI	electrospray ionization
FD	field duplicate
FID	flame ionization detector
FRB	field reagent blank
FWA	Fort Wainwright Alaska
GC	gas chromatography
GC/MS	gas chromatography/mass spectrometry
GPS	global positioning system
GRO	gasoline range organics
GW	groundwater
H&S	Health & Safety
HAZWOPER	Hazardous Waste Operations and Emergency Response
HCl	hydrochloric acid
HDPE	high density polyethylene
HFT	Haines Fuel Terminal
HH	human health
IATA	International Air Transport Association
ICAL	initial calibration
ICV	initial calibration verification
ID	identification
IDW	investigation-derived waste
IDQTF	Intergovernmental Data Quality Task Force
IS	internal standard
ISC	internal standard calibration
KO	Contracting Officer
LC-MS/MS	liquid chromatography and tandem mass spectrometry
LCS	laboratory control sample
LCSD	laboratory control sample duplicate
LOD	limit of detection
LOQ	limit of quantitation
MB	method blank
MED	Manual for Electronic Deliverables

MeOH	methanol
mg/kg	milligrams per kilogram
mL	milliliter
MPC	measurement performance criteria
MS	matrix spike
MSD	matrix spike duplicate
MTGW	migration to groundwater
N/A	not applicable
ND	non-detect
NEtFOSA	n-ethyl perfluorooctanesulfonamide
NEtFOSAA	n-methyl perfluorooctanesulfonamidoacetic acid
NEtFOSE	n-ethyl perfluorooctanesulfonamidoethanol
ng/L	nanogram per liter
NIS	non-extracted internal standards
North Wind	North Wind, Inc.
NPDL	North Pacific Division Laboratory
OSD	Office of the Assistant Secretary of Defense
OSHA	Occupational Safety and Health Administration
oz	ounce
PAH	polycyclic aromatic hydrocarbon
PARCCS	precision, accuracy, representativeness, completeness, comparability, and sensitivity
PFAS	per- and polyfluoroalkyl substances
PFHxS	perfluorohexane sulfonate
PFNA	perfluorononanoic acid
PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
PFOSA	perfluorooctanesulfonamide
PFPrA	perfluoropropanoic acid
PID	photoionization detector
PM	Project Manager
PMP	Project Manager Professional
POA	Pacific Ocean/Alaska District
POC	point of contact
PP	polypropylene
PSL	project screening level
QA	quality assurance
QC	quality control
QSM	Quality Systems Manual
RCRA	Resource Conservation and Recovery Act
RF	response factor
RI	remedial investigation
RPD	relative percent difference

RPM	Remedial Project Manager
RRF	relative response factor
RRO	residual range organics
RSD	relative standard deviation
RSE	relative standard error
RSL	Regional Screening Level
RT	retention time
SDG	sample delivery group
SEDD	staged electronic deliverable
SIM	selected ion monitoring
SO	soil
SOP	standard operating procedure
SPE	solid-phase extraction
SSHO	Site Safety Health Officer
TAT	turnaround time
TBD	to be decided
TCLP	toxicity characteristic leaching procedure
TFSI	bis(trifluoromethylsulfonyl)amine
THQ	target hazard quotient
TLC	Teflon-lined cap
TLS	Teflon-lined septa
UFP-QAPP	Uniform Federal Policy-Quality Assurance Project Plan
USACE	U.S. Army Corps of Engineers
USAG	U.S. Army Garrison
USAEC	U.S. Army Environmental Command
VOA	volatile organic analysis
VOC	volatile organic compound

EXECUTIVE SUMMARY

This Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP) describes the procedures that will be followed while conducting remedial investigation (RI) activities at the Haines Fuel Terminal (HFT) site in Haines, Alaska (Figure 1 of the Work Plan). Work will be performed for the U.S. Army Corps of Engineers (USACE), Alaska District, under Contract W911KB22D0019, Task Order W911KB23F0122 (USACE 2023a). This UFP-QAPP was prepared by Brice Environmental Services Corporation (Brice) in accordance with the following guidance document, as well as all other applicable federal and state requirements:

- Department of Defense (DoD) *Quality Systems Manual (QSM),* Version 5.4 (DoD 2021a)
- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 58 Federal Register 5475
- DoD *Environmental Field Sampling Handbook,* Revision 1 (DoD 2013)
- *UFP-QAPP Manual* (Intergovernmental Data Quality Task Force [IDQTF] 2005a)
- *Optimized UFP-QAPP Worksheets* (IDQTF 2012)
- *UFP-QAPP Quality Assurance/Quality Control (QA/QC) Compendium: Minimum QA/QC Activities* (IDQTF 2005b)
- *Engineer Manual 200-1-2 Technical Project Planning Process* (USACE 2016)
- *Manual for Electronic Deliverables* (MED) (USACE 2017)
- *USACE Performance of Work Statement* dated 27 April 2023 (USACE 2023a)

This UFP-QAPP is intended to be used in conjunction with the Work Plan and provides detailed information regarding the field procedures and analytical methods that will be used during the HFT per- and polyfluoroalkyl substances (PFAS) RI and baseline risk assessment. The Work Plan will be referenced on applicable Worksheets pertaining to site history and previous investigations, project tasks and field activities, and the conceptual site model (CSM); this UFP-QAPP focuses primarily on procedures for the collection, handling, and analysis of environmental samples; and describes the analytical and documentation procedures to be followed when reviewing and analyzing data collected from the project.

Table ES-1 QAPP Worksheets

QAPP Worksheet No.	Description	Additional Information/ IWP Component
1/2	Title and Affiliated Parties	--
3/5	Project Organizational Chart/QAPP Distribution	--
4/7/8	Personnel Qualifications	--
6	Communication Pathways	--
9	Project Scoping Session Participants Sheet	--
10	Conceptual Site Model	--
11	Data Quality Objectives	--
12	Measurement Performance Criteria	--
13	Secondary Data Uses and Limitations	--
14/16	Project Tasks and Schedule	--
15	Project Action Limits and Laboratory-Specific Detection/Quantitation Limits	--
17	Sampling Design and Rationale	--
18	Sampling Locations and Methods	--
19/30	Sample Containers, Preservation, and Hold Times	--
20	Field Quality Control Summary	--
21	Field Standard Operating Procedures	--
22	Field Equipment Calibration, Maintenance, Testing, and Inspection	--
23	Analytical Standard Operating Procedure References	--
24	Analytical Instrument Calibration	--
25	Analytical Instrument and Equipment Maintenance, Testing, and Inspection	--
26/27	Sample Handling, Custody, and Disposal	--
28	Analytical Quality Control and Corrective Action	--
29	Project Documents and Records	--
31/32/33	Assessments and Corrective Action	--
34	Data Verification and Validation Inputs	--
35	Data Verification Procedures	--
36	Data Validation Procedures	--
37	Data Usability Assessment	--

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

WORKSHEET 1/2 – TITLE AND AFFILIATED PARTIES

SITE/PROJECT NAME: Haines Fuel Terminal (HFT) Per- and Polyfluoroalkyl Substances (PFAS) Remedial Investigation (RI)

SITE LOCATION: HFT, Haines, Alaska

CONTRACT NUMBER: W911KB22D0019

TASK ORDER: W911KBKB23F0122

LEAD ORGANIZATION: U.S. Army Corps of Engineers (USACE)

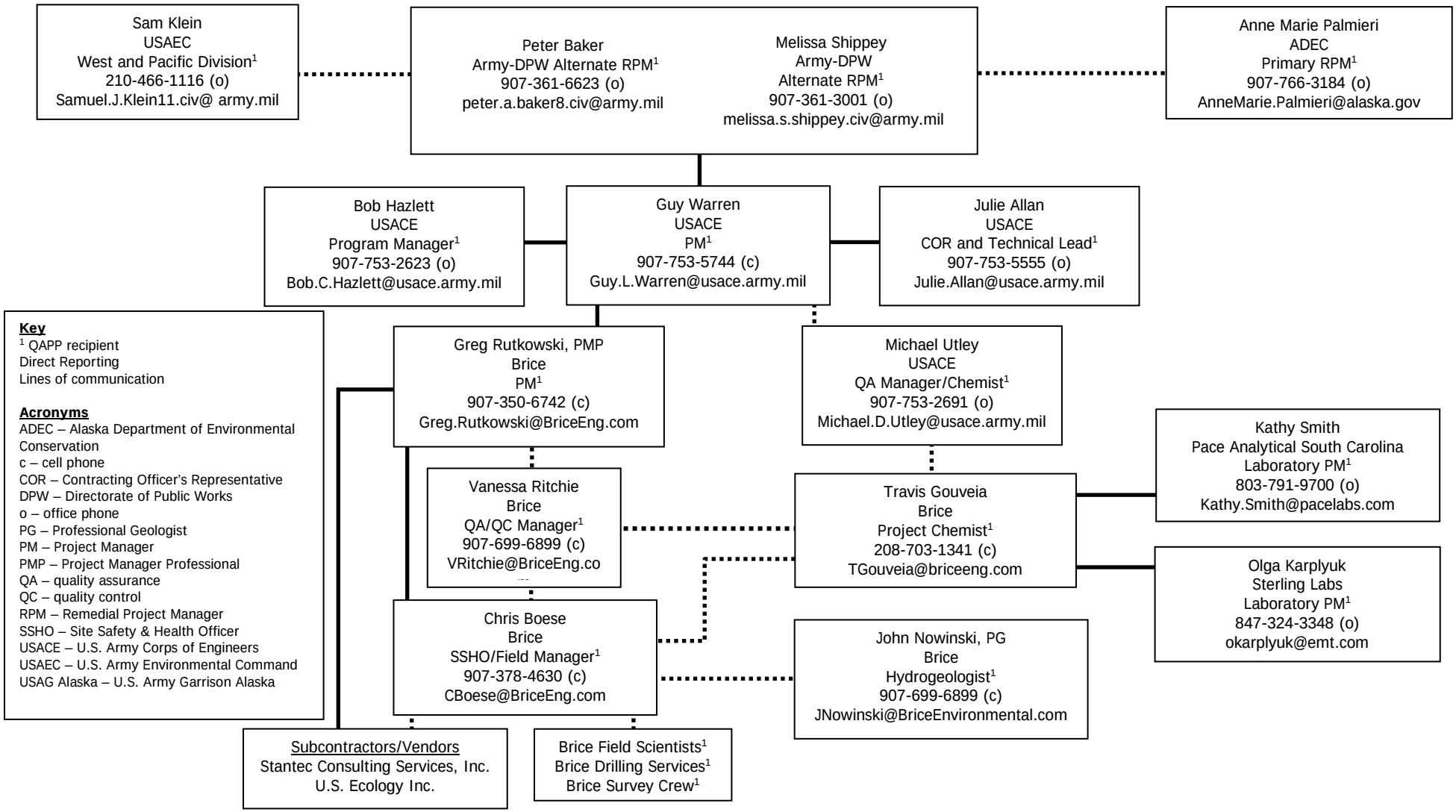
PRIME CONTRACTOR: Brice Environmental Services Corporation (Brice)

AFFILIATED PARTIES:

- **U.S. Army Environmental Command (USAEC)**
  - Sam Klein/West and Pacific Division, USAEC
- **U.S. Army Garrison Alaska (USAG Alaska) – Directorate of Public Works (DPW)**
  - Peter Baker/Alternate Remedial Program Manager
  - Melissa Shippey/Alternate Remedial Program Manager
- **USACE**
  - Robert Hazlett/Program Manager
  - Guy Warren/Project Manager (PM)
  - Julie Allan/Contracting Officer's Representative (COR) and Technical Lead
  - Michael Utley/Quality Assurance Manager/Chemist
- **Alaska Department of Environmental Conservation (ADEC)**
  - Anne Marie Palmieri/Primary Remedial Project Manager (RPM)

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WORKSHEET 3/5 – PROJECT ORGANIZATIONAL CHART/QAPP DISTRIBUTION



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WORKSHEET 4/7/8 – PERSONNEL QUALIFICATIONS

Table 4-1 identifies key project personnel for the HFT PFAS RI. Resumes are available upon request. Training records and certifications for personnel are on file in the Brice Anchorage office.

Table 4-1 Personnel Qualifications

Title	Name	Responsibilities	Education/ Experience	Specialized Training/Certifications
PM	Greg Rutkowski, PMP	Overall project performance; primary POC for USACE COR/Army; coordinates work with project personnel/subcontractors; monthly reporting/invoices; manages the scope, budget, schedule/critical path activities, project risk, and change management.	Education: B.S. Environmental Science Experience: 19+ years	• Project Management Professional (#1882561) • HAZWOPER 40-hour and 8-hour refresher • HAZWOPER 8-hour Supervisor refresher • OSHA 30-hour • Hazardous Waste Training • IATA Dangerous Goods Training • ADEC Qualified Environmental Professional • First Aid/CPR/AED
Senior Technical Advisor	Toni Mehraban, PE	Function as Senior Technical Advisor providing PFAS technical expertise, stakeholder insight, input for the project team, and assisting in senior reviews of plans and reports.	Education: B.S./M.S., Civil and Environmental Engineering Experience: 23 years	• Professional Engineer: Utah #477661-2202; Wyoming PE # 17888; California #CH 6981; Alaska #197725 • HAZWOPER 40-hour and 8-hour refreshers • First Aid/CPR/AED • USACE Construction Quality Management for Contractors • ADEC Qualified Environmental Professional
QA/QC Manager	Vanessa Ritchie	Implements QA/QC program; provides oversight of activities; conducts audits/inspections of processes; communicates lessons learned; oversees corrective actions.	Education: M.S. Environmental Chemistry; B.S. Chemistry/Minor Geology Experience: 18+ years	• HAZWOPER 40-hour and 8-hour refresher • HAZWOPER 8-hour Supervisor • USACE Construction Quality Management for Contractors • OSHA 8-hour Permit-Required Confined Space • RCRA Hazardous Waste Management • DOT & IATA Dangerous Goods Shipping • QA/QC Management Training • ADEC Qualified Environmental Professional • First Aid/CPR/AED • Bear Awareness and Safety • Firearm Safety • Industrial Firefighting

Table 4-1 Personnel Qualifications

Title	Name	Responsibilities	Education/ Experience	Specialized Training/Certifications
Program Safety and Health Manager	Jamey Smith	Implements H&S program, confirms compliance with H&S requirements; oversees development/implementation of the APP; conducts safety inspections, root-cause, and trend analyses.	Education: M.S. Management and Leadership; B.S. Applied Science in Occupational Health, and Safety. Certified Safety Professional Experience: 16 years	• Certified Safety Professional (CSP-30542, 2015) • Associate Safety Professional (ASP-24239, 2015) • Certified Mine Safety Professional (CMSP-989, 2012) • HAZWOPER/Hazmat Instructor • American Heart Saver Instructor (First aid, CPR, AED) • Construction Industry Outreach Trainer 30-hour/10-hour (26-0112998 exp. 01/06/2027) • Mine Safety and Health Administration Blue Cards IS, IU, MR (MIIN-M15661232) • Defensive Driving Instructor • Industrial Hygiene • 10- and 30-hour OSHA Construction • Industrial Firefighting
Hydrogeologist	John Nowinski	Provides geological and hydrogeological-related oversight during field/drilling activities; produces boring and well logs; and provides technical review of report	Education: M.S. Geological Sciences – Hydrology; B.A. Geology Experience: 10+ years	• Professional Geologist, Utah, License 10823698-2250 • HAZWOPER 40-hour and 8-hour refresher • First Aid/CPR • USACE Construction Quality Management for Contractors
Field Team Lead/SSHO	Chris Boese	Implements the Work Plan and UFP-QAPP. Collects analytical samples. Oversees project H&S during fieldwork.	Education: A.A.S. Process Engineering; A.A.S. Electronics Experience: 24+ years	• HAZWOPER 40-hour and 8-hour refresher • HAZWOPER 8-hour Supervisor • OSHA 30-hour Construction • OSHA 8-hour Permit-Required Confined Space • RCRA Hazardous Waste Management • DOT & IATA Dangerous Goods Shipping Training • USACE Construction Quality Manager for Contractors • ADEC Qualified Sampler • First Aid/CPR/AED • Bear Awareness and Safety • Firearm Safety

Table 4-1 Personnel Qualifications

Title	Name	Responsibilities	Education/ Experience	Specialized Training/Certifications
Project Chemist	Travis Gouveia	Ensures legally defensible and reliable data to support decision-making; oversees and verifies laboratories hold required certifications; monitors chemical data quality and implemented corrective actions; supports development of the UFP-QAPP and data validation.	Education: B.S. Microbiology Experience: 22 years	• HAZWOPER 40-hour and 8-hour refresher
Field Scientist	Jill Stockbridge	Provides fieldwork support; collects analytical samples; and provides technical writing support	Education: M.S. Biological Sciences; B.S. Biological Sciences Experience: 6+ years	• HAZWOPER 40-hour and 8-hour refresher • RCRA Hazardous Waste Management • DOT & IATA Dangerous Goods Shipping Training • ADEC Qualified Environmental Professional • Tank Integrity Management Certificate • First Aid/CPR/AED
Field Scientist	Kristin Hruska	Provides fieldwork support and collects analytical samples	Education: B.S. Biological Sciences Experience: 2+ years	• HAZWOPER 40-hour and 8-hour refresher • RCRA Hazardous Waste Management • DOT & IATA Dangerous Goods Shipping Training • ADEC Qualified Sampler • Wilderness First Aid/CPR • Bear Awareness and Safety • Firefighter Type II • Helicopter Crew Safety

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

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WORKSHEET 6 – COMMUNICATION PATHWAYS

Table 6-1 describes the communication pathways and modes of communication that will be used during the project after the QAPP has been approved. The communication pathways presented in Table 6-1 define the procedures in place for providing the appropriate notifications and generating the appropriate documentation when handling important communications, including those involving regulatory interfaces, unexpected events, emergencies, non-conformances, and stop-work orders.

Table 6-1 Communication Pathways

Communication Drivers	Responsible Entity	Name	Telephone Number	Procedure (Timing, Pathways, etc.)
Point of contact with ADEC during project execution	DPW	Peter Baker Melissa Shippey	(907) 361-6623 (907) 361-9622	Technical, QA, and decision-making matters concerning project execution (verbal, written, or electronic).
Amendments to the UFP-QAPP	USACE Program Manager	Bob Hazlett	(907) 753-2623	Coordination of the UFP-QAPP amendment dialog. ADEC will be notified by DPW personnel of significant corrective actions by phone or email within 1 week.
Contracting issues requiring coordination between the USACE PM and Brice	USACE PM	Guy Warren	(907) 753-5744	The USACE will maintain oversight for the overall project action.
Technical review and oversight of RI scope, activities, and process	USACE COR and Technical Lead	Julie Allan	(907) 753-5555	The USACE will maintain oversight for the overall project action.
Planning and preparatory communication and meetings	Brice PM	Greg Rutkowski	(907) 350-6742	Facilitates review meetings, status meetings, and other meetings with the client and stakeholders, as necessary.
Change in field conditions	Brice QA/QC Manager	Vanessa Ritchie	(907) 699-6899	Coordinates with the USACE and DPW to adjust approach, if necessary. Contact will be initiated by the end of the next business day.

Table 6-1 Communication Pathways

Communication Drivers	Responsible Entity	Name	Telephone Number	Procedure (Timing, Pathways, etc.)
Changes to fieldwork	Brice Field Manager	Chris Boese	(907) 378-4630	Notifies Brice PM of fieldwork issue by close of business the next business day.
	Brice PM Brice QA/QC Manager	Greg Rutkowski Vanessa Ritchie	(907) 350-6742 (907) 699-6899	Notifies the USACE PM and COR by the end of the next business day.
	USACE Program Manager USACE PM USACE COR and Technical Lead	Bob Hazlett Guy Warren Julie Allan	(907) 753-2623 (907) 753-5744 (907) 753-5555	Evaluates the situation based on information from the Brice PM and selects the recommended solution or an alternate solution. If a significant change to fieldwork will occur based on a recommended solution, ADEC will be notified prior to implementing the change.
Analytical data results and data quality issues	Brice Project Chemist	Travis Gouveia	(208) 703-1341	Identifies any data quality issues and works with the laboratory PM to resolve issues. Notifies Brice PM of the issue and resolution. If there is a significant data quality issue, the Project Chemist may immediately notify the Brice PM and the field team.
	Laboratory PM	Kathy Smith (Pace Analytical South Carolina) Olga Karplyuk (Sterling Labs – Illinois)	(803) 791-9700 (847) 324-3348	Identifies data quality issues and provides solutions for the Project Chemist to resolve the issue.
	Brice PM Brice QA/QC Manager	Greg Rutkowski Vanessa Ritchie	(907) 350-6742 (907) 699-6899	Notifies the USACE PM of data quality issues and initiates a resolution within 1 week.
	USACE Project Chemist	Michael Utley	(907) 753-2691	Evaluates whether actions to resolve data quality issues are adequate, with input from the USACE PM and Brice PM, if necessary.
Accident or unplanned health and safety incident	Brice SSHO	Chris Boese	(907) 378-4630	Notifies the Brice PM within 1 hour.
	Brice PM Brice QA/QC Manager	Greg Rutkowski Vanessa Ritchie	(907) 350-6742 (907) 699-6899	Notifies the USACE by phone within 24 hours.
Spill Response	Brice PM Brice QA/QC Manager	Greg Rutkowski Vanessa Ritchie	(907) 350-6742 (907) 699-6899	Notifies USACE by phone within 24 hours. USACE will then notify DPW, who will notify ADEC.

Table 6-1 Communication Pathways

Communication Drivers	Responsible Entity	Name	Telephone Number	Procedure (Timing, Pathways, etc.)
Stop work/initiate corrective action	Brice SSHO	Chris Boese	(907) 378-4630	Stops work and notifies the Brice PM within 1 hour.
	Brice PM Brice QA/QC Manager	Greg Rutkowski Vanessa Ritchie	(907) 350-6742 (907) 699-6899	Stops work and notifies the USACE PM by the end of the next business day. Recommends corrective action.
	Any USACE employee USACE KO through the COR	Julie Allan (COR)	(907) 753-5555	Stops work for safety issues and notifies the USACE PM, COR, and KO by the end of the next business day. Stops work for non-safety related issues. Recommends corrective action.
Stop work/initiate corrective action	ADEC PM	Anne Marie Palmieri	(907) 766-3184	Stops work to protect human health and/or the environment.

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

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WORKSHEET 9 – PROJECT SCOPING SESSION PARTICIPANTS SHEET

An internal USACE/Brice post-award kickoff meeting to discuss the contractual requirements of the project was held on 27 September 2023. A project scoping session that included the contractor and regulators was held on 27 March 2024.

Project Name: Haines Fuel Terminal PFAS RI

Site Location: Haines, Alaska

Date of Planning Session: 27 March 2024

Brice Project Manager (PM): Greg Rutkowski

Purpose: Work Plan Scoping Session

Participants:

Name	Title/Role	Organization	Contact Info
Anne Marie Palmieri	Project Manager	ADEC	annemarie.palmieri@alaska.gov
Mollie Dwyer	Technical Support	ADEC	mollie.dwyer@alaska.gov
Peter Baker	Project Manager	U.S. Army DPW	peter.a.baker8.civ@army.mil
Melissa Shippey	Alternate Project Manager	U.S. Army DPW	melissa.s.shippey.civ@army.mil
Sam Klein	Technical Representative	USAEC	samuel.j.klein11.civ@ army.mil
Guy Warren	Project Manager	USACE	guy.l.warren@usace.army.mil
Bob Hazlett	Program Manager	USACE	bob.c.hazlett@usace.army.mil
Julie Allan	Contracting Officer Representative	USACE	julie.allan@usace.army.mil
Greg Rutkowski	Project Manager	Brice	greg.rutkowski@briceeng.com
Vanessa Ritchie	QA/QC Manager	Brice	vritchie@briceeng.com
Aaron Swank	Technical Support	Brice	aswank@briceeng.com
John Nowinski	Hydrogeologist	Brice	jnowinski@briceenvironmental.com
Bruce Narloch	Principal Toxicologist	Stantec	bruce.narloch@stantec.com
Valerie Chen	Principal Risk Assessor	Stantec	valerie.chen@stantec.com

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
* Participated via teleconference

9.1 Comments/Discussion/Consensus Decisions

1. PFAS Preliminary Assessment / Site Inspection Summary

a. Greg summarized the findings of the PFAS Preliminary Assessment (PA) and Site Inspection (SI). The seven areas of potential interest (AOPIs) were investigated during the SI, resulting in following three categories:

Areas of Interest (AOI) to be further investigated during the RI	Retain as an AOPI from confirmation sampling during the RI	No further action related to PFAS
Firehouse Office, Shop, and Garage (1212)	Tank Farm Foam System (including Building 1231)	Marine Dock Fire Hose Building (1236)
Fire Pump Building (1208)	Hose Cart Building (1209)	Dockmaster Building (1234)
Fire Hose Building (1203)		

2. Proposed Remedial Investigation Activities

a. Greg explained that during the first mobilization the investigation would focus on better delineating groundwater contamination to aid in the identification of potential release locations. This will be accomplished through a combination of sampling existing monitoring wells and installing/sampling new monitoring wells.

b. Greg stated that groundwater sampling in the former Tank Farm Area is only to confirm that the PFAS concentrations detected during the SI remain below the screening levels. The wells being resampled are located within the groundwater paleochannel that flows southeast and east away for the former Fire Foam Building 1231.

c. Greg stated that the screening levels for the RI will be the EPA residential RSLs from November 2023 (target cancer risk=1×10^{-6} and hazard quotient=0.1) as currently approved by the DoD per the PFAS 101 webpage. The site is zoned industrial so the risk assessment and recommendations from the RI may also evaluate risks under the residential scenario.

d. Anne Marie asked how would the sites be separated for risk? Guy stated that the preferred approach would be to maintain the same site feature groupings as were evaluated in the 2020 RI Report. Greg added that the collection of additional groundwater data will help determine if this is possible. Due to the age of the release, the low-level concentrations detected thus far, the high solubility of PFAS, and the inorganic nature of the soil it may not be possible to locate specific release locations or sources.

e. Anne Marie asked about the temporary wells proposed along Lutak Road, if those could be made permanent and if DOT had been contacted? Greg stated that the Work Plan does call for making those wells permanent if locations can be selected that are unlikely to be damaged by storm surge and high tides. Greg added that we would prefer not to install those in the road right-of-way due to the safety concerns when drilling and sampling. The proposed locations will be evaluated during next week's site visit to get a better idea of the terrain. Photos of the locations will be taken to share with the drillers for planning purposes. Following the site visit, Brice will contact DOT about the proposed well locations and a Traffic Control Plan will be prepared for approval, if needed.

f. Anne Marie stated that the seeps are only accessible at very low tides and that we should consult the tide tables to make sure we time our field work accordingly. Greg indicated that

we are aware of that and would time our fieldwork accordingly. Vanessa added that we are planning two mobilizations, and these samples could be collected during that mobilization, if needed. Anne Marie added that the seeps appear as a line all along the beach and that we should consider sampling downgradient of monitoring wells AP-009 and AP-114, where PFAS was detected above screening levels.

i. Follow-up: The Work Plan does provide rationale for the seep sample locations and does specify that the area downgradient of AP-009 and AP-114 should be sampled if seeps are observed.

g. Anne Marie provided historical knowledge of the former fire suppression system. The system used ox blood as the foaming agent and after the facility was taken offline the drums of firefighting liquid were given to the City of Haines.

h. Greg stated that mobilization 2 would use the groundwater data from mobilization 1 to narrow down potential release locations to be investigated. A Work Plan Addendum will be provided to summarize the results of mobilization 1 and detail the proposed investigation activities for mobilization 2.

i. Greg reviewed the schedule for the planning, fieldwork, and reporting tasks.

3. Restoration Advisory Board Discussion

a. The last 30 minutes of the scoping meeting were used to discuss the upcoming Restoration Advisory Board (RAB) Meeting.

9.2 Action Items

Item	Action Item	Responsible Party
1	Incorporate discussion topics from this scoping meeting into the draft Work Plan and UFP-QAPP.	Brice

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WORKSHEET 10 – CONCEPTUAL SITE MODEL

Tables 10-1 through 10-3 present a summary of the CSMs for the HFT PFAS RI areas of potential interest (AOPIs) and areas of interest (AOIs) (Figure 2 of the Work Plan) and human health (HH) CSMs are provided in Attachment A-1. A CSM for the former Tank Farm Area is not included because only confirmation groundwater sampling is proposed for that area. CSM information for the former Tank Farm Area is included in the Preliminary Assessment and Site Inspection (PA/SI) Report (Arcadis U.S., Inc. [Arcadis] 2023). The CSMs were completed in accordance with the USACE *Conceptual Site Models* (USACE 2023b) and in general accordance with ADEC's *Guidance on Developing Conceptual Site Models* (ADEC 2017a) and will be revised based on results of this RI. Additional details are presented in Sections 2 and 3 of the RI Work Plan. Data collected from the PFAS RI will be used to further develop the CSM.

Sampling is being conducted within the Former Tank Farm Area in association with the Fire Foam Building 1231 to confirm findings of the 2022 PA/SI. A CSM was not completed as part of the planning efforts for this building because the 2022 PA/SI did not find PFAS at concentrations greater than the current project screening levels (PSLs) (Arcadis 2023) or identify a need for further investigation. PSLs are defined in Section 1.3 of the Work Plan and are presented in Worksheet 15. Attachment 1 of the Work Plan presents the sample results of the 2022 PA/SI, as well as RI results from 2015 and 2016, in comparison with the current PSLs. Based on this comparison, it was confirmed that there were no exceedances of the current PSLs for soil and groundwater. Monitoring well AP-207 did have a non-detection of PFOS for which the LOD was greater than the PSL; this monitoring well will be sampled to ensure there is no data gap. If the results of this RI indicate that PFAS is present at concentrations greater than the PSLs, a CSM will be completed and provided as part of the field report.

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Table 10-1 Former Firehouse Office, Shop, and Garage Building 1212

Key Physical Aspects of The Site	Sources and Types of Contaminants	Presence and Extent of Contamination	Primary and Secondary Release Mechanisms	Fate and Transport Considerations	Potential Receptors and Exposure Pathways
The former Firehouse Office, Shop, and Garage Building 1212 is located in the former Administrative Area of the HFT site (Figures 2 and 4 of the Work Plan). Past HFT operations included pumping fuel via a pipeline across Canada and Alaska to FWA in Fairbanks (1955-1971), and fuel storage (1971-1988). The buildings in the former Administrative Area were all demolished by 2005, with the exception of Building 1204 which is a dormitory used by the National Guard (North Wind 2012; North Wind 2014). The former Firehouse Office, Shop, and Garage Building 1212 was assessed in 2005 for GRO, DRO, RRO, VOCs, and lead in soil. There were no exceedances of ADEC MTGW or HH cleanup levels (Bristol and North Wind 2020). In 2022, soil and groundwater were sampled for PFAS as part of a PA/SI. PFOS and PFHxS were detected in groundwater in exceedance of the PSLs (see Section 1.3 of the Work Plan and Worksheet 15) of 4 ng/L and 39 ng/L, respectively. PFOS was found at concentrations of 43 J- ng/L and 270 ng/L, and PFHxS was detected at 45 ng/L. All soil results were non-detect (Arcadis 2023). The average snowfall is 164 inches per year with an average annual precipitation of 63 inches per year. Exposed bedrock near the HFT consists of metamorphic and hornblende diorite igneous rocks. The surficial deposits of the region predominantly consist of glacial and glacial-marine sediments. The till at the HFT has an abundance of gravel and cobbles, but also includes sand and silt with variable clay content. The gravel and cobble-size material reflects the local bedrock. The glacial till is generally poorly sorted, unstratified, and compact. Previous glaciation has scoured earlier sediments and the underlying bedrock. The HFT also contains colluvium and artificial fill (Bristol and North Wind 2020). No permanent freshwater surface water features are present within the HFT, and the facility is drained by a series of manmade ditches. There are six distinct aquifers (Figure 3 of the Work Plan) and generally have limited productivity. In general, groundwater in this area flows towards Tanani Bay.	Contamination at the former Firehouse Office, Shop, and Garage Building 1212 is most likely the result of past firefighting activities and the potential use, storage, and/or disposal of PFAS-containing materials. Firefighting crews were required to test nozzles and hoses periodically, which was likely performed in the field next to Building 1212. PFAS compounds are the COPCs. PFAS is commonly associated with firefighting foam and is also found in consumer products. PFOS and PFHxS were detected in groundwater at concentrations greater than the PSLs; there were no PFAS detections in soil. It is possible that due to the age of the release, high precipitation, and inorganic nature of the soil that a source in soil may no longer be present.	The presence of PFAS contamination was first identified during the 2022 PFAS PA/SI. PFOS was found in groundwater at concentrations of 43 J- ng/L and 270 ng/L, and PFHxS was detected at 45 ng/L. All soil results were non-detect. The extent of contamination is currently unknown.	The primary release mechanism to soil is believed to be from past firefighting activities, such as testing of equipment; and the use, storage, and/or disposal of PFAS-containing materials. A secondary release mechanism is contaminant migration through subsurface soil into groundwater. Impacted groundwater is part of the Emergent Beach Perched Aquifer which surfaces in Tanani Bay. Release and transport mechanisms for PFAS include dissolution/ desorption from soil to groundwater, transport via sediment carried by and/or dissolved in stormwater and surface water, discharge/recharge between groundwater and surface water, and adsorption/desorption between surface water and sediment.	PFAS typically has a carbon-fluorine tail and nonfluorinated head consisting of a polar functional group. The tail is hydrophobic and generally lipophobic, while the head group can be polar and hydrophilic. These competing tendences of the head and tail lead to widespread and uneven distribution in the environment. This competition can lead to soil/water, air/water, and water/non-aqueous phase liquids partitioning. PFAS compounds are typically soluble in water and will leach from soil. PFAS compounds are not readily biodegradable.	The HFT site is located 2.9 miles north of Haines. The land occupied and surrounding the HFT site is a combination of land withdrawn from the public domain and land acquired from private owners. Private residences are located approximately 950 feet southwest of the former Firehouse Office, Shop, and Garage Building 1212. The likely HH receptors exposed to potential contaminants consist of future residents, future commercial/industrial workers, current and future site visitors, trespassers, recreational users, current and future construction workers, and current and future subsistence harvesters and consumers.

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

Table 10-2 Former Fire Pump Building 1208

Key Physical Aspects of The Site	Sources and Types of Contaminants	Presence and Extent of Contamination	Primary and Secondary Release Mechanisms	Fate and Transport Considerations	Potential Receptors and Exposure Pathways
The former Fire Pump Building 1208 is located in the former Administrative Area of the HFT site (Figures 2 and 4 of the Work Plan). Past HFT operations included pumping fuel via a pipeline across Canada and Alaska to FWA in Fairbanks (1955-1971), and fuel storage (1971-1988). The buildings in the former Administrative Area were all demolished by 2005, with the exception of Building 1204 which is a dormitory used by the National Guard (North Wind 2012; North Wind 2014). The former Fire Pump Building 1208 had an underground storage tank removed in 1990; sampling at the time did not indicate contaminated soil remained and this was supported by further investigation in 2007. In 2004 soil samples were collected from within the footprint of the building and analyzed for GRO, DRO, RRO, VOCs, and lead; there were no exceedances of ADEC MTGW or HH cleanup levels (Bristol and North Wind 2020). In 2022 soil and groundwater were sampled for PFAS as part of a PA/SI. PFOS was detected in groundwater at a concentration of 43 J- ng/L, greater than the PSL of 4 ng/L. PFHxS was detected in groundwater below the PSL. All soil results were non-detect (Arcadis 2023). The average snowfall is 164 inches per year with an average annual precipitation of 63 inches per year. Exposed bedrock near the HFT consists of metamorphic and hornblende diorite igneous rocks. The surficial deposits of the region predominantly consist of glacial and glacial-marine sediments. The till at the HFT has an abundance of gravel and cobbles, but also includes sand and silt with variable clay content. The gravel and cobble-size material reflects the local bedrock. The glacial till is generally poorly sorted, unstratified, and compact. Previous glaciation has scoured earlier sediments and the underlying bedrock. The HFT also contains colluvium and artificial fill (Bristol and North Wind 2020). No permanent freshwater surface water features are present within the HFT, and the facility is drained by a series of manmade ditches. There are six distinct aquifers (Figure 3 of the Work Plan) and generally have limited productivity. In general, groundwater in this area flows towards Tanani Bay.	Contamination at the former Fire Pump Building 1208 is most likely the result of past use, storage, and/or disposal of PFAS-containing materials. PFAS compounds are COPCs. PFAS is commonly associated with firefighting foam and is also found in consumer products. PFOS is present in groundwater at a concentration greater than the PSL; there were no PFAS detections in soil. It is possible that due to the age of the release, high precipitation, and inorganic nature of the soil that a source in soil may no longer be present.	The presence of PFAS contamination was first identified during the 2022 PFAS PA/SI. PFOS was found in groundwater at a concentration of 43 J- ng/L; all soil results were non-detect. The extent of contamination is currently unknown.	The primary release mechanism to soil is believed to be from past use, storage, and/or disposal of PFAS-containing materials. A secondary release mechanism is contaminant migration through subsurface soil into groundwater. Impacted groundwater is part of the Emergent Beach Perched Aquifer which surfaces in Tanani Bay. Release and transport mechanisms for PFAS include dissolution/ desorption from soil to groundwater, transport via sediment carried by and/or dissolved in stormwater and surface water, discharge/recharge between groundwater and surface water, and adsorption/desorption between surface water and sediment.	PFAS typically has a carbon-fluorine tail and nonfluorinated head consisting of a polar functional group. The tail is hydrophobic and generally lipophobic, while the head group can be polar and hydrophilic. These competing tendences of the head and tail lead to widespread and uneven distribution in the environment. This competition can lead to soil/water, air/water, and water/non-aqueous phase liquids partitioning. PFAS compounds are typically soluble in water and will leach from soil. PFAS compounds are not readily biodegradable.	The HFT site is located 2.9 miles north of Haines. The land occupied and surrounding the HFT site is a combination of land withdrawn from the public domain and land acquired from private owners. Private residences are located approximately 800 feet southwest of the former Fire Pump Building 1208. The likely HH receptors exposed to potential contaminants consist of future residents, future commercial/industrial workers, current and future site visitors, trespassers, recreational users, current and future construction workers, and current and future subsistence harvesters and consumers.

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

Table 10-3 Former Fire Hose Building 1203

Key Physical Aspects of The Site	Sources and Types of Contaminants	Presence and Extent of Contamination	Primary and Secondary Release Mechanisms	Fate and Transport Considerations	Potential Receptors and Exposure Pathways
The former Fire Hose Building 1203 is located in the former Administrative Area of the HFT site (Figures 2 and 4 of the Work Plan). Past HFT operations included pumping fuel via a pipeline across Canada and Alaska to FWA in Fairbanks (1955-1971), and fuel storage (1971-1988). The buildings in the former Administrative Area were all demolished by 2005, with the exception of Building 1204 which is a dormitory used by the National Guard (North Wind 2012; North Wind 2014). The former Fire Hose Building 1203 was assessed in 2002 and soil samples were collected and analyzed for GRO, DRO, RRO, VOCs, and lead. There were no exceedances of ADEC MTGW or HH cleanup levels (Bristol and North Wind 2020). In 2022 soil and groundwater were sampled for PFAS The former Fire Hose Building 1203 was a wood-framed, single story, unheated building used to store fires hoses. In 2004 soil samples were collected from within the footprint of the building and analyzed for GRO, DRO, RRO, VOCs, and lead, there were no exceedances of ADEC MTGW or HH cleanup levels (Bristol and North Wind 2020). In 2022 soil and groundwater were sampled for PFAS as part of a PA/SI. PFOS was detected in groundwater at a concentration of 87 J- ng/L, greater than the PSL of 4 ng/L. PFHxS was detected in groundwater below the PSL. All soil results were non-detect (Arcadis 2023). The average snowfall is 164 inches per year with an average annual precipitation of 63 inches per year. Exposed bedrock near the HFT consists of metamorphic and hornblende diorite igneous rocks. The surficial deposits of the region predominantly consist of glacial and glacial-marine sediments. The till at the HFT has an abundance of gravel and cobbles, but also includes sand and silt with variable clay content. The gravel and cobble-size material reflects the local bedrock. The glacial till is generally poorly sorted, unstratified, and compact. Previous glaciation has scoured earlier sediments and the underlying bedrock. The HFT also contains colluvium and artificial fill (Bristol and North Wind 2020). No permanent freshwater surface water features are present within the HFT, and the facility is drained by a series of manmade ditches. There are six distinct aquifers (Figure 3 of the Work Plan) and generally have limited productivity. In general, groundwater in this area flows towards Tanani Bay.	Contamination at the former Fire Hose Building 1203 is most likely the result of residual PFAS-containing foam flowing from hoses to the ground surface. PFAS compounds are COPCs. PFAS is commonly associated with firefighting foam and is also found in consumer products. PFOS is present in groundwater at a concentration greater than the PSL, and there are no PFAS detections in soil. It is possible that due to the age of the release, high precipitation, and inorganic nature of the soil that a source in soil may no longer be present.	The presence of PFAS contamination was first identified during the 2022 PFAS PA/SI. PFOS was found in groundwater at a concentration of 87 J- ng/L; all soil results were non-detect. The extent of contamination is currently unknown.	The primary release mechanism to soil is believed to be the release of residual PFAS-containing foam flowing from hoses to the ground surface. A secondary release mechanism is contaminant migration through subsurface soil into groundwater. Impacted groundwater is part of the Emergent Beach Perched Aquifer which surfaces in Tanani Bay. Release and transport mechanisms for PFAS include dissolution/ desorption from soil to groundwater, transport via sediment carried by and/or dissolved in stormwater and surface water, discharge/recharge between groundwater and surface water, and adsorption/desorption between surface water and sediment.	PFAS typically has a carbon-fluorine tail and nonfluorinated head consisting of a polar functional group. The tail is hydrophobic and generally lipophobic, while the head group can be polar and hydrophilic. These competing tendences of the head and tail lead to widespread and uneven distribution in the environment. This competition can lead to soil/water, air/water, and water/non-aqueous phase liquids partitioning. PFAS compounds are typically soluble in water and will leach from soil. PFAS compounds are not readily biodegradable.	The HFT site is located 2.9 miles north of Haines. The land occupied and surrounding the HFT site is a combination of land withdrawn from the public domain and land acquired from private owners. Private residences are located approximately 600 feet southwest of the former Fire Hose Building 1203. The National Guard Dormitory Building 1204 is located within 100 feet of the site. The likely HH receptors exposed to potential contaminants consist of future residents, future commercial/industrial workers, current and future site visitors, trespassers, recreational users, current and future construction workers, and current and future subsistence harvesters and consumers.

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

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WORKSHEET 11 – DATA QUALITY OBJECTIVES

The objectives of the Performance of Work Statement are to conduct an RI for PFAS at the former HFT and evaluate HH and ecological risks (USACE 2023a). Data Quality Objectives (DQOs) guide decisions and procedures for collecting, analyzing, and evaluating data so that the overall project objectives are met. Table 11-1 presents the detailed DQOs for this work, which were developed using the U.S. Environmental Protection Agency (EPA) seven-step DQO process (EPA 2006). The DQOs for the first mobilization are listed below, DQOs for the second mobilization will be submitted as an addendum following assessment of PFAS data collected during the first mobilization:

1. **DQO 001:** Conduct a groundwater investigation to characterize the nature and extent of PFAS contamination present in groundwater and verify/confirm previous results exceeding the project screening levels (PSLs).
2. **DQO 002:** Conduct a soil investigation to characterize the nature and extent of PFAS contamination present in soil.
3. **DQO 003:** Collect surface water and sediment samples from a seep discharging the Emergent Beach Perched Aquifer into Tanani Bay to assess potential migration of PFAS contamination into the marine environment.
4. **DQO 004:** Conduct a Baseline HH and Ecological Risk Assessment.

11.1 Migration to Groundwater Pathway Evaluation

Additionally, multiple lines of evidence will be used to evaluate soil results and the potential for migration of contaminants to groundwater, will provide a framework to determine if contaminants in soil are likely serving as a continuing source to groundwater contamination. This multiple lines of evidence approach includes the following steps to evaluate potential migration to groundwater:

1. Was the contaminant detected in groundwater above the applicable screening level? Does exposure to groundwater present an unacceptable risk?
2. Is the vertical distribution of contaminant concentrations in soil suggestive of migration to groundwater? For example, do contaminant concentrations increase from shallow to deeper intervals?
3. Was the contaminant detected in soil in the deepest interval sampled above the water table (i.e., the vadose zone above the capillary fringe)?

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Table 11-1 Data Quality Objectives

Step 1: State the Problem	Step 2: Identify the Goals of the Study	Step 3: Identify Information Inputs	Step 4: Define Boundaries of the Study	Step 5: Develop the Analytical Approach	Step 6: Specify Performance or Acceptance Criteria	Step 7: Develop Plan for Obtaining Data
DQO 001 – Conduct a groundwater investigation to characterize the nature and extent of PFAS contamination present in groundwater and verify/confirm previous results exceeding the PSLs						
Groundwater samples collected from existing wells during the 2022 PFAS PA/SI exceeded (current) PSLs. **Former Administrative Area:** Three of the five wells sampled in the former Administrative Area (downgradient of former Buildings 1203, 1208, and 1212) exceeded the screening level for PFOS (AP-009, AP-114, and AP-148) and one of those wells also exceeded the screening level for PFHxS (AP-148). PFAS was non-detect in the other two wells (AP-006 and AP-146). PFAS detections in groundwater were limited to the Emergent Beach Perched Aquifer. **Former Tank Farm Area:** Three of the five wells sampled in the former Tank Farm Area had PFOS or PFHxS detections at concentrations less than the PSLs (AP-137, AP-207, and AP-515). PFAS was non-detect in the other two wells (AP-533 and AP-534). Further investigation is needed to delineate the extent of PFAS contamination in groundwater at the HFT and to verify the previous detections in groundwater.	• Confirm contaminant concentrations in previous wells with PFAS detections in the former Administrative Area and former Tank Farm Area. • Delineate the extent of groundwater contamination downgradient of former Buildings 1203, 1208, and 1212 in the former Administrative Area. • Identify potential source area(s). • Develop the CSM to understand potential source(s) of contamination and fate and transport pathways. • Collect data for the completion of a baseline risk assessment.	• Analytical PFAS results from groundwater samples collected in 2022 (Arcadis 2023) will be used to determine which existing wells to resample and help determine locations for the new wells to be installed. • Soil boring logs and associated hydrogeology data obtained during the 2015-2017 RI (Bristol and North Wind 2020) will be used as a guide for installation of new monitoring wells in the Emergent Beach Perched Aquifer. • Analytical PFAS results from the resampled existing wells and newly installed wells during the 2024 RI will be used to verify the presence or absence of PFAS in groundwater.	• The former Tank Farm Area is located north of the former Administrative Area. The existing monitoring wells AP-137, AP-207, and AP-515 will be sampled. These wells are downgradient of the former Fire Foam Building 1231. Results will be used to confirm contaminant concentrations from previous sampling event. • The former Administrative Area is located along Lutak Road north of Tanani Bay. Thirteen existing monitoring wells will be sampled located upgradient, crossgradient, and downgradient of the former Firefighting Office, Shop, and Garage Building 1212; Fire Foam Building 1208; and Fire Hose Building 1203 to further define the nature and extent of PFAS in groundwater. Results will be used to confirm contaminant concentrations in previous wells and support groundwater delineation. • Seven permanent monitoring wells will be installed across the former Administrative Area and three temporary monitoring wells will be installed south of Lutak Road adjacent to the shoreline of Tanani Bay. The purpose will be to delineate the extent of groundwater contamination.	Analytical groundwater samples will be collected to characterize the presence of PFAS in groundwater and the extent of contamination. Sampling will be conducted in accordance with the design, rationale, and procedures discussed in Worksheets 17 and 18, and the field SOPs provided in Appendix D of the Work Plan.	Field notes and analytical samples will be collected by a qualified sampler that has been properly trained and understands topics outlined in the DoD *Environmental Field Sampling Handbook* (DoD 2013). Analytical data will be reviewed against the following: • PSLs, DQOs, Checklists, QA Requirements of Laboratory Data, and Sample Handling. • DoD QSM, version 5.4 (DoD 2021a). • Worksheets 12 and 15.	Existing monitoring wells to be sampled have been identified in Figure 6 and Figure 7 of the Work Plan based on the previous PFAS PA/SI. Samples will be collected from 3 existing monitoring wells within the former Tank Farm Area and 13 existing monitoring wells in the former Administrative Area. Monitoring wells will be assessed to ensure that they can be sampled. The seven permanent monitoring wells and three temporary monitoring wells will be installed as detailed in Figure 6 of the Work Plan. Monitoring wells will be developed prior to sampling. Locations of the monitoring wells will ensure determination of clean upgradient boundaries, investigation of potential source areas, and contaminant delineation. One groundwater sample will be collected from each identified existing monitoring well, newly installed permanent monitoring wells, and newly installed temporary monitoring wells. Groundwater samples will be analyzed for PFAS by EPA Draft Method 1633. Method 1633 was finalized in January 2024; the final version of the method will be used if the selected laboratory receives method accreditation. Sampling design, rational, and procedures are discussed in Worksheets 17 and 18.

Table 11-1 Data Quality Objectives

Step 1: State the Problem	Step 2: Identify the Goals of the Study	Step 3: Identify Information Inputs	Step 4: Define Boundaries of the Study	Step 5: Develop the Analytical Approach	Step 6: Specify Performance or Acceptance Criteria	Step 7: Develop Plan for Obtaining Data
DQO 002 – Conduct a soil investigation to characterize the nature and extent of PFAS contamination present in soil						
Soil samples were collected during the 2022 PFAS PA/SI from Building 1212, Building 1208, and Building 1203 located in the former Administrative Area. All soil sample results associated with these buildings were non-detect; however, groundwater contamination associated with each building is present. Further investigation is needed to delineate the extent of PFAS contamination in soil and to identify contaminant source locations (if present).	• Delineate the horizontal and vertical extent of soil contamination across the former Administrative Area and identify potential PFAS contaminant source(s). • Identify potential source area(s). • Develop the CSM to understand potential source(s) of contamination and fate and transport pathways. • Collect data for the completion of a baseline risk assessment.	• Analytical PFAS results from groundwater samples collected in 2022 (Arcadis 2023) will be used to determine soil boring locations, which will coincide with groundwater monitoring wells. • Analytical results from the surface soil (0 to 2 feet bgs), subsurface (2 to 15 feet bgs), and groundwater interface will be used to determine the presence or absence of PFAS in soil.	Soil samples will be collected from 10 soil borings, co-located with new monitoring well locations. Soil samples will only be collected within the boundary of the former Administrative Area and south of Lutak Road adjacent to the shore of Tanani Bay.	Analytical soil samples will be collected to characterize the presence of PFAS in soil and the horizontal and vertical extent of contamination. Sampling will be conducted in accordance with the design, rationale, and procedures discussed in Worksheets 17 and 18, and the field SOPs provided in Appendix D of the Work Plan.	Field notes and analytical samples will be collected by a qualified sampler that has been properly trained and understands topics outlined in the DoD *Environmental Field Sampling Handbook* (DoD 2013). Analytical data will be reviewed against the following: • PSLs, DQOs, Checklists, QA Requirements of Laboratory Data, and Sample Handling. • DoD QSM, version 5.4 (DoD 2021a). • Worksheets 12 and 15.	Soil sample locations will be co-located with new monitoring well installation points, identified in Figure 6 of the Work Plan. Three soil samples will be collected from each boring: 1) surface soil (0 to 2 feet bgs), 2) subsurface soil within the vadose zone dependent upon soil conditions (e.g., change in soil horizon, perched water lens, confining layer) (2 to 15 feet bgs), and 3) groundwater interface. A total of 30 soil samples will be collected. Soil samples will be analyzed for PFAS by EPA Draft Method 1633. Method 1633 was finalized in January 2024; the final version of the method will be used if the selected laboratory receives method accreditation. Sampling design, rational, and procedures are discussed in Worksheets 17 and 18.
DQO 003 – Collect surface water and sediment samples from a seep discharging the Emergent Beach Perched Aquifer into Tanani Bay to assess potential migration of PFAS contamination into the marine environment						
The Emergent Beach Perched Aquifer which underlies the former Administrative Area flows towards Tanani Bay (Figure 3 of the Work Plan) and surfaces at seeps into the bay. This groundwater aquifer is impacted by PFOS and PFHxS at concentrations greater than the PSLs. Further investigation is required to determine if surface water and sediment in Tanani Bay are impacted by PFAS compounds.	• Determine if surface water and sediment of Tanani Bay are being impacted by PFAS compounds migrating from the former Administrative Area. • Develop the CSM to understand potential source(s) of contamination and fate and transport pathways. • Collect data for the completion of a baseline risk assessment.	• Surface water seeps will be identified during low tide. Sediment samples will be co-located with the surface water location. • Analytical results from the surface water and sediment will be used to determine the presence or absence of PFAS from each media.	Up to three co-located surface water and sediment samples will be collected. If the Tanani Point seep area (Figure 6) is wider than 20 feet in any dimension, surface water and sediment samples will be collected at two locations; otherwise, a single location will be sampled. The third sample point is reserved for any other unknown seeps that are observed west of Tanani Point. Seep areas observed downgradient of monitoring wells where previous PFAS results exceeded PSLs (AP-009, AP-114, and AP-148) will be prioritized.	Analytical PFAS surface water and sediment samples will be collected to characterize the presence of PFAS in Tanani Bay. Sampling will be conducted in accordance with the design, rationale, and procedures discussed in Worksheets 17 and 18, and the field SOPs provided in Appendix D of the Work Plan.	Field notes and analytical samples will be collected by a qualified sampler that has been properly trained and understands topics outlined in the DoD *Environmental Field Sampling Handbook* (DoD 2013). Analytical data will be reviewed against the following: • PSLs, DQOs, Checklists, QA Requirements of Laboratory Data, and Sample Handling. • DoD QSM, version 5.4 (DoD 2021a). • Worksheets 12 and 15.	Up to three surface water and sediment locations, co-located with each other, will be sampled. Surface water and sediment samples will be analyzed for PFAS by EPA Draft Method 1633. Method 1633 was finalized in January 2024; the final version of the method will be used if the selected laboratory receives method accreditation. Sampling design, rational, and procedures are discussed in Worksheets 17 and 18.

Table 11-1 Data Quality Objectives

Step 1: State the Problem	Step 2: Identify the Goals of the Study	Step 3: Identify Information Inputs	Step 4: Define Boundaries of the Study	Step 5: Develop the Analytical Approach	Step 6: Specify Performance or Acceptance Criteria	Step 7: Develop Plan for Obtaining Data
DQO 004 – Conduct a Baseline HH and Ecological Risk Assessment[1]						
PFAS compounds have been identified in soil and groundwater associated with the former Tank Farm Area at concentrations less than the PSLs and have been found in groundwater in the former Administrative Area in exceedance of PSLs. Preliminary CSMs were prepared (Worksheet 10), but due to lack of data further investigation is needed to determine impacted pathways and receptors.	• Determine if pathways are completed resulting in PFAS contamination impacting HH and ecological receptors based on 2022 PFAS PA/SI results (Arcadis 2023) and results generated as part of this RI. • Develop the CSM to understand potential source(s) of contamination and fate and transport pathways. • Complete a baseline HH and Ecological Risk Assessment.	• Analytical PFAS results collected in 2022 as part of the PA/SI (Arcadis 2023). • Analytical PFAS results for groundwater, soil, sediment, and surface water collected in 2024 as part of this RI. • Site background details collected during the 2015 – 2017 RI (Bristol and North Wind 2020) and 2022 PFAS PA/SI (Arcadis 2023).	• Former Firehouse Office, Shop, and Garage Building 1212. • Boundary of the former Administrative Area along with the shoreline of Tanani Bay and the bay itself.	Collect PFAS samples from groundwater, soil, sediment, and surface water. Compare results against regulatory criteria to determine if pathways are complete and evaluate risk to potential receptors based on regulatory guidance.	Field notes and analytical samples will be collected by a qualified sampler that has been properly trained and understands topics outlined in the DoD *Environmental Field Sampling Handbook* (DoD 2013). Analytical data will be reviewed against the following: • PSLs, DQOs, Checklists, QA Requirements of Laboratory Data, and Sample Handling • DoD QSM, version 5.4 (DoD 2021a) • Worksheets 12 and 15 Completion of the HH and Ecological Risk Assessment in line with the Baseline Risk Assessment (Appendix B of the Work Plan). The risk assessment will be completed in line with regulatory agency guidance: • EPA *Risk Assessment Guidance for Superfund Volume I: HH Evaluation Manual* (EPA 1989) • USACE *Risk Assessment Handbook Volumes I and II (EM 200-1-4)* (USACE 2010) • Risk Assessment Information System	Collect the following analytical samples: • 13 PFAS groundwater samples from existing monitoring wells within the former Administrative Area. • 7 PFAS groundwater samples from newly installed permanent monitoring wells within the former Administrative Area. • 3 PFAS groundwater samples from temporary monitoring wells installed south of Lutak Road along the shoreline of Tanani Bay. • 30 PFAS soil samples collected from borings co-located with newly installed monitoring wells and temporary monitoring wells. • Up to 3 PFAS sediment and 3 PFAS surface water samples collected from the seep area(s).

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

[1] The Former Tank Farm Area and associated Fire Foam Building 1231 are not included because RI efforts are only to confirm the finding of the 2022 PA/SI (Arcadis 2023), and results showed no PFAS analytes at concentrations greater than the PSLs. If RI results indicate that PFAS is present at concentrations greater than the PSLs, the building and area will be included as part of DQO 004.

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WORKSHEET 12 – MEASUREMENT PERFORMANCE CRITERIA

Table 12-1 through 12-5 summarizes the measurement performance criteria (MPC) for each matrix and analytical group. The tables identify the QC sampling and/or activity and data quality indicators (DQIs) that will be used to assess the measurement performance for both the sampling and analytical measurement systems. MPC follow those defined in the Department of Defense (DoD) *Quality Systems Manual* (QSM), Version 5.4 (DoD 2021a), referred to herein as the QSM, or the analytical methods.

12.1 Data Quality Indicators

The quality of the data collected for the HFT project will be verified through appropriate MPC established for both sampling procedures and analytical methods. The criteria also relate to DQIs consisting of precision, accuracy, representativeness, completeness, comparability, and sensitivity; commonly referred to as PARCCS parameters. The quality of the sampling procedures and laboratory results will be evaluated for compliance with project DQOs through a review of overall PARCCS, in accordance with procedures described in Worksheet 36.

DQIs are defined in the following subsections.

12.1.1 Precision

Precision will be evaluated by comparing the following:

- Laboratory control sample (LCS) and laboratory control sample duplicate (LCSD) (if prepared and analyzed) to determine the precision of the laboratory procedures and verify matrix interference.
- Matrix spike (MS) and matrix spike duplicate (MSD) samples to determine the effect of the sample matrix on the precision of the results generated using the selected analytical method.
- Primary and field duplicate (FD) sample results.

The required level of precision for FDs is relative percent difference (RPD) of 50 percent (%) for soil and 30% for water. FD precision is evaluated by calculating RPD using the following formula:

$$RPD = \frac{2[(D_1 - D_2)]}{D_1 + D_2} \times 100$$

Where: D1 = first sample value
D2 = second sample value (duplicate)

12.1.2 Accuracy

Accuracy will be evaluated by reviewing the following:

- Calibrations – Initial and continuing, acceptance, and frequency (deviations are assumed to be noted in case narratives)
- Surrogates – Recovery and frequency
- LCS and LCSD recoveries
- MS and MSD recoveries

- Method blanks (MBs) – Detections in the MB may indicate potential high bias in associated samples
- Relative response factors (RRFs) and relative standard deviation (RSD) (appropriate calibration procedures improve accuracy of measurement results; deviations are assumed to be noted in case narratives)
- Gas chromatography (GC) second-column confirmation (if required)
- Tuning criteria GC/mass spectroscopy (GC/MS) – Acceptability and frequency (to ensure accuracy of mass and ion abundance measurements; deviations are assumed to be noted in laboratory case narratives)
- Internal standards (ISs) (GC and GC/MS) – Acceptability and frequency (deviations are assumed to be noted in laboratory case narratives)

Percent recovery (%R) for surrogates, LCSs, and MSs is calculated using the following formula:

$$\%\ Recovery = \frac{(S - U)}{C_{sa}}\ x\ 100$$

Where: S = Measured concentration in spiked aliquot
U = Measured concentration in un-spiked aliquot
C_{sa} = Actual concentration of spike added

12.1.3 Representativeness

Representativeness shall be achieved through use of the standard field, sampling, and analytical procedures. Representativeness will be evaluated by reviewing the following:

- Sampling design, including sample quantities and locations
- Sampling procedures and equipment
- Sample chain-of-custody (CoC) forms and field logbooks
- Holding times and preservation

12.1.4 Completeness

Completeness is a measure of the amount of valid data obtained compared with the amount that was expected to be obtained under correct, normal conditions. For completeness requirements, valid results are all results not rejected and determined to be usable in the context of project DQOs. Completeness will be evaluated for each analytical method for a particular sampling event or other defined set of samples (such as by site) with respect to each DQO or end data use. Completeness will be calculated and evaluated for each method and matrix combination using the formula below. Completeness may also be calculated for each analyte, if determined necessary for a project (e.g., for a specific site contaminant of potential concern [COPC]).

$$\%\ Completeness = 100\ x\ (\frac{V}{n})$$

Where: V = Number of measurements determined to be valid (i.e., usable)
n = Total number of measurements expected

Valid data are considered usable in the context of project DQOs and/or end data use(s). The completeness goal is considered met when 90% of the sample data are considered valid and usable in the context of project goals.

12.1.5 Comparability

Comparability is a qualitative indicator of the confidence with which one data set can be compared to another. To ensure data set comparability, the following steps will be taken:

- Using standard methods for sampling and analysis.
- Reporting data in standard units.
- Operating instruments within their calibrated range according to established procedures that are based on approved methodology.
- Using only standards approved by the manufacturer for field screening instruments.
- Using standard and comprehensive reporting formats.
- As part of the comparability assessment, correlation between field screening and laboratory data will be evaluated.

12.1.6 Sensitivity

Sensitivity is the ability of a method or instrument to detect the target analytes at the level of interest (PSL). The capability of analytical laboratory methods and instrumentation to provide data with the sensitivity to meet the DQOs is evaluated during the planning phase. The laboratory-specific limits (including detection limits (DLs), limits of detection (LODs), and limits of quantitation [LOQs]) are evaluated against the regulatory standards to determine whether the analytical methods and/or laboratory can meet the project DQOs. Laboratory-specific limits for planned fields of testing are included in Worksheet 15.

If a result is greater than the DL and less than the LOQ, the result will be reported as estimated and flagged "J." If no detected concentration is determined down to the DL, the result will be reported to the LOD concentration (with the added variables of sample dilution, final volume, and sample mass included) as a non-detect result (with the LOD presented in brackets). A detected result greater than or equal to the LOQ will be reported without a qualifying flag unless otherwise required by QC exceedance.

Sample dilution due to target and/or non-target compound concentrations or matrix interference could prevent achievement of DLs. Samples must be analyzed initially while undiluted, when reasonable. If dilution is necessary, both the original and the diluted results must be reported. Samples that are not analyzed undiluted must be supported by matrix interference documentation, such as sample viscosity, color, odor, or results from other analyses of the same sample, to show that undiluted analysis is not possible. Appropriate cleanup procedures must be followed to minimize matrix effects on DLs, LODs, and LOQs.

12.2 Measurement Performance Criteria Worksheets

Tables 12-1 through 12-5 summarize the MPC for each matrix and analytical group.

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Table 12-1 Measurement Performance Criteria for Draft Method EPA 1633

Analytical Method/SOP	QC Sample or Measurement Performance Activity	Data Quality Indicator	Measurement Performance Criteria
Draft Method EPA 1633[1] in accordance with DoD QSM version 5.4 Table B-24 ENV-SOP-WCOL-0158 EMT-SOP-0-1633	FD	Precision	Soil/Sediment: RPD ≤ 50% for analytes detected in both samples ≥ LOQ Water: RPD ≤ 30% for analytes detected in both samples ≥ LOQ
	Blanks (MB, EB, or FRB)	Accuracy/Bias/Contamination	No analytes detected > 1/2 LOQ and > 1/10 the amount found in any sample or 1/10 the regulatory limit, whichever is greater.[3]
	LCS and LCSD Recoveries; RPD	Accuracy; Precision	%R limits, 40-150%; RPD ≤ 30%
	MS and MSD Recoveries; RPD	Accuracy; Precision	%R limits, 40-150%; RPD ≤ 30%
	EIS Analytes	Accuracy	Recoveries within 50-150% of ICAL midpoint standard area (or area measured in the opening CCV on days when an ICAL is not performed)
	NIS	Sensitivity	The NIS RTs for all field and QC samples should be within 0.40 minutes of the RT of the midpoint standard in the ICAL, or on days when an ICAL is not performed, the initial DV is used.
	Cooler temperature	Representativeness/Usability	Temperature 0-6°C
	Collection time/date, extraction time/date, analysis time/date	Representativeness/Usability	Samples must be extracted and analyzed within holding times as listed in Worksheet 19/30[2]
	Evaluate laboratory LODs and LOQs against project DQOs	Sensitivity	LOD for ND results less than the PSL.
	Completeness of samples collected and analytical requirements	Completeness	90% for all matrices

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
[1] Source: EPA 2023. Method 1633 was finalized in January 2024; the final version of the method will be used if the selected laboratory receives method accreditation.
[2] Holding times differ between the reporting laboratories. Evaluation of holding time is laboratory-specific to be consistent with the reporting laboratory's SOPs.
[3] DoD QSM v 5.4 (DoD 2021a). Default Table B-24 limits are specified until historical laboratory limits can be determined.

Table 12-2 Measurement Performance Criteria for Methods SW8260D (Soil and Water IDW)

Data Quality Indicator	QC Sample OR Measurement Performance Activity	Measurement Performance Criteria
Precision	FD	Soil/Sediment: RPD < 50% for analytes detected in both samples ≥ LOQ.[1] Water: RPD < 30% for analytes detected in both samples ≥ LOQ.[1]
Accuracy/Bias/Contamination	Blanks (MB, TB)	No analytes detected > 1/2 LOQ and > 1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected > LOQ and > 1/10 the amount measured in any sample.[2] Sample results will be qualified if contamination is detected above the DL in the associated MB.
Accuracy	LCS and MS/MSD Recoveries	Soil/Sediment: %R limits, Table C-23, DoD QSM v5.4[2] Water: %R limits, Table C-24, DoD QSM v5.4[2]
Precision	LCS/LCSD, MS/MSD RPD	RPD ≤ 20%[2]
Accuracy	Surrogate Recoveries	Soil/Sediment: %R limits, Table C-23, DoD QSM v5.4[2] Water: %R limits, Table C-24, DoD QSM v5.42
Accuracy/Bias	ICV and CCV	≤ 20% difference (≤ 50% for end of analytical batch CCV)[2]
Sensitivity	ISs	RT ±10 seconds from RT of the IS of the calibration midpoint and extracted ion current profile area within -50% to +100% of area from IS calibration midpoint standard
Representativeness/Usability	Collection time/date, extraction time/date, analysis time/date	Samples must be extracted and analyzed within holding times as listed in Worksheet 19/30 (14 days to analysis, 7 days if unpreserved.)
Representativeness/Usability	Cooler Temperature and Temperature Blank	Temperature 0° to 6°C[1]
Sensitivity	Evaluate laboratory LODs and LOQs against project DQOs	LOD for ND results less than the regulatory criteria
Completeness	Completeness of samples collected; completeness of analytical requirements per the UFP-QAPP	90% for all matrices

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
[1] In general accordance with the ADEC Field Sampling Guidance (ADEC 2022a).
[2] DoD QSM, Version 5.4 (DoD 2021a). If DoD QSM criteria are not available, laboratory statistically derived limits will be used.

Table 12-3 Measurement Performance Criteria for Method SW8270D-SIM (Soil and Water IDW)

Data Quality Indicator	QC Sample OR Measurement Performance Activity	Measurement Performance Criteria
Precision	FD	Soil/Sediment: RPD < 50% for analytes detected in both samples ≥ LOQ.[1] Water: RPD < 30% for analytes detected in both samples ≥ LOQ.[1]
Accuracy/Bias/Contamination	Blanks (MB)	No analytes detected > 1/2 LOQ and > 1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected > LOQ and > 1/10 the amount measured in any sample.[2] Sample results will be qualified if contamination is detected above the DL in the associated MB.
Accuracy	LCS and MS/MSD Recoveries	Soil/Sediment: %R limits, Table C-25 and C-27, DoD QSM v5.4[2] Water: %R limits, Table C-26 and C-28, DoD QSM v5.4[2]
Precision	LCS/LCSD, MS/MSD RPD	SIM Mode: RPD ≤ 40%[2]
Accuracy	Surrogate Recoveries	Soil/Sediment: %R limits, Table C-25 and C-27, DoD QSM v5.4[2] Water: %R limits, Table C-26 and C-28, DoD QSM v5.4[2]
Accuracy/Bias	ICV and CCV	≤ 20% difference (≤ 50% for end of analytical batch CCV)[2]
Sensitivity	ISs	RT ±10 seconds from RT of the IS of the calibration midpoint and extracted ion current profile area within -50% to +100% of area from IS calibration midpoint standard
Representativeness/Usability	Collection time/date, extraction time/date, analysis time/date	Samples must be extracted and analyzed within holding times as listed in Worksheet 19/30 (14 days to extraction, 40 days from extraction to analysis)
Representativeness/Usability	Cooler Temperature and Temperature Blank	Temperature 0 to 6°C[1]
Sensitivity	Evaluate laboratory LODs and LOQs against project DQOs	LOD for ND results less than regulatory criteria
Completeness	Completeness of samples collected; completeness of analytical requirements per the UFP-QAPP	90% for all matrices

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
[1] In general accordance with the ADEC Field Sampling Guidance (ADEC 2022a).
[2] DoD QSM, Version 5.4 (DoD 2021a). If DoD QSM criteria are not available, laboratory statistically derived limits will be used.

Table 12-4 Measurement Performance Criteria for Method AK101 (Soil and Water IDW)

Data Quality Indicator	QC Sample OR Measurement Performance Activity	Measurement Performance Criteria
Precision	FD	Soil/Sediment: RPD < 50% for analytes detected in both samples ≥ LOQ.[1] Water: RPD < 30% for analytes detected in both samples ≥ LOQ.[1]
Accuracy/Bias/Contamination	Blanks (MB, TB)	No analytes detected > 1/2 LOQ and > 1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected > LOQ and > 1/10 the amount measured in any sample.[2] Sample results will be qualified if contamination is detected above the DL in the associated MB.
Accuracy	LCS/LCSD Recoveries MS/MSD Recoveries	60 to 120% Recovery[3]
Precision	LCS/LCSD, MS/MSD RPD	RPD ≤ 20%[3]
Accuracy	Surrogate Recoveries	60 to 120% Recovery for QC samples (MB/LCS/LCSD)[3] 50 to 150% Recovery for field samples (including MS/MSD)[3]
Accuracy/Bias	ICV and CCV	≤ 25% difference[3]
Representativeness/Usability	Collection time/date, extraction time/date, analysis time/date	Samples must be extracted and analyzed within holding times as listed in Worksheet 19/30 (Soil: 28 days, Water: 14 days)
Representativeness/Usability	Cooler Temperature and Temperature Blank	Temperature 0 to 6°C[1]
Sensitivity	Evaluate laboratory LODs and LOQs against project DQOs	LOD for ND results less than the regulatory criterion
Completeness	Completeness of samples collected; completeness of analytical requirements per the UFP-QAPP	90% for all matrices

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
[1] In general accordance with the ADEC Field Sampling Guidance (ADEC 2022a).
[2] DoD QSM, Version 5.4 (DoD 2021a). If DoD QSM criteria are not available, laboratory statistically derived limits will be used.
[3] *Underground Storage Tank Procedures Manual* (ADEC 2017b)

Table 12-5 Measurement Performance Criteria for Method AK102 (Soil and Water IDW)

Data Quality Indicator	QC Sample OR Measurement Performance Activity	Measurement Performance Criteria
Analytical Group or Method	FD	Soil/Sediment: RPD < 50% for analytes detected in both samples ≥ LOQ.[1] Water: RPD < 30% for analytes detected in both samples ≥ LOQ.[1]
Accuracy/Bias/Contamination	Blanks (MB)	No analytes detected > 1/2 LOQ and > 1/10 the amount found in any sample. For common laboratory contaminants, no analytes detected > LOQ and > 1/10 the amount measured in any sample.[2] Sample results will be qualified if contamination is detected above the DL in the associated MB.
Accuracy	LCS/LCSD Recoveries MS/MSD Recoveries	DRO: 75 to 125% Recovery[3] RRO: 60 to 120% Recovery[3]
Precision	LCS/LCSD, MS/MSD RPD	RPD ≤ 20%[3]
Accuracy	Surrogate Recoveries	60 to 120% Recovery for QC samples (MB/LCS/LCSD)[3] 50 to 150% Recovery for field samples (including MS/MSD)[3]
Accuracy/Bias	ICV and CCV	≤ 25% difference[3]
Representativeness/Usability	Collection time/date, extraction time/date, analysis time/date	Samples must be extracted and analyzed within holding times as listed in Worksheet 19/30 (Soil and Water: 14 days to extraction, 40 days to analysis)
Representativeness/Usability	Cooler Temperature and Temperature Blank	Temperature 0° to 6°C[1]
Sensitivity	Evaluate laboratory LODs and LOQs against project DQOs	LOD for ND results less than regulatory criteria
Completeness	Completeness of samples collected; completeness of analytical requirements per the UFP-QAPP	90% for all matrices

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
[1] In general accordance with the ADEC Field Sampling Guidance (ADEC 2022a).
[2] DoD QSM, Version 5.4 (DoD 2021a). If DoD QSM criteria are not available, laboratory statistically derived limits will be used.
[3] *Underground Storage Tank Procedures Manual* (ADEC 2017b)

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WORKSHEET 13 – SECONDARY DATA USES AND LIMITATIONS

Table 13-1 presents the secondary data used in project planning for the HFT PFAS RI. How the secondary data are used and any applicable limitations to the data is also described.

Table 13-1 Secondary Data Uses and Limitations

Data Type	Data Source	Data Uses Relative to Current Project	Limitations on Data Use
Historical background information of contaminant sources; historical sample locations	*Final 2010 Haines Fuel Terminal Annual Report, Haines-Fairbanks Pipeline Environmental Remediation Services.* April. (North Wind 2012).	This document summarizes stockpile soil treatment with microbes that occurred in 2009 and groundwater sampling that occurred in 2010. The document is used to complete the site background and history.	All non-rejected data may be used for project purposes.
Historical background information of contaminant sources; historical sample locations	*Final Former Haines Fuel Terminal Data Gap Analysis Report*. October. (North Wind 2014).	This document summarizes previous sampling data across the HFT site, until the time of its preparation, and identifies data gaps based on data collected along with site history and details. The document is used to complete the site background and history.	All non-rejected data may be used for project purposes.
Historical background information of contaminant sources; historical sample locations; risk assessment	*Final Former Haines Fuel Terminal Remedial Investigation Report.* June. (Bristol and North Wind 2020).	This document describes the sampling approach and results from the RI conducted in 2015-2017. The sampling locations and analytical results will be used to plan the PFAS RI.	All non-rejected data may be used for project purposes.
Historical background information of contaminant sources; historical sample locations	*Final Preliminary Assessment and Site Inspection of Per- and Polyfluoroalkyl Substances.* Fort Wainwright Sub-Installations, Alaska. March. (Arcadis 2023).	This document describes the sampling approach and results from the PFAS PA/SI conducted in 2020. The sampling locations and analytical results will be used to plan the PFAS RI.	All non-rejected data may be used for project purposes.

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

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WORKSHEET 14/16 – PROJECT TASKS AND SCHEDULE

Table 14-1 presents project tasks and the schedule for deliverables and site fieldwork. Modifications to the project schedule after submittal of the Final Work Plan will be discussed with the regulatory PMs.

Table 14-1 Project Tasks and Schedule

Activity	Responsible Party	Anticipated Initiation Date	Anticipated Completion Date	Deliverable
Prepare Preliminary Draft Work Plan	Brice	30 August 2023	14 December 2023	Preliminary Draft Planning Documents
USACE/Army Review of Preliminary Draft Work Plan	USACE/Army	14 December 2023	13 January 2024	Comments
Resolve Comments/Prepare Draft Work Plan	Brice	13 January 2024	12 April 2024	Draft Planning Documents
Stakeholder Review of Draft Work Plan	USACE/Army/ADEC	12 April 2024	12 May 2024	Comments
Resolve Comments/Prepare Draft-Final Work Plan	Brice	12 May 2024	2 June 2024	Draft-Final Planning Documents
USACE/Army and ADEC Backcheck of Draft-Final Work Plan	USACE/Army/ADEC	2 June 2024	2 July 2024	Comments/Approval
Prepare Final Work Plan	Brice	2 July 2024	9 July 2024	Final Planning Documents
Fieldwork – Mobilization 1	Brice	10 July 2024	24 July 2024	Fieldwork Complete
Prepare Preliminary Draft Work Plan Addendum	Brice	23 August 2024	6 September 2024	Preliminary Draft Work Plan Addendum
USACE/Army Review of Preliminary Draft Work Plan Addendum	USACE/Army	6 September 2024	20 September 2024	Comments
Resolve Comments/Prepare Draft Work Plan Addendum	Brice	20 September 2024	4 October 2024	Draft Work Plan Addendum
Stakeholder Review of Draft Work Plan Addendum	USACE/Army/ADEC	4 October 2024	18 October 2024	Comments
Resolve Comments/Prepare Draft-Final Work Plan Addendum	Brice	18 October 2024	1 November 2024	Draft-Final Work Plan Addendum
USACE/Army and ADEC Backcheck of Draft-Final Work Plan Addendum	USACE/Army/ADEC	1 November 2024	15 November 2024	Comments/Approval
Prepare Final Work Plan Addendum	Brice	15 November 2024	22 November 2024	Final Work Plan Addendum
Fieldwork – Mobilization 2	Brice	23 November 2024	5 December 2024	Fieldwork Complete
Prepare Preliminary Draft Report	Brice	4 January 2025	14 April 2025	Preliminary Draft Report
USACE/Army Review of Preliminary Draft Report	USACE/Army	14 April 2025	14 May 2025	Comments

Table 14-1 Project Tasks and Schedule

Activity	Responsible Party	Anticipated Initiation Date	Anticipated Completion Date	Deliverable
Resolve Comments/Prepare Draft Report	Brice	14 May 2025	4 June 2025	Draft Report
Stakeholder Review of Draft Report	ADEC	4 June 2025	4 July 2025	Comments
Resolve Comments/Prepare Draft-Final Report	Brice	4 July 2025	18 July 2025	Draft-Final Report
USACE/Army and ADEC Backcheck of Draft-Final Report	USACE/Army/ADEC	18 July 2025	17 August 2025	Comments/Approval
Prepare Final Report	Brice	17 August 2025	31 August 2025	Final Report

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

WORKSHEET 15 – PROJECT ACTION LIMITS AND LABORATORY-SPECIFIC DETECTION/QUANTITATION LIMITS

This worksheet and associated tables provide target analyte lists, analytical methods, and PSLs. The purpose of this worksheet and associated tables is to demonstrate that the selected analytical laboratories and analytical methods can provide accurate data (i.e., quantitative results with known precision and bias) at the PSLs. To meet MPC for sensitivity, the LOD for non-detect results and the LOQ for detected results shall be less than the applicable screening levels (to the extent practicable). Laboratory LOD and LOQ are included in each of the following tables for the planned chemical analyses.

The PSLs for this project are the EPA Regional Screening Levels (RSLs) established in November 2023, as stated on the DoD PFAS 101 webpage *Regional Screening Levels Used in DoD Cleanups* (https://www.acq.osd.mil/eie/eer/ecc/pfas/pfas101/rsl.html) (DoD 2024). Updates to EPA RSLs that occur prior to reporting will be incorporated into the PSLs and toxicity levels with DoD approval and as appropriate, any differences from this work plan will be summarized as part of the report. Updates to PFAS-related RSLs are maintained at https://www.acq.osd.mil/eie/eer/ecc/pfas/tf/policies.html. Although DoD recognizes that EPA has published RSLs for lithium bis(trifluoromethylsulfonyl)amine (TFSI) and perfluoropropanoic acid (PFPrA) there are currently no EPA-approved analytical methods for these analytes. These analytes are not associated with fire-fighting foam and are not considered COPCs at the site.

Soil and groundwater PSLs and laboratory-specific quantitation limits are presented in Tables 15-1 and 15-2 respectively. The PSLs used for this project are the most conservative residential scenarios for soil and tap water. The residential scenario is considered for the evaluation of unlimited use and unrestricted exposure. Future residential use of the property is not a reasonable anticipated scenario because the vast majority of the property is zoned heavy industrial.

Analytical results from investigation-derived waste (IDW) samples (soil) will also be compared to Resource Conservation and Recovery Act (RCRA) regulatory criteria listed in Table 15-3 to determine waste status. IDW water analytical results will be compared to the PSLs listed in Table 15-4.

The laboratory LOQs, LODs, and DLs presented in the following tables represent the achievable limits for analytes in a laboratory matrix. If the laboratory LOD exceeds the investigation screening level, the sample LOD will be evaluated against the laboratory LOD. Additionally, the analysis of field samples may result in sample dilutions that cause laboratory reporting limits to be elevated above screening levels. ND results will be reported to the LOD; if the LOD is greater than the screening level, then it cannot be definitively said that the analyte is not present at or below the screening level. ND sample results with LOQ and LOD that exceed the screening levels will be evaluated for potential effects on the usability of these data with regards to project DQOs.

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Table 15-1 Soil PFAS Project Screening Levels and Laboratory-Specific Limits for Draft Method EPA 1633

Analyte	Acronym	CASRN	PSL[2] (µg/kg)	Pace Analytical, South Carolina[1] (µg/kg)			Sterling Labs (Backup) (µg/kg)		
				DL	LOD	LOQ	DL	LOD	LOQ
Perfluoroalkyl carboxylic acids (PFCA)									
Perfluorobutanoic acid	PFBA	375-22-4	7800	0.1	0.32	0.8	0.048	0.4	0.8
Perfluoropentanoic acid	PFPeA	2706-90-3	NE	0.041	0.16	0.4	0.066	0.2	0.4
Perfluorohexanoic acid	PFHxA	307-24-4	3200	0.025	0.08	0.2	0.035	0.1	0.2
Perfluoroheptanoic acid	PFHpA	375-85-9	NE	0.025	0.08	0.2	0.015	0.1	0.2
Perfluorooctanoic acid	PFOA	335-67-1	19	0.029	0.08	0.2	0.015	0.1	0.2
Perfluorononanoic acid	PFNA	375-95-1	19	0.026	0.08	0.2	0.024	0.1	0.2
Perfluorodecanoic acid	PFDA	335-76-2	NE	0.029	0.08	0.2	0.015	0.1	0.2
Perfluoroundecanoic acid	PFUnA	2058-94-8	NE	0.028	0.08	0.2	0.017	0.1	0.2
Perfluorododecanoic acid	PFDoA	307-55-1	NE	0.032	0.08	0.2	0.034	0.1	0.2
Perfluorotridecanoic acid	PFTrDA	72629-94-8	NE	0.04	0.08	0.2	0.03	0.1	0.2
Perfluorotetradecanoic acid	PFTeDA	376-06-7	NE	0.029	0.08	0.2	0.017	0.1	0.2
Perfluoroalkyl sulfonic acids (PFSA)									
Perfluorobutanesulfonic acid	PFBS	375-73-5	1900	0.021	0.071	0.2	0.034	0.0887	0.177
Perfluoropentanesulfonic acid	PFPeS	2706-91-4	NE	0.022	0.075	0.2	0.024	0.0941	0.188
Perfluorohexanesulfonic acid	PFHxS	355-46-4	130	0.02	0.073	0.2	0.022	0.0914	0.183
Perfluoroheptanesulfonic acid	PFHpS	375-92-8	NE	0.033	0.076	0.2	0.024	0.0953	0.191
Perfluorooctanesulfonic acid	PFOS	1763-23-1	13	0.02	0.074	0.2	0.061	0.0928	0.186
Perfluorononanesulfonic acid	PFNS	68259-12-1	NE	0.025	0.077	0.2	0.043	0.0962	0.192
Perfluorodecanesulfonic acid	PFDS	335-77-3	NE	0.03	0.077	0.2	0.03	0.0965	0.193
Perfluorododecanesulfonic acid	PFDoS	79780-39-5	NE	0.024	0.078	0.2	0.022	0.097	0.194
Fluorotelomer sulfonic acids (FTSA)									
1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	4:2FTS	757124-72-4	NE	0.098	0.3	0.8	0.0960	0.375	0.750
1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	6:2FTS	27619-97-2	NE	0.165	0.608	0.8	0.969	1.00	1.90
1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	8:2FTS	39108-34-4	NE	0.082	0.307	0.8	0.119	0.384	0.768
Fluorooctane sulfonamides (FOSA)									
Perfluorooctanesulfonamide	PFOSA	754-91-6	NE	0.014	0.04	0.2	0.017	0.1	0.2
N-methyl perfluorooctanesulfonamide	NMeFOSA	31506-32-8	NE	0.015	0.04	0.2	0.128	1	2
N-ethyl perfluorooctanesulfonamide	NEtFOSA	4151-50-2	NE	0.034	0.08	0.2	0.085	0.1	0.2
Perfluorooctane sulfonamidoacetic acids (FOSAA)									
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9	NE	0.04	0.08	0.2	0.047	0.1	0.2
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6	NE	0.044	0.16	0.2	0.04	0.1	0.2
Perfluorooctane sulfonamide ethanols (FOSE)									
N-methyl perfluorooctanesulfonamidoethanol	NMeFOSE	24448-09-7	NE	0.209	0.8	2	0.128	1	2
N-ethyl perfluorooctanesulfonamidoethanol	NEtFOSE	1691-99-2	NE	0.291	0.8	2	0.306	1	2
Per- and polyfluoroether carboxylic acids									
Hexafluoropropylene oxide dimer acid	HFPO-DA/ GenX	13252-13-6	23	0.32	0.8	1	0.059	0.2	0.4
4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4	NE	0.248	0.756	0.8	0.028	0.189	0.378
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NE	0.124	0.32	0.4	0.034	0.2	0.4
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NE	0.109	0.32	0.4	0.062	0.2	0.4
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NE	0.348	0.8	1	0.148	0.2	0.4
Ether sulfonic acids									
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	9Cl-PF3ONS	756426-58-1	NE	0.327	0.748	1	0.031	0.187	0.374
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9	NE	0.227	0.756	0.8	0.04	0.189	0.378
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NE	0.122	0.285	0.4	0.07	0.178	0.356
Fluorotelomer carboxylic acids (FTCA)									
3-Perfluoropropyl propanoic acid	3:3FTCA	356-02-5	NE	0.213	0.8	1	0.213	0.4	0.8
2H,2H,3H,3H-Perfluorooctanoic acid	5:3FTCA	914637-49-3	NE	1.415	4	5	0.54	2	4
3-Perfluoroheptyl propanoic acid	7:3FTCA	812-70-4	NE	1.734	4	5	0.744	2	4

Notes:

For definitions, refer to the Acronyms and Abbreviations section.

[1] Pace Analytical network laboratories were selected as the primary laboratory for PFAS analysis by Draft EPA 1633 (EPA 2023). Samples will be submitted based on certification status and laboratory capacity at the time of sampling activities.

[2] EPA RSLs for residential soil (target risk 1×10^{-6} and THQ 0.1) per DoD PFAS 101 webpage *Regional Screening Levels Used in DoD Cleanups* (https://www.acq.osd.mil/eie/eer/ecc/pfas/pfas101/rsl.html) (DoD 2024).

Table 15-2 Groundwater PFAS Project Screening Levels and Laboratory-Specific Limits for Draft Method EPA 1633

Analyte	Acronym	CASRN	PSL[2] (ng/L)	Pace Analytical, South Carolina[1] (ng/L)			Sterling Labs (Backup) (ng/L)		
				DL	LOD	LOQ	DL	LOD	LOQ
Perfluoroalkyl carboxylic acids (PFCA)									
Perfluorobutanoic acid	PFBA	375-22-4	1800	0.51	1.6	4	0.48	3.2	6.4
Perfluoropentanoic acid	PFPeA	2706-90-3	NE	0.18	0.4	2	0.14	1.6	3.2
Perfluorohexanoic acid	PFHxA	307-24-4	990	0.14	0.4	1	0.13	0.8	1.6
Perfluoroheptanoic acid	PFHpA	375-85-9	NE	0.21	0.8	1	0.16	0.8	1.6
Perfluorooctanoic acid	PFOA	335-67-1	6.0	0.21	0.8	1	0.12	0.8	1.6
Perfluorononanoic acid	PFNA	375-95-1	5.9	0.10	0.4	1	0.09	0.8	1.6
Perfluorodecanoic acid	PFDA	335-76-2	NE	0.14	0.4	1	0.13	0.8	1.6
Perfluoroundecanoic acid	PFUnA	2058-94-8	NE	0.25	0.8	1	0.19	0.8	1.6
Perfluorododecanoic acid	PFDoA	307-55-1	NE	0.11	0.4	1	0.11	0.8	1.6
Perfluorotridecanoic acid	PFTrDA	72629-94-8	NE	0.19	0.4	1	0.07	0.8	1.6
Perfluorotetradecanoic acid	PFTeDA	376-06-7	NE	0.27	0.8	1	0.12	0.8	1.6
Perfluoroalkyl sulfonic acids (PFSA)									
Perfluorobutanesulfonic acid	PFBS	375-73-5	600	0.094	0.4	1	0.19	0.71	1.42
Perfluoropentanesulfonic acid	PFPeS	2706-91-4	NE	0.26	0.8	1	0.21	0.75	1.51
Perfluorohexanesulfonic acid	PFHxS	355-46-4	39	0.18	0.7	1	0.23	0.73	1.46
Perfluoroheptanesulfonic acid	PFHpS	375-92-8	NE	0.19	0.4	1	0.41	0.76	1.52
Perfluorooctanesulfonic acid	PFOS	1763-23-1	4.0	0.25	0.7	1	0.22	0.74	1.48
Perfluorononanesulfonic acid	PFNS	68259-12-1	NE	0.15	0.4	1	0.2	0.77	1.54
Perfluorodecanesulfonic acid	PFDS	335-77-3	NE	0.16	0.4	1	0.14	0.77	1.54
Perfluorododecanesulfonic acid	PFDoS	79780-39-5	NE	0.15	0.4	1	0.08	0.78	1.55
Fluorotelomer sulfonic acids (FTSA)									
1H,1H, 2H, 2H-Perfluorohexane sulfonic acid	4:2FTS	757124-72-4	NE	0.40	1.5	4	0.41	3	6
1H,1H, 2H, 2H-Perfluorooctane sulfonic acid	6:2FTS	27619-97-2	NE	2.0	4.6	5	2.77	3.04	6.08
1H,1H, 2H, 2H-Perfluorodecane sulfonic acid	8:2FTS	39108-34-4	NE	0.61	1.5	4	0.61	3.07	6.14
Fluorooctane sulfonamides (FOSA)									
Perfluorooctanesulfonamide	PFOSA	754-91-6	NE	0.20	0.4	1	0.1	0.8	1.6
N-methyl perfluorooctanesulfonamide	NMeFOSA	31506-32-8	NE	0.22	0.8	1	0.26	0.8	1.6
N-ethyl perfluorooctanesulfonamide	NEtFOSA	4151-50-2	NE	0.13	0.4	1	0.31	0.8	1.6
Perfluorooctane sulfonamidoacetic acids (FOSAA)									
N-methyl perfluorooctanesulfonamidoacetic acid	NMeFOSAA	2355-31-9	NE	0.29	0.8	1	0.44	0.8	1.6
N-ethyl perfluorooctanesulfonamidoacetic acid	NEtFOSAA	2991-50-6	NE	0.29	0.8	1	0.29	0.8	1.6
Perfluorooctane sulfonamide ethanols (FOSE)									
N-methyl perfluorooctanesulfonamidoethanol	NMeFOSE	24448-09-7	NE	0.63	2.0	10	1.01	8	16
N-ethyl perfluorooctanesulfonamidoethanol	NEtFOSE	1691-99-2	NE	0.61	2.0	10	1.26	8	16
Per- and polyfluoroether carboxylic acids									
Hexafluoropropylene oxide dimer acid	HFPO-DA/ GenX	13252-13-6	1.5	0.99	2.4	4	0.41	1.6	3.2
4,8-Dioxa-3H-perfluorononanoic acid	ADONA	919005-14-4	NE	0.66	2.3	4	0.15	1.51	3.02
Perfluoro-3-methoxypropanoic acid	PFMPA	377-73-1	NE	0.18	0.6	2	0.11	1.6	3.2
Perfluoro-4-methoxybutanoic acid	PFMBA	863090-89-5	NE	0.39	1.3	2	0.12	1.6	3.2
Nonafluoro-3,6-dioxaheptanoic acid	NFDHA	151772-58-6	NE	0.58	1.3	2	0.45	1.6	3.2
Ether sulfonic acids									
9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	9Cl-PF3ONS	756426-58-1	NE	0.67	2.2	4	0.18	1.5	2.99
11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	11Cl-PF3OUdS	763051-92-9	NE	0.87	2.3	4	0.31	1.51	3.02
Perfluoro(2-ethoxyethane)sulfonic acid	PFEESA	113507-82-7	NE	0.36	1.1	2	0.17	1.42	2.85
Fluorotelomer carboxylic acids (FTCA)									
3-Perfluoropropyl propanoic acid	3:3FTCA	356-02-5	NE	0.60	2.0	5	0.66	3.2	6.4
2H,2H,3H,3H-Perfluorooctanoic acid	5:3FTCA	914637-49-3	NE	4.3	10	25	3.66	16	32
3-Perfluoroheptyl propanoic acid	7:3FTCA	812-70-4	NE	4.2	10	25	3.06	16	32

Notes:

For definitions, refer to the Acronyms and Abbreviations section.

[1] Pace Analytical network laboratories were selected as the primary laboratory for PFAS analysis by Draft EPA 1633 (EPA 2023). Samples will be submitted based on certification status and laboratory capacity at the time of sampling activities.

[2] EPA RSLs for tap water (target risk 1×10^{-6} and THQ 0.1) per DoD PFAS 101 webpage *Regional Screening Levels Used in DoD Cleanups* (https://www.acq.osd.mil/eie/eer/ecc/pfas/pfas101/rsl.html) (DoD 2024).

Table 15-3 Regulatory Criteria and Laboratory-Specific Limits for Waste Characterization Samples

ANALYTE	RCRA TCLP SCREENING LEVEL[1] (mg/L)	TOTALS SCREENING LEVEL[2] (mg/kg)	LABORATORY-SPECIFIC LIMITS[3]		
			DL (mg/kg)	LOD (mg/kg)	LOQ (mg/kg)
AK Series by AK101 and AK102					
GRO	NS	260	0.95	2.5	5
DRO	NS	230	52.1	100	150
Volatile Organic Compounds by SW8260D					
1,1,1-Trichloroethane	NS	32	0.000923	0.002	0.004
1,1,2,2-Tetrachloroethane	NS	0.003	0.000695	0.002	0.004
1,1-Dichloroethane	NS	0.0055	0.000491	0.00125	0.0025
1,1-Dichloroethene	14	1.2	0.000606	0.00125	0.0025
1,2-Dichlorobenzene	NS	2.4	0.000425	0.0025	0.005
1,3-Dichlorobenzene	NS	2.3	0.0006	0.0025	0.005
1,4-Dichlorobenzene	150	0.037	0.0007	0.0025	0.005
Benzene	10	0.022	0.000467	0.001	0.002
Bromodichloromethane	NS	0.0043	0.000725	0.0015	0.003
Bromoform	NS	0.1	0.00117	0.0125	0.025
Carbon tetrachloride	10	0.021	0.000898	0.0025	0.005
Chlorobenzene	2,000	0.46	0.00103	0.0025	0.005
Chloroform	120	0.0071	0.000734	0.0015	0.003
cis-1,2-Dichloroethene	NS	0.12	0.000923	0.002	0.004
Dibromochloromethane	NS	0.0027	0.000612	0.00125	0.0025
Ethylbenzene	NS	0.13	0.000737	0.002	0.004
Methylene chloride	NS	0.33	0.00664	0.015	0.03
Tetrachlorothene (PCE)	14	0.19	0.000896	0.002	0.004
Toluene	NS	6.7	0.0013	0.003	0.006
trans-1,2-Dichloroethene	NS	1.3	0.00104	0.0025	0.005
Trichloroethene (TCE)	10	0.011	0.000584	0.0015	0.003
Vinyl chloride	4	0.0008	0.00116	0.0025	0.005
Xylenes (total)	NS	1.5	0.00088	0.00325	0.0065
Semi Volatile Organic Compounds by SW8270E-SIM					
1-methylnaphthalene	NS	0.41	0.00449	0.01	0.02
2-methylnaphthalene	NS	1.3	0.00427	0.01	0.02
2-chloronaphthalene	NS	26	0.00466	0.01	0.02
anthracene	NS	390	0.0023	0.005	0.01
acenaphthene	NS	37	0.00209	0.005	0.01
acenaphthylene	NS	18	0.00216	0.005	0.01
benzo(a)anthracene	NS	0.7	0.00173	0.005	0.01
benzo(a)pyrene	NS	1.2	0.00179	0.005	0.01
benzo(b)fluoranthene	NS	12	0.00153	0.005	0.01
benzo(g,h,i)perylene	NS	1900	0.00177	0.005	0.01
benzo(k)fluoranthene	NS	120	0.00215	0.005	0.01
chrysene	NS	600	0.00232	0.005	0.01
dibenz(a,h)anthracene	NS	1.2	0.00172	0.005	0.01
dibenzofuran	NS	0.97	0.00213	0.005	0.01
fluoranthene	NS	590	0.00227	0.005	0.01
fluorene	NS	36	0.00205	0.005	0.01
indeno(1,2,3-cd)pyrene	NS	12	0.00181	0.004	0.008
naphthalene	NS	0.038	0.00408	0.01	0.02
phenanthrene	NS	39	0.00231	0.005	0.01
pyrene	NS	87	0.002	0.004	0.008

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
[1] RCRA screening level is defined as the toxicity characteristic, Table 1, 40 CFR Section 261.24.
[2] Totals screening level is defined as the ADEC Method Two, Over 40-Inch Zone, soil cleanup levels (most stringent between human health and migration to groundwater) (ADEC 2023).
[3] Pace National-TN laboratory limits.

Table 15-4 Regulatory Criteria and Laboratory-Specific Limits for Waste Characterization Water Samples

ANALYTE	RCRA TCLP SCREENING LEVEL[1] (mg/L)	TOTALS SCREENING LEVEL[2] (mg/L)	LABORATORY-SPECIFIC LIMITS[3]		
			DL (mg/L)	LOD (mg/L)	LOQ (mg/L)
AK Series by AK101 and AK102					
GRO	NS	2.2	0.01	0.05	0.1
DRO	NS	1.5	0.17	0.4	0.8
Volatile Organic Compounds by SW8260D					
1,1,1-Trichloroethane	NS	8.0	0.000149	0.0005	0.001
1,1,2,2-Tetrachloroethane	NS	0.00076	0.000133	0.0005	0.001
1,1-Dichloroethane	NS	0.028	0.0001	0.0005	0.001
1,1-Dichloroethene	14	0.28	0.0001	0.0005	0.001
1,2-Dichlorobenzene	NS	0.3	0.000107	0.0005	0.001
1,3-Dichlorobenzene	NS	0.3	0.00011	0.0005	0.001
1,4-Dichlorobenzene	150	0.0048	0.00012	0.0005	0.001
Benzene	10	0.0046	0.0000941	0.0005	0.001
Bromodichloromethane	NS	0.0013	0.000136	0.0005	0.001
Bromoform	NS	0.033	0.000129	0.0005	0.001
Carbon tetrachloride	10	0.0046	0.000128	0.0005	0.001
Chlorobenzene	2,000	0.078	0.000116	0.0005	0.001
Chloroform	120	0.0022	0.000111	0.002	0.005
cis-1,2-Dichloroethene	NS	0.036	0.000126	0.0005	0.001
Dibromochloromethane	NS	0.0087	0.000137	0.0005	0.001
Ethylbenzene	NS	0.015	0.00043	0.002	0.005
Methylene chloride	NS	0.11	0.0003	0.0006	0.0012
Tetrachlorothene (PCE)	14	0.041	0.000278	0.0006	0.0012
Toluene	NS	1.1	0.000149	0.0005	0.001
trans-1,2-Dichloroethene	NS	0.36	0.00019	0.0005	0.001
Trichloroethene (TCE)	10	0.0028	0.000234	0.0005	0.001
Vinyl chloride	4	0.00019	0.000174	0.0015	0.003
Xylenes (total)	NS	0.19	0.000128	0.0005	0.001
Semi Volatile Organic Compounds by SW8270E-SIM					
1-methylnaphthalene	NS	0.011	0.0000687	0.0002	0.0004
2-methylnaphthalene	NS	0.036	0.0000674	0.002	0.004
2-chloronaphthalene	NS	0.75	0.0000682	0.00015	0.0003
anthracene	NS	0.043	0.000019	0.00005	0.0001
acenaphthene	NS	0.53	0.000019	0.00005	0.0001
acenaphthylene	NS	0.26	0.0000171	0.00005	0.0001
benzo(a)anthracene	NS	0.0003	0.0000203	0.00005	0.0001
benzo(a)pyrene	NS	0.00025	0.0000184	0.00005	0.0001
benzo(b)fluoranthene	NS	0.0025	0.0000168	0.00005	0.0001
benzo(g,h,i)perylene	NS	0.00026	0.0000184	0.00005	0.0001
benzo(k)fluoranthene	NS	0.0008	0.0000202	0.00005	0.0001
chrysene	NS	0.002	0.0000179	0.00005	0.0001
dibenz(a,h)anthracene	NS	0.00025	0.000016	0.00005	0.0001
fluoranthene	NS	0.26	0.000027	0.00006	0.00012
fluorene	NS	0.29	0.0000169	0.00005	0.0001
indeno(1,2,3-cd)pyrene	NS	0.00019	0.0000158	0.00004	0.00008
naphthalene	NS	0.0017	0.0000917	0.0002	0.0004
phenanthrene	NS	0.17	0.000018	0.00005	0.0001
pyrene	NS	0.12	0.0000169	0.00005	0.0001

Notes:

For definitions, refer to the Acronyms and Abbreviations section.

[1] RCRA screening level is defined as the toxicity characteristic, Table 1, 40 CFR Section 261.24.

[2] Totals screening level is defined as the ADEC Table C Groundwater Cleanup Levels (ADEC 2023)

[3] Pace National-TN laboratory limits.

WORKSHEET 17 – SAMPLING DESIGN AND RATIONALE

To meet the DQOs presented in Worksheet 11, groundwater, soil, surface water, and sediment will be sampled using a phased approach consisting of two mobilizations. The sampling design and rationale for the investigation is discussed below. Field activities will be performed in accordance with the standard operating procedures (SOPs) presented in Appendix D of the Work Plan and in Worksheet 21 of this QAPP. Field QC sampling will be conducted and evaluated in accordance with Worksheet 20 of this QAPP.

17.1 Site Contamination Summaries and Remaining Data Gaps

Refer to Section 3.0 of the Work Plan for a summary of previous investigations and results.

17.1.1 Former Administrative Area

The PFAS PA/SI 2022 results indicate that groundwater within the former Administrative Area has concentrations greater than PSLs (Worksheet 15) for perfluorooctanesulfonic acid (PFOS) and perfluorohexane sulfonate (PFHxS). PFOS contamination in exceedance of the PSL is associated with the former Firehouse Office, Shop, and Garage Building 1212 (43 J- nanograms per liter [ng/L] and 270 ng/L), Fire Pump Building 1208 (43 J- ng/L), and Fire Hose Building 1203 (87 J- ng/L). PFHxS contamination in exceedance of the PSL is associated with the former Firehouse Office, Shop, and Garage at a concentration of 45 ng/L (Arcadis 2023). These groundwater impacts have not been delineated and require additional investigation to determine their nature and extent. The source area(s) has also not been confirmed as PFAS was only detected in one surface soil sample in the former Administrative during the SI (at a concentration less than the PSL), as shown in Figure 4 of the Work Plan. The monitoring well (AP-148) with the highest PFAS concentrations is located immediately downgradient of former Firehouse Office, Shop, and Garage Building 1212, which suggests Building 1212 is a source area. However, PFAS was not detected in either of the two soil samples collected near the Building 1212 during the SI. The former Fire Pump Building 1208, former Hose Cart Building 1209, and former Fire Hose Building 1203 are also considered potential source areas because PFAS was detected at concentrations greater than PSLs in two monitoring wells (AP-009 and AP-114) downgradient or potentially downgradient from these features.

Due to the age of the potential releases (30+ years) and the high levels of precipitation in the Haines area (63 inches per year), it is possible that much of the potential PFAS contaminant mass formerly in surface and subsurface soil has leached through the vadose zone and into groundwater, which presents a challenge for identifying source areas through soil sampling.

As a result of the uncertain relationship between PFAS-impacted groundwater and the potential source area(s) discussed above, Mobilization 1 will focus on determining the nature and extent of PFAS contamination in groundwater and surface/subsurface soil within the former Administrative Area. The first mobilization will also assess impacts to Tanani Bay as impacted groundwater located in the Emergent Beach Perched Aquifer enters the bay through surface water seeps, surface water and sediment will be sampled. The second mobilization, Mobilization 2, will occur after the analytical data collected from groundwater, soil, surface water, and sediment during Mobilization 1 has been assessed and a Work Plan Addendum has been reviewed and approved.

Soil and groundwater sampling during Mobilization 1 will help clarify the relationship between potential source areas and groundwater contamination by further delineating the groundwater plume(s) as well as provide broad spatial coverage across the former Administrative Area. It is expected that PFAS concentrations in groundwater will be higher near the source area(s), and groundwater upgradient of the

source area(s) will not contain PFAS or have lower concentrations if comingling is occurring. Subsequent soil sampling in Mobilization 2 will then focus on delineating soil impacts and assessing soil exposure risks at locations determined to be likely source areas based on the groundwater results. If necessary, Mobilization 2 will include additional groundwater sampling and soil sampling to address any data gaps.

17.1.2 Former Tank Farm Area

The results from the 2015 – 2017 RI (Bristol and North Wind 2020) and 2022 PFAS SI (Arcadis 2023) indicate soil and groundwater within the former Tank Farm Area have PFAS detections; however, all concentrations were less than PSLs (Worksheet 15) as shown in Figure 5 of the Work Plan. Since no exceedances of PFAS PSLs were observed in the former Tank Farm Area, the 2024 investigation activities will be limited to groundwater confirmation sampling of select existing monitoring wells during Mobilization 1 to confirm the concentrations present in groundwater are less than the PSLs.

17.2 Sampling Design and Rationale – Mobilization 1

17.2.1 Former Administrative Area

The activities planned at the former Administrative Area during Mobilization 1 include soil, groundwater, surface water, and sediment sampling. The proposed sampling locations are shown in Figure 6 of the Work Plan and are discussed in the following paragraphs.

Groundwater activities to be completed during Mobilization 1 include sampling select existing monitoring wells and installation and sampling of new monitoring wells. Thirteen existing monitoring wells located in the former Administrative Area will be sampled, and one groundwater sample will be collected from each monitoring well and analyzed for PFAS by EPA Draft Method 1633 (EPA 2023). Method 1633 was finalized in January 2024; the final version of the method will be used if the selected laboratory receives method accreditation. The 13 wells provide a broad spatial coverage of site groundwater, and where possible, delineation around potential source areas. Of the selected wells, 3 had PFAS exceedances during the 2022 PFAS PA/SI and are being sampled a second time to confirm the prior results. Previous samples were analyzed using an analytical method that is ELAP-accredited and compliant with QSM 5.4 (DoD 2021a), Table B-15. Specific existing monitoring wells to be sampled are identified in Worksheet 18 and Figure 6 of the Work Plan. This activity will support DQO 1 and DQO 4.

Groundwater activities will further be supported during Mobilization 1 through the installation of 7 new permanent monitoring wells and 3 temporary monitoring wells (Figure 6 of the Work Plan), the temporary monitoring wells may be made permanent by adding a protective casing. The new well locations were selected to provide delineation within and surrounding potential source areas and surrounding wells with PFAS exceedances identified during the PFAS PA/SI (Arcadis 2023). Rationale for specific well locations is included in Worksheet 18. It is expected all wells will be installed within the shallow Emergent Beach Perched Aquifer (Figure 3 of the Work Plan) to depths of approximately 30 feet. Based on information and data presented in the 2020 former HFT RI (Bristol and North Wind 2020) and non-detect results in deep well AP-146 during the SI (Arcadis 2023), all groundwater PFAS impacts are believed to be limited to the perched zone and no wells will be installed within the deep artesian aquifer. All wells will be installed, developed, surveyed, and sampled according to the specifications in Section 4 of the Work Plan. This activity will support DQO 1 and DQO 4.

In addition to the installation of monitoring wells at the selected locations, soil samples will be collected from each of the 10 soil borings. Three soil samples will be collected from each boring for a total of 30 samples. One sample will be collected from the surface soil (0 to 2 feet below ground surface [bgs]),

one from subsurface soil within the vadose zone dependent upon soil conditions (e.g., change in soil horizon, perched water lens, confining layer) (2 to 15 feet bgs), and one at the groundwater interface. The purpose of soil samples will be to delineate the horizontal and vertical extent of contamination, along with potential source area(s) identification (ID). This activity will support DQO 2 and DQO 4.

Surface water and sediment samples will be collected from co-located locations from the seep area identified in Tanani Bay (Figure 6 of the Work Plan) during low tide. Groundwater seeps have been previously identified along the coast adjacent to HFT, including a seep southeast of the former Administrative Area near Tanani Point on Tlegu Beach. Because the predominant groundwater flow direction in the former Administrative Area is to the south-southeast, it is possible that PFAS-impacted groundwater may reach and discharge from the Tanani Point seep. To evaluate the surface water and sediment exposure pathways and address a potential data gap for the Baseline Risk Assessment, up to three surface water and three sediment samples will be collected from the Tanani Point seep and any other downgradient seeps that are identified. If the Tanani Point seep is observed as being wider than 20 feet in any dimension, surface water and sediment samples will be collected at two locations, otherwise a single location will be sampled. A third pair of surface water and sediment samples is reserved for any other unknown seeps that are observed further west of Tanani Point. Seep areas observed downgradient of monitoring wells where previous PFAS results exceeded PSLs (AP-009, AP-114, and AP-148) will be prioritized. Based on previous sampling of the Tanani Point Seep during the RI, it is expected the seep(s) will only be exposed during very low tide (approximately -2 feet or lower). Very low tides are predicted at various points throughout the field season; however, they are infrequent enough that they must be taken into consideration when determining the field schedule. Due to the ephemeral nature of the seep(s), specific sample locations will be selected based on professional judgment. This activity will support DQO 3 and DQO 4.

17.2.2 Former Tank Farm Area

Groundwater sampling will be conducted at the former Tank Farm Area during Mobilization 1. Three existing monitoring wells (AP-137, AP-207, and AP-515; Figure 7 of the Work Plan) will be sampled. A single sample will be collected from each monitoring well and analyzed for PFAS by EPA Draft Method 1633 (EPA 2023). Method 1633 was finalized in January 2024; the final version of the method will be used if the selected laboratory receives method accreditation. No additional activities are planned for the former Tank Farm Area because the detections in groundwater and soil were historically all less than the PSLs.

17.3 Sampling Design and Rationale – Mobilization 2

Based on the analytical results of Mobilization 1, the Mobilization 2 efforts will be identified and an addendum to the Work Plan will be submitted for planned field activities. If further delineation is necessary, up to 10 additional soil borings may be completed; from each boring 3 soil samples will be collected for up to 30 samples. One sample will be collected from the surface soil (0 to 2 feet bgs), one from subsurface soil within the vadose zone dependent upon soil conditions (e.g., change in soil horizon, perched water lens, confining layer) (2 to 15 feet bgs), and one at the groundwater interface. Up to 4 of these soil borings may be completed as monitoring wells; monitoring wells will be developed, and one groundwater sample will be collected. Any collected samples will be analyzed for PFAS by EPA Draft Method 1633 (EPA 2023). Method 1633 was finalized in January 2024; the final version of the method will be used if the selected laboratory receives method accreditation. Further details will be determined and provided based on the identified field activities needed to support the DQOs.

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WORKSHEET 18 – SAMPLING LOCATIONS AND METHODS

Tables 18-1 and 18-2 present the proposed sample IDs and depths for planned field samples for Mobilizations 1 and 2. Field SOPs that outline the procedures to be followed for environmental sample collection are included in Appendix D of the Work Plan and summarized in Worksheet 21. Quality assurance (QA)/quality control (QC) samples will be collected as specified in Worksheet 20.

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Table 18-1 Sample Locations, Identifiers, Depths, Field QA/QC Samples, and Analytical Methods – Mobilization 1

Sample Location	Sample ID	Matrix	Type	Analyte/Method	Location Notes
TASK: ADVANCE 10 SOIL BORINGS AND COMPLETE ALL AS MONITORING WELLS, AND COLLECT SOIL AND GROUNDWATER SAMPLES					
24HFT-SB01/ 24HFT-MW01	24HFT-SO-SB01-0.0-2.0 24HFT-SO-SB01-DD-DD 24HFT-SO-SB01-DD-DD	SO	Discrete	EPA Draft Method 1633[1]	Ten soil borings will be advanced as shown in Figure 6. Three discrete soil samples will be collected from each boring: one from surface soil (0 to 2 feet bgs interval), one from subsurface soil within the vadose zone dependent upon soil conditions (e.g., change in soil horizon, perched water lens, confining layer) or other notable features (2 to 15 feet bgs interval), and one from the groundwater interface. Seven borings will be completed as permanent monitoring wells, and three borings will be completed as temporary monitoring wells. Groundwater samples will be collected from each monitoring well. The three temporary monitoring wells will be completed downgradient, south of Lutak Road, as high on the beach as possible but outside of the road right-of-way.
	24HFT-GW-MW01	GW	Grab		
24HFT-SB02/ 24HFT-MW02	24HFT-SO-SB02-0.0-2.0 24HFT-SO-SB02-DD-DD 24HFT-SO-SB02-DD-DD	SO	Discrete		
	24HFT-GW-MW02	GW	Grab		
24HFT-SB03/ 24HFT-MW03	24HFT-SO-SB03-0.0-2.0 24HFT-SO-SB03-DD-DD 24HFT-SO-SB03-DD-DD	SO	Discrete		
	24HFT-GW-MW03	GW	Grab		
24HFT-SB04/ 24HFT-MW04	24HFT-SO-SB04-0.0-2.0 24HFT-SO-SB04-DD-DD 24HFT-SO-SB04-DD-DD	SO	Discrete		
	24HFT-GW-MW04	GW	Grab		
24HFT-SB05/ 24HFT-MW05	24HFT-SO-SB05-0.0-2.0 24HFT-SO-SB05-DD-DD 24HFT-SO-SB05-DD-DD	SO	Discrete		
	24HFT-GW-MW05	GW	Grab		
24HFT-SB06/ 24HFT-MW06	24HFT-SO-SB06-0.0-2.0 24HFT-SO-SB06-DD-DD 24HFT-SO-SB06-DD-DD	SO	Discrete		
	24HFT-GW-MW06	GW	Grab		
24HFT-SB07/ 24HFT-MW07	24HFT-SO-SB07-0.0-2.0 24HFT-SO-SB07-DD-DD 24HFT-SO-SB07-DD-DD	SO	Discrete		
	24HFT-GW-MW07	GW	Grab		
24HFT-SB08/ 24HFT-TW01	24HFT-SO-SB08-0.0-2.0 24HFT-SO-SB08-DD-DD 24HFT-SO-SB08-DD-DD	SO	Discrete		
	24HFT-GW-TW01	GW	Grab		
24HFT-SB09/ 24HFT-TW02	24HFT-SO-SB09-0.0-2.0 24HFT-SO-SB09-DD-DD 24HFT-SO-SB09-DD-DD	SO	Discrete		
	24HFT-GW-TW02	GW	Grab		
24HFT-SB10/ 24HFT-TW03	24HFT-SO-SB10-0.0-2.0 24HFT-SO-SB10-DD-DD 24HFT-SO-SB10-DD-DD	SO	Discrete		
	24HFT-GW-TW03	GW	Grab		

Table 18-1 Sample Locations, Identifiers, Depths, Field QA/QC Samples, and Analytical Methods – Mobilization 1

Sample Location	Sample ID	Matrix	Type	Analyte/Method	Location Notes
TASK: SAMPLE EXISTING MONITORING WELLS					
AP-009	24HFT-GW-AP009	GW	Grab	EPA Draft Method 1633[1]	Former Administrative Area – downgradient – previous PFAS exceedance of the PSLs
AP-011	24HFT-GW-AP011	GW	Grab		Former Administrative Area – presumed upgradient/crossgradient
AP-013	24HFT-GW-AP013	GW	Grab		Former Administrative Area – presumed upgradient/crossgradient
AP-102	24HFT-GW-AP102	GW	Grab		Former Administrative Area – presumed crossgradient
AP-114	24HFT-GW-AP114	GW	Grab		Former Administrative Area – downgradient – previous PFAS exceedance of the PSLs
AP-115	24HFT-GW-AP115	GW	Grab		Former Administrative Area – presumed downgradient/crossgradient
AP-145	24HFT-GW-AP145	GW	Grab		Former Administrative Area – presumed crossgradient
AP-148	24HFT-GW-AP148	GW	Grab		Former Administrative Area – downgradient – previous PFAS exceedance of the PSLs
AP-192	24HFT-GW-AP192	GW	Grab		Former Administrative Area – presumed crossgradient
AP-536	24HFT-GW-AP536	GW	Grab		Former Administrative Area – presumed crossgradient
AP-537	24HFT-GW-AP537	GW	Grab		Former Administrative Area – presumed upgradient/crossgradient
AP-605	24HFT-GW-AP605	GW	Grab		Former Administrative Area – downgradient
NW-005	24HFT-GW-NW005	GW	Grab		Former Administrative Area – downgradient
AP-137	24HFT-GW-AP137	GW	Grab		Former Tank Farm Area – previous PFAS detection less than the PSLs
AP-207	24HFT-GW-AP207	GW	Grab		Former Tank Farm Area – previous PFAS detection less than the PSLs
AP-515	24HFT-GW-AP515	GW	Grab		Former Tank Farm Area – previous PFAS detection less than the PSLs
TASK: SAMPLE A SEEP(S) IN TANANI BAY AT LOW TIDE, COLLECT UP TO THREE COLLOCATED SEDIMENT AND SURFACE WATER SAMPLES					
24HFT-TBS-01	24HFT-SW-TBS-01/ 24HFT-SE-TBS-01	Collocated SW/SE	Grab	EPA Draft Method 1633[1]	Tanani Bay – a seep(s) discharging the Emergent Beach Perched Aquifer, downgradient of the former Administrative Area
24HFT-TBS-02	24HFT-SW-TBS-02/ 24HFT-SE-TBS-02	Collocated SW/SE	Grab		Tanani Bay – a seep(s) discharging the Emergent Beach Perched Aquifer, downgradient of the former Administrative Area
24HFT-TBS-03	24HFT-SW-TBS-03/ 24HFT-SE-TBS-03	Collocated SW/SE	Grab		Tanani Bay – a seep(s) discharging the Emergent Beach Perched Aquifer, downgradient of the former Administrative Area
TASK: WASTE CHARACTERIZATION SAMPLES					
Waste Characterization – Soil	24HFT-WS-WC01	WS	Composite	AK101, AK102, 8260, and 8270-SIM	One composite sample will be collected from the IDW soil cutting and analyzed by these additional methods for waste characterization. The PFAS results from the soil borings (maximum concentration) will also be used for waste characterization. This composite sample result will be used to characterize the waste generated during both mobilizations.
Waste Characterization – Water	24HFT-WW-WC01	WW	Composite	EPA Draft Method 1633[1], AK101, AK102, 8260, and 8270-SIM	One IDW water sample will be collected and analyzed for PFAS and these additional methods for waste characterization. The composite sample will be collected from the wastewater post-GAC filtration per Section 4.10.2 of the Work Plan.
TASK: FIELD QUALITY CONTROL SAMPLES					
FD (Soil)	24HFT-SO-SB01A-DD-DD	SO	Discrete	EPA Draft Method 1633[1]	See Worksheet 20 for field QC information.
FD (Groundwater)	24HFT-GW-AP009A	GW	Grab		
FRB	24HFT-FRB01	WQ	Grab		
EB	24HFT-EB01	WQ	Grab		

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
[1] Source: EPA 2023. Method 1633 was finalized in January 2024; the final version of the method will be used if the selected laboratory receives method accreditation.

Table 18-2 Sample Locations, Identifiers, Depths, Field QA/QC Samples, and Analytical Methods – Mobilization 2

Sample Location	Sample ID	Matrix	Type	Analyte/ Method	Location Notes
TASK: ADVANCE 10 SOIL BORINGS AND COMPLETE ALL 4 AS MONITORING WELLS, AND COLLECT SOIL AND GROUNDWATER SAMPLES					
24HFT-SB11	24HFT-SO-SB11-0.0-2.0 24HFT-SO-SB11-DD-DD 24HFT-SO-SB11-DD-DD	SO	Discrete	EPA Draft Method 1633[1]	Former Administrative Area – Locations of the soil borings and monitoring wells are TBD. Proposed locations will be presented in a forthcoming Work Plan Addendum following receipt of laboratory results from Mobilization 1. Three discrete soil samples will be collected from each boring: one from surface soil (0 to 2 feet bgs interval), one from subsurface soil within the vadose zone dependent upon soil conditions (e.g., change in soil horizon, perched water lens, confining layer) or other notable features (2 to 15 feet bgs interval), and one from the groundwater interface. Up to four borings may be completed as permanent monitoring wells and groundwater samples will be collected from each monitoring well.
24HFT-SB12	24HFT-SO-SB12-0.0-2.0 24HFT-SO-SB12-DD-DD 24HFT-SO-SB12-DD-DD	SO	Discrete		
24HFT-SB13	24HFT-SO-SB13-0.0-2.0 24HFT-SO-SB13-DD-DD 24HFT-SO-SB13-DD-DD	SO	Discrete		
24HFT-SB14	24HFT-SO-SB14-0.0-2.0 24HFT-SO-SB14-DD-DD 24HFT-SO-SB14-DD-DD	SO	Discrete		
24HFT-SB15	24HFT-SO-SB15-0.0-2.0 24HFT-SO-SB15-DD-DD 24HFT-SO-SB15-DD-DD	SO	Discrete		
24HFT-SB16	24HFT-SO-SB16-0.0-2.0 24HFT-SO-SB16-DD-DD 24HFT-SO-SB16-DD-DD	SO	Discrete		
24HFT-SB17/ 24HFT-MW09	24HFT-SO-SB17-0.0-2.0 24HFT-SO-SB17-DD-DD 24HFT-SO-SB17-DD-DD	SO	Discrete		
	24HFT-GW-MW09	GW	Grab		
24HFT-SB18/ 24HFT-MW10	24HFT-SO-SB18-0.0-2.0 24HFT-SO-SB18-DD-DD 24HFT-SO-SB18-DD-DD	SO	Discrete		
	24HFT-GW-MW10	GW	Grab		
24HFT-SB19/ 24HFT-MW11	24HFT-SO-SB19-0.0-2.0 24HFT-SO-SB19-DD-DD 24HFT-SO-SB19-DD-DD	SO	Discrete		
	24HFT-GW-MW11	GW	Grab		
24HFT-SB20/ 24HFT-MW12	24HFT-SO-SB20-0.0-2.0 24HFT-SO-SB20-DD-DD 24HFT-SO-SB20-DD-DD	SO	Discrete	Continued	Continued
	24HFT-GW-MW12	GW	Grab		
TASK: FIELD QUALITY CONTROL SAMPLES					
FD (Soil)	24HFT-SO-SB11A-DD-DD	SO	Discrete	EPA Draft Method 1633[1]	See Worksheet 20 for field QC information.
FD (Groundwater)	24HFT-GW-MW09A	GW	Grab		
Field Reagent Blank	24HFT-FRB02	WQ	Grab		
Equipment Blank	24HFT-EB02	WQ	Grab		

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
[1] Source: EPA 2023. Method 1633 was finalized in January 2024; the final version of the method will be used if the selected laboratory receives method accreditation.

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WORKSHEET 19/30 – SAMPLE CONTAINERS, PRESERVATION, AND HOLD TIMES

Table 19-1 provides the analytical, preparation method, SOP, associated sample volume, container specifications, preservation requirements, and maximum holding times for each matrix and analytical group. The container requirements below are applicable to primary and backup laboratories. Laboratory certifications are presented in Appendix F and laboratory SOPs are provided electronically in the Supplemental folder.

Laboratory:

Primary (PFAS)
Pace Analytical South Carolina; Kathy Smith
106 Vantage Point Drive
West Columbia, SC 29172
(803) 791-9700

Accreditation: DoD ELAP Certification v.5.4, #L2224.01, exp. 11/18/2024

ADEC CSP Approval 20-002, expires 12/18/2024
Sample Delivery Method: See Worksheet 26/27

Primary (IDW Characterization)
Pace National-TN; Jared Starkey
12065 Lebanon Rd
Mt. Juliet, TN 37122
(800) 767-5859

Accreditation: DoD ELAP Certification v.5.4, #1461.01, exp. 11/30/2025

ADEC CSP Approval 17-026, expires 12/30/2025
Sample Delivery Method: See Worksheet 26/27

Backup (PFAS and IDW Characterization)
Sterling Laboratories; Olga Karplyuk
509 N. 3rd Avenue
Des Plaines, IL 60016
(847) 324-3348

Accreditation: DoD ELAP Certification v.5.4, #L22-226-RI, exp. 3/31/2024[1]

ADEC CSP Approval 17-011, expires 4/30/2024[1]
Sample Delivery Method: See Worksheet 26/27

Table 19-1 Sample Containers, Preservation, and Hold Times

Matrix	Analytical Group	Analytical and Preparation Method/ Laboratory SOP Reference	Containers (Number, Size, and Type per Sample)	Preservation	Preparation Holding Time[2]	Analytical Holding Time[2]
Soil and Sediment	PFAS	Draft Method 1633[3]/ ENV-SOP-WCOL-0158 (primary lab) EMT-SOP-0-1633 (backup lab)	1 x 90 mL, PP with PP – liner-less cap	Cool, 0 to 6°C[4], protect from light	90 days	90 days
Water	PFAS	Draft Method 1633[3]/ ENV-SOP-WCOL-0158 (primary lab) EMT-SOP-0-1633 (backup lab)	2 x 500 mL and 1 x 125 mL, HDPE with PP – liner-less cap	Cool, 0 to 6°C[4], protect from light	28 days	90 days
IDW (soil)	TCLP VOCs	ENV-SOP-MTJL-0100	1 x 4 oz glass jar with TLC	Cool, 0 to 6°C[4], Zero headspace	14 days	14 days
	TCLP PAHs	ENV-SOP-MTJL-0081	1 x 4 oz glass jar with TLC	Cool, 0 to 6°C[4]	7 days	40 days
	GRO	ENV-SOP-MTJL-0087	1 x 60 mL amber glass jar with TLC	Cool, 0 to 6°C[4], MeOH	14 days	14 days
	DRO	ENV-SOP-MTJL-0096	1 x 4 oz amber glass jar with TLC	Cool, 0 to 6°C[4]	14 days	40 days
IDW (water)	VOCs	ENV-SOP-MTJL-0100	3 x 40 mL VOA vials	Cool, 0 to 6°C[4], HCl	14 days	14 days
	PAHs	ENV-SOP-MTJL-0081	2 x 100 mL amber glass with TLC	Cool, 0 to 6°C[4]	14 days	40 days

Table 19-1 Sample Containers, Preservation, and Hold Times

Matrix	Analytical Group	Analytical and Preparation Method/ Laboratory SOP Reference	Containers (Number, Size, and Type per Sample)	Preservation	Preparation Holding Time[2]	Analytical Holding Time[2]
	GRO	ENV-SOP-MTJL-0087	3 x 40 mL VOA vials	Cool, 0 to 6°C[4], HCl	14 days	14 days
	DRO	ENV-SOP-MTJL-0096	2 x 100 mL amber glass with TLC	Cool, 0 to 6°C[4], HCl	14 days	40 days

Notes:

For definitions, refer to the Acronyms and Abbreviations section.

[1] If the backup laboratory is needed, updated certifications will be obtained prior to sample collection.

[2] Maximum preparation holding time is calculated from the time the sample is collected to the time the sample is prepared/extracted. Maximum analytical holding time is calculated from the time the sample is prepared/extracted to the time the sample is analyzed.

[3] Method 1633 was finalized in January 2024; the final version of the method will be used if the selected laboratory receives method accreditation.

[4] Maintain all samples protected from light at 0 to 6°C from the time of collection until shipped to the laboratory. Samples must be shipped as soon as practical with sufficient ice to maintain the sample temperature below 6°C during transport. The laboratory must confirm that the sample temperature is 0 to 6°C upon receipt.

WORKSHEET 20 – FIELD QUALITY CONTROL SUMMARY

This worksheet summarizes the number of field primary and QC samples that will be collected and submitted to the laboratory for each matrix, analytical group, and concentration level. Field QC samples are not applicable to waste characterization samples.

20.1 Field Duplicates

FDs are two samples taken at the same time in the same location. They are intended to represent the same population and are taken through all steps of the analytical procedure in an identical manner. These samples are used to assess precision of the entire data collection activity, including sampling, analysis, and heterogeneity.

Duplicate samples are collected simultaneously or in immediate succession, using identical recovery techniques, and are treated in an identical manner during storage, transportation, and analysis. The duplicate samples will be collocated samples of a single sample collection. Examples of collocated samples include groundwater monitoring samples, surface water grab samples, and side-by-side soil core samples. The sample containers are assigned a unique ID number in the field.

One FD sample will be collected for every 10 or fewer primary samples, for each matrix sampled and for each target analyte. FDs will be collected from locations of suspected contamination at the same time and location as the primary sample and will be submitted to the laboratory blind with unique sample IDs.

20.2 Matrix Spike/Matrix Spike Duplicates

An MS/MSD is an aliquot of sample spiked with known concentrations of all target analytes. The spiking occurs prior to sample preparation and analysis. Each analyte in the MS/MSD will be spiked at a level less than or equal to the midpoint of the calibration curve for each analyte. The MS/MSD will be designated on the CoC.

The MS/MSDs are used to document potential matrix effects associated with a site. Brice must select the samples for MS/MSDs. The MS/MSD volumes will be collected in the field and will be used by the laboratory to prepare the appropriate MS/MSDs.

MS/MSD samples will be collected at a frequency of 5% of primary samples overall for the project and/or one per 20. MS/MSDs will be required to be run at the laboratory for each analytical/prep batch regardless of the number of samples in a batch.

20.3 Field Reagent Blanks

An FRB is a sample of PFAS-free water supplied by the laboratory poured in ambient air conditions (e.g., above a monitoring well), collected in a sample container, and transported to the laboratory for analysis. FRBs are used to assess potential cross-contamination in the ambient environment and the groundwater collected for testing.

FRBs will be collected at a frequency of one per sampling event. FRBs will only be collected for the required PFAS method.

When an analyte is detected in the FRB, the appropriate flag, as described in Worksheet 36, will be applied to all sample results from samples collected that same collection date at the relating PFAS samples.

20.4 Equipment Blanks

An equipment blank (EB) is a sample of PFAS-free water supplied by the laboratory poured over non-dedicated equipment after decontamination procedures have been applied. EBs are used to assess potential cross-contamination from the equipment used for collecting samples.

This would only apply to groundwater samples when submersible pumps are employed, as the soil will be collected using disposable liners, sediment will be collected using disposable stainless-steel spoons, and surface water will be collected directly into laboratory containers. If peristaltic pumps are employed for groundwater sampling, using new or dedicated tubing for each well, EBs will not be required. When using submersible pumps, one EB will be collected for every 10 monitoring wells sampled. Following decontamination of the submersible pump, PFAS-free water will be pumped through the submersible pump and placed directly into laboratory-provided sample jars.

When an analyte is detected in the EB, the appropriate flag, as described in Worksheet 36, will be applied to all sample results from samples collected that same collection date at the relating PFAS samples.

WORKSHEET 21 – FIELD STANDARD OPERATING PROCEDURES

21.1 Field SOPs

SOPs applicable to this project are outlined in Table 21-1 and provided in Appendix D of the Work Plan.

Table 21-1 Field Standard Operating Procedures Reference

SOP Number	SOP Title	Description	Date Last Reviewed or Updated
BE-SOP-01	Logbook Documentation and Field Notes	• Digital photographs • Field datasheets and forms • Electronic data documents	6/30/2021
BE-SOP-02	Sample Chain-of-Custody	• Sample custody • Transfer of custody and shipment • Laboratory sample custody procedures • CoC records	3/3/2022
BE-SOP-03	Labeling, Packaging, and Shipping Samples	• Sample labels • Sample ID • Sample handling and storage • Packing and shipping samples	3/3/2023
BE-SOP-04	Quality Control Samples	• Requirements for collecting QC samples from various matrices	3/3/2022
BE-SOP-05	Soil Logging	• Classifying and logging core/cuttings	3/11/2020
BE-SOP-06	Soil Sampling	• Sample materials and equipment • Discrete sampling • Composite sampling • Sample collection procedures • Sample preservation and handling	3/3/2022
BE-SOP-07	Sediment Sampling	• Sampling materials and equipment • Grab and core sampling procedures • Sample preservation and handling	3/3/2022
BE-SOP-09	Groundwater Sampling	• Sampling materials and equipment • Sampling procedures • Free product and water level measurements • Stabilization requirements • Sampling preservation and handling	3/3/2022
BE-SOP-10	Surface Water Sampling	• Sampling materials and equipment • Sampling procedures • Free product and water level measurements • Sampling preservation and handling	3/3/2022
BE-SOP-14	Equipment Decontamination	• Decontamination area • Decontamination equipment • Decontamination procedures	3/8/2022
BE-SOP-20	Water Quality Measurements	• Equipment and Calibration Procedures • Parameters • Parameter stabilization requirements	3/3/2022

Table 21-1 Field Standard Operating Procedures Reference

SOP Number	SOP Title	Description	Date Last Reviewed or Updated
BE-SOP-22	Monitoring Well Installation, Development, and Decommissioning	• Equipment and materials • Documentation and Forms • Installation Procedures and Requirements • Well Development Procedures • Decommissioning	3/3/2022
BE-SOP-25	Underground Utility Locates	• Utility ID and clearance procedures • Marking ID	4/15/2020
BE-SOP-29	GeoXH/Geo7X GPS Location Survey	• Equipment and operation procedures • Data collection and downloading • Post processing data • Troubleshooting and maintenance	4/25/2022
BE-SOP-34	Field Sampling Protocol for PFAS	• Processes for collecting and handling PFAS environmental media samples • Acceptable/unacceptable equipment and supplies while PFAS sampling • Equipment decontamination	3/27/2023
BE-SOP-38	Water Seep Sampling	• Sampling materials and equipment • Sampling procedures • Sampling preservation and handling	3/14/2022
BE-SOP-53	Boat and Watercraft Operation	• Personal safety and pre-departure check • Safe boating techniques • Boat maintenance • Inclement weather • Boating accidents	3/15/2022
BE-SOP-61	Working around Drill Rigs	• Field Safety Officer role and authority • Safe drill rig operations • Utility locates • Personal protective equipment • Drill rig maintenance	1/26/2019
BE-SOP-79	Waste Management	• Regulatory programs • General procedures for managing wastes • Waste characterization and management • Shipping of waste • Security/emergency/response • Managing spills • Recordkeeping • Includes note about DoD guidance on the destruction of PFAS-containing materials	3/25/2024
BE-SOP-87	Working with Hand Tools	• Tool safety • Tool use • Personal protective equipment	12/16/2022

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

WORKSHEET 22 – FIELD EQUIPMENT CALIBRATION, MAINTENANCE, TESTING, AND INSPECTION

Table 22-1 identifies all field equipment and instruments (other than analytical instrumentation) that require calibration, maintenance, testing, or inspection and provides the SOP reference number for each type of equipment. In addition, this table documents the frequency, acceptance criteria, and corrective action requirements for calibration of each type of equipment.

Table 22-1 Field Equipment Calibration, Maintenance, Testing, and Inspection

Field Equipment	Activity	SOP Reference	Frequency	Acceptance Criteria	Corrective Action
YSI	Calibration using applicable solutions (pH, conductivity, ORP)	BE-SOP-20	Calibrate daily prior to use, and as needed	See BE-SOP-20	Recalibrate, as necessary. If acceptable calibration cannot be obtained, return equipment to vendor for repair or replacement.
Turbidity Meter	Bump test using known standards	BE-SOP-20	Check daily prior to use	See BE-SOP-20	Refer to the troubleshooting sections in BE-SOP-20.
GPS	Inspect equipment	BE-SOP-29	Daily before use	N/A	If unit fails, follow manufacturer's troubleshooting instructions. Otherwise, do not use unit.

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

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WORKSHEET 23 – ANALYTICAL STANDARD OPERATING PROCEDURE REFERENCES

Table 23-1 lists all SOPs for the specific sample preparation and analytical procedures that will be used for project samples. Laboratory SOPs are provided electronically in the Supplemental folder accompanying this Work Plan.

Table 23-1 Analytical Standard Operating Procedure References

Organization Performing Analysis	Laboratory SOP Number	Title, Revision Date, and/or Number	Definitive or Screening Data	Matrix and Analytical Group	Instrument	Modified for Project Work (Yes/No)
Pace Analytical-SC (primary lab)	ENV-SOP-WCOL-0158	Draft Method 1633, Rev3, 16Aug2022[1]	Definitive	SO/GW, PFAS	Sciex 5500 Triple Quad LC-MS/MS	No
Sterling Laboratories (backup lab)	EMT-SOP-0-1633	Draft Method 1633, Rev1, 02Jun2022[1]	Definitive	SO/GW, PFAS	Agilent 1290 Infinity II Triple Quad LC-MS/MS	No
Pace National-TN (IDW)	ENV-SOP-MTJL-0100	Volatile Organic Compounds by GC/MS, Rev8, 15May2023	Definitive	SO/GW, VOCs	GC/MS	No
Pace National-TN (IDW)	ENV-SOP-MTJL-0081	Semi volatile Organics by GC/MS using Capillary Column, Rev5, 20Jan2022	Definitive	SO/GW, PAHs	GC/MS	No
Pace National-TN (IDW)	ENV-SOP-MTJL-0087	BTEX (Method 8021B, 602, SM6200C 2th) and Gasoline Range Organics (Meth0d 8015B, 8015C, 8015D) by GC, Rev4, 13Nov2023	Definitive	SO/GW, GRO	GC	No
Pace National-TN (IDW)	ENV-SOP-MTJL-0096	DRO & RRO by AK102, AK103, Rev3, 14March2023	Definitive	SO/GW, DRO	GC	No

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

[1] Method 1633 was finalized in January 2024; the final version of the method will be used if the selected laboratory receives method accreditation.

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WORKSHEET 24 – ANALYTICAL INSTRUMENT CALIBRATION

To ensure that the analytical methods and the selected instrumentation meet the project requirements, each analytical instrument shall be calibrated following the procedures and frequency specified by the SOP, analytical method, and in accordance with the most current version of the QSM (DoD 2021a). Specific analytical method SOP references are provided in Worksheet 23, and the laboratory analytical SOPs are included in the Supplemental folder submitted along with this Work Plan.

Table 24-1 through 24-5 is intended to provide information regarding laboratory calibration procedures for the requested methods for the project. Instrument calibration procedures, acceptance criteria, and corrective actions for the analytical methods are provided below.

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Table 24-1 Analytical Instrument Calibration Table – PFAS by Draft EPA 1633[1]

INSTRUMENT	CALIBRATION PROCEDURE	FREQUENCY OF CALIBRATION	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	PERSON RESPONSIBLE FOR CORRECTIVE ACTION	SOP REFERENCE
LC-MS/MS	Mass Calibration, Mass Calibration Verification	Instrument must have a valid mass calibration prior to any sample analysis and updated on an as-needed basis (e.g., QC failures, ion masses fall outside of the ±0.5 amu of the true value, major maintenance or the instrument is moved). Mass calibration is verified after each mass calibration, prior to ICAL.	Calibrate the mass scale of the MS with calibration compounds and procedures described by the manufacturer. Mass calibration range must bracket the ion masses of interest. The most recent mass calibration must be used for every acquisition in an analytical run. Mass Calibration Verification must meet manufacturer's acceptance criteria.	If the mass calibration fails, then recalibrate. If it fails again, consult manufacturer instructions on corrective maintenance. Flagging is not appropriate. Problem must be corrected.	Analyst, supervisor, QA manager	ENV-SOP-WCOL-0158 (primary lab) EMT-SOP-0-1633 (backup lab)
LC-MS/MS	Ion Transitions (Precursor → Product)	Every field sample, standard, blank, and QC sample.	In addition to the requirements of EPA Draft Method 1633[2], the following must be met: 1) If a qualitative or quantitative standard containing an isomeric mixture (branched and linear isomers) of an analyte is commercially available for an analyte, the quantification ion used must be the quantification ion identified in Table 2 of EPA Draft Method 1633[2] unless interferences render the product ion unusable as the quantification ion. 2) In cases where interferences render the product ion unusable as the quantification ion, project approval is required before using the alternative product ion.	N/A. Flagging is not appropriate.	Analyst, supervisor, QA manager	ENV-SOP-WCOL-0158 (primary lab) EMT-SOP-0-1633 (backup lab)
LC-MS/MS	ICAL	At instrument set-up, after major maintenance, and after ICV or CCV failure, prior to sample analysis.	One of the following two approaches must be used to evaluate the linearity of the instrument calibration. Weighting (typically 1/x or 1/x2) is allowed for linear and non-linear regressions. Option 1: Calculate the RSD of the RR or RF values of the six ICAL standards for each native compound and isotopically labeled compound. The RSD must be ≤ 20% to establish instrument linearity. Option 2: Calculate the RSE of the six ICAL standards for each native compound and isotopically labeled compound. The RSE for all method analytes must be ≤ 20% to establish instrument linearity. Commercial PFAS standards available as salts are acceptable providing the measured mass is corrected to the neutral acid concentration. Results shall be reported as the neutral acid with appropriate CASRN.	Correct problem, then repeat ICAL. Flagging is not appropriate. No samples shall be analytes until the ICAL has passed.	Analyst, supervisor, QA manager	ENV-SOP-WCOL-0158 (primary lab) EMT-SOP-0-1633 (backup lab)
LC-MS/MS	Instrument blank	Immediately following the highest standard analyzed, daily prior to sample analysis, and after each bracketing CCV.	Concentration of each analyte must be ≤ ½ the LOQ. Instrument Blank must contain EIS to enable quantitation of contamination.	If acceptance criteria are not met after the highest calibration standard, calibration must be performed using a lower concentration for the highest standard until acceptance criteria is met. If sample concentrations exceed the highest allowed standard and the sample(s) following exceed this acceptance criteria (> 1/2 LOQ), they must be reanalyzed.	Analyst, supervisor, QA manager	ENV-SOP-WCOL-0158 (primary lab) EMT-SOP-0-1633 (backup lab)
LC-MS/MS	ICV	Once after each ICAL, analysis of a second source standard prior to sample analysis.	Analyte concentrations must be within ±30% of their true value.	Correct problem and verify second source standard; rerun second source verification. If that fails, correct problem and repeat ICAL.	Analyst, supervisor, QA manager	ENV-SOP-WCOL-0158 (primary lab) EMT-SOP-0-1633 (backup lab)
LC-MS/MS	ISC	Daily. At the beginning of each analytical sequence, prior to sample analysis.	Analyte concentrations must be at LOQ; concentrations must be within ±30% of their true values.	Correct problem, rerun ISC. If problem persists, repeat ICAL.	Analyst, supervisor, QA manager	ENV-SOP-WCOL-0158 (primary lab) EMT-SOP-0-1633 (backup lab)

Table 24-1 Analytical Instrument Calibration Table – PFAS by Draft EPA 1633[1]

INSTRUMENT	CALIBRATION PROCEDURE	FREQUENCY OF CALIBRATION	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	PERSON RESPONSIBLE FOR CORRECTIVE ACTION	SOP REFERENCE
LC-MS/MS	CCV	Daily prior to sample analysis (ISC); after every 10 field samples; at end of analytical sequence.	All analytes must be within ±30% of their true value.	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails, or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since last successful CCV. Alternately, recalibrate if necessary; then reanalyze all samples since the last acceptable CCV.	Analyst, supervisor, QA manager	ENV-SOP-WCOL-0158 (primary lab) EMT-SOP-0-1633 (backup lab)
LC-MS/MS	Bile Salt Standards	Daily, prior to analysis of all matrix types (aqueous, solid, tissue, and AFFF).	All EPA Draft Method 1633[1] requirements for evaluation of the relationship of the RT of the bile salt peak(s) to the RT window of PFOS must be met for all matrix types. The RT window of PFOS applies to the RT of all isomers of PFOS. The RT of the bile salt(s) peak must fall out of the RT window of PFOS by at least 1 minute.	N/A No samples shall be analyzed until acceptance criteria for the bile salt standard(s) has been met.	Analyst, supervisor, QA manager	ENV-SOP-WCOL-0158 (primary lab) EMT-SOP-0-1633 (backup lab)
LC-MS/MS	LOD/LOQ verification	Quarterly	LOD meets method qualitative requirements; LOQ is recovered within LCS criteria.	Perform instrument maintenance and repeat failed LOD or LOQ study passing two consecutive tests or perform new DL study.	Analyst, supervisor, QA manager	ENV-SOP-WCOL-0158 (primary lab) EMT-SOP-0-1633 (backup lab)

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
[1] Method 1633 was finalized in January 2024; the final version of the method will be used if the selected laboratory receives method accreditation.
[2] Source: EPA 2023.

Table 24-2 Analytical Instrument Calibration – SW8260D

INSTRUMENT	CALIBRATION PROCEDURE	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	TITLE/POSITION RESPONSIBLE FOR CORRECTIVE ACTION	SOP REFERENCE
GC/MS	Tune Check	Prior to ICAL and prior to each 12-hour period of sample analysis.	Specific abundance criteria of BFB.	Retune instrument and verify.	Laboratory analyst Supervisor	ENV-SOP-MTJL-0100
	ICAL for all analytes (including surrogates)	At instrument set-up and after ICV or CCV failure; prior to sample analysis	Each analyte must meet one of the three options listed: RSD for each analyte ≤ 15%; linear regression for each analyte: $r^2 \geq 0.99$; non-linear regression (quadratic): $r^2 \geq 0.99$.	Correct problem, then repeat ICAL		
	RT window position establishment	Once per ICAL and at the beginning of the analytical sequence.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is no performed, the ICV is used.	N/A		
	ICV (from a second source)	Immediately after each ICAL	±20 % of True Value	Correct problem, Rerun ICV. If reanalysis fails, repeat ICAL		
	CCV	Before sample analysis, after every 10 samples and at the end of the analytical sequence	Initial CCV ±20% of True Value; Closing CCV ±50% of True Value	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since last successful CCV. Alternately, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV.		

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

Table 24-3 Analytical Instrument Calibration – SW8270E-SIM

INSTRUMENT	CALIBRATION PROCEDURE	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	TITLE/POSITION RESPONSIBLE FOR CORRECTIVE ACTION	SOP REFERENCE
GC/MS	Tune Check	Prior to ICAL and prior to each 12-hour period of sample analysis.	Specific abundance criteria of DFTPP from method.	Retune instrument and verify.	Laboratory analyst Supervisor	ENV-SOP-MTJL-0081
	Performance Check	At the beginning of each 12-hour period, prior to analysis of samples	≤ 20% degradation for DDT Benzidine and pentachlorophenol shall be present at their normal responses and shall not exceed a tailing factor of 2.	Correct problem, then repeat performance checks.		
	ICAL for all analytes (including surrogates)	At instrument set-up and after ICV or CCV failure; prior to sample analysis	Each analyte must meet one of the three options listed: RSD for each analyte ≤ 15% (20% for SIM Mode); linear regression for each analyte: $r^2 \geq 0.99$; non-linear regression (quadratic): $r^2 \geq 0.99$.	Correct problem, then repeat ICAL		
	RT window position establishment	Once per ICAL and at the beginning of the analytical sequence.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is no performed, the ICV is used.	N/A		
	ICV (from a second source)	Immediately after each ICAL	±20 % of True Value	Correct problem, Rerun ICV. If reanalysis fails, repeat ICAL		
	CCV	Before sample analysis, after every 10 samples and at the end of the analytical sequence	Initial CCV ±20% of True Value; Closing CCV ±50% of True Value	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or if two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since last successful CCV. Alternately, recalibrate if necessary; then reanalyze all associated samples since the last acceptable CCV.		

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

Table 24-4 Analytical Instrument Calibration – AK101

INSTRUMENT	CALIBRATION PROCEDURE	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	TITLE/POSITION RESPONSIBLE FOR CORRECTIVE ACTION	SOP REFERENCE
GC/PID/FID	ICAL	At instrument set-up and after ICV or CCV failure, prior to sample analysis.	ICAL must meet one of the three options below: Option 1: RSD for each analyte ≤ 20%; Option 2: linear least squares regression for each analyte: $r^2 \geq 0.99$; Option 3: non-linear least squares regression (quadratic) for each analyte: $r^2 \geq 0.99$.	Correct problem, then repeat ICAL	Laboratory analyst Supervisor	ENV-SOP-MTJL-0087
	RT window position establishment	Once per ICAL and at the beginning of the analytical sequence.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	N/A		
	ICV (from a second source)	Immediately after each ICAL	±20% of true value	Correct problem; rerun ICV. If this fails, repeat ICAL		
	CCV	Before sample analysis; after every 10 samples and at the end of the analytical sequence	±20% of true value	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since last successful CCV. Alternately recalibrate, if necessary, then reanalyze all associated samples since the last acceptable CCV		

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

Table 24-5 Analytical Instrument Calibration – AK102

INSTRUMENT	CALIBRATION PROCEDURE	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	TITLE/POSITION RESPONSIBLE FOR CORRECTIVE ACTION	SOP REFERENCE
GC/FID	ICAL	At instrument set-up and after ICV or CCV failure, prior to sample analysis.	ICAL must meet one of the three options below: Option 1: RSD for each analyte ≤ 20%; Option 2: linear least squares regression for each analyte: $r^2 \geq 0.99$; Option 3: non-linear least squares regression (quadratic) for each analyte: $r^2 \geq 0.99$.	Correct problem, then repeat ICAL	Laboratory analyst Supervisor	ENV-SOP-MTJL-0096
	RT window position establishment	Once per ICAL and at the beginning of the analytical sequence.	Position shall be set using the midpoint standard of the ICAL curve when ICAL is performed. On days when ICAL is not performed, the initial CCV is used.	N/A		
	ICV (from a second source)	Immediately after each ICAL	±20% of true value	Correct problem; rerun ICV. If this fails, repeat ICAL		
	CCV	Before sample analysis; after every 10 samples and at the end of the analytical sequence	±20% of true value	Immediately analyze two additional consecutive CCVs. If both pass, samples may be reported without reanalysis. If either fails or two consecutive CCVs cannot be run, perform corrective action(s) and repeat CCV and all associated samples since last successful CCV. Alternately recalibrate, if necessary, then reanalyze all associated samples since the last acceptable CCV		

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

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WORKSHEET 25 – ANALYTICAL INSTRUMENT AND EQUIPMENT MAINTENANCE, TESTING, AND INSPECTION

The analytical instrument calibration, maintenance, testing, and inspection activities to be included in Table 25-1 and are documented in the laboratory SOPs. Laboratory SOPs are provided electronically in the Supplemental folder accompanying this Work Plan.

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Table 25-1 Analytical Instrument Maintenance, Testing, and Inspection

INSTRUMENT/ EQUIPMENT	MAINTENANCE ACTIVITY	TESTING ACTIVITY	FREQUENCY	ACCEPTANCE CRITERIA	CORRECTIVE ACTION	RESPONSIBLE PERSON	SOP REFERENCE
LC-MS/MS	Clean ESI chamber.	N/A	Weekly or as needed	N/A	N/A	Analyst	ENV-SOP-WCOL-0158 (primary lab) EMT-SOP-0-1633 (backup lab)
	Replace delay column.	Peak shape and resolution; LC pressure profiles	Biannually or as needed	N/A	N/A	Analyst	
	Replace analytical column.	Peak shape and resolution; ICAL or sensitivity problems	Biannually or as needed	N/A	N/A	Analyst	
	Replace guard cartridge.	Visible blockage and/or dirt on frit	Weekly or as needed	N/A	N/A	Analyst	
GC/MS	Change Septum, clip column, clean/replace detector, clean injection port liners, etc.	QC samples performed before, during and with each analytical batch	As needed to meet method criteria	As needed to meet method criteria. See Worksheet 12 and 24.	Perform maintenance; recalibrate instrument	Analyst/Supervisor	ENV-SOP-MTJL-0100 ENV-SOP-MTJL-0081;
GC/MS	Clean sources, maintain vacuum pumps	Tuning	Service vacuum pumps twice per year, other maintenance varies from daily to every 6 months and as needed.	Tune and CCV pass. As needed to meet method criteria. See Worksheet 12 and 24.	Correct the problem and repeat calibration or calibration verification.	Analyst	ENV-SOP-MTJL-0100 ENV-SOP-MTJL-0081
GC	Clip column, change pump oil, replace septum, change injection port liners, etc.	QC samples and monitoring compounds performed before and during each analytical batch Detector signals and chromatogram review	As needed to meet method criteria	As needed to meet method criteria CCV passes criteria	Perform necessary maintenance; Reinspect injector port, cut additional column, reanalyze CCV, recalibrate instrument	Analyst/Supervisor	ENV-SOP-MTJL-0087 ENV-SOP-MTJL-0096

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

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WORKSHEET 26/27 – SAMPLE HANDLING, CUSTODY, AND DISPOSAL

Table 26-1 lists personnel that are primarily responsible for ensuring proper handling, custody, and storage of field samples from the time of collection to laboratory delivery, to final sample disposal. This table also lists their organizational affiliations and describes the procedures and forms that will be used to maintain sample custody and integrity including CoC forms, traffic reports, sample ID, custody seals, laboratory sample receipt forms, and laboratory sample transfer forms.

Sampling Organization:	Brice Environmental Services Corporation	
Laboratories:		
Primary (PFAS) Pace Analytical South Carolina; Kathy Smith 106 Vantage Point Drive West Columbia, SC 29172 (803) 791-9700	**Primary (IDW Characterization)** Pace National-TN; Jared Starkey 12065 Lebanon Rd Mt. Juliet, TN 37122 (800) 767-5859	**Backup (PFAS and IDW Characterization)** Sterling Laboratories; Olga Karplyuk 509 N. 3rd Avenue Des Plaines, IL 60016 (847) 324-3348
Method of sample delivery:	Alaska Seaplanes (or similar air carrier) from Haines to Juneau, AK; FedEx from Juneau, AK to the laboratories	
Number of days from reporting until sample disposal:	In accordance with laboratory QA procedures	

Table 26-1 Sample Management

Activity	Organization and Person Responsible for Activity	Reference
Sample documentation and labeling	Brice Field Scientist/Technical Lead	Worksheet 26/27 BE-SOP-01 BE-SOP-03
Sampling ID	Brice Field Scientist/Technical Lead	Worksheet 26/27 BE-SOP-03
Packaging and delivery coordination	Brice Field Scientist/Technical Lead	Worksheet 26/27 BE-SOP-03
CoC completion	Brice Field Scientist/Technical Lead Brice Project Chemist	BE-SOP-02
Sample receipt, inspection, and log-in	Laboratory PM	Worksheet 26/27 BE-SOP-02
Sample custody and storage	Brice Field Scientist/Technical Lead Laboratory Sample Custodian	Worksheet 26/27 BE-SOP-02
Sample disposal	Laboratory PM	Worksheet 26/27

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

26.1 Sample Documentation and Labeling Requirements

Accurate and comprehensive recordkeeping is critical to documenting sample custody and includes CoC records. The field logbook and field forms will be the primary tools for capturing information collected during the field effort. Field forms are included in the task specific SOPs attached as Appendix D of the Work Plan.

Daily activities, including sample collection, will be recorded in a bound field logbook with pre-numbered pages. Procedures for field documentation and logbook notes are described in BE-SOP-01.

Each field logbook will contain the following information on the cover:

- Owner of the book
- Book number
- Job name and work order
- Start date
- End date

Field notes will be entered in permanent ink. If any changes are made to the field record, the original notation will be crossed out with a single line, initialed, and dated by the person making the correction. The field logbook will contain the information required to recreate the sampling event and will be attached in the field activity report. At a minimum, field logbooks will contain the following information:

- Project name and number
- Date and time of work, including daily start and stop times
- Name and location of site
- Full names and titles/roles of field personnel, including visitors
- Level of personal protective equipment (PPE)
- Summary of equipment preparation procedures
- Description/sketch of work area
- Weather conditions
- Field observations (e.g., stressed biota, staining)
- Sample locations (including sketches when appropriate)
- Date and time of each sample collection event
- All calibrations performed
- Field screening locations and results
- Sample ID, location, matrix, and depth
- Explanation of any deviations from the field sampling SOP(s) or Work Plan/Uniform Federal Policy-Quality Assurance Project Plan (UFP-QAPP), including rational for the deviation
- Photograph information (e.g., location, direction, description)

Enough information will be recorded throughout collection, transport, and analysis of samples to support creation of a sample summary sheet per MED requirements (USACE 2017).

This document will identify all the samples collected during the sampling event (and track the samples to the coolers that they were shipped to the laboratory in) and provided the following minimum data:

- Location ID
- Sample depth
- Sample ID
- Date/Time sample collected
- Analytical methods

- Matrix
- Container type/volume
- North Pacific Division Laboratory (NPDL) Number (24-033)
- QC (e.g., FD, MS/MSD, FRB, EB)
- Laboratory
- Sample delivery group (SDG)
- Field preservation
- Cooler name
- Sampler initials
- Turnaround time (TAT)

26.2 Sample Identification

Samples will be given a unique identifier reflecting the sample year, location, and depth. Sample containers will be labeled to match the CoC records. At the time of sampling, appropriate sample numbers will be recorded in the field logbook and/or field forms. Samples collected for this project will be numbered with unique identifiers as described below:

- **Year:** Two-digit code for the sampling year (24 for 2024)
- **Site:** HFT for Haines Fuel Terminal
- **Sample Matrix:** Anticipated matrices for samples are defined below:
  - GW: groundwater samples
  - SE: sediment samples
  - SS: surface soil samples
  - SO: subsurface soil samples
  - SW: surface water samples
  - SQ: soil QC samples (e.g., EBs)
  - WQ: water QC samples (e.g., EBs)
  - WS: waste soil (waste characterization)
  - WW: wastewater (waste characterization)
- **Sample Type:**
  - SB: soil boring
  - AP148: example of existing monitoring well ID
  - MW: newly installed permanent monitoring well
  - TW: newly installed temporary monitoring well
  - TBS: Tanani Bay seep
  - FRB: field reagent blank
  - WC: waste characterization
- **Boring/Well/Seep Number:** Unique, sequential number, starting at "01"

Examples for sample IDs:

- "24HFT-SO-SB01-0.0-2.0" indicates a subsurface soil sample collected from the interval of 0 to 2 feet bgs from the first soil boring drilled at the HFT in 2024.

- "24HFT-GW-MW08" indicates the groundwater sample collected from newly installed monitoring well MW-08 at the HFT in 2024.
- "24HFT-WS-WC01" indicates the first waste characterization sample collected for IDW soil at the HFT in 2024.

FD samples are submitted blind to the laboratory and are generally given a sample collection time a few minutes after the primary sample collection time. Additional examples of sample and locations IDs are presented in Worksheet 18 for Mobilizations 1 and 2.

26.3 Chain-of-Custody Form Completion

The CoC form tracks sample possession and handling from the time of collection through analysis and final disposition. Collected samples will remain in the custody of the field team that collected the samples until shipment to the analytical laboratory. CoC procedures are described in detail in *BE-SOP-02 Sample Chain-of-Custody* (Appendix D of the Work Plan).

Each CoC form will contain the information listed below:

- The first four digits define the sampling year (2024)
- The next characters define the project site HFT
- The next two digits represent the sequential CoC number (-01, -02, -03)
- The laboratory the samples will be shipped to

The cooler will be given a unique ID, which will be recorded on the CoC form.

The CoC form will include the sample ID, location ID, sample date/time, sampler initials, container (quantity, type, and volume), preservation method, matrix, analytical group, QC, TAT, NPDL Number, and any notes associated with the sample. This information will be entered for each sample collected for laboratory analysis.

The CoC form will be signed by the person transferring custody at any stage of delivery and sample receipt.

A separate CoC form will be completed for each cooler, and the samples listed on the CoC will reflect those included in the cooler.

26.4 Packaging and Shipment

Samples will be labeled, stored, and packaged in accordance with the procedures described in *BE-SOP-03 Labeling, Packaging, and Shipping Samples* (Appendix B). Sample coolers will be packaged and shipped to Pace Analytical South Carolina or Pace National-TN for analysis.

26.5 Sample Receipt, Inspection, and Log-in Procedures

A sample custodian at the laboratory will accept custody of the shipped samples, and check them for discrepancies, proper preservation, and integrity. The laboratory will complete a cooler receipt form when samples are received. Cooler receipt information, including the signed CoC, custody seals, and the completed cooler receipt form will be provided to the Brice Project Chemist and emailed to receipt.cooler@usace.army.mil with 24 hours of cooler receipt. Discrepancies or other data quality issues identified by the laboratory will be forwarded to the laboratory PM and/or the Brice Project Chemist for corrective action.

26.6 Sample Custody and Storage, and Disposal Procedures

The sample custodian will relinquish custody of the samples to the appropriate department for analysis. Sample disposal will occur only after analyses and QA/QC checks are completed, and the final data report has been submitted.

Following completion of chemical analysis, the samples will be maintained according to the preservation methods included on Worksheet 19/30 for at least 2 weeks after expiration of the appropriate holding time. Samples will be stored until disposal in accordance with laboratory QA procedures. Samples will be disposed of in accordance with federal, state, and local requirements.

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WORKSHEET 28 – ANALYTICAL QUALITY CONTROL AND CORRECTIVE ACTION

The purpose of the laboratory QC sample activities is to produce data of known quality that satisfy the project-specific DQOs. This worksheet provides additional discussions relevant to the analytical QC requirements that laboratories producing definitive data will be required to follow. Tables 28-1 through 28-5 provide documentation for corrective actions, flagging criteria, and expectations for analytical services.

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Table 28-1 Analytical Quality Control and Corrective Action – PFAS by Draft EPA 1633[1]

qc sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria	Comments
AFFF samples	Each AFFF sample. Note: This does not include AFFF samples that are to be evaluated for MIL-PRF-14385 compliance. Those AFFF samples must be performed in compliance with DoD AFFF01, not EPA Draft Method 1633[1].	AFFF samples must be subsampled in duplicate for analysis in accordance with DoD AFFF01, Section 11.2.1 through 11.2.9. Note: In lieu of the LCSD required in Section 11.2.6 of DoD AFFF01, one MS/MSD pair must be prepared with each batch of AFFF samples. All AFFF samples must be processed in duplicate in the same manner as whole sample aqueous samples (SPE, carbon cleanup) per EPA Draft Method 1633.	N/A	Analyst	N/A	A copy of the latest version of DoD AFFF01 can be found at https://denix.osd.mil/edqw/. Note that this document is only for QC reference purposes, and not the procedure, if AFFF samples are NOT being analyzed for compliance with MIL-PRF-14385.
Ion Transitions (Precursor -> Product)	Every field sample, standard, blank, and QC sample.	In addition to the requirements of EPA Draft Method 1633, the following must be met: 1) If a qualitative or quantitative standard containing an isomeric mixture (branched and linear isomers) of an analyte is commercially available for an analyte, the quantification ion used must be the quantification ion identified in Table 2 of EPA Draft Method 1633 unless interferences render the product ion unusable as the quantification ion. 2) In cases where interferences render the product ion unusable as the quantification ion, project approval is required before using the alternative product ion.	N/A	Analyst	Flagging is not appropriate. Provide technical justification in the Case Narrative.	Currently, qualitative or quantitative standards containing isomeric mixtures for an analyte are commercially available for PFOA, PFOS, PFHxS, NMeFOSAA, NEtFOSAA, PFNA, PFOSA, NMeFOSA, NEtFOSA, NMeFOSE, and NEtFOSE.
Ion Ratio	All analytes detected in a sample.	Must meet all the requirements of EPA Draft Method 1633[2].	Must meet all the requirements of EPA Draft Method 1633[1].	Analyst	Document and discuss the failure in the Case Narrative. Apply I-flag to the result associated with the failure.	
ISC	Daily. At the beginning of each analytical sequence, prior to sample analysis.	In addition to the requirements of EPA Draft Method 1633[2], the following must be met: All analyte concentrations must be within ±30% of their true values.	Correct problem, rerun ISC. If problem persists, repeat ICAL.	Analyst	Flagging is not appropriate.	No samples shall be analyzed until acceptance criteria for ISC has been met.
ICV	Once after each ICAL, prior to sample analysis.	Must be made from a second source standard. All analyte concentrations must be within ±30% of their true values.	Correct problem, rerun ICV. If problem persists, repeat ICAL.	Analyst	Flagging is not appropriate.	No samples shall be analyzed until acceptance criteria for ICV has been met.
Instrument Blank	Immediately following the highest standard analyzed in the calibration, daily prior to analyzing standards, after each CCV, and immediately following samples with PFAS concentrations exceeding the quantification range.	In addition to the requirements of EPA Draft Method 1633[2], the following must be met: Concentration of each analyte must be ≤ ½ the LOQ.	If acceptance criteria are not met after the highest calibration standard, calibration must be performed using a lower concentration for the highest standard until acceptance criteria is met. If sample concentration exceeds the highest calibration standard and the sample(s) following exceed this acceptance criteria (> ½ LOQ), they must be reanalyzed using a fresh aliquot of the sample extract.	Analyst	Flagging is only appropriate in cases where the extract cannot be reanalyzed, and re-extraction is not possible.	EPA Draft Method 1633[1] equivalent to the CCV is the CV.

Table 28-1 Analytical Quality Control and Corrective Action – PFAS by Draft EPA 1633[1]

qc sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria	Comments
EIS Compounds	Every field sample, standard, blank, and QC sample.	In addition to the requirements of EPA Draft Method 1633[2], the following must be met: 1) Isotopically labeled analogs of analytes must be used when they are commercially available. 2) QC samples and field samples must recover within in-house limits if project limits are not provided; otherwise, project limits must be met. Preliminary in- house acceptance criteria of 20-150% must be used until in- house limits are generated in accordance with Sections 9.4.1 and 9.4.2 of EPA Draft Method 1633[1].) The lower limit of in- house acceptance criteria cannot be < 20%.	Repeat the analysis using a fresh aliquot of the extract. If failure does not confirm, report the second analysis. If the failure confirms, follow the requirements listed in EPA Draft Method 1633[1], Section 15.3.2. If EIS recoveries still fall outside of the acceptance range, the client must be contacted for additional measures to be taken.	Analyst	Document and discuss the failure in the Case Narrative. Apply Q-flag to the result associated with the failure.	
NIS Compounds	Every field sample, standard, blank, and QC sample.	In addition to the requirements of EPA Draft Method 1633[2], the following must be met: 1) NIS areas must be greater than 30% of the average area of the calibration standards in undiluted sample extracts and sample extracts that required additional NIS to be added. 2) NIS areas corrected for the dilution factor must be greater than 30% of the average area of the calibration standards in diluted samples when additional NIS was not added post dilution of the extract.	Repeat the analysis using a fresh aliquot of the extract. If failure does not confirm, report the second analysis. If the failure confirms, examine the project-specific requirements. Contact the client as to additional measures to be taken.	Analyst	Document and discuss the failure in the Case Narrative. Apply Q-flag to the result associated with the failure.	
MB	One per preparatory batch.	In addition to the requirements of EPA Draft Method 1633[2], the following must be met: No analytes detected > ½ LOQ or > 1/10 the amount measured in any associated sample or 1/10 the regulatory limit, whichever is greater.	Correct the problem. If required, re-extract and reanalyze MB and all QC samples and field samples processed with the contaminated blank. Samples may be re-extracted and analyzed outside of holding times, as necessary for corrective action associated with QC failure. Examine the project-specific requirements. Contact the client as to additional measures to be taken.	Analyst	If reanalysis cannot be performed, data must be qualified and explained in the Case Narrative. Apply B-flag to all results for the specific analyte(s) in all samples in the associated preparatory batch.	
MD	Each AFFF sample prepared using an aliquot of the field sample must be prepared in duplicate.	In addition to the requirements of EPA Draft Method 1633[2], the following must be met: RPD ≤ 30% (between sample and MD).	Examine the project-specific requirements. Contact the client as to additional measures to be taken. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified.	Analyst	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met and explain in the Case Narrative.	The data shall be evaluated to determine the source of difference. For Sample/MD: RPD criteria only applies to analytes whose concentration in the sample is ≥ LOQ.
Bile Salt Standards	Daily, prior to analysis of all matrix types (aqueous, solid, tissue, and AFFF).	All EPA Draft Method 1633[2] requirements for evaluation of the relationship of the RT of the bile salt peak(s) to the RT window of PFOS must be met for all matrix types. The RT window of PFOS applies to the RT of all isomers of PFOS. No samples shall be analyzed until acceptance criteria for the bile salt standard(s) has been met. The RT of the bile salt(s) peak must fall out of the RT window of PFOS by at least one minute.	N/A	Analyst	N/A	No samples shall be analyzed until acceptance criteria for the bile salt standard(s) has been met.

Table 28-1 Analytical Quality Control and Corrective Action – PFAS by Draft EPA 1633[1]

qc sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria	Comments
LCS and Low-Level Laboratory Control Standard	One set per preparatory batch.	In addition to the requirements of EPA Draft Method 1633[2] the following must be met: 1) Analyte recoveries must be within in-house limits if project limits are not provided; otherwise, project limits must be met. Preliminary in-house acceptance criteria of 40-150% must be used until in-house limits are generated in accordance with Section 14.5.4 of EPA Draft Method 1633. 2) The lower limit of in-house acceptance criteria cannot be < 40%.	In addition to the requirements of EPA Draft Method 1633, the following must be met: 1) Samples may be re-extracted and analyzed outside of holding times, as necessary for corrective action associated with QC failure. 2) Examine the project-specific requirements. Contact the client as to additional measures to be taken.	Analyst	If reanalysis cannot be performed, data must be qualified and explained in the Case Narrative. Apply Q-flag to specific analyte(s) in all samples in the associated preparatory batch.	EPA Draft Method 1633 equivalent to the LCS is the Ongoing Precision and Recovery Standard. EPA Draft Method 1633 equivalent to the Low-Level Laboratory Control Standard is Low-Level Ongoing Precision and Recovery Standard.
MS/MSD	One MS/MSD pair per prep batch.	In addition to the requirements of EPA Draft Method 1633, the following must be met: 1) Analyte recoveries must be within in-house LCS limits if project limits are not provided; otherwise, project limits must be met. 2) RPD ≤ 30% (between MS and MSD).	Examine the project-specific requirements. Contact the client as to additional measures to be taken. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified.	Analyst	For the specific analyte(s) in the parent sample, apply J-flag if acceptance criteria are not met and explain in the Case Narrative.	The data shall be evaluated to determine the source of the difference.

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
[1] Method 1633 was finalized in January 2024; the final version of the method will be used if the selected laboratory receives method accreditation.
[2] Source: EPA 2023.

Table 28-2 Analytical Quality Control and Corrective Action for Method SW8260D

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
MB	One per preparatory batch	No analytes detected > ½ LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater. Common laboratory contaminants must not be detected > LOQ.	Correct problem. If required, re-prep and reanalyze MB and all QC samples and field samples processed with the contaminated blank.	Laboratory Analyst Supervisor	Results may not be reported without a valid MB. Flagging is only appropriate where the samples cannot be reanalyzed. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all associated positive results for the specific analyte(s) in all samples in the associated preparatory batch.
LCS (and LCSD, if prepared and analyzed)	One per preparatory batch	A laboratory must use the DoD/DOE QSM Appendix C Limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified.	Correct problem, then re-prep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes if sufficient sample material is available.	Laboratory Analyst Supervisor	Must contain all surrogates and all analytes to be reported. Results may not be reported without a valid LCS. Flagging is only appropriate where the samples cannot be reanalyzed. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all associated positive results for the specific analyte(s) in all samples in the associated preparatory batch.
Surrogate spike	All field and QC samples	QC acceptance criteria specified by the project if available; otherwise use DoD/DOE QSM Appendix C limits or in-house LCS limits if analyte(s) are not listed.	Correct problem, then re-prep and reanalyze all failed samples for all surrogates in the associated preparatory batch if sufficient sample material is available. If obvious chromatographic interference is present, reanalysis may not be necessary, the failures must be discussed in the Case Narrative.	Laboratory Analyst Supervisor	Apply Q-flag to all associated analytes if acceptance criteria are not met and explain the case narrative.
MS/MSD	One set per preparatory batch	A laboratory must use the DoD/DOE QSM Appendix C Limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified. MSD or MD: RPD of all analytes ≤ 20% (between MS and MSD or sample and MD).	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	Laboratory Analyst Supervisor	For the specific analyte(s), in the parent sample, apply J-flag if acceptance criteria are not met and explain in the case narrative. Must contain all surrogates and all analytes to be reported. For matrix evaluation only. If MS results are outside the limits, the data shall be evaluated to determine the source(s) of difference, i.e., matrix effect or analytical error. For Sample/MD: RPD criteria only apply to analytes whose concentration in the sample is greater than or equal to the LOQ.
IS	Every field sample, standard, and QC sample	RT within ±10 seconds from RT of midpoint standard in ICAL; extracted ion current profile from -50% to +100% of ICAL midpoint standard. On days when ICAL is not performed, the daily initial CCV can be used.	Inspect mass spectrometer and GC for malfunctions and correct problem. Repeat analysis of samples while system was malfunctioning is mandatory.	Laboratory Analyst Supervisor	If corrective action fails in field samples, data must be qualified and explained in the Case Narrative. Apply Q-flag to analytes associated with the noncompliant IS. Flagging is not appropriate for failed standards.

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

Table 28-3 Analytical Quality Control and Corrective Action for Method SW8270E-SIM

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
MB	One per preparatory batch	No analytes detected > 1/2 LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater. Common laboratory contaminants must not be detected > LOQ.	Correct problem. If required, re-prep and reanalyze MB and all QC samples and field samples processed with the contaminated blank.	Laboratory Analyst Supervisor	Results may not be reported without a valid MB. Flagging is only appropriate where the samples cannot be reanalyzed. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all associated positive results for the specific analyte(s) in all samples in the associated preparatory batch.
LCS (and LCSD, if prepared and analyzed)	One per preparatory batch	A laboratory must use the DoD/DOE QSM Appendix C Limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified.	Correct problem, then re-prep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes if sufficient sample material is available.	Laboratory Analyst Supervisor	Must contain all surrogates and all analytes to be reported. Results may not be reported without a valid LCS. Flagging is only appropriate where the samples cannot be reanalyzed. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all associated positive results for the specific analyte(s) in all samples in the associated preparatory batch.
Surrogate spike/Deuterated Monitoring Compounds (DMCs; SIM only)	All field and QC samples	QC acceptance criteria specified by the project if available; otherwise use DoD/DOE QSM Appendix C limits or in-house LCS limits if analyte(s) are not listed. <u>PAH analysis (SIM Mode):</u> DMCs required for PAH target analytes: fluoranthene-d10 and 2-methylnaphthalene-d10. Minimum RRF for PAH DMCs: 0.40. All DMCs: Requires 50-150% recovery until in-house limits can be established.	Correct problem, then re-prep and reanalyze all failed samples for all surrogates in the associated preparatory batch if sufficient sample material is available. If obvious chromatographic interference is present, reanalysis may not be necessary, the failures must be discussed in the Case Narrative.	Laboratory Analyst Supervisor	Apply Q-flag to all associated analytes if acceptance criteria are not met and explain the case narrative.
MS/MSD	One set per preparatory batch	A laboratory must use the DoD/DOE QSM Appendix C Limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified. MSD or MD: RPD of all analytes ≤ 20% (between MS and MSD or sample and MD). <u>PAH analysis (SIM Mode):</u> MSD or MD: RPD of all analytes ≤ 40% (between MS and MSD or sample and MD).	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	Laboratory Analyst Supervisor	For the specific analyte(s), in the parent sample, apply J-flag if acceptance criteria are not met and explain in the case narrative. Must contain all surrogates and all analytes to be reported. For matrix evaluation only. If MS results are outside the limits, the data shall be evaluated to determine the source(s) of difference, i.e., matrix effect or analytical error. For Sample/MD: RPD criteria only apply to analytes whose concentration in the sample is greater than or equal to the LOQ.
IS	Every field sample, standard, and QC sample	RT within ±10 seconds from RT of midpoint standard in ICAL; extracted ion current profile from -50% to +100% of ICAL midpoint standard. On days when ICAL is not performed, the daily initial CCV can be used.	Inspect mass spectrometer and GC for malfunctions and correct problem. Repeat analysis of samples while system was malfunctioning is mandatory.	Laboratory Analyst Supervisor	If corrective action fails in field samples, data must be qualified and explained in the Case Narrative. Apply Q-flag to analytes associated with the noncompliant IS. Flagging is not appropriate for failed standards.
Characteristic ions for MS confirmation (SIM Mode)	Minimum 3 ions	The relative intensities of the characteristic ions of target analytes agree within 30% of the relative intensities in the reference spectrum and the relative intensities must be > 0.	Characteristic ions for MS confirmation	Laboratory Analyst Supervisor	N/A Need 3 structurally significant ions that are logical fragments – not isotopic clusters. IS and DMC can use fewer than 3 ions.

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

Table 28-4 Analytical Quality Control and Corrective Action for Method AK101

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
MB	One per preparatory batch	No analytes detected > 1/2 LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater.	Correct problem. If required, re-prep and reanalyze MB and all QC samples and field samples processed with the contaminated blank.	Laboratory Analyst Supervisor	Problem must be corrected. Results may not be reported without a valid MB. Flagging is only appropriate where the samples cannot be reanalyzed. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all associated positive results for the specific analyte(s) in all samples in the associated preparatory batch.
LCS and LCSD[1]	One set per preparatory batch	DoD/DOE QSM Appendix C Limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified.	Correct problem, then re-prep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes if sufficient sample material is available.	Laboratory Analyst Supervisor	Results may not be reported without a valid LCS. Flagging is only appropriate where the samples cannot be reanalyzed. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all associated positive results for the specific analyte(s) in all samples in the associated preparatory batch.
Surrogate spike	All field and QC samples	QC acceptance criteria specified by the project if available; otherwise use DoD/DOE QSM Appendix C limits or in-house LCS limits if analyte(s) are not listed.	Correct problem, then re-prep and reanalyze all failed samples for all surrogates in the associated preparatory batch if sufficient sample material is available. If obvious chromatographic interference is present, reanalysis may not be necessary, the failures must be discussed in the Case Narrative.	Laboratory Analyst Supervisor	Apply Q-flag to all associated analytes if acceptance criteria are not met and explain the case narrative.
MS and MSD	One set per preparatory batch	DoD/DOE QSM Appendix C Limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified. RPD ≤ 30% (between MS and MSD or sample and MD).	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	Laboratory Analyst Supervisor	For the specific analyte(s), in the parent sample, apply J-flag if acceptance criteria are not met and explain in the case narrative. For matrix evaluation only. If MS results are outside the limits, the data shall be evaluated to determine the source(s) of difference (i.e., matrix effect or analytical error). For Sample/MD: RPD criteria only apply to analytes whose concentration in the sample is greater than or equal to the LOQ.

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
J LCS and LCSD required by analytical method.

Table 28-5 Analytical Quality Control and Corrective Action for Method AK102/AK103

QC Sample	Frequency/Number	Method/SOP QC Acceptance Limits	Corrective Action	Person(s) Responsible for Corrective Action	Measurement Performance Criteria
MB	One per preparatory batch	No analytes detected > 1/2 LOQ or > 1/10 the amount measured in any sample or 1/10 the regulatory limit, whichever is greater.	Correct problem. If required, re-prep and reanalyze MB and all QC samples and field samples processed with the contaminated blank.	Laboratory Analyst Supervisor	Problem must be corrected. Results may not be reported without a valid MB. Flagging is only appropriate where the samples cannot be reanalyzed. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply B-flag to all associated positive results for the specific analyte(s) in all samples in the associated preparatory batch.
LCS and LCSD[1]	One set per preparatory batch	DoD/DOE QSM Appendix C Limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified.	Correct problem, then re-prep and reanalyze the LCS and all samples in the associated preparatory batch for failed analytes if sufficient sample material is available.	Laboratory Analyst Supervisor	Results may not be reported without a valid LCS. Flagging is only appropriate where the samples cannot be reanalyzed. If reanalysis cannot be performed, data must be qualified and explained in the case narrative. Apply Q-flag to all associated positive results for the specific analyte(s) in all samples in the associated preparatory batch.
Surrogate spike	All field and QC samples	QC acceptance criteria specified by the project if available; otherwise use DoD/DOE QSM Appendix C limits or in-house LCS limits if analyte(s) are not listed.	Correct problem, then re-prep and reanalyze all failed samples for all surrogates in the associated preparatory batch if sufficient sample material is available. If obvious chromatographic interference is present, reanalysis may not be necessary, the failures must be discussed in the Case Narrative.	Laboratory Analyst Supervisor	Apply Q-flag to all associated analytes if acceptance criteria are not met and explain the case narrative.
MS and MSD	One set per preparatory batch	DoD/DOE QSM Appendix C Limits for batch control if project limits are not specified. If the analyte(s) are not listed, use in-house LCS limits if project limits are not specified. RPD ≤ 30% (between MS and MSD or sample and MD).	Examine the project-specific requirements. Contact the client as to additional measures to be taken.	Laboratory Analyst Supervisor	For the specific analyte(s), in the parent sample, apply J-flag if acceptance criteria are not met and explain in the case narrative. For matrix evaluation only. If MS results are outside the limits, the data shall be evaluated to determine the source(s) of difference (i.e., matrix effect or analytical error). For Sample/MD: RPD criteria only apply to analytes whose concentration in the sample is greater than or equal to the LOQ.

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
J LCS and LCSD required by analytical method.

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WORKSHEET 29 – PROJECT DOCUMENTS AND RECORDS

Table 29-1 identifies the documents and records that will be generated for the project. It describes how information will be collected, verified, and stored to support data completeness, data integrity, and ease of retrieval.

Table 29-1 Project Documents and Records

Record	Generation	Verification	Storage Location/ Archival
Sample Collection and Field Records			
Completed Field Logbook Pages	Field Sampler	Field Team Lead	Project Files
Completed Sampling Field Forms	Field Sampler	Field Team Lead	Project Files
CoC Forms	Field Sampler	Field Team Lead	Project Files
Deviations and Corrective Actions	Field Sampler	Field Team Lead	Project Files
Daily Site Safety Meeting Forms	Field Team Lead/SSHO	PM	Project Files
Waste Manifests	Field Manager	PM	Project Files
Daily Quality Control Report	Field Team Lead	PM	Project Files
Project Assessment			
Field Sampling Audit Checklists	Field Team Lead	Project Chemist	Project Files
Data Verification Checklists	Project Chemist	Project Team	Project Files
Chemical Data Quality Report	Project Chemist	Project Team	Project Files
Data Usability Assessment Report	Project Chemist	Project Team	Project Files
Laboratory Records			
Electronic Data Deliverables	Subcontract laboratory	Project Chemist	Project Files

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
Project files will be stored electronically.

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WORKSHEET 31/32/33 – ASSESSMENTS AND CORRECTIVE ACTION

Table 31-1 identifies the type and frequency of assessment activities that will be performed for the project. Table 31-2 describes corrective actions for assessments, and Table 31-3 lists reporting requirements. Additional reporting content is detailed in Section 5.0 of the Work Plan.

Table 31-1 Planned Project Assessments

Assessment Type	Frequency	Internal or External	Organization Performing Assessment	Person(s) Responsible for Performing Assessment	Person(s) Responsible for Responding to Assessment Findings	Person(s) Responsible for Identifying and Implementing Corrective Actions	Person(s) Responsible for Monitoring Effectiveness of Corrective Actions
Laboratory technical evaluation	Once, prior to subcontract award and before sampling begins	Internal	Brice	Brice Project Chemist	Analytical Laboratory PM	Analytical Laboratory PM	Brice Project Chemist
Premobilization meeting	Once, prior to project mobilization	Internal	Brice	Brice PM	Brice Field Scientist/ Technical Lead	Brice PM	Brice PM
Field sampling technical evaluation	Initial and ongoing	Internal	Brice	Brice PM	Brice Field Scientist/ Technical Lead	Brice PM	Brice Field Scientist/ Brice PM
Analytical data review	After receipt of analytical results	Internal	Brice	Brice Project Chemist	Analytical Laboratory PM	Brice Project Chemist	Brice PM
Field inspection/ audit	As determined by ADEC	External	ADEC	ADEC	USACE	USACE	USACE

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

Table 31-2 Assessment Response and Corrective Action

Assessment Type	Nature of Deficiencies Documentation	Individual(s) Notified of Findings (Name, Title, Organization)	Timeframe of Notification	Nature of Corrective Action Response Documentation	Individual(s) Receiving Corrective Action Response (Name, Title, Org.)	Timeframe for Response
Premobilization meeting	Submittal register	Brice PM	Within 24 hours or sooner, if necessary	Email or other written documentation	Field Staff and Subcontractor Staff	While on site, if possible
Field sampling technical evaluation	Logbook notes, groundwater sampling forms, core logs	Brice Field Scientist	Within 24 hours	Logbook notes, email correspondence, or documentation in report	Brice Field Scientist/ Technical Lead	While on site if possible; otherwise, document deviations in the logbook notes and/or in the report
Analytical data review	Email correspondence, CoC variance request forms, cooler receipt forms	Analytical Laboratory PM	Within 24 hours	Email correspondence, formal corrective action report/letter, case narrative	Brice Project Chemist	Within holding times, if possible; otherwise, prior to reporting analytical data

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

Table 31-3 Reporting

Type of Report	Frequency (daily, weekly monthly, quarterly, annually, etc.)	Projected Delivery Date(s)	Party Responsible for Report Preparation	Report Recipient(s) (Organizational Affiliation)
Final Report	Pre-Draft, Draft, and Final versions, after completion of fieldwork and receipt of the final analytical data reports	See Worksheet 14/16	Brice	USACE, ADEC, Army
Data quality review and assessment, including the ADEC *Laboratory Data Review Checklist* (ADEC 2022c)	Once, after completion of fieldwork and receipt of the final analytical data reports	See Worksheet 14/16	Brice	USACE, ADEC, Army

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

WORKSHEET 34 – DATA VERIFICATION AND VALIDATION INPUTS

Table 34-1 lists the inputs that will be used during data verification and validation. Inputs include planning documents, field records, and laboratory records. Data verification is a check that all specified activities involved in collecting and analyzing samples have been completed and documented and that the necessary records are available to proceed to data validation. Data validation includes an evaluation of conformance to stated requirements, including those in the contract, methods, SOPs, and QAPP.

Table 34-1 Data Verification and Validation Inputs

Description	Verification (Completeness)	Validation (Conformance to Specifications)
Planning Documents/Records		
Approved UFP-QAPP	X	
Contract	X	
Field SOPs	X	
Laboratory certifications, SOPs, and reporting limits	X	X
Statement(s) of work	X	
Field Records		
Field logbook(s)	X	X
Field instrument calibration logs	X	X
CoC and cooler receipt form	X	X
Sampling diagrams/surveys	X	X
Daily quantity reports	X	X
Waste manifests and disposal records	X	X
Correspondence	X	X
Change orders/deviations	X	X
Field audit reports	X	X
Field corrective action reports	X	X
Analytical Data Package		
Case narrative	X	X
Internal laboratory CoC form(s)	X	X
Cooler receipt form(s) for each cooler of samples	X	X
Sample date/time of receipt, date/time of prep (begin and end), date/time of analysis	X	X
Initial and continuing calibration	X	X
Field sample and field QC sample results	X	X
Laboratory QC sample results	X	X
DL, LOD, and LOQ reported	X	X
Raw data	X	X
Benchsheets/worksheets	X	X
Instrument analytical run logs	X	X

Table 34-1 Data Verification and Validation Inputs

Description	Verification (Completeness)	Validation (Conformance to Specifications)
Instrument maintenance and operations logs	X	X
Definition of laboratory qualifiers	X	X
SEDD Version 5.2, Stage 2B	X	X
Electronic versions of the laboratory report	X	X
Communication records	X	X
Documentation of data quality issues and resolutions, including Cas	X	X

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

WORKSHEET 35 – DATA VERIFICATION PROCEDURES

Table 35-1 describes data verification procedures, including types of records, required documents, process descriptions, and responsible persons.

Table 35-1 Data Verification Procedures

Records Reviewed	Requirement Documents	Process Description	Responsible Person, Organization
Field documentation including field logbook(s), GPS coordinates, and photographs	UFP-QAPP Field SOPs	Verify accuracy and completeness for each day of field activities. Verify that all planned samples, including field QC samples, were collected and documented in accordance with the Field SOPs and QAPP requirements. Verify that deviations from planned activities were documented. Verify that field monitoring and field measurements were recorded.	Brice Field Scientist and Brice PM
Field SOPs	UFP-QAPP Field SOPs	Verify that the sampling SOPs were followed.	Brice Field Scientist and Brice PM
Analytical SOPs	UFP-QAPP	Verify that the analytical SOPs were followed.	Laboratory QA Manager and Subcontract Laboratory
Sample receipt documentation (CoC forms, cooler receipt forms, laboratory log-in information)	UFP-QAPP Field SOPs	Examine CoC forms against project requirements (correct analytical methods requested, samples identified correctly, complete CoC). Verify CoC (CoC relinquished, samples received). Verify accuracy and completeness. Verify that discrepancies were documented and resolution of any potential data quality issues.	Brice Project Chemist and Brice Field Scientist
Sample summary table(s)	UFP-QAPP	Verify sample summary sheet generated in accordance with the USACE Alaska District MED (2017). Verify accuracy and completeness of the sample summary by comparing against the planned samples and the CoCs and cooler receipt forms for samples actually submitted to the laboratory.	Brice Field Scientist and Brice Project Chemist
Field measurements, including field screening results	UFP-QAPP Field SOPs	Verify that field measurements meet the QA/QC requirements established in the project QAPP. Verify accuracy and completeness.	Brice Field Scientist and Brice Project Chemist

Table 35-1 Data Verification Procedures

Records Reviewed	Requirement Documents	Process Description	Responsible Person, Organization
Laboratory data packages	UFP-QAPP	Verify accuracy and completeness of the laboratory data packages: • Verify that laboratory procedures used to generate the analytical data were performed in accordance with the DoD QSM. • Verify that data for all samples submitted to the laboratory (based on the sample summary) have been provided. • Verify that the complete copy of the laboratory report includes all relevant laboratory QC data (including raw data) and is provided in searchable PDF format. • Verify that the specified analytical and extraction methods were performed by the laboratories.	Brice Project Chemist
EDDs	UFP-QAPP	Verify that EDDs meet contract requirements. Verify that the EDDs are consistent with the hardcopy data package. Verify that the SEDD 5.2, Stage 2a is error-free, matches the hardcopy data package, and is compliant with the USACE Alaska District MED (Pacific Ocean – Alaska Instructional Set).	Laboratory QA Manager and Brice Project Chemist
Analytical results, including DL/LOD/LOQ, and laboratory data qualifiers	UFP-QAPP CoC Forms	Verify that the specified analytical methods were used by the laboratory. Verify that data for all samples submitted to the laboratory have been provided. Verify that reporting limits meet DQOs specified in the QAPP. Verify that method and required QC samples were analyzed, and all relevant data (including chromatograms) have been provided. Verify that soil sample results are dry-weight corrected. Ensure that required lists of analytes were reported as specified.	Laboratory QA Manager and Brice Project Chemist
Field QC sample results	UFP-QAPP	Verify that all QAPP-required QC samples were collected and analyzed.	Brice Field Scientist and Brice Project Chemist
Audit reports, corrective action reports	UFP-QAPP	Verify accuracy and completeness. Verify that Cas were documented and implemented.	Laboratory QA Manager, Subcontract Laboratory, and Brice Project Chemist

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

WORKSHEET 36 – DATA VALIDATION PROCEDURES

The data quality review process consists of data verification, data validation, and data usability assessment. Data verification confirms that the specified requirements have been performed. Data verification and validation inputs are included in Worksheet 34, and data verification procedures are included in Worksheet 35.

Data validation is the systematic process of evaluating whether the data comply with the predefined requirements of the project (including method, procedural, and contractual requirements) and comparing the data with criteria based on the DQOs documented in this UFP-QAPP. This worksheet documents procedures that will be used to validate project data. The validation process is summarized in Table 36-1.

Table 36-1 Data Validation Procedures to be Performed

Procedures	Description
Analytical Group/Method	All methods analyzed by the analytical laboratory.
Data deliverable requirements	Level IV report in PDF, SEDD version 5.2 Stage 2a (compliant with the POA Instructional set), and EquIS EQEDD (for Brice internal data management)
Analytical specifications	Worksheet 28
MPC	Worksheet 12
Percent of data packages to be validated	100%
Percent of raw data reviewed	Varies: Raw data may be reviewed when matrix interference is suspected, or discrepancies are identified by the laboratory.
Percent of results to be recalculated	0%
Data validation procedures	Worksheet 36; Data Validation Guidelines Module 6: Data Validation Procedure for PFAS Analysis by QSM Table B-24 (DoD 2022).
Level of data quality review	100% of data will undergo Stage 2B validation

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

All types of data, including screening data and definitive data, are relevant to the data validation and usability assessment. The following subsections focus on the data review requirements for definitive data only.

36.1 Laboratory Reporting Requirements

The laboratories used to perform work for this project are required to follow the appropriate program and method requirements to ensure that the data quality is acceptable and can be used to support project decisions. Laboratory certification requirements include the following:

- Current State of Alaska certificate of approval for Contaminated Sites analysis
- DoD Environmental Laboratory Accreditation Program (ELAP) approval for the fields of testing and matrices proposed on the project

Pace Analytical South Carolina (primary laboratory), Sterling Laboratories (backup laboratory), and Pace National-TN (IDW laboratory) hold current ADEC laboratory approval and DoD ELAP accreditation for the planned analytical method. Certifications are included in Appendix E of the Work Plan for reference.

36.2 Analytical Data Package Requirements

A group of samples submitted to the laboratory at the same time and included on the same CoC will be considered an SDG. The results for an SDG will be reported as one analytical data package. Laboratories must provide Level IV data packages that meet the minimum requirements included in the ADEC *Guidelines for Data Reporting* (ADEC 2022b) and the most current version of the *DoD QSM* (DoD 2021a).

Laboratory analytical reports must meet the following minimum requirements:

- Case narrative must meet ADEC requirements and will include the project name and USACE NPDL Work Order Number (24-033)
- Project name
- Field sample ID number on CoC
- Abbreviated subcontracted laboratory name
- Subcontracted laboratory report number
- Lab ID number for sample
- Date sample collected
- Date sample received at subcontracted laboratory
- Date sample extracted or prepared, and date analyzed
- Extraction or preparation procedures, if appropriate
- Analysis procedure including method numbers
- Analyte or parameter
- DL/LOD/LOQ for all results
- Initial and continuing calibration
- Analytical results and units
- Dilution factor
- Chromatograms and raw data for all methods
- Matrix
- Sample description (e.g., multi-phase, non-homogeneous, pebbles, roots, cloudy, viscous)
- Soil/sludge and solid waste data will be reported on a dry-weight basis with percent moisture included
- Original CoC record, custody seals, and sample cooler receipt forms, with all forms properly signed and dated

36.3 Laboratory Data Reporting Requirements

At minimum, laboratory data deliverables for each SDG will include the following:

- Searchable and bookmarked electronic Level IV data package in PDF for each SDG consistent with the requirements specified in ADEC *Technical Memorandum 22-001, Guidelines for Data Reporting* (ADEC 2022b) and the DoD *QSM* (DoD 2021a)
- Staged Electronic Data Deliverable (SEDD), Version 5.2, Stage 2a compliant with Pacific Ocean/Alaska District (POA) instructional set

- Brice Environmental Quality Information System (EquIS) electronic data deliverable (EQEDD) for internal data review purposes

36.4 Laboratory Data Evaluation

The following result reporting requirements will be met for laboratory data:

- DLs and sample results should be reported to one decimal place more than the corresponding LOQ, unless the appropriate number of significant figures for the measurement dictates otherwise.
- Results for soil samples will be reported on a dry-weight basis. DLs, LODs, and LOQs will be adjusted for moisture.
- Samples should be analyzed undiluted, if possible. The ND results will be reported to the LOD.

All reported data will reflect any dilutions and/or concentrations. The dilution factor, if applicable, will be noted in the analytical report. Such changes should also be reflected in the reporting limits with footnotes detailing the reason for the dilution. If dilution is required, data from both runs will be recorded and reported; however, one result will be selected and reported as the primary result. If samples must be rerun for any reason, the data will be included in the report. Chemical data results between the DL and the LOQ will be flagged "J."

36.5 Laboratory Data Validation Procedures

All analytical data that the laboratory generates will be verified before submittal to the project team. This internal data review process will include all aspects of data generation, reduction, and QC assessment.

The calibration, QC, corrective actions, and flagging requirements for definitive data are included in Worksheet 24 and Worksheet 28. The laboratory will apply data qualifiers as part of its internal validation activities. The allowable laboratory data qualifiers for definitive data are Q, J, B, U, and N, and are defined in the DoD *QSM* v.5.4 (DoD 2021a). Flagging criteria apply when acceptance criteria are not met and when corrective actions are not successful or not performed.

The Contractor Project Chemist or data reviewer will subsequently evaluate the flags that the laboratory applied as part of its internal data review and reporting. The flags may be accepted, modified, or rejected. For all data qualifiers that are changed, clear justification must be provided.

36.6 Chemical Data Quality Review Procedures

All project data will be reviewed on an analytical-batch basis by assessing QC samples and associated field sample results. Data quality review and assessment will be performed using the QC criteria defined in this UFP-QAPP; the DoD *QSM* v.5.4 (DoD 2021a); DoD *General Data Validation Guidelines* (DoD 2019); DoD *Data Validation Guidelines Module 1: Data Validation Procedure for Organic Analysis by GC/MS* (DoD 2020); DoD *Data Validation Guidelines Module 4: Data Validation Procedure for Organic Analysis by GC* (DoD 2021b); DoD *Data Validation Guidelines Module 6: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by QSM Table B-24* (DoD 2022);*Technical Memorandum 22-001, Guidelines for Data Reporting* (ADEC 2022b); *Test Methods for Evaluating Solid Waste: Physical/Chemical Methods Compendium (SW-846)*, through Update VII (EPA 2021); and the laboratory SOPs, in that order.

Data quality review and assessment is typically performed by a person(s) independent of the activity being evaluated. Data quality review includes completing the ADEC *Laboratory Data Review Checklist (*ADEC 2022c) for each SDG; the review of the analytical data including QC sample results, field and laboratory QA reports; and all data submittals. The Contractor Project Chemist will obtain the most current version of the USACE Alaska District SEDD Checker prior to processing electronic chemistry data for the project.

The following information will be reviewed during the data quality review and assessment:

- CoC documentation
- Holding time compliance
- QC sample frequencies
- Blanks
- LCS recoveries (and precision if LCSD performed)
- Surrogate spike recoveries
- MS/MSD recoveries and precision
- Initial and continuing calibration summary information, where applicable
- IS recoveries
- Lab duplicate precision
- FD precision
- Case narrative review, laboratory flagging review, and other method-specific criteria.

Electronic data deliverables (EDDs) will be evaluated for consistency with project and contract requirements. The EDDs will be verified consistent with the Level IV PDF report.

36.7 Data Validation Guidelines

The data quality review will identify results requiring qualification and potential effects on data usability based on the MPC in Worksheet 12 and Worksheet 28. Table 36-2 defines the qualifiers to be applied to the analytical data set, as appropriate. Direction of bias will be indicated wherever possible.

Sample results that are affected by significant data quality deficiencies will be evaluated by the data reviewer and may be recommended for rejection by applying the “X” qualifier in the pre-draft and draft report. The project team will review the recommendations made by the data reviewer and make the final decision to reject results in the final report submittal. Rejected sample results will be replaced with an “R” in the final submittal in the analytical data tables.

Table 36-2 Validation and Usability Assessment Data Qualifiers

Qualifier	Description
ND [LOD]	Analyte is not detected above the DL [LOD is presented in brackets]
J	Analyte is considered an estimated value. The analyte may be estimated due to its quantitation level (≥ DL and <LOQ), or it may signify that there is a QC deviation and the bias is unknown.
J+	The analyte is considered an estimated value with a high-bias due to a QC deviation.
J-	The analyte is considered an estimated value with a low-bias due to a QC deviation
UJ	The analyte was not detected; however, the result is estimated because of discrepancies in meeting certain analyte specific QC criteria.
X[1]	The sample result (including NDs) was affected by serious deficiencies in the ability to analyze the sample and to meet published method and project QC criteria. The presence or absence of the analyte cannot be substantiated by the data provided. Acceptance or rejection of the data should be decided by the project team (which should include a Project Chemist), but exclusion of the data is recommended.

Notes:

For definitions, refer to the Acronyms and Abbreviations section.

J Data validation will indicate when performance criteria are not met. The final rejection of data (qualified R) and their use must be decided by the project team during the data usability assessment in the context of project objectives, and not based solely on the assessment performed by the data validator.

In some cases, more than one qualifier may apply to a result. Final validation qualifiers will be assigned on bias, and when opposing bias is noted, the qualifier QN will be used as the final flag. J, B and H qualifiers will be applied independently, as they reflect a specific deviation.

36.8 Blank Evaluation Guidelines

The Brice Project Chemist will evaluate laboratory blanks and field blanks based on the concentration of the analyte in the samples in relation to the concentration in the blank as outlined in DoD *Data Validation Guidelines Module 6: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by QSM Table B-24* (DoD 2022).The Brice Project Chemist must discuss any blank contamination that may affect data usability in conjunction with project-specific goals. When a data set contains low-level detects in field samples and has associated field or laboratory blanks that have detects at similar concentrations, this suggests that the low-level detects in these field samples may be artifacts because of either field or laboratory practices. MBs and calibration blanks (CBs) will be evaluated to the DL. If an analyte is detected in the MB or CB above the DL, associated sample results will be qualified as outlined in DoD *Data Validation Guidelines Module 6: Data Validation Procedure for Per- and Polyfluoroalkyl Substances Analysis by QSM Table B-24* (DoD 2022).

36.9 Duplicate Evaluation Guidance

QC measures for precision include FDs, laboratory duplicates, and MSDs. The laboratory will evaluate and qualify these measures according to procedures outlined in Worksheet 28, with the exception of the FDs.

To evaluate FD precision, the RPD between duplicate results will be calculated. Duplicate results will be qualified "J" if the RPD exceeds the recommended 50% for soil and 30% for water (Worksheet 12). Duplicate results will be qualified when one result is greater than the LOQ and one result is ND. RPD will not be calculated for duplicate pairs with both results below the LOQ.

FD results can be used to assess field sampling precision, laboratory precision, and, potentially, the representativeness of the matrix sampled. Poor overall precision may result from one or more of the following:

- Field instrument variation
- Analytical measurement variation
- Poor sampling technique
- Sample transport problems
- Spatial variation (heterogeneous sample matrices)

To identify the cause of imprecision, the project team should evaluate the field sampling design rationale and sampling techniques, as well as review both field and analytical duplicate sample results. If poor precision is indicated in both the field and analytical duplicates, then the laboratory may be the source of error. If poor precision is limited to the FD results, then the sampling technique, field instrument variation, sample transport, and/or spatial variability may be the source of error. If data validation reports indicate that analytical imprecision exists for a particular data set or SDG, then the reports must discuss the effect of that imprecision on usability.

36.10 Data Analysis and Interpretation

General guidelines for applying validation qualifiers include, but are not limited to, those listed in Table 36-3.

Table 36-3 General Data Qualifying Conventions

QC Requirement	Criteria	Flag	Flag Applied To
Holding time	Time exceeded for extraction or analysis	J for positive results; UJ for NDs	All analytes in analysis group
	Time exceeded for extraction or analysis by a factor of > 2	J for positive results; X for NDs	
Sample preservation	Improper sample preservation	J- for positive results; UJ for NDs	Sample
	Temperature > 6°C upon receipt	J for positive results; UJ for NDs	
	Temperature > 15°C upon receipt at laboratory	J for positive results; X for NDs	
	Temperature < 0°C upon receipt and not frozen or otherwise adversely affected	No flag required	
Instrument tuning	Ion abundance method-specific criteria not met	X for all results	All associated samples in analytical batch
ICAL	All analytes should be within method-specified criteria, however, if RSD > 20% and ≤ 30%	J for positive results; UJ for NDs	All associated samples in analytical batch
	RSD > 30%	X for all results	
Second source check (ISC) and CCVs	All analytes should be within method-specified criteria, however if %D > ±30%	J+/J- for positive results; UJ for NDs	All associated samples in analytical batch
	%D > ± 50%	X for all results	
LCS	%R > UCL	J+ for positive results	The specific analyte(s) in all samples in associated analytical batch
	%R < LCL	J- for positive results; UJ for NDs	
	%R < LCL and < 10%	J- for positive results; X for NDs	

Table 36-3 General Data Qualifying Conventions

QC Requirement	Criteria	Flag	Flag Applied To
EIS	%R > upper CL	J- for positive results	Sample
	%R < LCL and > 10%	J+ for positive results	
	%R < 10%	X for positive results and NDs	
	Dilution with refortification	J for positive results, and ND should be reported from a lower dilution.	
	Analyte RT > 0.10 minutes from associated EIS RT	Professional judgment and documentation	
NIS	Area count < 30%	X for positive results and NDs	Sample
Ion Ratio	Analytes detected > DL	J for positive results	
Blanks (MB, EB, FRB)	Analyte(s) detected above the DL (use the blank of the highest concentration)	U for positive sample results ≤ LOD J+ for positive sample results > LOQ but ≤ 5 times the blank concentration No flag required for positive result > 5 times the blank concentration	All samples in preparation, field, or analytical batch, whichever applies
FD samples	RPD > CL and FDs > LOQ	J for positive results	The specific analyte(s) in duplicate pair
	One FD > LOQ, one ND	J for positive results; UJ for NDs	
	One FD> LOQ, one FD > LOD but < LOQ	J for positive results for RPDs outside QC limits	
	Both results < LOQ	No flagging required for RPDs outside QC limits	
MS/MSD	MS or MSD %R > upper CL	J+ for positive results	The specific analyte(s) in parent sample
	MS or MSD %R < LCL	J- for positive results; UJ for NDs	
	MS or MSD %R < LCL and < 10%	J- for positive results; X for NDs	
	MS/MSD RPD > CL	J for positive results; UJ for NDs	
	Sample concentration > 3x spike concentration; excessive dilution (dilution > 5x)	No flag required	
Retention time window	Analyte within established window	X for all results if analyte is outside established window	Sample

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
Information in this table reflects flagging criteria from guidance documents, as well as criteria applied based on professional judgment.

Qualification will not be required in the following circumstances:

- Surrogate or MS recoveries were outside QC limits, and dilution of the sample resulted in surrogate or spike dilution to a level beyond quantitation.
- MS recoveries were outside QC limits, and the spiked concentration was less than that of the parent sample.
- An analyte was detected in the associated blank, but there was no detection in the sample, or the sample detections were greater than 10 times the blank amount.
- MS/MSD or LCS/LCSD recovery exceeds the upper CL, and there was no detection in the sample(s).
- MS/MSD or LCS/LCSD RPD exceeds the CL, and there was no detection in the sample(s).

Data may be recommended for rejection on the following grounds:

- Initial calibration (ICAL; per compound) criteria not met
- Continuing calibration (per compound) not verified
- All NDs with the continuing calibration recovery less than CLs
- All NDs with the LCS recovery less than CLs
- Any compound with LCS recovery less than 10%
- Missed holding times greater than two times the method-specified holding time
- Surrogate recovery of less than 10% and a dilution factor of 5 or less

36.11 Chemical Data Quality Report

A Chemical Data Quality Report (CDQR) will be prepared summarizing the findings of the data quality review and discussing their effect on overall data usability. In addition to the overall data quality report, the Contractor Project Chemist or data reviewer will complete the ADEC *Laboratory Data Review Checklist* (ADEC 2022c) for each laboratory data package. A summary of the findings of the CDQR will be included in the text of the report.

The CDQR will present detailed results of the data quality review and assessment, including, but not limited to, a discussion of all QC parameters evaluated; the acceptance criteria used to evaluate each parameter; the extent of the QC exceedance; ID of samples affected by the QC exceedance; and discussion of any qualifiers applied to the samples results, including potential direction of bias and relationship to screening levels (if possible). Significant trends and biases in the data will be evaluated and identified. A detailed description will be provided for any corrective actions and/or systematic problems that were identified during the data review process.

Analytical results with LOQs greater than laboratory LOQ and/or screening levels will be identified and evaluated for potential effects on usability. Rejected results will be presented in a table with a brief explanation of the reason for rejection.

Analytical data will be tabulated in the completed report. All analytical results, including duplicate results, will be reported with any appropriate qualifiers in accompanying data tables. Chemical data tables will include the following information:

- Location ID
- Field sample ID
- Laboratory ID number
- Matrix
- Analytical method
- Percent moisture
- Concentration units
- Result
- Screening levels
- LOQ for each sample ID/method/analyte/matrix
- Data qualifier flags

Laboratory LODs for ND results will be compared to the screening levels established for the method/analyte/matrix in Worksheet 15. If the laboratory LOD for the ND result exceeds the screening level, the result will be flagged or otherwise highlighted. Rejected data will be presented in a table with a brief explanation of the reason(s) for data rejection.

WORKSHEET 37 – DATA USABILITY ASSESSMENT

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

The following subsections summarize (1) the processes used to determine whether the collected data are of the right type, quality, and quantity to support project decision-making; (2) how data quality issues will be addressed; and (3) how limitations of the use of the data will be handled.

The data usability assessment (Table 37-1, which follows the text discussion) includes specific examples of items that may be evaluated during the usability assessment, as applicable.

37.1 Summary of Usability Assessment Processes

A usability assessment is performed to determine how well the data collected for a project support the project objectives. Decisions can then be made by the project team (e.g., PM, Project Chemist).

Data gaps may be present if (1) a sample is not collected, (2) a sample is not analyzed for the requested parameters, or (3) the data are determined to be unusable. The need for further investigation will be determined on a case-by-case basis. This determination will depend on whether data can be extrapolated from adjacent sample locations and whether the data are needed based on the results from adjacent sample locations.

The Project Chemist and the analytical laboratory subcontractor will ensure that the collected data meet the DLs, LODs, LOQs, and laboratory QC limits specified in this UFP-QAPP, as referenced. During the data quality review and assessment, non-conformances will be documented, and the Project Chemist will apply qualifiers in accordance with the procedures in Worksheet 36. Except for rejected data, all data are considered usable as qualified by the Project Chemist. The Project Chemist will then evaluate potential effects on data usability and work with the project team to determine whether the data are usable within the context of project objectives. The final usability assessment of data will be determined by stakeholders and the project team.

37.2 Personnel Responsible for Performing the Usability Assessment

Brice's in-house data management team will be responsible for performing the analytical data quality review and usability assessment. The Brice PM and Environmental Scientist, with support from the Brice Project Chemist, will use the results of the usability assessments to determine whether the data generated during the investigation can be used to answer the principal study questions. This data usability assessment will receive final approval from stakeholders (the government and regulators) before accepting the overall usability assessment.

Additional personnel such as geologists, statisticians, risk assessors, and others will also perform a usability assessment as it relates to specific project DQOs.

37.3 Usability Assessment Procedures and Documentation

As described in Worksheet 36, the Contractor Project Chemist will generate a CDQR to be included with the project report that describes the results of the data verification, validation, and usability assessment. The Contractor Project Chemist will work with the Contractor PM, Environmental Scientist, and other project staff to discuss conclusions drawn and determine any potential limitations on the usability of the project data as a result of the assessment. The data quality assessment will document all data non-conformance and usability determinations, even in cases where it is determined that the usability of the data is not affected.

The usability of the data collected during field activities will be assessed in several ways:

- Any deviations from proposed field activities and sampling and handling procedures will be reviewed and their effect on data usability evaluated.
- Field screening and analytical results for field samples and field and laboratory QC samples will be compared against the project DQOs and evaluated using the MPC in Worksheet 12.
- Analytical results, including ND values, will be compared against the project screening limits in Worksheet 15.
- Data verification and data quality review will be completed following the procedures in Worksheet 31/32/33, Worksheet 34, Worksheet 35, and Worksheet 36.
- Based on the results of data verification and data quality review, the usability of the data will be evaluated in the context of project-specific DQOs following the procedures in Worksheet 37.

Measurement error will be evaluated by reviewing sampling design, sampling locations, and sample collection methods. The Contractor Project Chemist or data validator will evaluate laboratory and field QC sample results (FDs, blanks, LCSs, surrogate recoveries, and matrix effect, if any) to assess the overall measurement error associated with the project.

37.4 Bias Contamination

The analytical results for blanks (including IBs, MBs, and EBs) will be checked against the MPC in Worksheet 12 to evaluate possible bias as a result of contamination.

37.4.1 Precision and Accuracy

Laboratory precision is measured by the variability associated with duplicate (two) analyses. One type of sample that can be used to assess laboratory precision is the LCS. Multiple LCS analyses over the duration of the project can be used to evaluate the overall laboratory precision for the project. In this case, the comparison is not between a sample and a duplicate sample analyzed in the same batch but between LCSs analyzed in multiple batches.

Precision and accuracy will be evaluated using DQIs such as FDs, MS/MSDs, LCSs, and surrogates. Precision and accuracy of the data set will be considered acceptable after integration of qualified results (i.e., estimated [J] and ND estimated results).

37.4.2 Representativeness

All samples for each method and matrix will be evaluated for holding time compliance. The representativeness of the project data is evaluated by reviewing qualified results regarding the use of standard methods and sampling procedures, sampling locations and quantities, and sampling design.

37.4.3 Sensitivity

Analytical methods and laboratory instrumentation are selected for use based on the ability of the method to detect target analytes at or below the screening levels. The capability of analytical laboratory methods and instrumentation to provide data with the sensitivity to meet the DQOs in the project sample matrix will be evaluated as part of the usability assessment. The DLs, LODs, and LOQs will be evaluated against the screening levels to determine whether the analytical methods and/or laboratory meet the project DQOs.

37.4.4 Comparability

Data comparability will be evaluated through the collection and analysis of FDs and field blanks. The laboratory use of standard analytical methods for their analyses and operation of instruments within their range of calibration will be reviewed. The analytical results will be reported in correct standard units. Holding times, sample preservation, and sample integrity will be evaluated for compliance with QC criteria.

Complete field documentation using standardized data collection forms will support the assessment of comparability. Historical comparability will be achieved through consistent use of methods and documentation procedures throughout the project. Assessment of comparability is primarily subjective. Experienced environmental professionals with a clear knowledge of the DQOs and project decisions should interpret the results.

37.4.5 Completeness

Following the data validation, a completeness check will be performed based on the MPC in Worksheet 12. Valid data are data that are usable in the context of the project goals. Completeness is calculated and reported for each method, matrix, and analyte combination. The number of valid results divided by the number of possible individual analyte results, expressed as a percentage, determines the completeness of the data set.

For completeness requirements, valid results are all results not qualified as rejected with an X-flag (draft) or R-flag (final) after the usability assessment has been performed. Completeness should not be determined based solely on the laboratory data qualifiers.

37.4.6 Uncertainty Based on Laboratory Limits of Quantitation

LOQs, LODs, and DLs for sample results will be evaluated against the UFP-QAPP requirements. The LOQs for non-detect results will be evaluated against the laboratory limits and cleanup levels and/or screening criteria in Worksheet 15. If the LOQ exceeds the PSL, the LOD will be evaluated.

The laboratory LOQs, LODs, and DLs included in Worksheet 15 represent the achievable limits for analytes in a laboratory matrix. However, analysis of field samples may result in sample dilutions that cause elevation of laboratory reporting limits above PSLs.

When the PSL is less than the DL, the sample result cannot be used to verify that the chemical is not of potential concern at the site. A high degree of uncertainty exists when the PSL is greater than the DL and less than the LOD for non-detect results, and these non-detect results should be considered potentially greater than the screening level. When the PSL is greater than the LOD and less than the LOQ and the sample result is non-detect, by definition there is a 1% false negative rate, and the result will be considered below PSL with 99% confidence. For non-detect results with LODs over the PSL, the potential for the presence of those analytes will be evaluated based on site history, uses of the analyte, and professional judgment in coordination with the regulatory agencies. Table 37-1 presents the data usability assessment criteria.

Table 37-1 Data Usability Assessment

Item	Assessment Activity	Responsibility
Laboratory data deliverables and Work Plan	Ensure that all necessary information was provided, including (but not limited to) QC sample results and data validation results.	Brice Project Chemist
Sampling locations, deviation	Determine whether alterations to sampling locations continue to satisfy the project DQOs.	Brice Field Scientist, Brice Field Team Lead, Brice PM
CoC, deviation	Establish that any problems with documentation or custody procedures do not prevent the data from being used for the intended purpose.	Brice Project Chemist
Holding times, deviation	Determine the acceptability of data where holding times were exceeded.	Brice Project Chemist
SOPs and methods, deviations	Evaluate the impact of deviations from analytical and field SOPs and specified methods on data quality.	Brice Field Scientist, Brice Field Team Lead, Brice Project Chemist
QC samples	Evaluate the implications of unacceptable QC sample results on the data usability for the associated samples. For example, consider the effects of observed blank contamination.	Brice Project Chemist
Matrix	Evaluate matrix effects (interference or bias).	Brice Project Chemist
Meteorological data and site conditions	Evaluate the possible effects of meteorological (e.g., wind, rain, temperature) and site conditions on sample results. Review field reports to identify whether any unusual conditions were present and how the sampling plan was executed.	Brice Field Scientist, Brice Field Team Lead
Comparability	Ensure that results from different data collection events achieve an acceptable level of agreement.	Brice Project Chemist
Completeness	Evaluate the impact of missing information. Ensure that enough information was obtained for the data to be usable (completeness as defined in the project DQOs documented in this UFP-QAPP).	Brice PM, Brice Field Team, Brice Project Chemist
Critical samples	Establish that critical samples and critical target analytes, as defined in the UFP-QAPP, were collected and analyzed. Determine whether the results meet criteria specified in the UFP-QAPP.	Brice PM, Brice Field Team, Brice Project Chemist
Data restrictions	Describe the exact process for handling data that do not meet project DQOs (i.e., when MPC are not met). Depending on how those data will be used, specify the restrictions on use of those data for environmental decision-making.	Brice PM, Brice Field Team, Brice Project Chemist
Usability decision	Determine whether the data can be used to make a specific decision considering the implications of all deviations and corrective actions.	Brice PM, Brice Field Team, Brice Project Chemist

Table 37-1 Data Usability Assessment

Item	Assessment Activity	Responsibility
Usability report	Discuss and compare overall precision, accuracy/bias, representativeness, comparability, completeness, and sensitivity for each matrix, analytical group, and concentration level. Describe limitations on the use of project data if criteria for DQIs are not met.	Brice Project Chemist

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

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Attachment A-1
Conceptual Site Models

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Print Form

Appendix A - Human Health Conceptual Site Model Scoping Form and Standardized Graphic

Site Name: U.S. Army Haines POL Terminal - Former Fire Hose Building 1203

File Number: 1508.38.002

Completed by: Brice Environmental Services

Introduction

The form should be used to reach agreement with the Alaska Department of Environmental Conservation (DEC) about which exposure pathways should be further investigated during site characterization. From this information, summary text about the CSM and a graphic depicting exposure pathways should be submitted with the site characterization work plan and updated as needed in later reports.

General Instructions: Follow the italicized instructions in each section below.

1. General Information:

Sources *(check potential sources at the site)*

- ☐ USTs
- ☐ ASTs
- ☐ Dispensers/fuel loading racks
- ☐ Drums
- ☐ Vehicles
- ☐ Landfills
- ☐ Transformers
- ☒ Other: Fire fighting hoses

Release Mechanisms *(check potential release mechanisms at the site)*

- ☒ Spills
- ☒ Leaks
- ☐ Direct discharge
- ☐ Burning
- ☐ Other:

Impacted Media *(check potentially-impacted media at the site)*

- ☒ Surface soil (0-2 feet bgs*)
- ☒ Subsurface soil (>2 feet bgs)
- ☐ Air
- ☒ Sediment
- ☒ Groundwater
- ☒ Surface water
- ☒ Biota
- ☐ Other:

Receptors *(check receptors that could be affected by contamination at the site)*

- ☐ Residents (adult or child)
- ☒ Commercial or industrial worker
- ☒ Construction worker
- ☒ Subsistence harvester (i.e. gathers wild foods)
- ☒ Subsistence consumer (i.e. eats wild foods)
- ☒ Site visitor
- ☒ Trespasser
- ☒ Recreational user
- ☐ Farmer
- ☐ Other:

* bgs - below ground surface

2. Exposure Pathways: *(The answers to the following questions will identify complete exposure pathways at the site. Check each box where the answer to the question is "yes".)*

a) Direct Contact -

1. Incidental Soil Ingestion

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site-specific basis.) ☒

If the box is checked, label this pathway complete: Complete

Comments:

Contaminants may be potentially present in the soil, previous sampling events were non-detect for PFAS compounds. However, PFAS is found in the groundwater and further investigation is required.

2. Dermal Absorption of Contaminants from Soil

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Can the soil contaminants permeate the skin (see Appendix B in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

Contaminants may be potentially present in the soil, previous sampling events were non-detect for PFAS compounds. However, PFAS is found in the groundwater and further investigation is required. PFOS is listed in Appendix B of the CSM guidance document as being able to permeate the skin.

b) Ingestion -

1. Ingestion of Groundwater

Have contaminants been detected or are they expected to be detected in the groundwater, or are contaminants expected to migrate to groundwater in the future? ☒

Could the potentially affected groundwater be used as a current or future drinking water source? Please note, only leave the box unchecked if DEC has determined the groundwater is not a currently or reasonably expected future source of drinking water according to 18 AAC 75.350. ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

PFOS is present at 87 ng/L in groundwater, in exceedance of the RSL 4 ng/L. The perched aquifers are not likely to be a viable drinking water source due to their discontinuous nature and low-productivity lenses. The fractured bedrock aquifer and discontinuous sands and gravels overlying bedrock have the potential for saltwater intrusion.

2. Ingestion of Surface Water

Have contaminants been detected or are they expected to be detected in surface water, or are contaminants expected to migrate to surface water in the future? ☒

Could potentially affected surface water bodies be used, currently or in the future, as a drinking water source? Consider both public water systems and private use (i.e., during residential, recreational or subsistence activities). ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

Groundwater contamination is found in the Emergent Beach Deposit Aquifer that surfaces at seeps into Tanani Bay, seeps are visible during low-tide. The bay is not a drinking water source because of salt water.

3. Ingestion of Wild and Farmed Foods

Is the site in an area that is used or reasonably could be used for hunting, fishing, or harvesting of wild or farmed foods? ☒

Do the site contaminants have the potential to bioaccumulate (see Appendix C in the guidance document)? ☒

Are site contaminants located where they would have the potential to be taken up into biota? (i.e. soil within the root zone for plants or burrowing depth for animals, in groundwater that could be connected to surface water, etc.) ☒

If all of the boxes are checked, label this pathway complete: Complete

Comments:

This site could reasonably support subsistence activities in the future. Previously berry pickers have been observed just beyond the fence line. It is unlikely that contamination from Building 1203 extends that far. PFOS can bioaccumulate and groundwater is connected to surface water (Tanani Bay).

c) Inhalation-

1. Inhalation of Outdoor Air

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Are the contaminants in soil volatile (see Appendix D in the guidance document)? ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

PFAS compounds are not considered to be volatile and are not listed in Appendix D of the CSM guidance.

2. Inhalation of Indoor Air

Are occupied buildings on the site or reasonably expected to be occupied or placed on the site in an area that could be affected by contaminant vapors? (within 30 horizontal or vertical feet of petroleum contaminated soil or groundwater; within 100 feet of non-petroleum contaminted soil or groundwater; or subject to "preferential pathways," which promote easy airflow like utility conduits or rock fractures) ☒

Are volatile compounds present in soil or groundwater (see Appendix D in the guidance document)? ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

The National Guard dormitory Building 1204 is within 100 feet of the Former Hose Building 1203, it is only occasionally occupied. There is the potential that a building could be placed in the area of Building 1203 in the future, however PFAS compounds are not listed in Appendix D of the CSM guidance.

3. **Additional Exposure Pathways:** *(Although there are no definitive questions provided in this section, these exposure pathways should also be considered at each site. Use the guidelines provided below to determine if further evaluation of each pathway is warranted.)*

Dermal Exposure to Contaminants in Groundwater and Surface Water

Dermal exposure to contaminants in groundwater and surface water may be a complete pathway if:

- Climate permits recreational use of waters for swimming.
- Climate permits exposure to groundwater during activities, such as construction.
- Groundwater or surface water is used for household purposes, such as bathing or cleaning.

Generally, DEC groundwater cleanup levels in 18 AAC 75, Table C, are deemed protective of this pathway because dermal absorption is incorporated into the groundwater exposure equation for residential uses.

Check the box if further evaluation of this pathway is needed: ☒

Comments:

Current workers could come into contact with groundwater during excavation activities if they were to occur at the site. It is not reasonably anticipated that future residential development will occur. Further evaluation of this pathway is required.

Inhalation of Volatile Compounds in Tap Water

Inhalation of volatile compounds in tap water may be a complete pathway if:

- The contaminated water is used for indoor household purposes such as showering, laundering, and dish washing.
- The contaminants of concern are volatile (common volatile contaminants are listed in Appendix D in the guidance document.)

DEC groundwater cleanup levels in 18 AAC 75, Table C are protective of this pathway because the inhalation of vapors during normal household activities is incorporated into the groundwater exposure equation.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

PFAS compounds are not listed in Appendix D of the CSM guidance, further evaluation of this pathway is not required.

Inhalation of Fugitive Dust

Inhalation of fugitive dust may be a complete pathway if:

- Nonvolatile compounds are found in the top 2 centimeters of soil. The top 2 centimeters of soil are likely to be dispersed in the wind as dust particles.
- Dust particles are less than 10 micrometers (Particulate Matter - PM_{10}). Particles of this size are called respirable particles and can reach the pulmonary parts of the lungs when inhaled.

DEC human health soil cleanup levels in Table B1 of 18 AAC 75 are protective of this pathway because the inhalation of particulates is incorporated into the soil exposure equation.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

This pathway is incomplete as the soil is vegetated and not likely to be dispersed in the wind as dust particles. No further evaluation of this pathway is required.

Direct Contact with Sediment

This pathway involves people's hands being exposed to sediment, such as during some recreational, subsistence, or industrial activity. People then incidentally ingest sediment from normal hand-to-mouth activities. In addition, dermal absorption of contaminants may be of concern if the the contaminants are able to permeate the skin (see Appendix B in the guidance document). This type of exposure should be investigated if:

- Climate permits recreational activities around sediment.
- The community has identified subsistence or recreational activities that would result in exposure to the sediment, such as clam digging.

Generally, DEC direct contact soil cleanup levels in 18 AAC 75, Table B1, are assumed to be protective of direct contact with sediment.

Check the box if further evaluation of this pathway is needed: ☒

Comments:

Groundwater enters Tanani Bay through surface seeps, visible at low tide, and PFOS is listed in Appendix B of the guidance document. The shoreline along Tanani Bay allows for recreational activities around sediment and there could be the potential for subsistence harvesting. Further evaluation of this pathway is required.

4. Other Comments *(Provide other comments as necessary to support the information provided in this form.)*

HUMAN HEALTH CONCEPTUAL SITE MODEL GRAPHIC FORM

Site: Former Fire Hose Building 1203
HFT Site - Former Administrative Area

Completed By: Brice Environmental Services
Date Completed: December 2023

***Instructions*: Follow the numbered directions below. Do not consider contaminant concentrations or engineering/land use controls when describing pathways.**

(1)
Check the media that could be directly affected by the release.

(2)
For each medium identified in (1), follow the top arrow and check possible transport mechanisms. Check additional media under (1) if the media acts as a secondary source.

(3)
Check all exposure media identified in (2).

(4)
*Check all pathways that could be complete. The pathways identified in this column **must** agree with Sections 2 and 3 of the Human Health CSM Scoping Form.*

(5)
Identify the receptors potentially affected by each exposure pathway: Enter "C" for current receptors, "F" for future receptors, "C/F" for both current and future receptors, or "I" for insignificant exposure.

Current & Future Receptors

Media	Transport Mechanisms	Exposure Media	Exposure Pathway/Route	Residents (adults or children)	Commercial or industrial workers	Site visitors, trespassers, or recreational users	Construction workers	Farmers or subsistence harvesters	Subsistence consumers	Other
☑ Surface Soil (0-2 ft bgs)	☑ Direct release to surface soil — check soil	☑ soil	☑ Incidental Soil Ingestion		F	C/F	C/F	F	F	
	☑ Migration to subsurface — check soil		☑ Dermal Absorption of Contaminants from Soil		F	C/F	C/F	F	F	
	☑ Migration to groundwater — check groundwater		☐ Inhalation of Fugitive Dust							
	☐ Volatilization — check air									
	☐ Runoff or erosion — check surface water									
	☑ Uptake by plants or animals — check biota									
	☐ Other (list):									
☑ Subsurface Soil (2-15 ft bgs)	☑ Direct release to subsurface soil — check soil	☑ groundwater	☑ Ingestion of Groundwater		F	F	F	I	I	
	☑ Migration to groundwater — check groundwater		☑ Dermal Absorption of Contaminants in Groundwater		F	F	F	I	I	
	☐ Volatilization — check air		☐ Inhalation of Volatile Compounds in Tap Water							
	☑ Uptake by plants or animals — check biota									
	☐ Other (list):									
☑ Ground-water	☑ Direct release to groundwater — check groundwater	☐ air	☐ Inhalation of Outdoor Air							
	☐ Volatilization — check air		☐ Inhalation of Indoor Air							
	☑ Flow to surface water body — check surface water		☐ Inhalation of Fugitive Dust							
	☑ Flow to sediment — check sediment									
	☑ Uptake by plants or animals — check biota									
	☐ Other (list):									
☑ Surface Water	☑ Direct release to surface water — check surface water	☑ surface water	☐ Ingestion of Surface Water							
	☐ Volatilization — check air		☑ Dermal Absorption of Contaminants in Surface Water		F	C/F	I	C/F	C/F	
	☑ Sedimentation — check sediment		☐ Inhalation of Volatile Compounds in Tap Water							
	☑ Uptake by plants or animals — check biota									
	☐ Other (list):									
☑ Sediment	☑ Direct release to sediment — check sediment	☑ sediment	☑ Direct Contact with Sediment		F	C/F	C/F	C/F	C/F	
	☑ Resuspension, runoff, or erosion — check surface water									
	☑ Uptake by plants or animals — check biota									
	☐ Other (list):									
		☑ biota	☑ Ingestion of Wild or Farmed Foods		I	C/F	I	C/F	C/F	

Revised, 10/01/2010

Print Form

Appendix A - Human Health Conceptual Site Model Scoping Form and Standardized Graphic

Site Name: U.S. Army Haines POL Terminal - Former Fire Pump Building 1208

File Number: 1508.38.002

Completed by: Brice Environmental Services

Introduction

The form should be used to reach agreement with the Alaska Department of Environmental Conservation (DEC) about which exposure pathways should be further investigated during site characterization. From this information, summary text about the CSM and a graphic depicting exposure pathways should be submitted with the site characterization work plan and updated as needed in later reports.

General Instructions: Follow the italicized instructions in each section below.

1. General Information:

Sources *(check potential sources at the site)*

- ☐ USTs
- ☐ ASTs
- ☐ Dispensers/fuel loading racks
- ☒ Drums
- ☐ Vehicles
- ☐ Landfills
- ☐ Transformers
- ☒ Other: Firefighting activities including use, storage, and disposal of PFAS containing materials.

Release Mechanisms *(check potential release mechanisms at the site)*

- ☒ Spills
- ☒ Leaks
- ☒ Direct discharge
- ☐ Burning
- ☐ Other:

Impacted Media *(check potentially-impacted media at the site)*

- ☒ Surface soil (0-2 feet bgs*)
- ☒ Subsurface soil (>2 feet bgs)
- ☐ Air
- ☒ Sediment
- ☒ Groundwater
- ☒ Surface water
- ☒ Biota
- ☐ Other:

Receptors *(check receptors that could be affected by contamination at the site)*

- ☐ Residents (adult or child)
- ☒ Commercial or industrial worker
- ☒ Construction worker
- ☒ Subsistence harvester (i.e. gathers wild foods)
- ☒ Subsistence consumer (i.e. eats wild foods)
- ☒ Site visitor
- ☒ Trespasser
- ☒ Recreational user
- ☐ Farmer
- ☐ Other:

* bgs - below ground surface

2. Exposure Pathways: *(The answers to the following questions will identify complete exposure pathways at the site. Check each box where the answer to the question is "yes".)*

a) Direct Contact -

1. Incidental Soil Ingestion

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site-specific basis.) ☒

If the box is checked, label this pathway complete: Complete

Comments:

Contaminants may be potentially present in the soil, previous sampling events were non-detect for PFAS compounds. However, PFAS is found in the groundwater and further investigation is required.

2. Dermal Absorption of Contaminants from Soil

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Can the soil contaminants permeate the skin (see Appendix B in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

Contaminants may be potentially present in the soil, previous sampling events were non-detect for PFAS compounds. However, PFAS is found in the groundwater and further investigation is required. PFOS is listed in Appendix B of the CSM guidance document.

b) Ingestion -

1. Ingestion of Groundwater

Have contaminants been detected or are they expected to be detected in the groundwater, or are contaminants expected to migrate to groundwater in the future? ☒

Could the potentially affected groundwater be used as a current or future drinking water source? Please note, only leave the box unchecked if DEC has determined the groundwater is not a currently or reasonably expected future source of drinking water according to 18 AAC 75.350. ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

PFOS is present at 43 ng/L in groundwater, in exceedance of the RSL 4 ng/L. The perched aquifers are not likely to be a viable drinking water source due to their discontinuous nature and low-productivity lenses. The fractured bedrock aquifer and discontinuous sands and gravels overlying bedrock have the potential for saltwater intrusion.

2. Ingestion of Surface Water

Have contaminants been detected or are they expected to be detected in surface water, or are contaminants expected to migrate to surface water in the future? ☒

Could potentially affected surface water bodies be used, currently or in the future, as a drinking water source? Consider both public water systems and private use (i.e., during residential, recreational or subsistence activities). ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

Groundwater contamination is found in the Emergent Beach Deposit Aquifer that surfaces into Tanani Bay, seeps are visible during low-tide. The bay is not a drinking water source because of salt water.

3. Ingestion of Wild and Farmed Foods

Is the site in an area that is used or reasonably could be used for hunting, fishing, or harvesting of wild or farmed foods? ☒

Do the site contaminants have the potential to bioaccumulate (see Appendix C in the guidance document)? ☒

Are site contaminants located where they would have the potential to be taken up into biota? (i.e. soil within the root zone for plants or burrowing depth for animals, in groundwater that could be connected to surface water, etc.) ☒

If all of the boxes are checked, label this pathway complete: Complete

Comments:

This site could reasonably support subsistence activities in the future. Previously berry pickers have been observed just beyond the fence line. It is unlikely that contamination from Building 1208 extends that far. PFOS can bioaccumulate and groundwater is connected to surface water (Tanani Bay).

c) Inhalation-

1. Inhalation of Outdoor Air

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Are the contaminants in soil volatile (see Appendix D in the guidance document)? ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

PFAS compounds are not considered to be volatile and are not listed in Appendix D of the CSM guidance.

2. Inhalation of Indoor Air

Are occupied buildings on the site or reasonably expected to be occupied or placed on the site in an area that could be affected by contaminant vapors? (within 30 horizontal or vertical feet of petroleum contaminated soil or groundwater; within 100 feet of non-petroleum contaminted soil or groundwater; or subject to "preferential pathways," which promote easy airflow like utility conduits or rock fractures) ☒

Are volatile compounds present in soil or groundwater (see Appendix D in the guidance document)? ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

There are no occupied buildings within 100 feet of the former Fire Pump Building 1208. There is the potential that a building could be placed here in the future, however PFAS compounds are not listed in Appendix D of the CSM guidance.

3. **Additional Exposure Pathways:** *(Although there are no definitive questions provided in this section, these exposure pathways should also be considered at each site. Use the guidelines provided below to determine if further evaluation of each pathway is warranted.)*

Dermal Exposure to Contaminants in Groundwater and Surface Water

Dermal exposure to contaminants in groundwater and surface water may be a complete pathway if:

- Climate permits recreational use of waters for swimming.
- Climate permits exposure to groundwater during activities, such as construction.
- Groundwater or surface water is used for household purposes, such as bathing or cleaning.

Generally, DEC groundwater cleanup levels in 18 AAC 75, Table C, are deemed protective of this pathway because dermal absorption is incorporated into the groundwater exposure equation for residential uses.

Check the box if further evaluation of this pathway is needed: ☒

Comments:

Current workers could come into contact with groundwater during excavation activities if they were to occur at the site. It is not reasonably anticipated that future residential development will occur. Further evaluation of this pathway is required.

Inhalation of Volatile Compounds in Tap Water

Inhalation of volatile compounds in tap water may be a complete pathway if:

- The contaminated water is used for indoor household purposes such as showering, laundering, and dish washing.
- The contaminants of concern are volatile (common volatile contaminants are listed in Appendix D in the guidance document.)

DEC groundwater cleanup levels in 18 AAC 75, Table C are protective of this pathway because the inhalation of vapors during normal household activities is incorporated into the groundwater exposure equation.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

PFAS compounds are not listed in Appendix D of the CSM guidance, further evaluation of this pathway is not required.

Inhalation of Fugitive Dust

Inhalation of fugitive dust may be a complete pathway if:

- Nonvolatile compounds are found in the top 2 centimeters of soil. The top 2 centimeters of soil are likely to be dispersed in the wind as dust particles.
- Dust particles are less than 10 micrometers (Particulate Matter - PM_{10}). Particles of this size are called respirable particles and can reach the pulmonary parts of the lungs when inhaled.

DEC human health soil cleanup levels in Table B1 of 18 AAC 75 are protective of this pathway because the inhalation of particulates is incorporated into the soil exposure equation.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

This pathway is incomplete as the soil is vegetated and not likely to be dispersed in the wind as dust particles. No further evaluation of this pathway is required.

Direct Contact with Sediment

This pathway involves people's hands being exposed to sediment, such as during some recreational, subsistence, or industrial activity. People then incidentally ingest sediment from normal hand-to-mouth activities. In addition, dermal absorption of contaminants may be of concern if the the contaminants are able to permeate the skin (see Appendix B in the guidance document). This type of exposure should be investigated if:

- Climate permits recreational activities around sediment.
- The community has identified subsistence or recreational activities that would result in exposure to the sediment, such as clam digging.

Generally, DEC direct contact soil cleanup levels in 18 AAC 75, Table B1, are assumed to be protective of direct contact with sediment.

Check the box if further evaluation of this pathway is needed: ☒

Comments:

Groundwater enters Tanani Bay through surface seeps, visible at low tide, and PFOS is listed in Appendix B of the guidance document. The shoreline along Tanani Bay allows for recreational activities around sediment and there could be the potential for subsistence harvesting. Further evaluation of this pathway is required.

4. Other Comments *(Provide other comments as necessary to support the information provided in this form.)*

HUMAN HEALTH CONCEPTUAL SITE MODEL GRAPHIC FORM

Site: Former Fire Pump Building 1208
HFT Site - Former Administrative Area

Completed By: Brice Environmental Services
Date Completed: December 2023

***Instructions*: Follow the numbered directions below. Do not consider contaminant concentrations or engineering/land use controls when describing pathways.**

(1)
Check the media that could be directly affected by the release.

(2)
For each medium identified in (1), follow the top arrow and check possible transport mechanisms. Check additional media under (1) if the media acts as a secondary source.

(3)
Check all exposure media identified in (2).

(4)
*Check all pathways that could be complete. The pathways identified in this column **must** agree with Sections 2 and 3 of the Human Health CSM Scoping Form.*

(5)
Identify the receptors potentially affected by each exposure pathway: Enter "C" for current receptors, "F" for future receptors, "C/F" for both current and future receptors, or "I" for insignificant exposure.

Current & Future Receptors

Media	Transport Mechanisms	Exposure Media	Exposure Pathway/Route	Residents (adults or children)	Commercial or industrial workers	Site visitors, trespassers, or recreational users	Construction workers	Farmers or subsistence harvesters	Subsistence consumers	Other
☑ Surface Soil (0-2 ft bgs)	☑ Direct release to surface soil — check soil	☑ soil	☑ Incidental Soil Ingestion		F	C/F	C/F	F	F	
	☑ Migration to subsurface — check soil		☑ Dermal Absorption of Contaminants from Soil		F	C/F	C/F	F	F	
	☑ Migration to groundwater — check groundwater		☐ Inhalation of Fugitive Dust							
	☐ Volatilization — check air									
	☐ Runoff or erosion — check surface water									
	☑ Uptake by plants or animals — check biota									
	☐ Other (list):									
☑ Subsurface Soil (2-15 ft bgs)	☑ Direct release to subsurface soil — check soil	☑ groundwater	☑ Ingestion of Groundwater		F	F	F	I	I	
	☑ Migration to groundwater — check groundwater		☑ Dermal Absorption of Contaminants in Groundwater		F	F	F	I	I	
	☐ Volatilization — check air		☐ Inhalation of Volatile Compounds in Tap Water							
	☑ Uptake by plants or animals — check biota									
	☐ Other (list):									
☑ Ground-water	☑ Direct release to groundwater — check groundwater	☐ air	☐ Inhalation of Outdoor Air							
	☐ Volatilization — check air		☐ Inhalation of Indoor Air							
	☑ Flow to surface water body — check surface water		☐ Inhalation of Fugitive Dust							
	☑ Flow to sediment — check sediment									
	☑ Uptake by plants or animals — check biota									
	☐ Other (list):									
☑ Surface Water	☑ Direct release to surface water — check surface water	☑ surface water	☐ Ingestion of Surface Water							
	☐ Volatilization — check air		☑ Dermal Absorption of Contaminants in Surface Water		F	C/F	I	C/F	C/F	
	☑ Sedimentation — check sediment		☐ Inhalation of Volatile Compounds in Tap Water							
	☑ Uptake by plants or animals — check biota									
	☐ Other (list):									
☑ Sediment	☑ Direct release to sediment — check sediment	☑ sediment	☑ Direct Contact with Sediment		F	C/F	C/F	C/F	C/F	
	☑ Resuspension, runoff, or erosion — check surface water									
	☑ Uptake by plants or animals — check biota									
	☐ Other (list):									
		☑ biota	☑ Ingestion of Wild or Farmed Foods		I	C/F	I	C/F	C/F	

Revised, 10/01/2010

Print Form

Appendix A - Human Health Conceptual Site Model Scoping Form and Standardized Graphic

Site Name: U.S. Army Haines POL Terminal - Building 1212

File Number: 1508.38.002

Completed by: Brice Environmental Services Corporation

Introduction

The form should be used to reach agreement with the Alaska Department of Environmental Conservation (DEC) about which exposure pathways should be further investigated during site characterization. From this information, summary text about the CSM and a graphic depicting exposure pathways should be submitted with the site characterization work plan and updated as needed in later reports.

General Instructions: Follow the italicized instructions in each section below.

1. General Information:

Sources *(check potential sources at the site)*

- ☐ USTs
- ☐ ASTs
- ☐ Dispensers/fuel loading racks
- ☒ Drums
- ☐ Vehicles
- ☐ Landfills
- ☐ Transformers
- ☒ Other: Firefighting activities including use, storage, and disposal of PFAS containing materials.

Release Mechanisms *(check potential release mechanisms at the site)*

- ☒ Spills
- ☒ Leaks
- ☒ Direct discharge
- ☐ Burning
- ☐ Other:

Impacted Media *(check potentially-impacted media at the site)*

- ☒ Surface soil (0-2 feet bgs*)
- ☒ Subsurface soil (>2 feet bgs)
- ☐ Air
- ☒ Sediment
- ☒ Groundwater
- ☒ Surface water
- ☒ Biota
- ☐ Other:

Receptors *(check receptors that could be affected by contamination at the site)*

- ☐ Residents (adult or child)
- ☒ Commercial or industrial worker
- ☒ Construction worker
- ☒ Subsistence harvester (i.e. gathers wild foods)
- ☒ Subsistence consumer (i.e. eats wild foods)
- ☒ Site visitor
- ☒ Trespasser
- ☒ Recreational user
- ☐ Farmer
- ☐ Other:

* bgs - below ground surface

2. Exposure Pathways: *(The answers to the following questions will identify complete exposure pathways at the site. Check each box where the answer to the question is "yes".)*

a) Direct Contact -

1. Incidental Soil Ingestion

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site-specific basis.) ☒

If the box is checked, label this pathway complete: Complete

Comments:

Contaminants may be potentially present in the soil, previous sampling events were non-detect for PFAS compounds. However, PFAS is found in the groundwater and further investigation is required.

2. Dermal Absorption of Contaminants from Soil

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Can the soil contaminants permeate the skin (see Appendix B in the guidance document)? ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

Contaminants may be potentially present in the soil, previous sampling events were non-detect for PFAS compounds. However, PFAS is found in the groundwater and further investigation is required. PFOS is listed in Appendix B of the CSM guidance document.

b) Ingestion -

1. Ingestion of Groundwater

Have contaminants been detected or are they expected to be detected in the groundwater, or are contaminants expected to migrate to groundwater in the future? ☒

Could the potentially affected groundwater be used as a current or future drinking water source? Please note, only leave the box unchecked if DEC has determined the groundwater is not a currently or reasonably expected future source of drinking water according to 18 AAC 75.350. ☒

If both boxes are checked, label this pathway complete: Complete

Comments:

PFOS (270 ng/L) and PFHxS (45 ng/L) are present in groundwater in exceedance of RSLs. The perched aquifers are not likely to be a viable drinking water source due to their discontinuous nature and low-productivity lenses. The fractured bedrock aquifer and discontinuous sands and gravels overlying bedrock have the potential for saltwater intrusion.

2. Ingestion of Surface Water

Have contaminants been detected or are they expected to be detected in surface water, or are contaminants expected to migrate to surface water in the future? ☒

Could potentially affected surface water bodies be used, currently or in the future, as a drinking water source? Consider both public water systems and private use (i.e., during residential, recreational or subsistence activities). ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

Groundwater contamination is found in the Emergent Beach Deposit Aquifer that surfaces into Tanani Bay, seeps are visible during low-tide. The bay is not a drinking water source because of salt water.

3. Ingestion of Wild and Farmed Foods

Is the site in an area that is used or reasonably could be used for hunting, fishing, or harvesting of wild or farmed foods? ☒

Do the site contaminants have the potential to bioaccumulate (see Appendix C in the guidance document)? ☒

Are site contaminants located where they would have the potential to be taken up into biota? (i.e. soil within the root zone for plants or burrowing depth for animals, in groundwater that could be connected to surface water, etc.) ☒

If all of the boxes are checked, label this pathway complete: Complete

Comments:

This site could reasonably support subsistence activities in the future. Previously berry pickers have been observed just beyond the fence line. It is unlikely that contamination from Building 1212 extends that far. PFOS can bioaccumulate and groundwater is connected to surface water (Tanani Bay).

c) Inhalation-

1. Inhalation of Outdoor Air

Are contaminants present or potentially present in surface soil between 0 and 15 feet below the ground surface? (Contamination at deeper depths may require evaluation on a site specific basis.) ☒

Are the contaminants in soil volatile (see Appendix D in the guidance document)? ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

PFAS compounds are not considered to be volatile and are not listed in Appendix D of the CSM guidance.

2. Inhalation of Indoor Air

Are occupied buildings on the site or reasonably expected to be occupied or placed on the site in an area that could be affected by contaminant vapors? (within 30 horizontal or vertical feet of petroleum contaminated soil or groundwater; within 100 feet of non-petroleum contaminted soil or groundwater; or subject to "preferential pathways," which promote easy airflow like utility conduits or rock fractures) ☒

Are volatile compounds present in soil or groundwater (see Appendix D in the guidance document)? ☐

If both boxes are checked, label this pathway complete: Incomplete

Comments:

There are no occupied buildings located within 100 feet of the site. There is the potential that a building could be placed here in the future, however PFAS compounds are not listed in Appendix D of the CMS guidance.

3. **Additional Exposure Pathways:** *(Although there are no definitive questions provided in this section, these exposure pathways should also be considered at each site. Use the guidelines provided below to determine if further evaluation of each pathway is warranted.)*

Dermal Exposure to Contaminants in Groundwater and Surface Water

Dermal exposure to contaminants in groundwater and surface water may be a complete pathway if:

- Climate permits recreational use of waters for swimming.
- Climate permits exposure to groundwater during activities, such as construction.
- Groundwater or surface water is used for household purposes, such as bathing or cleaning.

Generally, DEC groundwater cleanup levels in 18 AAC 75, Table C, are deemed protective of this pathway because dermal absorption is incorporated into the groundwater exposure equation for residential uses.

Check the box if further evaluation of this pathway is needed: ☒

Comments:

Current workers could come into contact with groundwater during excavation activities if they were to occur at the site. It is not reasonably anticipated that future residential development will occur. Further evaluation of this pathway is required.

Inhalation of Volatile Compounds in Tap Water

Inhalation of volatile compounds in tap water may be a complete pathway if:

- The contaminated water is used for indoor household purposes such as showering, laundering, and dish washing.
- The contaminants of concern are volatile (common volatile contaminants are listed in Appendix D in the guidance document.)

DEC groundwater cleanup levels in 18 AAC 75, Table C are protective of this pathway because the inhalation of vapors during normal household activities is incorporated into the groundwater exposure equation.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

PFAS compounds are not listed in Appendix D of the CSM guidance, further evaluation of this pathway is not required.

Inhalation of Fugitive Dust

Inhalation of fugitive dust may be a complete pathway if:

- Nonvolatile compounds are found in the top 2 centimeters of soil. The top 2 centimeters of soil are likely to be dispersed in the wind as dust particles.
- Dust particles are less than 10 micrometers (Particulate Matter - PM_{10}). Particles of this size are called respirable particles and can reach the pulmonary parts of the lungs when inhaled.

DEC human health soil cleanup levels in Table B1 of 18 AAC 75 are protective of this pathway because the inhalation of particulates is incorporated into the soil exposure equation.

Check the box if further evaluation of this pathway is needed: ☐

Comments:

This pathway is incomplete as the soil is vegetated and not likely to be dispersed in the wind as dust particles. No further evaluation of this pathway is required.

Direct Contact with Sediment

This pathway involves people's hands being exposed to sediment, such as during some recreational, subsistence, or industrial activity. People then incidentally ingest sediment from normal hand-to-mouth activities. In addition, dermal absorption of contaminants may be of concern if the the contaminants are able to permeate the skin (see Appendix B in the guidance document). This type of exposure should be investigated if:

- Climate permits recreational activities around sediment.
- The community has identified subsistence or recreational activities that would result in exposure to the sediment, such as clam digging.

Generally, DEC direct contact soil cleanup levels in 18 AAC 75, Table B1, are assumed to be protective of direct contact with sediment.

Check the box if further evaluation of this pathway is needed: ☒

Comments:

Groundwater enters Tanani Bay through surface seeps, visible at low tide, and PFOS is listed in Appendix B of the guidance document. The shoreline along Tanani Bay allows for recreational activities around sediment and there could be the potential for subsistence harvesting. Further evaluation of this pathway is required.

4. Other Comments *(Provide other comments as necessary to support the information provided in this form.)*

HUMAN HEALTH CONCEPTUAL SITE MODEL GRAPHIC FORM

Site: Former Firefighter Office, Shop and Garage Building 1212
HFT Site - Former Administrative Area

Completed By: Brice Environmental Services

Date Completed: December 2023

***Instructions*: Follow the numbered directions below. Do not consider contaminant concentrations or engineering/land use controls when describing pathways.**

(1)
Check the media that could be directly affected by the release.

(2)
For each medium identified in (1), follow the top arrow and check possible transport mechanisms. Check additional media under (1) if the media acts as a secondary source.

(3)
Check all exposure media identified in (2).

(4)
*Check all pathways that could be complete. The pathways identified in this column **must** agree with Sections 2 and 3 of the Human Health CSM Scoping Form.*

(5)
Identify the receptors potentially affected by each exposure pathway: Enter "C" for current receptors, "F" for future receptors, "C/F" for both current and future receptors, or "I" for insignificant exposure.

Current & Future Receptors

Media	Transport Mechanisms	Exposure Media	Exposure Pathway/Route	Residents (adults or children)	Commercial or industrial workers	Site visitors, trespassers, or recreational users	Construction workers	Farmers or subsistence harvesters	Subsistence consumers	Other
☑ Surface Soil (0-2 ft bgs)	☑ Direct release to surface soil — check soil									
	☑ Migration to subsurface — check soil									
	☑ Migration to groundwater — check groundwater									
	☐ Volatilization — check air									
	☐ Runoff or erosion — check surface water									
	☑ Uptake by plants or animals — check biota									
	☐ Other (list):									
☑ Subsurface Soil (2-15 ft bgs)	☑ Direct release to subsurface soil — check soil									
	☑ Migration to groundwater — check groundwater									
	☐ Volatilization — check air									
	☑ Uptake by plants or animals — check biota									
	☐ Other (list):									
☑ Ground-water	☑ Direct release to groundwater — check groundwater									
	☐ Volatilization — check air									
	☑ Flow to surface water body — check surface water									
	☑ Flow to sediment — check sediment									
	☑ Uptake by plants or animals — check biota									
	☐ Other (list):									
☑ Surface Water	☑ Direct release to surface water — check surface water									
	☐ Volatilization — check air									
	☑ Sedimentation — check sediment									
	☑ Uptake by plants or animals — check biota									
	☐ Other (list):									
☑ Sediment	☑ Direct release to sediment — check sediment									
	☑ Resuspension, runoff, or erosion — check surface water									
	☑ Uptake by plants or animals — check biota									
	☐ Other (list):									
		☑ soil	☑ Incidental Soil Ingestion		F	C/F	C/F	F	F	
			☑ Dermal Absorption of Contaminants from Soil		F	C/F	C/F	F	F	
			☐ Inhalation of Fugitive Dust							
		☑ groundwater	☑ Ingestion of Groundwater		F	F	F	I	I	
			☑ Dermal Absorption of Contaminants in Groundwater		F	F	F	I	I	
			☐ Inhalation of Volatile Compounds in Tap Water							
		☐ air	☐ Inhalation of Outdoor Air							
			☐ Inhalation of Indoor Air							
			☐ Inhalation of Fugitive Dust							
		☑ surface water	☐ Ingestion of Surface Water							
			☑ Dermal Absorption of Contaminants in Surface Water		F	C/F	I	C/F	C/F	
			☐ Inhalation of Volatile Compounds in Tap Water							
		☑ sediment	☑ Direct Contact with Sediment		F	C/F	C/F	C/F	C/F	
		☑ biota	☑ Ingestion of Wild or Farmed Foods		I	C/F	I	C/F	C/F	

Revised, 10/01/2010

APPENDIX B
BASELINE RISK ASSESSMENT WORK PLAN

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DRAFT-FINAL RISK ASSESSMENT WORK PLAN

Per and Polyfluoroalkyl Substance (PFAS)
Remedial Investigation Work Plan

Haines, Alaska

5 June 2024

Prepared for:
Brice Environmental Services Corporation

Prepared by:
Stantec Consulting Services Inc.

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Revision	Description	Date
1	Draft Final Redline to Alaska Department of Environmental Conservation	5 Jun 2024

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The conclusions in the report titled “Risk Assessment Work Plan” are Stantec’s professional opinion, as of the time of the report, and concerning the scope described in the report. The opinions in the document are based on conditions and information existing at the time the scope of work was conducted and do not take into account any subsequent changes. The report relates solely to the specific project for which Stantec was retained and the stated purpose for which the report was prepared. The report is not to be used or relied on for any variation or extension of the project, or for any other project or purpose, and any unauthorized use or reliance is at the recipient’s own risk.

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LIST OF ATTACHMENTS

Attachment 1 Ecoscoping Form

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ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
%	percent
µg/L	micrograms per liter
µg/m^3	micrograms per cubic meter
µg/mg	micrograms per milligram
ADEC	Alaska Department of Environmental Conservation
AOPI	area of potential interest
bgs	below ground surface
CDI	chronic daily intake
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
cm^2	square centimeter
COPC	contaminant of potential concern
CSF	cancer slope factor
CSM	conceptual site model
DoD	Department of Defense
EPA	U.S. Environmental Protection Agency
EPC	exposure point concentration
HFPO-DA	hexafluoropropylene oxide dimer acid
HFT	Former Haines Fuel Terminal
HHERA	human health and ecological risk assessment
HHRA	human health risk assessment
HI	hazard index
HQ	hazard quotient
ILCR	incremental lifetime cancer risk
kg	kilograms
L/m^3	liters per cubic meter
m^3/kg	cubic meters per kilogram
mg/kg	milligrams per kilogram
mg/cm^2	milligrams per square centimeter
NCP	National Oil and Hazardous Substances Pollution Contingency Plan
OSD	Office of the Secretary of Defense
PA	preliminary assessment
PFAS	per- and polyfluoroalkyl substances
PFBS	perfluorobutanesulfonic acid
PFHxS	perfluorohexane sulfonate
PFNA	perfluorononanoic acid

ACRONYMS AND ABBREVIATIONS (CONTINUED)

PFOA	perfluorooctanoic acid
PFOS	perfluorooctanesulfonic acid
RAGS	Risk Assessment Guidance for Superfund
RfC	reference concentration
RfD	reference dose
RI	remedial investigation
RL	reporting limit
RSL	Regional Screening Level
SI	site inspection
Stantec	Stantec Consulting Services, Inc.
UCL	upper confidence limit
URF	unit risk factor
USACE	U.S. Army Corps of Engineers
VOC	volatile organic compound
WP	work plan

1 INTRODUCTION

The U.S. Army Corps of Engineers (USACE), Alaska District has tasked Brice Environmental Services Corporation with conducting a per- and polyfluoroalkyl substances (PFAS) remedial investigation (RI) at the Former Haines Fuel Terminal (HFT) under Contract No. W911KB-22-D00019, Delivery Order No. W911KB-23-F0122. Brice, in turn, has teamed with Stantec Consulting Services, Inc. (Stantec) to conduct risk assessment planning, preparation, and reporting services for the PFAS RI. This human health and ecological risk assessment (HHERA) Work Plan (WP) serves as the planning portion of the PFAS RI risk assessment and describes the methods and assumptions that will be used to evaluate potential risks to human health and the environment from any PFAS detected in environmental media (i.e., soil and groundwater) in the Former Administrative Area at the HFT.

1.1 Purpose and Scope

An RI, which included human health and ecological risk evaluations, was previously conducted at the HFT where characterization of PFAS compounds was limited. The findings of the RI are provided in the Final Former Haines Fuel Terminal Remedial Investigation Report (RI Report, Bristol and North Wind, 2020). Following the RI, a preliminary assessment and site inspection (PA/SI; Arcadis 2023) was performed at the HFT for PFAS compounds. The PA identified areas of potential interest (AOPIs) and soil and groundwater were sampled during the SI. The SI identified PFAS in groundwater above Department of Defense (DoD) risk screening levels at the Former Administrative Area (fire house office, shop, and garage). Additionally, perfluorooctanesulfonic acid (PFOS) was detected at estimated concentrations higher than the DoD risk screening level in groundwater at Building 1203 (fire house), Building 1208 (fire pump), and the Tank Farm Fire Foam System. The SI recommended further study in an RI for the Former Administrative Area and confirmation SI sampling for Building 1203, 1208, and the Tank Farm Fire Foam System. The PFAS RI is intended to delineate the nature and extent of PFAS compounds in soil and groundwater at the HFT.

The purpose of the PFAS RI risk assessment is to evaluate risks to human health and the environment due to potential exposures of human and ecological receptors to PFAS compounds detected in soil and/or groundwater samples collected in the Former Administrative Area. The PFAS RI risk assessment will also evaluate potential cumulative risks from PFAS and non-PFAS compounds (Section 4.4.2).

This HHERA WP describes the methods and assumptions to be used in the PFAS RI risk assessment for the Former Administrative Area.

1.2 Organization

This HHERA WP is organized into the following sections:

- **Section 1 – Introduction.** This section describes the purpose, scope, and organization of the HHERA WP.
- **Section 2 – Background.** This section presents descriptions of the site, land use, climate, and physical setting.
- **Section 3 – Site Investigation History and Data Evaluation.** This section presents brief summaries of the site investigation history and the data evaluation methods.

- **Section 4 – Human Health Risk Assessment Methods.** This section describes the methods and assumptions to be used in the preparation of the human health risk assessment (HHRA).
- **Section 5 – Ecological Risk Assessment Methods.** This section describes the methods and assumptions to be used in the preparation of the ecological risk evaluation.
- **Section 6 – Uncertainty Analysis.** This section presents descriptions of the uncertainties in the human health and ecological risk evaluations.
- **Section 7 – References.** This section presents the references cited in this HHERA WP.

2 BACKGROUND

The following subsections present descriptions of the site, land use, climate, and physical setting at, and in the vicinity of, the HFT.

2.1 Site Description

The HFT is located in southeastern Alaska, between the Chilkat and Chilkoot inlets on the Chilkat Peninsula, at Tanani Point, approximately 2.9 miles north of the town of Haines. The locations of Haines and the HFT are shown on Figure 2-1. The locations of individual features within the HFT property are shown on Figure 2-2.

HFT operations included pumping fuel via a pipeline across Canada and Alaska to Eielson Air Force Base and Fort Wainwright near Fairbanks, Alaska from 1955 to 1971. Following termination of pipeline operations, the fuel terminal was used for fuel storage from 1971 through 1988. Fuel was stored in 13 aboveground storage tanks. These tanks were removed in 2001 and 2003. Buildings located at the HFT were removed in 2005. In 2015 and 2016, most of the underground fuel piping was also removed during pipeline investigation activities.

Fuel-handling operations have led to releases of petroleum-related constituents (e.g., diesel range organics, gasoline range organics and residual range organics) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) contaminants (e.g., tetrachloroethene, 1,1,2,2-tetrachloroethane, and 2-hexanone) to soil and groundwater at several locations within the former tank farm. The RI (Bristol and North Wind 2020) has identified the presence of multiple areas of soil and groundwater petroleum-related contamination. Some of the identified soil contamination has been removed, while other areas of soil contamination remain at the HFT. PFAS-containing materials may have been used, stored, or disposed at the fire-related buildings (e.g., fire pump building, firehouse building, and hose cart building) (Arcadis 2023).

2.2 Land Use

The land occupied by and surrounding the HFT is a combination of land withdrawn from the public domain and land acquired from private owners. A total of 88.98 acres was withdrawn from the public domain and a total of 178.31 acres was acquired from private landowners. The area within the HFT fence line is composed entirely of land acquired from private ownership, the majority of which was taken from two homesteads.

On 4 January 1977, the General Services Administration deeded 62.68 acres of the HFT and the dry cargo dock to the City of Haines. This area is now the terminal area for the Alaska State Ferry System. The Army currently owns 203.31 acres of land in association with the HFT. Land within the intertidal zone below the mean high tide (approximately 15.8 feet) is owned by the State of Alaska.

The land within the fenced perimeter of the HFT is zoned as “Heavy Industrial.” The areas of the HFT property located south and east of Lutak Road are zoned as “Waterfront” or “Waterfront Industrial.” A small portion of the property located to the southwest of the HFT fenced area is zoned as “Rural Mixed Use.”

2.3 Climate

The site is in the maritime climate zone and has relatively mild winters and summers. The average snowfall is 238.2 inches per year with an average precipitation of 47.6 inches per year (NOAA 2023). The average number of days with measurable precipitation is 149. On average, there are 84 sunny days per year in Haines, Alaska (Bristol and North Wind 2020). The July high temperature is around 68 degrees Fahrenheit (°F), and the February low is around 13°F (NOAA 2023).

The HFT is in the over 40-inch precipitation zone, for purposes of determining screening levels based on Alaska Department of Environmental Conservation (ADEC) method two cleanup levels.

2.4 Physical Setting

The HFT is situated approximately 300 to 1,000 feet inland, topographically above Lutak Inlet on the northeastern slope of Mount Ripinski. The surrounding area is characterized by the steep mountainous terrain characteristic of the Takshanuk Mountain Range. The overall topography at the HFT is considered a “side slope”, generally facing eastward towards Lutak Inlet with steeper slopes facing north and more gentle slopes facing towards the south.

Upland portions of the HFT and surrounding area are within and consistent with the coastal western hemlock-Sitka spruce forest ecoregion (ADEC 1999). However, the formerly active areas of the HFT are ruderal and characterized by scattered vegetation consisting mainly of grasses and weedy vegetation over bare ground with some shrubs/herbaceous understory and young coniferous and deciduous trees scattered throughout. Forest recovery is more advanced in areas that were previously clear-cut to accommodate infrastructure and line of sight, but were not otherwise physically impacted (aside from clear-cutting) or actively used during HFT operations.

No perennial streams, ponds, or other aquatic habitat occur at the HFT. An onsite seep is present near Tank 107 at the north end of the Former Bulk Fuel Storage Area. A drainage ditch, draining the lower portion of the Former Bulk Fuel Storage Area adjacent to the Manifold Building/Tank 100 area, flows intermittently. Flow could potentially reach Lutak Inlet during snowmelt or heavy precipitation. As described in Section 2.2.3 of the PFAS RI Work Plan, however, the drainage ditch is not considered to be a contaminant migration pathway. In addition, the drainage ditch lies outside of the Former Administrative Area. Therefore, the drainage ditch will not be evaluated in the PFAS RI risk assessment. Tanani Bay lies directly south of the Former Administrative Area. Seeps have been noted along the shoreline (below the mean high tide line). Collection of samples from these seeps is in the planned activities for the PFAS RI.

2.4.1 GEOLOGY

The Haines area is situated on the Chilkat block of the Coastal Granite Plutonic Complex, in southeastern Alaska (Redman et al. 1984). The regional geology is controlled by the location of the area along the active plate boundary of the northern Pacific Basin. The Chilkat block is a large-scale trough developed from down-dropped blocks of metabasalt and pyroxenite bedrock between the older, uplifted granitic and volcanic rocks.

The oldest rocks in the HFT area are Early Cretaceous metabasalt of the Chilkat block. Metabasalt outcrops are seen along Lutak Road north of the HFT and on the beach along the western portion of Tanani Bay. Exposed bedrock near the HFT consists of metamorphic and hornblende diorite igneous rocks. Contacts between the metabasalt and the pyroxenite occur along faults. Magnetite-bearing pyroxenite occurs along Lutak Road in Johnson Creek and along the Haines Highway. The metamorphism of these rocks has influenced and, in most cases, increased the concentration of naturally occurring metal-bearing minerals at the HFT.

2.4.1.1 Surficial Deposits

The surficial deposits of the region predominantly consist of glacial and glacial-marine sediments (Peapple et al. 1999). The latest glacial event deposited sediments of various origins, including elevated marine deposits, glacial till, modern beach deposits, and drop stones from melting icebergs (Peapple et al. 1999). The HFT also contains colluvium and man-made fill.

The soil at the HFT is divided into units based on time of deposition, mode of origin, and grain size:

- Glacial till
- Elevated deep-water clay and silts
- Marine varves
- Emergent beach deposits
- Colluvium deposits

The deep-water clay and emergent beach deposits appear in areas of the Former Administrative Area to be deposited contemporaneously and have discontinuous contact, while at other places (i.e., the Bulk Fuel Area), the clay and overlying soil have an abrupt contact.

Elevated Deep-Water Clay and Silts

The origin of the elevated deep-water clay and silts is the settling of fine-grained sediments in fjords from glaciers, rivers, and streams (Redman et al. 1984). The gray, low to medium plastic sediments are predominantly silt and clay-sized particles, with sand and a lower proportion of fine gravel making up the remaining size fraction.

Emergent Beach Deposits

Emergent beach sediments were deposited sequentially after the elevated deep marine clay and silt deposits, because both features were elevated above sea level by isostatic rebound. As the land began to uplift from regional deglaciation, it was then subjected to wave action and longshore and tidal currents. Depending on these variables and sediment load, beach deposits of varying thickness and grain size were deposited. The beach deposits may be deposited over an erosional surface on the underlying clays. The

clay surface may have channels or low spots eroded into it that could produce preferential pathways for contaminant transport.

In the HFT area, the emergent beach deposits primarily consist of moderately well-sorted sands, gravels, and cobbles. These deposits range from 5 to 20 feet thick throughout the HFT area, with thinner accumulations deposited upslope of the Bulk Fuel Area and thicker accumulations within the Former Administrative Area.

2.4.1.2 Geologic Effect on Fate and Transport

The specific contacts and lithologic units are a major controlling factor in the fate and transport of any contamination present at the HFT.

A bedrock ridge composed of diorite is evident in the subsurface and surface extending from Tanani Point to the area near the HFT fuel dock. A bedrock low is present to the west of the ridge. Several channels have been eroded through the Tanani Point Bedrock Ridge before the deposition of surficial sediments following the most recent glacial advance. These channels may offer preferential pathways for contaminant migration. As described further in Section 2.2.4 of the PFAS RI Work Plan, however, only one significant paleochannel is present at the HFT, which occurs within the former Tank Farm Area. This paleochannel was investigated during the PFAS SI and will be further evaluated during the PFAS RI. No distinct paleochannels are present in bedrock within the Administrative Area.

The elevated marine clays, silts, and varves appear to influence contaminant transport in two distinct ways. Contamination appears to move along the top surface of the clay unit, preferentially in the direction of slope of the unit and in some cases along low spots in the upper surface of the unit. Additionally, the fine-grained units serve as an aquitard, restricting the downward mobility of contamination.

2.4.1.3 Geologic Effect on Background Metals Concentrations

The soil at the HFT is derived locally from slope creep, glacial scour, and deposition, as well as marine and beach sedimentation of locally derived materials. Therefore, the concentrations of background metals at the site are the result of erosion of local geologic bedrock chemistry. Samples of soil and sediment near the HFT were collected by the State of Alaska Department of Natural Resources and the U.S. Geological Survey. Analytical results for these soil and stream sediment samples collected from the geologic units near the HFT show elevated levels of arsenic, chromium, and silver at concentrations above the ADEC default method two cleanup levels (ADNR 1991; USGS 1985).

2.4.2 HYDROGEOLOGY AND GROUNDWATER

The fine-grained sediments of the HFT dramatically limit the productivity and transmissivity of groundwater aquifers at the site. Additionally, the fine-grained sediments tend to isolate stratigraphic units of slightly higher transmissivity into separate and often discontinuous individual aquifers. A review of previous sampling data indicates that monitoring wells at the HFT can be sampled at rates that range from a few gallons per hour to as little as less than 1 quart per hour (Bristol and North Wind 2020).

Groundwater at the HFT is not currently, previously, nor reasonably anticipated to be a future source of drinking water since it occurs in discontinuous lenses with poor transmissivity and storativity, and drinking water could be acquired from a readily available surface water source. For these reasons, future occupants

are unlikely to install, utilize, and maintain drinking water wells in favor of alternate, readily available surface water. A surface water catchment reservoir and dam located northwest of the HFT was used for the procurement of water during the operation of the facility. The water was transferred to the HFT by means of a freshwater pipeline. The surface water reservoir is still operational and provides water for the Alaska State Ferry terminal. No wells were found to have sufficient storativity and transmissivity to provide water service to the facility during the period of HFT operation. An Alternative Cleanup Decision Document, approved by ADEC in April of 2001 (ADEC 2001), concluded "that the surficial aquifer at the site was not suitable as a drinking water source due to its discontinuous nature and low storage capacity." ADEC established alternative cleanup levels in the Decision Document in accordance with 18 AAC 75.345 (as in effect at the time of the alternative cleanup level decision) for groundwater that is not suitable as a drinking water source. However, ADEC vacated the Decision Document in November of 2016. Therefore, for the purposes of this risk assessment, groundwater at the site is considered a drinking water source.

Near surface soil of the emergent beach deposits within the southern portion of the HFT is composed of materials laid down in a beach environment. The emergent beach deposits unconformably overlie very fine-grained clays. The surface of the underlying clay appears to have minor channels eroded in it that control the direction of flow for groundwater contamination within the beach deposits. Most monitoring wells constructed within the Former Administrative Area at the HFT are completed into these emergent beach deposits. The underlying clay unit is up to 80 feet thick in the area and acts as an aquiclude for the downward migration of groundwater contamination. The underlying clay unit also acts as a confining member for the still deeper artesian aquifer (Bristol and North Wind 2020). A well completed in this aquifer, pumping at a rate of 0.07 gallons per minute with a drawdown of 0.33 feet, could produce approximately 100 gallons of water per day. It is worth noting that the national average self-supplied water use rate in 2015 was 77 gallons per capita per day (USGS, 2018). Thus, a family of four would require more than 300 gallons of water per day. Although the shallow emergent beach perched aquifer is considered a drinking water source for purposes of this risk assessment, the low pump rate measured in this aquifer makes future use as a drinking water source highly unlikely. Groundwater flow direction within the Emergent Beach Aquifer is generally to the south-southeast (Bristol and North Wind 2020). An aquifer with artesian pressure underlies the deep-water deposited clays of the southern portion of the HFT. The artesian conditions appear to be present in a thin, approximately 5-foot-thick zone of well-sorted sand present between the bedrock and the overlying clay confining unit. Some wells completed within this zone have true artesian flow with groundwater flowing at the ground surface. The discharge from the deep system to Lutak Inlet evidently occurs below the clay unit at a point and depth well below the low tide line. A well completed in this aquifer, flowing at a natural rate of approximately 0.4 gallons per minute, could produce approximately 500 gallons of water per day (Bristol and North Wind 2020).

3 SITE INVESTIGATION HISTORY AND DATA EVALUATION

A brief description of the environmental investigations performed at the HFT, and results of these investigations are provided below.

3.1 Data Gap Analysis

As summarized in the RI Report (Bristol and North Wind 2020), a Data Gap Analysis was performed on the historical data from site investigations and treatability studies, or interim actions conducted for the HFT prior to the RI, to determine whether additional data were required to adequately characterize the nature and

extent of contamination at the HFT. The analysis determined that based on previous investigations, some buildings were not contaminated and had sufficient historical data to verify that no further actions were required. The analysis identified areas that required additional data collection to definitively determine whether contamination was present, and if present, the nature and extent of that contamination. The RI, as described in Section 3.2, was conducted to fill these data gaps.

3.2 Remedial Investigation

The RI (Bristol and North Wind 2020) was conducted to assess the potential presence and extent of contamination resulting from the operation of the facility. The RI evaluated the following:

- Features identified as needing further characterization, per the Data Gap Analysis
- Former underground storage tank locations
- Potential dry wells within the Former Administrative Area
- Nine potential areas of soil contamination identified during the Pipeline Investigation
- Potential contamination in Lutak Beach Debris Area, discovered after the Data Gap Analysis

Sample locations selected during the RI were determined using previous investigation results (where available) and data needs for each site feature. Soil and groundwater samples were analyzed for gasoline range organics, diesel range organics, residual range organics, volatile organic compounds (VOCs), polycyclic aromatic hydrocarbons, semi-volatile organic compounds, pesticides, polychlorinated biphenyls, PFAS, metals, glycols, and dioxins/furans. Specific analyses for each site feature were selected based on the known or potential contaminant sources.

The results of the RI evaluation (identification of contaminants in soil and groundwater above cleanup levels) and the risk evaluation (summarized in Sections 3.2.1 and 3.2.2) were used to provide recommendations for each site feature. Based on the results of RI evaluation, most site features were recommended for no further evaluation. The following site features within the Former Administrative Area were recommended for remedy evaluation in a feasibility study:

- Building 1200: Mainline Pump House (comingled source)
- Building 1206: Petroleum, oil, and lubricant Laboratory
- Building 1207: Utility Building, Building 1208: Fire Pump Building
- Building 1231, Fire Foam Building
- Building 1232, Manifold Building
- Building 1237, Tank 100 Pump House Building
- Valve Box 2

3.2.1 HUMAN HEALTH RISK EVALUATION

A human health risk evaluation was conducted as part of the RI (Bristol and North Wind 2020) to evaluate direct contact exposures to soil and groundwater under the default residential scenario, and direct contact exposures to soil for indoor and outdoor worker receptors. Maximum detected concentrations of constituents in soil (0 to 15 feet below ground surface [bgs]) or groundwater were compared to applicable screening levels to identify contaminants of potential concern (COPCs) in soil and groundwater, respectively, for further evaluation. Where ADEC's Method Two cleanup levels were available, screening levels were equal to one-tenth of the Over 40-Inch Precipitation Zone Human Health risk levels as specified

in ADEC's Method Two Table B1 or Table C Human Health cleanup levels for the Over 40-Inch Zone (ADEC 2018a). Where ADEC's Method Two cleanup levels were not available, screening levels were equal to the U.S. Environmental Protection Agency (EPA) Regional Screening Levels (RSLs). A summary of the human health risk evaluation results summarized in the RI Report is provided below.

Of the 28 sites evaluated at the HFT, the RI risk evaluation showed cumulative risks for outdoor workers exposed to soil were above the ADEC cancer target risk level and/or the noncarcinogenic hazard index (HI) threshold used in the human health risk evaluation only at the Lutak Burn Pit. The risk results for outdoor workers exposure to soil met the target risk levels at the remaining 27 sites. The cumulative risks for outdoor workers exposed to soil were within or below EPA's acceptable cancer risk range of $1x10^{-6}$ to $1x10^{-4}$.

Of the 28 sites evaluated, 15 sites met target health goals used in the human health risk evaluation for both industrial (soil only) and future residential receptors (cumulative risk from soil and groundwater combined). Sixteen sites were within or below EPA's acceptable cancer risk range of $1x10^{-6}$ to $1x10^{-4}$ and hazard threshold of 1 for both industrial (soil only) and future residential receptors (cumulative risk from soil and groundwater combined). Future residential exposures from COPCs in groundwater contribute to most of the unacceptable cumulative health risk for the remaining sites at HFT. Risk results from future residential exposure to soil were at acceptable levels used in the human health risk evaluation for all sites, except Tank 102 and the Lutak Burn Pit. The results of the petroleum hydrocarbon evaluation concluded that concentrations of petroleum hydrocarbons in soil and/or groundwater at 15 sites were considered in the RI to represent an unacceptable health risk for residential drinking water exposures.

The risk evaluation noted the lack of perfluorooctanoic acid (PFOA) and PFOS data for groundwater as a potential data gap. PFOA or PFOS data available during the RI were not detected above direct contact soil screening levels used in the human health evaluation. PFOS was only detected in soil (0.0055 milligrams per kilogram [mg/kg]), slightly above the cleanup level based on the migration to groundwater pathway (0.003 mg/kg). No groundwater data were available during the RI to confirm whether PFOA or PFOS were present in groundwater at detectable concentrations. As a result, the risk evaluation concluded the risk results for groundwater could be underestimated for these compounds.

3.2.2 ECOLOGICAL RISK EVALUATION

An ecological risk evaluation was conducted as part of the RI (Bristol and North Wind 2020) for 25 potential source areas in association with the primary investigation areas. Of these, 23 subareas were readily off-ramped based on the lack of ecological contaminants of potential concern or limited area of impact. However, 2 potential source areas associated with the Manifold Building and Tank 104 contained elevated lead remaining from paint residue from fuel lines. Lead is a potentially bioaccumulative chemical which may impact ecological risk. Given the localized nature of the lead exceedance in surface soil and the otherwise relatively low concentrations of lead in both areas, the potential for significant exposure was determined to be unlikely.

3.3 Preliminary Assessment/Site Inspection of PFAS

A PA/SI was completed for PFAS with a focus on PFOS, PFOA, perfluorobutanesulfonic acid (PFBS), perfluorononanoic acid (PFNA), perfluorohexane sulfonate (PFHxS), and hexafluoropropylene oxide dimer acid (HFPO-DA) in accordance with CERCLA, the National Oil and Hazardous Substances Pollution Contingency Plan (NCP), and Army/DoD policy and guidance for HFT (Arcadis 2023). A PA identifies AOPIs

where PFAS-containing materials were used, stored, and/or disposed, or areas where known or suspected releases to the environment occurred. The SI includes multi-media sampling at AOPIs to determine whether a release has occurred. The SI may conclude further investigation is warranted, a removal action is required to address immediate threats, or no further action is required.

In the PA, seven AOPIs were identified for investigation during the SI phase at HFT. SI sampling results from these AOPIs were compared to risk-based screening levels calculated by the Office of the Secretary of Defense (OSD) for PFOS, PFOA, PFBS, PFNA, and PFHxS (OSD 2022). There were no HFPO-DA SI analytical results to screen against the 2022 OSD risk screening levels. HFPO-DA is also not typically associated with aqueous film-forming foam/fire training activities and would not be expected to be present at DoD sites associated with those activities. PFOS, PFOA, PFBS, PFNA and/or PFHxS were detected in soil and/or groundwater at five AOPIs at HFT; one of the five AOPIs with detections had PFOS, PFOA, PFBS, PFNA, and/or PFHxS present at concentrations greater than the risk-based screening levels. Two additional AOPIs (Building 1203 and Building 1208) with detections had PFOS, PFOA, PFBS, PFNA, and/or PFHxS present at estimated concentrations greater than the risk-based screening levels and are recommended for confirmation SI sampling. The PA/SI identified the need for further study in a CERCLA RI for the Former Administrative Area and confirmation SI sampling for Building 1203, 1208, and the Tank Farm Fire Foam System.

3.4 Data Evaluation

Only data collected during the PA/SI for PFAS (Arcadis 2023) and the upcoming RI for PFAS, and determined to be acceptable based on the data usability and quality objectives of the respective investigations, will be considered usable for quantitative evaluation in the risk assessment. The following general criteria, based on EPA guidance (EPA 1992) will be followed in generating risk assessment datasets:

- Estimated values (flagged with a “J” qualifier) will be treated as detected concentrations.
- For analytical results where there are both primary and duplicate sample data or results reported due to multiple analytical methods, the value selected for that primary/duplicate/analytical method pair for use in the risk assessment will be based on the following criteria:
    - When the primary and duplicate or different analytical method results are both detected values, the maximum detected value will be selected.
    - When one result in the primary/duplicate/analytical method pair is a detected value and the other result is a non-detect value, the higher of the detected concentration or the reporting limit (RL) for the non-detect result will be selected.
    - When both the primary and duplicate or analytical method results are non-detect values, the minimum RL will be selected.

4 HUMAN HEALTH RISK ASSESSMENT METHODS

This section presents the methods and assumptions to be used in the HHRA to evaluate risks from potential exposure to PFAS constituents detected in samples collected from the Former Administrative Area at the HFT (PFAS HHRA). As summarized in Section 3.2.1, a risk evaluation was previously conducted primarily for non-PFAS constituents in the Former Administrative Area. The PFAS HHRA is intended to supplement

the previous human health risk evaluation to provide updated cumulative risk estimates including contribution from potential exposure to PFAS constituents.

The PFAS HHRA will be conducted in general accordance with CERCLA, the NCP, and the following Army/DoD, EPA, and ADEC policy and guidance documents:

- Environmental Quality Risk Assessment Handbook Volume I: Human Health Evaluation. Engineering Manual 200-1-004 (USACE 1999)
- Environmental Quality Conceptual Site Models. Engineering Manual 200-1-12 (USACE 2023)
- Regional Screening Levels Used in DoD Cleanups (DoD 2024a)
- Emerging Chemicals of Environmental Concern (DoD 2024b)
- Risk Assessment Guidance for Superfund (RAGS). Volume I: Human Health Evaluation Manual, Part A (EPA 1989)
- Guidance for Data Usability in Risk Assessment (Part A) (EPA 1992)
- Calculating Upper Confidence Limits for Exposure Point Concentrations at Hazardous Waste Sites (EPA 2002)
- Human Health Toxicity Values in Superfund Risk Assessments (EPA 2003)
- Risk Assessment Guidance for Superfund (RAGS), Volume 1: Human Health Evaluation Manual, Part E, Supplemental Guidance for Dermal Risk Assessment (EPA 2004)
- Risk Assessment Guidance for Superfund (RAGS), Volume 1: Human Health Evaluation Manual, Part F, Supplemental Guidance for Inhalation Risk Assessment (EPA 2009)
- Human Health Evaluation Manual, Supplemental Guidance: Update of Standard Default Exposure Factors (EPA 2014)
- Risk Assessment Procedures Manual (ADEC 2018b)

The steps included in HHRA include data evaluation (which includes COPC identification), exposure assessment, toxicity assessment, and risk characterization (EPA 1989). The methods and assumptions that will be used in the data evaluation step are discussed in Sections 3.4 and 4.1. The methods and assumptions that will be used for the remaining risk assessment steps are discussed in Sections 4.2 through 4.4.

4.1 Site COPC Identification

COPCs to be further evaluated in the PFAS HHRA will be identified based on a comparison of PFAS sampling results to human health risk screening criteria. Human health COPC screening will be conducted for each exposure area in accordance with EPA guidance (EPA 1989) and Army/DoD guidance (DoD 2024a).

Surface and Subsurface Soil. Human health COPC screening for surface and subsurface soil will be based on comparison of maximum concentrations of constituents detected in site soil (0 to 15 feet bgs) to EPA RSLs for Resident Soil based on a cancer risk of 1×10^{-6} or hazard quotient (HQ) of 0.1.

Groundwater. Human health COPC screening for groundwater will be based on comparison of maximum concentrations of chemicals detected in groundwater to EPA RSLs for Resident Tap Water based on a cancer risk of 1×10^{-6} or HQ of 0.1.

Constituents with a maximum detected concentration exceeding the selected human health screening level will be identified as COPCs for further evaluation in the HHRA. If a human health screening level is not available for a detected constituent, the constituent will be identified as a COPC and qualitatively evaluated in the PFAS HHRA. If a constituent is not detected in samples collected from an exposure area, RLs will be compared to human health screening levels. Constituents with RLs exceeding human health screening levels will be qualitatively evaluated in the PFAS HHRA.

4.2 Exposure Assessment

Exposure assessment is the process of determining the nature, extent, and magnitude of exposure of receptors to a chemical or physical agent (USACE 1999). The exposure assessment consists of: (1) development of a conceptual site model (CSM); (2) derivation of exposure assumptions, chemical-specific parameters, and exposure point concentrations (EPCs); and (3) estimation of chronic daily intake (CDI). Each of these steps of the exposure assessment are described in the following subsections.

4.2.1 HUMAN HEALTH CONCEPTUAL SITE MODEL

The CSM includes the identification of chemical sources and contaminated environmental media, potentially exposed populations under current and future exposure scenarios, and potentially complete exposure pathways between contaminated media and human receptors based on current site knowledge. The CSM included in the PFAS HHRA will be updated, as needed, based on the results of the PFAS RI. The human health CSM for the HFT is depicted graphically on Figure 4-1 and described in the following subsections.

4.2.1.1 Release Mechanisms and Contaminated Media

PFAS-containing materials may have been used, stored, or disposed at the fire-related buildings (e.g., fire pump building, firehouse building, and hose cart building) at HFT (Arcadis 2023). The media potentially impacted by PFAS constituents on or near the site include:

- Surface Soil (0 to 2 feet bgs)
- Subsurface Soil (greater than 2 feet bgs)
- Groundwater

There are no perennial surface waterbodies present within the HFT. Although groundwater seeps are present, the seeps are intermittent/seasonal and/or of low flow (Bristol and North Wind 2020).

4.2.1.2 Receptor Identification

As described in Section 2.2, the area within the fenced perimeter of the HFT property is currently zoned as "Heavy Industrial". The areas of the HFT property located south and east of Lutak Road are zoned as "Waterfront" or "Waterfront Industrial." A small portion of the property located to the southwest of the HFT fenced area is zoned as "Rural Mixed Use". As noted in the Worksheet 10 tables in Appendix A of the PFAS RI Work Plan, private residences are located approximately 950 feet southwest of the former Firehouse Office, Shop and Garage Building 1212; 800 feet southwest of the former Fire Pump Building 1208; and 600 feet southwest of the former Fire Hose Building 1203. In addition, Building 1204 (a dormitory used by the Alaska National Guard) is located within 100 feet of Building 1203. Though the HFT property is currently unoccupied, individuals have been observed conducting subsistence harvesting in the areas immediately adjacent to the HFT fence line. Typical activities include berry picking, harvesting of seaweed, harvesting of clams and mussels, fishing, harvesting of crabs, as well as duck and moose hunting (Bristol and North Wind 2020). However, there is currently no confirmation that the seeps between the Administrative Area and Tanani Bay provide potential migration pathways for PFAS contamination into the marine environment, it is unlikely that contamination from the HFT PFAS RI AOPIs extends beyond the fenced area of the HFT where individuals have been observed conducting subsistence harvesting (Attachment A-1 of the PFAS RI Work Plan), and upland terrestrial game species that are potentially used for subsistence purposes are expected to find more desirable habitat in areas surrounding the site (Bristol and North Wind 2020).

As described further in Section 2.2.4 of the PFAS RI Work Plan, seven distinct aquifers have been identified at HFT: the fractured granite-diorite bedrock aquifer, northern aquifer, discontinuous sands and gravels overlying bedrock aquifer, the deep artesian (confined) aquifer, the perched emergent beach aquifer, the marine varve aquifer, and the perched upper colluvium aquifer (refer to Figure 3 of the PFAS RI Work Plan). Besides the fractured granite-diorite bedrock aquifer, these aquifers generally have very limited productivity because they are composed of fine-grained sediments and/or have limited spatial extent. Consequently, nearly all residents near the HFT obtain their domestic water from wells drilled into the underlying bedrock (Bristol and North Wind 2020). The Alaska Well Log Tracking System indicates that two wells within 4 miles of the HFT are completed in the discontinuous sand and gravel layer that occasionally directly overlies bedrock. No residents use the perched aquifers as a drinking water source.

Future residential development is currently prohibited by local zoning codes throughout most of the HFT. Therefore, residential development is not considered reasonably anticipated. However, risks from a hypothetical residential land use scenario will be evaluated along with more realistic land use scenarios to inform management decisions about the range of possible outcomes between the most realistic human receptors (future industrial workers) and most sensitive receptors (hypothetical future child residents).The Final Risk Assessment Workplan (USACE 2015) and the human health risk evaluation in the RI (Bristol and North Wind 2020) identified the following potential receptors at the HFT:

- Current and future adult and adolescent site visitors, trespassers, or recreational users
- Hypothetical future residents (should homes be constructed)
- Future construction workers (should the land be developed)
- Future industrial workers

Consistent with the RI (Bristol and North Wind 2020), potential risks for hypothetical future residents and future industrial workers will be evaluated quantitatively.

4.2.1.3 Exposure Pathways

Consistent with the RI, potential exposure pathways that will be quantitatively evaluated in the PFAS HHRA include direct contact exposures to soil and groundwater by hypothetical future residents and future industrial workers. These include the following:

- **Soil:** Incidental ingestion, dermal contact, and inhalation of soil particulates and VOCs adsorbed to soil particulates by hypothetical future residents and future industrial workers.
- **Groundwater:** Incidental ingestion, dermal contact, and inhalation of VOCs by hypothetical future residents.

The conservative assumptions used to evaluate soil and groundwater exposure by residential and industrial receptors are considered protective of the other receptors and exposure pathways (Bristol and North Wind 2020).

4.2.2 EXPOSURE QUANTIFICATION

Potential exposures and risks associated with the complete and potentially significant exposure pathways identified in Section 4.2.1 will be quantified in the HHRA for each exposure area. An exposure area is the area throughout which a receptor comes in contact with an environmental medium for the duration of the exposure. Exposure areas will be identified based onsite history and operations and available site data; available representative site PFAS data will be used to develop EPCs and characterize potential risks for complete and potentially significant pathways for each exposure area. Methods to be used in the derivation of media EPCs and procedures for quantifying CDIs for human receptors are described in the following subsections.

4.2.2.1 Deriving Exposure Point Concentrations

An EPC describes the level of a constituent in site media to which a receptor is potentially exposed over the duration of the exposure (USACE 1999; EPA 2002). As such, the EPC serves as the basis for quantifying pathway-specific CDIs. EPCs will be estimated separately for each exposure area identified at the HFT.

Soil. EPCs for soil will initially be based on the maximum detected concentration of each COPC within a given exposure area, for consistency with the human health risk evaluation provided in the RI Report (Bristol and North Wind 2020). However, if cumulative risk estimates based on maximum detected concentrations exceed acceptable risk criteria and there are sufficient quantity and quality of data, cancer risk and noncancer hazard estimates will also be calculated using EPCs derived as the upper confidence limit (UCL) on the mean concentration for the exposure area.

UCL on the mean concentrations will be calculated using the current version of EPA's ProUCL software. In cases where the UCL on the mean concentration exceeds the maximum detected concentration, the maximum detected concentration will be used as the soil EPC.

Groundwater. The EPC for each exposure area will be the maximum concentration of each constituent detected in samples collected from the exposure area.

4.2.2.2 Calculating Chronic Daily Intakes

This section presents the methods for quantifying CDIs of COPCs for human receptors. As described in Section 4.2.1, complete and potentially significant exposure pathways between human receptors and site -related COPCs are limited to direct contact pathways (i.e., incidental ingestion and dermal contact) and inhalation of VOCs or particulates derived from soil or groundwater. Consistent with the RI (Bristol and North Wind 2020), CDIs will be estimated using default parameters for future residents and outdoor workers. Exposure and chemical-specific parameters will be provided in the PFAS HHRA. The CDI equations to be used in the quantification of direct exposure pathways are consistent with EPA guidance for conducting exposure assessments (EPA 1989, 2004, 2009). With the inclusion of carcinogenic modes of action, exposures are averaged for different stages of development by applying age-adjusted factors and equations adjusted in accordance with EPA guidance (EPA 2014, 2023).

Soil – Incidental Ingestion:

Hypothetical Future Residents (Child Noncancer) and Future Industrial Workers

Incidental Ingestion CDI (mg/kg-day) =

$$\frac{C_{soil} \times CF \times RBA \times EF \times ED \times IR_{soil}}{AT \times BW}$$

Where:

C_{soil} = Concentration in soil (mg/kg)
CF = Conversion factor (10^{-6} kg/mg)
RBA = Relative bioavailability factor (percent [%])
EF = Exposure frequency (days per year [days/year])
ED = Exposure duration (years)
IR_{soil} = Soil ingestion rate (milligrams per day [mg/day])
AT = Averaging time (period over which exposure is averaged – days)
BW = Body weight (kg)

Hypothetical Future Residents (Cancer)

Incidental Ingestion CDI for Carcinogenic COPCs (mg/kg-day) =

$$\frac{C_{soil} \times CF \times RBA \times IFS_{res\text{-}adj}}{AT}$$

Where:

$$IFS_{res\text{-}adj} = \frac{EF_c \times ED_c \times IR_{soil_c}}{BW_c} + \frac{EF_a \times ED_a \times IR_{soil_a}}{BW_a}$$

And:

C_{soil} = Concentration in soil (mg/kg)
CF = Conversion factor (10^{-6} kg/mg)
RBA = Relative bioavailability factor (%)
$IFS_{res\text{-}adj}$ = Age-adjusted soil Ingestion factor (mg/kg)
AT = Averaging time (period over which exposure is averaged – days)

EF_c = Child exposure frequency (days/year)
ED_c = Child exposure duration (years)
IR_{soil_c} = Child soil ingestion rate (mg/day)
BW_c = Child body weight (kg)
EF_a = Adult exposure frequency (days/year)
ED_a = Adult exposure duration (years)
IR_{soil_a} = Adult soil ingestion rate (mg/day)
BW_a = Adult body weight (kg)

Soil – Dermal Contact:

Hypothetical Future Residents (Child Noncancer) and Future Industrial Workers

Dermal Absorption CDI (mg/kg-day) =

$$\frac{C_{soil} \times CF \times EF \times ED \times SA_{soil} \times AF \times ABS}{AT \times BW}$$

Where:

C_{soil} = Concentration in soil (mg/kg)
CF = Conversion factor (10^{-6} kg/mg)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
SA_{soil} = Skin surface area exposed (square centimeters [cm^2]/day)
AF = Adherence factor of soil (mg/cm^2)
ABS = Skin absorption factor (unitless)
AT = Averaging time (period over which exposure is averaged – days)
BW = Body weight (kg)

Hypothetical Future Residents (Cancer)

Dermal Absorption CDI for Carcinogenic COPCs (mg/kg-day) =

$$\frac{C_{soil} \times CF \times DFS_{res\text{-}adj} \times ABS}{AT}$$

Where:

$$DFS_{res\text{-}adj} = \frac{EF_c \times ED_c \times SA_{soil_c} \times AF_c}{BW_c} + \frac{EF_a \times ED_a \times SA_{soil_a} \times AF_a}{BW_a}$$

And:

C_{soil} = Concentration in soil (mg/kg)
CF = Conversion factor (10^{-6} kg/mg)
$DFS_{res\text{-}adj}$ = Age-adjusted dermal factor (mg/kg)
ABS = Skin absorption factor (unitless)
AT = Averaging time (period over which exposure is averaged – days)
EF_c = Child exposure frequency (days/year)
ED_c = Child exposure duration (years)
SA_{soil_c} = Child skin surface area exposed (cm^2)
AF_c = Child adherence factor of soil (mg/cm^2)

BW_c = Child body weight (kg)
EF_a = Adult exposure frequency (days/year)
ED_a = Adult exposure duration (years)
SA_{soil_a} = Adult skin surface area exposed (cm^2)
AF_a = Adult adherence factor of soil (mg/cm^2)
BW_a = Adult body weight (kg)

Soil – Inhalation of Particulates and Volatile Constituents:

Hypothetical Future Residents and Future Industrial Workers

Inhalation of Particulates and Volatiles (micrograms per cubic meter [$\mu g/m^3$]) =

$$\frac{C_{soil} \times CF \times EF \times ED \times ET \times \left(\frac{1\ day}{24\ hours}\right) \times \left(\frac{1}{VF} + \frac{1}{PEF}\right)}{AT}$$

Where:

C_{soil} = Concentration in soil (mg/kg)
CF = Conversion factor (1,000 µg/mg)
PEF = Particulate emission factor (m^3/kg)
VF = Volatilization factor (m^3/kg)
ET = Exposure time (hours/day)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
AT = Averaging time (days)

Groundwater – Incidental Ingestion:

Hypothetical Future Residents (*Child Noncancer*)

Ingestion CDI (mg/kg-day) =

$$\frac{C_{gw} \times CF \times EF \times ED \times IR_{gw}}{AT \times BW}$$

Where:

C_{gw} = Concentration in groundwater (micrograms per liter [µg/L])
CF = Conversion factor (10^{-3} mg/µg)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
IR_{gw} = Groundwater ingestion rate (L/day)
AT = Averaging time (period over which exposure is averaged – days)
BW = Body weight (kg)

Hypothetical Future Residents (*Cancer*)

Ingestion CDI for Carcinogenic COPCs (mg/kg-day) =

$$\frac{C_{gw} \times CF \times IFW_{res\text{-}adj}}{AT}$$

Where:

$$IFW_{res\text{-}adj} = \frac{EF_c \times ED_c \times IR_{gw_c}}{BW_c} + \frac{EF_a \times ED_a \times IR_{gw_a}}{BW_a}$$

And:

C_{gw}	= Concentration in groundwater (µg/L)
CF	= Conversion factor (10^{-3} mg/µg)
$IFW_{res\text{-}adj}$	= Age-adjusted groundwater ingestion factor (L/kg)
AT	= Averaging time (period over which exposure is averaged – days)
EF_c	= Child exposure frequency (days/year)
ED_c	= Child exposure duration (years)
IR_{gw_c}	= Child ingestion rate (L/day)
BW_c	= Child body weight (kg)
EF_a	= Adult exposure frequency (days/year)
ED_a	= Adult exposure duration (years)
IR_{gw_a}	= Adult ingestion rate (L/day)
BW_a	= Adult body weight (kg)

Groundwater – Dermal Contact:

Hypothetical Future Residents (*Child Noncancer*)

Dermally Absorbed CDI (mg/kg-day) =

$$\frac{DA_{event\text{-}inorganics} \text{ or } DA_{event\text{-}organics} \times CF1 \times EF_c \times ED_c \times EV_c \times SA_{gw_c}}{AT \times BW_c}$$

Where:

$$DA_{event\text{-}inorganics} = C_{GW} \times Kp \times CF2 \times ET_c$$

And:

$$DA_{event\text{-}organics,\ _ET>t^*} = C_{GW} \times CF2 \times FA \times Kp \times \left[\frac{ET_c}{1+B} + 2 \times \tau_{event}\left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]$$

$$DA_{event\text{-}organics,\ _ET\le t^*} = C_{GW} \times CF2 \times 2 \times FA \times Kp \times \sqrt{\frac{6 \times \tau_{event} \times ET_c}{\pi}}$$

$DA_{event\text{-}inorganics}$	= Absorbed dose per event for inorganics (µg/cm^2-event)
$DA_{event\text{-}organics}$	= Absorbed dose per event (µg/cm^2-event)
CF1	= Conversion Factor (10^{-3} mg/µg)
EF_c	= Child exposure frequency (days/year)
ED_c	= Child exposure duration (years)
EV_c	= Child dermal exposure event (events/day)
AT	= Averaging time (period over which exposure is averaged – days)
BW_c	= Child body weight (kg)
SA_{gw_c}	= Child skin surface area (cm^2)
C_{gw}	= Concentration in groundwater (µg/L)
Kp	= Dermal permeability constant (centimeters/hour)

$CF2$ = Conversion factor (10^{-3} L/cm^3)
ET_c = Child dermal exposure time (hours/event)
t* = Time to reach steady state (hour)
FA = Fraction absorbed (unitless)
B = Dermal permeability coefficient ratio (unitless)
τ_{event} = Lag time per event (hour/event)

Hypothetical Future Residents (*Cancer*)

Dermally Absorbed CDI for Carcinogenic COPCs (mg/kg-day) =

$$\frac{DA_{event\text{-}inorganics} \text{ or } DA_{event\text{-}organics} \times CF1 \times DFW_{res\text{-}adj}}{AT}$$

Where:

$$DA_{event\text{-}inorganics} = C_{GW} \times Kp \times CF2 \times ET_{event_res_adj}$$

$$DA_{event\text{-}organics,\ _ET>t^*} = C_{GW} \times CF2 \times FA \times Kp \times \left[\frac{ET_{event_res_adj}}{1+B} + 2 \times \tau_{event}\left(\frac{1+3B+3B^2}{(1+B)^2}\right)\right]$$

$$DA_{event\text{-}organics,\ _ET\le t^*} = C_{GW} \times CF2 \times 2 \times FA \times Kp \times \sqrt{\frac{6 \times \tau_{event} \times ET_{event_res_adj}}{\pi}}$$

And:

$$DFW_{res\text{-}adj} = \frac{EF_c \times ED_c \times EV_c \times SA_{gw_c}}{BW_c} + \frac{EF_a \times ED_a \times EV_a \times SA_{gw_a}}{BW_a}$$

And:

$$ET_{event_res_adj} = \frac{ED_c \times ET_c + ED_a \times ET_a}{ED_c + ED_a}$$

$DA_{event\text{-}inorganics}$ = Absorbed dose per event for inorganics (µg/cm^2-event)
$DA_{event\text{-}organics}$ = Absorbed dose per event (µg/cm^2-event)
CF1 = Conversion Factor (10^{-3} mg/µg)
$DFW_{res\text{-}adj}$ = Age-adjusted dermal factor (cm^2-event/kg)
AT = Averaging time (period over which exposure is averaged – days)
C_{gw} = Concentration in groundwater (µg/L)
K_p = Dermal permeability constant (centimeters/hour)
$CF2$ = Conversion factor (10^{-3} L/cm^3)
$ET_{event_res_adj}$ = Adjusted dermal exposure time (hours/day)
t* = Time to reach steady state (hour)
FA = Fraction absorbed (unitless)
B = Dermal permeability coefficient ratio (unitless)
τ_{event} = Lag time per event (hour/event)
EF_c = Child exposure frequency (days/year)
ED_c = Child exposure duration (years)
EV_c = Child dermal exposure event (events/day)
SA_{gw_c} = Child skin surface area (cm^2)
BW_c = Child body weight (kg)
EF_a = Adult exposure frequency (days/year)

ED_a = Adult exposure duration (years)
EV_a = Adult dermal exposure event (events/day)
SA_{gw_a} = Adult skin surface area (cm^2)
BW_a = Adult body weight (kg)
ET_c = Child dermal exposure time (hours/day)
ET_a = Adult dermal exposure time (hours/day)

Groundwater – Inhalation of Volatile Constituents:

Hypothetical Future Residents

Inhalation of Volatile Concentration ($\mu g/m^3$) =

$$\frac{C_{gw} \times EF \times ED \times ET_{gw} \times \left(\frac{1\ day}{24\ hours}\right) \times K}{AT}$$

Where:

C_{gw} = Concentration in groundwater (µg/L)
EF = Exposure frequency (days/year)
ED = Exposure duration (years)
ET_{gw} = Inhalation exposure time (hours/day)
K = Volatilization factor (L/m^3)
AT = Averaging time (period over which exposure is averaged – days)

4.3 Toxicity Assessment

The toxicity assessment identifies the potential adverse effects associated with COPCs and estimates the likelihood that these adverse effects will occur based on the extent of the exposure (USACE 1999). The toxicity assessment for the PFAS HHRA will be performed in accordance with Army/DoD policy (DoD 2024a, 2024b).

4.3.1 TOXICITY VALUE HIERARCHY

Consistent with Appendix 3A of DoD Instruction 4715.18 (DoD 2024b), the following hierarchy of sources of toxicity values will be used in the PFAS HHRA:

1. EPA's Integrated Risk Information System.
2. EPA's Provisional Peer Reviewed Toxicity Values.
3. Other final, peer reviewed toxicity values for PFAS constituents cited in the EPA RSLs (DoD 2024a).

4.3.2 DERMAL TOXICITY

Although the EPA has developed toxicity values for the oral and inhalation routes of exposure, toxicity values for the dermal route of exposure have not been developed. The EPA has proposed a method for extrapolating oral toxicity values to the dermal route in *Risk Assessment Guidance for Superfund, Volume I: Human Health Evaluation Manual (Part E, Supplemental Guidance for Dermal Risk Assessment)* (EPA 2004). This EPA guidance states that the adjustment of the oral toxicity factor for dermal exposures

is necessary only when the oral-gastrointestinal absorption efficiency of the constituent of interest is less than 50% (due to the variability inherent in absorption studies).

If the oral-gastrointestinal absorption efficiency of any constituent is less than 50%, adjustment of oral toxicity values to dermal cancer slope factors (CSFs) and reference doses (RfDs) will be conducted as follows:

$$\text{Dermal CSF} = \frac{\text{Oral CSF}}{ABS_{GI}}$$

$$\text{Dermal RfD} = \text{Oral RfD} \times ABS_{GI}$$

Where:

CSF = Cancer slope factor $(mg/kg\text{-}day)^{-1}$
RfD = Reference dose (mg/kg-day)
ABS_{GI} = Oral absorption efficiency

For constituents lacking an oral-gastrointestinal absorption efficiency value, the oral absorption efficiency will be assumed to be 100% and the oral CSF or RfD will be used to estimate toxicity via the dermal route.

4.4 Risk Characterization

Risk characterization integrates the results of the exposure and toxicity assessments to derive quantitative and qualitative evaluations of potential risks to current and potential future human receptors. The risk of developing cancer and the potential for noncancer effects will be quantified separately by calculating an incremental lifetime cancer risk (ILCR) and noncancer HQ, respectively. These quantitative estimates will be accompanied by an interpretive discussion qualifying the risks.

4.4.1 COPC-SPECIFIC ILCR AND HQ ESTIMATES

The risk of developing cancer from ingestion, dermal, and inhalation exposures to COPCs in soil and groundwater will be estimated by summing the products of the oral CDI and CSF, the dermal CDI and CSF, and the ambient air inhalation exposure concentration and unit risk factor (URF) (EPA 1989):

ILCR = (Oral CDI x Oral CSF) + (Dermal CDI x Dermal CSF) + (Inhalation Concentration x URF)

Where:

ILCR	=	Incremental lifetime cancer risk (unitless)
CDI	=	Chronic daily intake (mg/kg-day)
CSF	=	Cancer slope factor $(mg/kg\text{-}day)^{-1}$
Concentration	=	Exposure concentration $(\mu g/m^3)$
URF	=	Unit risk factor $(\mu g/m^3)^{-1}$

The potential for noncancer effects resulting from ingestion, dermal, and inhalation exposures to COPCs in soil and groundwater is defined as the sum of the ratios of the oral and dermal CDIs and ambient air inhalation concentration to the oral and dermal RfDs and inhalation reference concentration (RfC), respectively (EPA 1989):

$$HQ = \frac{\text{Oral CDI}}{\text{Oral RfD}} + \frac{\text{Dermal CDI}}{\text{Dermal RfD}} + \frac{\text{Inhalation Concentration}}{\text{Inhalation RfC x CF}}$$

Where:

HQ	=	Hazard quotient (unitless)
CDI	=	Chronic daily intake (mg/kg-day)
RfD	=	Reference dose (mg/kg-day)
Concentration	=	Exposure concentration (µg/m^3)
RfC	=	Reference concentration (mg/m^3)
CF	=	Conversion factor (µg/mg)

4.4.2 CUMULATIVE ILCR AND HAZARD INDEX ESTIMATES

Consistent with EPA guidance (EPA 1989), COPC-specific ILCR and HQ estimates will be summed to cumulative medium-specific ILCR and HI estimates for the HFT. Groundwater is not reasonably anticipated to be a future source of drinking water based on the information summarized in Section 4.2.1.2. However, a hypothetical future resident may be exposed to COPCs in soil and groundwater for the purposes of the risk assessment. Therefore, cumulative soil and groundwater ILCR and HI estimates will be summed to cumulative exposure pathway-specific ILCR and HI estimates for hypothetical future residents. In addition, risks estimated for potential exposure to PFAS COPCs will be summed with risks presented for non-PFAS COPCs in the RI Report (Bristol and North Wind 2020).

5 ECOLOGICAL RISK ASSESSMENT METHODS

The ecological risk evaluation in the RI PFAS risk assessment will be an extension of the ecological risk evaluation presented in the RI Report (Bristol and North Wind 2020). In the RI Report, two potential source areas associated with fuel storage and handling (Tank 104 and the Manifold Building [Building 1232]) contained elevated lead and were evaluated for potential ecological impacts. The RI Report concluded that the potential for significant exposure is unlikely based on the localized nature of lead exceedances in surface soil. Other areas evaluated in detail either did not have sufficient habitat or sufficient contamination for ecological impacts to occur. This ecological risk evaluation for the Former Administrative Area follows the ADEC scoping process (ADEC 2014) to evaluate potential ecological impacts.

5.1 Environmental Setting

The environmental setting for the Former Administrative Area is low elevation, topographically flat ruderal grassland with some areas of bare ground and scattered shrubs. No permanent or ephemeral surface water drainages or ponds exist in the Former Administrative Area. The area is bounded to the south and northeast first by Lutak Road and then by the rocky shores of Tanani Bay and Lutak Inlet. To the southwest, the area is bounded by forest and rural development; to the northwest the area is bounded by the Former Bulk Fuel Storage Area; at a broader scale, the Former Administrative Area is bounded to the west by the forested northeastern toe of the 3,675-foot Mount Ripinski. Coastal western hemlock-Sitka spruce forest and

southeast coastal/estuary habitats of the Southeast Alaska ecoregion surround this disturbed ruderal area (ADEC 1999). As described previously, structures had been removed from the HFT, and most of the underground piping was removed in 2015-2016. The ruderal vegetation that has encroached on the Former Administrative Area after these demolition activities is expected to continue to spread into former building footprints and adjacent former high-traffic areas at a slower rate than revegetation of areas that were merely clear-cut (Bristol and North Wind 2020).

No federal- or state-listed endangered, threatened, or special status species inhabit the Chilkat Peninsula (ADF&G 2023a). Common terrestrial wildlife species that may be observed at low elevations on Chilkat Peninsula include boreal owl, eagles, brown bear, moose, and porcupine. Common wildlife species inhabiting Mount Ripinsky include black bear, grouse, mountain goat, ptarmigan, and Sitka black-tailed deer (ADF&G 2023b). A wide variety of bird species use the area seasonally, while willow ptarmigan, ravens, crows, and magpies are resident to the area. Small mammals known to occur in the area include squirrels, voles, shrews, bats, mice, and snowshoe hares (ADF&G 2023c).

5.2 Ecoscoping

ADEC established a simple, systematic ecological scoping process (ecoscoping) to determine whether an in-depth ecological risk evaluation is required at sites contaminated with hazardous substances (ADEC 2014). Five scoping factors, listed below, are described in ADEC's Ecoscoping Guidance (ADEC 2014):

1. Direct visual impacts or signs of acute toxicity
2. Terrestrial and aquatic exposure routes
3. Quality and availability of habitat
4. Quantity of contaminated media
5. Toxicity benchmark levels

The systematic ecoscoping evaluation includes "off-ramps" from the scoping process to eliminate unnecessary evaluation. The first decision point, at scoping factor 1 (direct visual impacts or signs of acute toxicity), requires that no off-ramps be taken if direct impacts from site contamination are evident or expected. The remaining decision points involve evaluation of the existence of exposure routes between potentially contaminated media and ecological receptors, the presence of quality habitat, the size of the area of potential contamination, and the level of toxicity of potential contamination (ADEC 2014).

An ecoscoping evaluation conducted during the RI (Appendices Q3.3 and Q3.6 of Bristol and North Wind 2020) off-ramped the Former Administrative Area from the scoping process at the scoping factor 3 step (habitat for valued species) because the habitat present at the Former Administrative Area does not provide a sufficiency of ecological resources (e.g., food, water, cover) to support valued species populations and the reasonably anticipated future land use will remain commercial/industrial. An updated ecoscoping form for the Administrative Area is provided in Attachment 1 to this HHERA WP.

6 UNCERTAINTY ANALYSIS

Uncertainty is inherent in the risk assessment process. In general, uncertainties can be associated with: (1) limitations in the site characterization data; (2) elements of the human health CSM; (3) conservative exposure parameters and other information taken from the literature; (4) toxicity information and uncertainty factors used in the development of toxicity values; and (5) quantitative estimation of risk. Overall,

uncertainties in the risk assessment process tend to err on the conservative side.

As documented in the RI Report (Bristol and North Wind 2020), the sites have been adequately characterized for non-PFAS compounds. The PFAS RI is intended to complete characterization of the HFT for PFAS compounds. Presumably, the PFAS RI to be conducted will result in adequate characterization of the sites for PFAS compounds. However, uncertainties in the use of the PFAS RI characterization data to support risk assessment will be evaluated in the PFAS RI risk assessment.

EPCs for PFAS COPCs will be based on maximum detected concentrations or UCL on the mean concentrations and, therefore, result in upper bound estimates of risk.

The exposure pathways outlined in the human health CSM, and the exposure modeling parameters used to evaluate those pathways, are conservative by design. It is unlikely that hypothetical future land use at the HFT will include improvements to the sites that would result in residential land use or more frequent use by future site workers. Uncertainties in the exposure modeling methods and assumptions to be used in the HHRA will be identified and described.

Groundwater at the HFT is not currently, previously, nor reasonably anticipated to be a future source of drinking water since it occurs in discontinuous lenses with poor transmissivity and storativity, and drinking water could be acquired from a readily available surface water source. For these reasons, future occupants are unlikely to install, utilize, and maintain drinking water wells in favor of alternate, readily available surface water. Uncertainties associated with the inclusion of the groundwater pathway will be described in the HHERA report.

Any uncertainties in the ecological risk evaluation to be conducted as described in Section 5 will be identified and described in the HHERA report.

The toxicity values that will be used in the HHRA are derived primarily from EPA sources. Toxicity values that are developed by EPA generally represent upper bound estimates of toxicity and incorporate uncertainty factors for extrapolation from animal data to humans, differences in individual sensitivity within populations, and the overall confidence in the data set. Because the toxicity values established by EPA are typically no observed adverse effect level-based concentrations and incorporate uncertainty factors, the values are generally considered to be protective. The use of conservative toxicity values in the risk estimate tends to overestimate actual risks.

The different sources of uncertainty described above will be incorporated in the risk estimate. Because the majority of these uncertainties err on the conservative side, estimated risks tend to represent upper bound estimates of risk.

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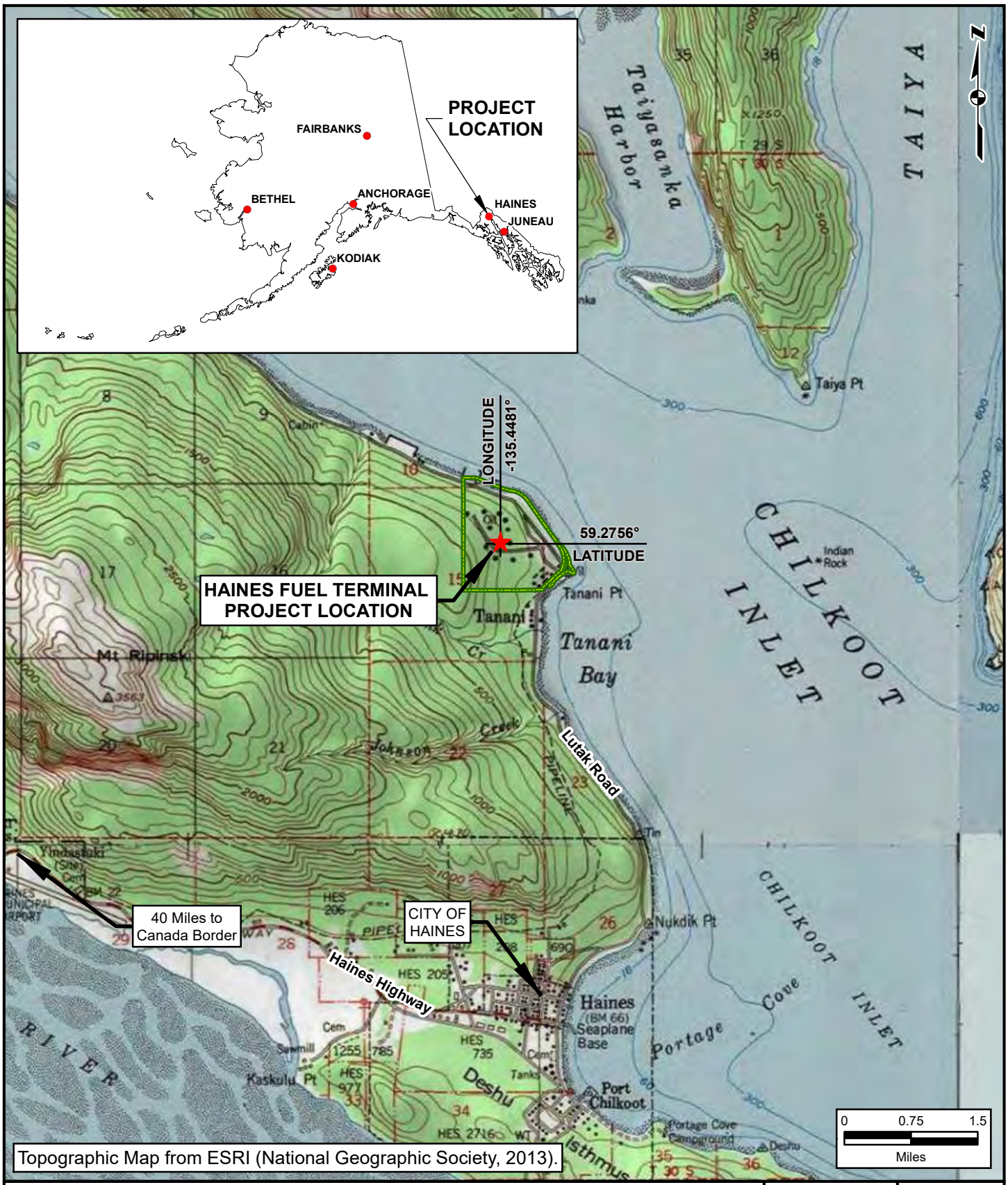
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USGS. 2018. Estimated Use of Water in the United States in 2015. Circular 1441. U.S. Department of Interior, U.S. Geological Survey.

Figures

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Topographic Map from ESRI (National Geographic Society, 2013).

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HAINES FUEL TERMINAL PFAS REMEDIAL INVESTIGATION
WORK PLAN - HAINES, ALASKA
U.S. ARMY GARRISON ALASKA

LOCATION AND VICINITY MAP

DATE: 11/15/2023

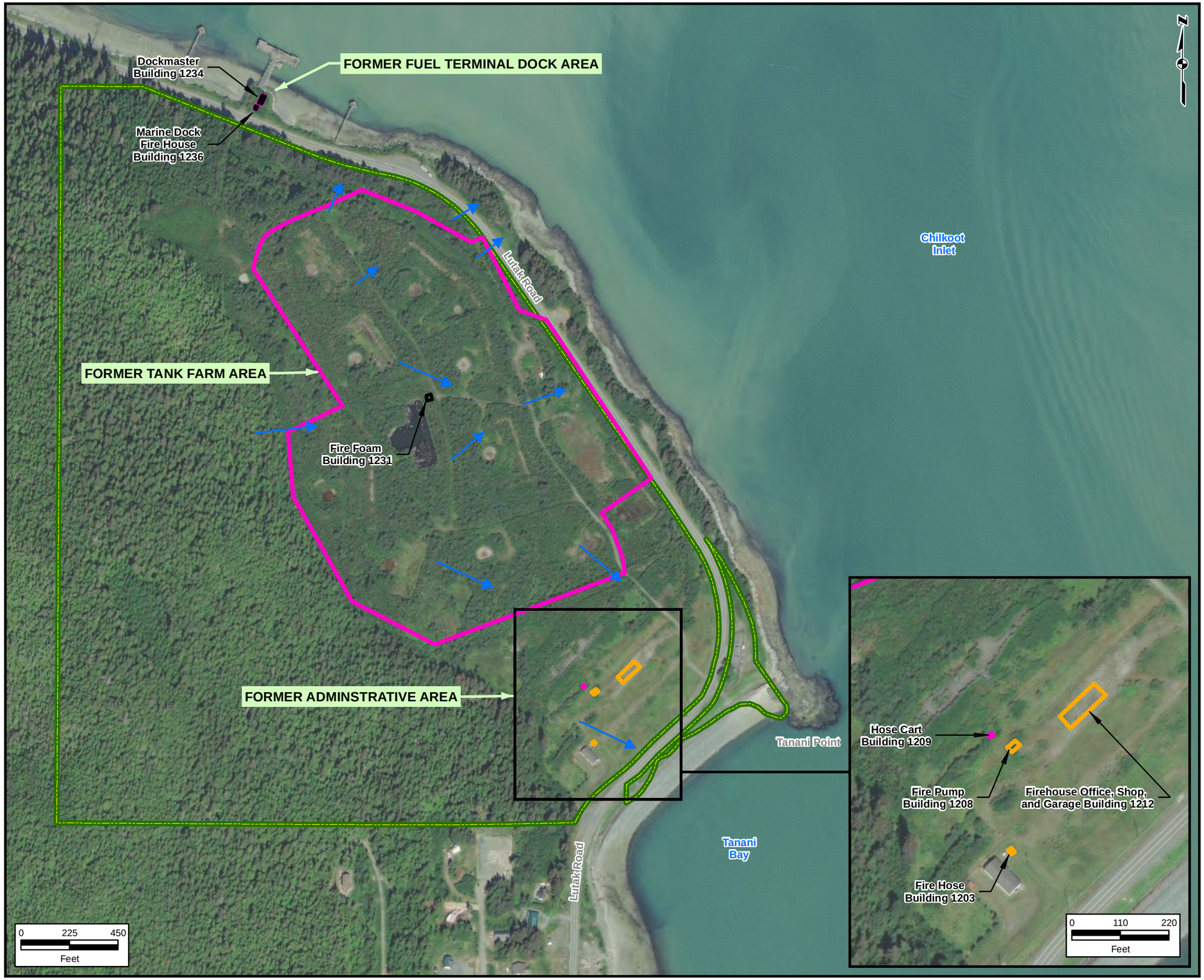
PROJECT No.: 450202

DRAWN: C.B.

FIGURE: **2-1**

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1 INCH



HAINES FUEL TERMINAL PFAS REMEDIAL INVESTIGATION WORK PLAN - HAINES, ALASKA

U.S. ARMY GARRISON ALASKA

SITE MAP AND AOI AND AOPI LOCATIONS

Legend:

- Groundwater Flow Direction
- Former Building
- AOI
- AOPI
- Installation Boundary

Acronyms and Abbreviations:

AOI - area of interest
AOPI - area of potential interest
PFAS - per- and polyfluoroalkyl substances

Note:

1. Coordinate Systems: Horizontal - World Geodetic System of 1984 (WGS84), Universal Transverse Mercator (UTM), Zone 8N

Sources:

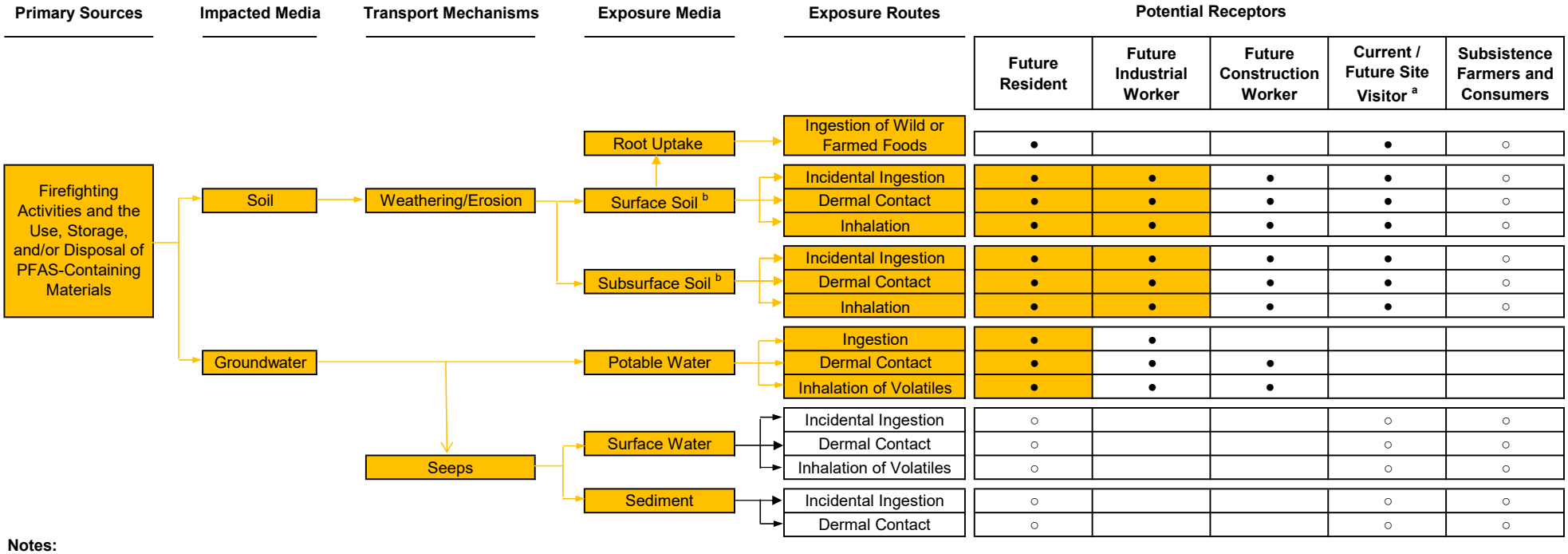
1. Groundwater flow direction reported by Bristol and North Wind, Inc. 2020
2. Aerial imagery obtained from ESRI ArcGIS Online

PROJECT No.:	DATE:	FIGURE:
450202	4/10/2024	2-2
P.M.: G.R.	DRAWN: C.B.	

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Figure 4-1
Human Health Conceptual Site Model
Haines Fuel Terminal



Notes:

Potentially Complete Exposure Pathway

Potentially Complete but Insignificant Pathway

Incomplete Pathway

● Potentially Complete Exposure Pathway Evaluated in the HHRA

● Potentially Complete Exposure Pathway Not Evaluated in the HHRA [c]

○ Potentially Complete but Insignificant Pathway

Incomplete Exposure Pathway

[a] A Current / Future Site Visitor is an individual who trespasses on the site for recreation as an adolescent and adult.

[b] Surface and subsurface soil are 0 to 2, and 2 to 15 feet below ground surface (bgs), as indicated in ADEC's 2017 *Guidance on Developing Conceptual Site Models*. In this HHRA, consistent with the 2020 RI (Bristol and Northwind, 2020), it is conservatively assumed that soil disturbance could bring subsurface contamination to the surface, and therefore contact with soil from 0 to 15 feet bgs is assumed to be a potentially complete exposure pathway for all receptors.

[c] Consistent with the 2020 RI, potential exposures to soil and groundwater by future residents and outdoor workers are evaluated quantitatively in this HHRA using default parameters. The conservative assumptions used to evaluate soil and groundwater exposure by residential and industrial receptors are considered protective of the other receptors and exposure pathways.

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Attachment 1
Ecoscoping Form

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Attachment 1 - Ecoscoping Form

Site Name: Administration Area, Former Haines Fuel Terminal
Completed by: Stantec Consulting Services, Inc.
Date: March 18, 2024

Instructions: Follow the italicized instructions in each section below. "Off-ramps," where the evaluation ends before completing all of the sections, can be taken when indicated by the instructions. Comment boxes should be used to help support your answers.

1. Direct Visual Impacts and Acute Toxicity

Are direct impacts that may result from the site contaminants evident, or is acute toxicity from high contaminant concentrations suspected? C*heck the appropriate box.*

☐ Yes – *Describe observations below and evaluate all of the remaining sections without taking any off-ramps.*
☒ No – *Go to next section.*

Comments:

Conditions at the Former Haines Fuel Terminal (HFT) Administrative Area are consistent with natural recolonization of a formerly developed area. Grasses and herbaceous species dominate, and scattered stands of woody vegetation are present, with reduced growth in highly impacted areas such as the footprints of roads and former buildings. Acute toxicity is not suspected.

2. Terrestrial and Aquatic Exposure Routes

Check each terrestrial and aquatic route that could occur at the site.

Terrestrial Exposure Routes

☐ Exposure to water-borne contaminants as a result of wading or swimming in contaminated waters or ingesting contaminated water.
☐ Contaminant uptake in terrestrial plants whose roots are in contact with contaminated surface water.
☐ Contaminant migration via saturated or unsaturated groundwater zones and discharge at upland "seep" locations (not associated with a wetland or water body).
☒ Contaminant uptake by terrestrial plants whose roots are in contact with soil moisture or groundwater present within the root zone (generally no more than 4 feet below ground surface).
☐ Particulates deposited on plants directly or from rain splash.
☒ Incidental ingestion and/or exposure while animals grub for food, burrow (up to 2 feet for small animals or 6 feet for large animals), or groom.
☐ Inhalation of fugitive dust or vapors disturbed by foraging or burrowing activities.
☒ Bioaccumulatives (other than PAHs, which bioaccumulate more readily in aquatic environments) taken up by soil invertebrates, which are in turn eaten by higher food

chain organisms (see the *Policy Guidance on Developing Conceptual Site Models*).

☐ Other site-specific exposure pathways.

Aquatic Exposure Routes

☐ Contaminated surface runoff migration to water bodies through swales, drainage ditches, or overland flow.

☐ Aquatic receptors exposed through osmotic exchange, respiration, or ventilation of surface waters.

☐ Contaminant migration via saturated or unsaturated groundwater zones and discharge at "seep" locations along banks or directly to surface water.

☐ Deposition into sediments from upwelling of contaminated groundwater.

☐ Aquatic receptors may be exposed directly to contaminated sediments through foraging or burrowing, or indirectly exposed due to osmotic exchange, respiration, or ventilation of sediment pore water.

☐ Aquatic plants rooted in contaminated sediments.

☐ Bioaccumulatives (see the *Policy Guidance on Developing Conceptual Site Models*) taken up by sediment invertebrates, which are in turn eaten by higher food chain organisms.

☐ Other site-specific exposure pathways.

If any of the above boxes are checked go on to the next section. If none are checked, end the evaluation and check the box below.

☐ OFF-RAMP: NO FURTHER ECOLOGICAL EVALUATION NECESSARY

Comments:

The Administrative Area is approximately 10 acres in size. Potential soil contamination within the Administrative Area would have occurred due to building-specific activities and, therefore, any areas of contaminated soil would be much smaller than the 10-acre footprint of the entire Administrative Area. Historical compaction for roads, staging areas, and buildings has limited revegetation in areas with potential for soil contamination, however complete exposure pathways for terrestrial receptors exist. These include contaminant uptake by terrestrial plants, incidental ingestion by birds and mammals, and bioaccumulation from terrestrial plants and invertebrates to birds and mammals.

Potential groundwater contamination may be more widely distributed; however, surface expression of groundwater does not occur within the Administrative Area. Therefore, there are no aquatic exposure routes for ecological receptors at the Administrative Area.

3. Habitat

Check all that may apply. See Ecoscoping Guidance for additional help.

☐ Habitat that could be affected by the contamination supports valued species (i.e., species that are regulated, used for subsistence, have ceremonial importance, have commercial value, or provide recreational opportunity).
☐ Critical habitat or anadromous stream in an area that could be affected by the contamination.
☐ Habitat that is important to the region that could be affected by the contamination.
☐ Contamination is in a park, preserve, or wildlife refuge.

If any of the above boxes are checked go on to the next scoping factor. If none are checked, end the evaluation and check the box below.

☒ OFF-RAMP: NO FURTHER ECOLOGICAL EVALUATION NECESSARY

Comments:

Soil within the Administrative Area is generally compacted as a result of historical roadways, staging areas, and buildings. Except for one structure (Building 1204, the former Dormitory), all buildings were demolished prior to the fall of 2005, and recolonization by herbaceous species and small stands of woody shrubs has occurred. However, ecological habitat within the Administrative Area remains distinct from the forested habitat in the surrounding area, which is classified as coastal western hemlock-Sitka spruce forest ecoregion (ADEC, 1999). Compared to adjacent forest, the Administrative Area provides limited cover and no water to attract ecological receptors, and a chain-link fence further limits potential for use of the Administrative Area by large mammals.

No federal- or state-listed endangered, threatened, or special status species inhabit the Chilkat Peninsula (ADF&G 2023a). Common terrestrial wildlife species that may be observed regionally include boreal owl, eagles, brown bear, moose, and porcupine (ADF&G 2023b). A wide variety of bird species use the area seasonally, while willow ptarmigan, ravens, crows, and magpies are resident to the area. Small mammals known to occur in the area include squirrels, voles, shrews, bats, mice, and snowshoe hares (ADF&G 2023c). The Administrative Area is zoned heavy industrial, and reasonably anticipated future use, following remediation, is industrial. The low quality of current and likely future habitat within the Administrative Area relative to adjacent undisturbed areas is expected to limit wildlife to transient use.

4. Contaminant Quantity
Check all that may apply. See Ecoscoping Guidance for additional help.

☐ Endangered or threatened species are present.
☐ The aquatic environment is or could be affected.
☐ Non-petroleum contaminants may be present, or the total area of petroleum-

contaminated surface soil exceeds one-half acre.

If any of the above boxes are checked go on to the next scoping factor. If none are checked, end the evaluation and check the box below.

☐ OFF-RAMP: NO FURTHER ECOLOGICAL EVALUATION NECESSARY

Comments:

5. Toxicity Determination

Check all that apply.

☐ Bioaccumulative chemicals are present (see *Policy Guidance on Developing Conceptual Site Models*).
☐ Contaminants exceed benchmark levels (see the Ecological Benchmark Tool in RAIS, available at: http://rais.ornl.gov/tools/eco_search.php).

If either box is checked complete a detailed Ecological Conceptual Site Model (see DEC's Policy Guidance on Developing Conceptual Site Models*) and submit it with the form to you DEC project manager.*

If neither box is checked, check the box below and submit this form to your DEC project manager.

☐ OFF-RAMP: NO FURTHER ECOLOGICAL EVALUATION NECESSARY

Comments:

Alaska Department of Environmental Conservation (ADEC). 1999. *Ecoregions/Assessment Endpoint Project Technical Background Document for Selection and Application of Default Assessment Endpoints and Indicator Species in Alaskan Ecoregions.* Alaska Department of Environmental Conservation. June

APPENDIX C
ACCIDENT PREVENTION PLAN

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EMERGENCY INFORMATION

Emergency Contacts

ORGANIZATION	NUMBER
Emergency	911
Hospital: Haines Health Center 131 1st Avenue, Haines, AK 99827	907-766-6300
Fire: Haines Fire Department 315 Haines Rd, Haines, AK 99827	907-766-6441
Police: Haines Police Department 315 Haines Rd, Haines, AK 99827	907-766-2121
Brice Program Manager (Jamie Oakley)	907-275-2912
Brice Project Manager (Greg Rutkowski)	907-350-6742
Brice QA/QC Manager (Vanessa Ritchie)	907-699-6899
Brice Site Safety and Health Officer (Chris Boese)	907-290-8994
Brice Field Scientist (Jill Stockbridge)	907-590-2916
Brice Field Scientist (Kristin Hruska)	907-378-2630
Brice Health and Safety Manager (Jamey Smith)	503-539-9504
USACE Program Manager (Bob Hazlett)	907-753-2623
USACE Contracting Officer Representative (Julie Allan)	907-753-5555
USACE Project Manager (Guy Warren)	907-753-5774
USAG Alaska DPW Primary RPM (Peter Baker)	907-361-6623
USAG Alaska DPW Alternate RPM (Melissa Shippey)	907-361-9622
USAEC (Sam Klein)	210-466-1116

Transport and Evacuation

ORGANIZATION	NUMBER
LifeMED Alaska Air Ambulance	800-478-5433
Alaska Regional LifeFlight Air Ambulance (Anchorage)	800-478-9111
Alaska State Troopers	800-269-5511

Spills and Toxins Contact List

ORGANIZATION	NUMBER
Spill Prevention and Response Division Alaska Department of Environmental Conservation	907-451-2121 After hours: 800-478-9300
National Response Center (Oil and Toxic Chemical Spills)	800-424-8802
Poison Control Center	800-222-1222

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

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ACRONYMS AND ABBREVIATIONS

AHA	Activity Hazard Analysis
APP	Accident Prevention Plan
Brice	Brice Environmental Services Corporation
CFR	Code of Federal Regulations
CPR	cardiopulmonary resuscitation
DPW	Directorate of Public Works
EM 385-1-1	Engineer Manual 385-1-1, Safety and Health Requirements
HFT	Haines Fuel Terminal
HSE	health, safety, and environment
HSM	Health and Safety Manager
NFPA	National Fire Protection Association
OFR	Office of the Federal Register
OSHA	Occupational Safety and Health Administration
PFAS	per-and polyfluoroalkyl substances
PM	Project Manager
PPE	personal protective equipment
QA	quality assurance
QC	quality control
RI	Remedial Investigation
RPM	Remedial Project Manager
SDS	Safety Data Sheet
SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Army Environmental Command
USAG Alaska	U.S. Army Garrison Alaska

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SIGNATURE SHEET AND PLAN CONCURRENCE

Haines Fuel Terminal PFAS Remedial Investigation Accident Prevention Plan

Haines, Alaska

Prepared for:
U.S. Army Corps of Engineers, Alaska District

Prepared by:
Brice Environmental Services Corporation
3700 Centerpoint Drive, Suite 800
Anchorage, Alaska 99503

The material and data in this report have been prepared under the supervision and direction of the undersigned.

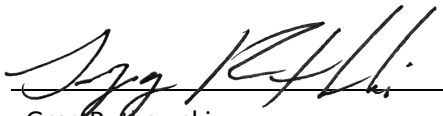


9/27/2024

Name: Jamey Smith **Date**

Title/Qualifications: Health and Safety Manager

Phone: 503-539-9504

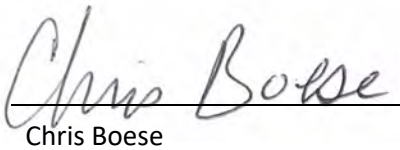


9/27/2024

Name: Greg Rutkowski **Date**

Title/Qualifications: Project Manager

Phone: 907-350-6742



9/27/2024

Name: Chris Boese **Date**

Title/Qualifications: Site Safety and Health Officer

Phone: 907-290-8994

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ACCIDENT PREVENTION PLAN ACKNOWLEDGMENT

I have read, understand, and agree to abide by the provisions as detailed in the Accident Prevention Plan and associated Site Safety and Health Plan. Failure to comply with these provisions may lead to disciplinary action and/or dismissal from the worksite.

Table C-1 Accident Prevention Plan/Site Safety and Health Plan Acknowledgment

NAME	COMPANY AND TITLE	SIGNATURE	DATE

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1.0 BACKGROUND INFORMATION

1.1 Introduction

Contractor: Brice Environmental Services Corporation (Brice)

Contract Number: W911KB22D0019, Task Order W911KB23F0122

Project Name: Haines Fuel Terminal PFAS Remedial Investigation

Preparation Date: December 2023

This Accident Prevention Plan (APP) presents the procedures to be followed for Haines Fuel Terminal (HFT) Per-and Polyfluoroalkyl Substances (PFAS) Remedial Investigation (RI) in Haines, Alaska under the U.S Army Corps of Engineers (USACE), Alaska District Contract W911KB22D0019, Task Order W911KB23F0122.

The APP complies with the Occupational Safety and Health Administration (OSHA) standards outlined in Code of Federal Regulations (CFR) Title 40, Sections 1910 and 1926; Office of the Federal Register (OFR) *Hazardous Waste Operations and Emergency Response* (OFR 2005); CFR Title 29, Sections 1910.120 and 1926.65; U.S. Environmental Protection Agency, and federal, state, and local health and safety regulations and guidance as well as the USACE *Engineer Manual 385-1-1, Safety and Health Requirements* (EM 385-1-1; USACE 2014).

In accordance with EM 385-1-1, this APP includes a Site Safety and Health Plan (SSHP), provided in Attachment C-1. Key personnel contact information for the project is summarized in Table C-2.

Table C-2 Project Contact List

TITLE	NAME	TELEPHONE
USACE Program Manager	Bob Hazlett	907-753-2623
USACE PM	Guy Warren	907-753-5774
USACE Contracting Officer's Representative	Julie Allan	907-753-5555
USAG Alaska DPW Primary RPM	Peter Baker	907-361-6623
USAG Alaska DPW Alternate RPM	Melissa Shippey	907-361-9622
Brice Program Manager	Jamie Oakley	907-275-2912
Brice PM	Greg Rutkowski	907-350-6742
Brice Program Chemist	Victoria Pennick	907-205-9892
Brice Field Scientist	Jill Stockbridge/Kristin Hruska	907-590-2916/907-378-2630
Brice Field Lead/SSHO	Chris Boese	907-290-8994
Brice QA/QC Manager	Vanessa Ritchie	907-699-6899
Brice Hydrogeologist	John Nowinski	512-497-2773
Brice Senior Technical Advisor	Steve Becker	760-798-6772
Program HSM	Jamey Smith	503-539-9504

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

1.2 Project Description

The HFT is located at Tanani Point, 2 miles north of the city of Haines on the Chilkat Peninsula near the mouth of the Lutak Inlet. The Army established the HFT in 1955 for pumping fuel via a pipeline across Canada and Alaska to Fort Wainwright in Fairbanks. The HFT functioned in that capacity from 1955 until 1971, when the pipeline was shut down. The facility itself was shut down in 1988.

The entire installation encompasses 201 acres, with a fenced area of 89 acres comprising the tank farm and supporting facilities. The land outside the fence (112 acres) contains the dock where fuel was transferred from ships to the tank farm. The HFT operations consisted of 13 aboveground storage tanks (ASTs) capable of storing a total of 380,000 barrels of fuel, a manifold building, a pump house, a dock loading area, and associated piping to transfer fuel. Operation support facilities included: two landfills, a boiler/heating building, a tank truck unloading facility, a tank farm burn pit, and septic systems. Tank 100 and Tank 107 were removed in April 2001, and the remaining tanks were removed in the summer of 2003. All buildings were removed in 2005.

The objective of the RI is to characterize the nature and extent of PFAS contamination present at the site and to evaluate the human health and ecological risk. To meet this objective, field activities will be completed over two mobilizations, with results from the first mobilization informing locations to be sampled during the second.

Before entering any potential worksites, personnel will be briefed on this APP and will commit to follow applicable procedures by signing the APP/SSHP acknowledgment form (Table C-1). A copy of this APP will be made available at the project site.

The Site Safety and Health Officer (SSHO), Project Manager (PM), and the Health and Safety Manager (HSM) will maintain copies of this APP, and copies will be made available for each work crew, as approved by the SSHO. Each supervisor, lead person, laborer, operator, and visitor will be held accountable and responsible for working safely and following the procedures and guidance set forth in this APP.

The SSHO and HSM also must be familiar with the following information:

- Applicable federal, state, and local regulations
- Procedures contained in site-specific work plans
- Requirements found in EM 385-1-1 (USACE 2014)

The purpose of this APP is to create a site health and safety program that effectively identifies, evaluates, controls, and reduces health and safety hazards. This APP may be complemented by other required and specific plans. These plans, when needed, will be developed and submitted for approval by USACE and Fort Wainwright Directorate of Public Works (DPW). The SSHP for this project is provided in Attachment C-1. Key personnel contact information for the project, including the HSM, is summarized in Table C-2.

2.0 STATEMENT OF HEALTH AND SAFETY POLICY

This section identifies Brice's health and safety policies, safety program goals and objectives, incident rate, and disciplinary policies.

2.1 General Safety

Brice maintains a policy of providing a healthy, safe, and productive workplace for its employees. We believe that employees have a responsibility to themselves, their families, their fellow workers, the company, and the public to do everything possible to prevent accidents. Safe and efficient equipment, proper training, safety guidelines, and safety devices will be provided for every Brice project. The employee's contributions toward prevention of worksite accidents are awareness and communication.

Safe work habits are a result of emphasis on safety, both by management and employees. Brice's basic principles are:

- All jobs will be performed in a safe manner.
- Every injury/illness, accident, or spill is preventable.
- Safety, health, and the environment are everyone's responsibility.
- Brice will strive for zero accidents and will not tolerate unsafe acts, the workers who perpetuate them, or PMs who condone such action.

These principles are the core of our safety program. Brice management will not ask or allow any employee to conduct work that will compromise their safety, the safety of others, property, or the environment. Brice team members will conduct work with honesty, integrity, and attention to detail. Following these principles, using proper personal protective equipment (PPE), and protecting the environment are requirements of working for Brice.

The Brice safety program was designed with employees, subcontractors, and their families in mind. Brice intends to keep safety awareness high and injury/illness to a minimum; therefore, employees can enjoy a safe work environment and return home safely to their families. The corporate vision is to have zero accidents, zero incidents, and zero injuries. Safety is a commitment and a priority for every Brice manager, site superintendent, and employee on every project. All employees must remain focused on safety, as each employee is responsible for its success.

This policy and the safety rules, instructions, and procedures are conditions of subcontracts issued by Brice, in addition to applicable state, federal, and local laws, codes, and regulations. Failure to comply is a breach of contract terms. Visitors to any Brice operation will be required to follow the safety rules and regulations in effect during their visit. This includes suppliers, owner representatives, agents of the architect or engineer, regulatory authorities, and insurance company representatives.

2.2 Safety Program Goals and Objectives

Brice considers site safety the highest priority during fieldwork, and maintaining a safe working environment is the responsibility of every employee. The project will be conducted in a manner that minimizes the possibility of injury, accident, or incident.

The following Health, Safety, and Environment (HSE) goals and objectives are established for this project:

- Create an injury-free environment
- Have zero injuries or incidents
- Provide management leadership for HSE by communicating performance expectations, reviewing and tracking performance, and leading by example
- Effectively implement the APP through education, delegation, and teamwork

- Maintain 100 percent participation in HSE compliance
- Continuously improve our safety performance
- Maintain free and open lines of communication
- Make a personal commitment to safety as a value
- Continue strong employee involvement initiatives
- Achieve health and safety excellence

2.3 Disciplinary Policies

A disciplinary system is in place to protect workers and promote a safe work environment. If an employee fails to comply with established safety rules and regulations as presented in this APP or corporate policies and procedures, work will be stopped; the violator will be required to leave the site; and where appropriate, the individual will be subject to further disciplinary actions. This disciplinary system applies to every PM, site superintendent, subcontractor personnel, and laborer.

3.0 RESPONSIBILITIES

This section identifies the project organization and personnel responsibilities for management and implementation of this APP.

Brice takes pride in having a reputation of safety and quality. Brice team members have full support from management to enforce the provisions of this program. To conduct this program successfully, every PM, subcontractor personnel, and laborer is charged with the ability to stop work when unsafe conditions exist. Enforcement of the policies and procedures described herein will be treated seriously; repeat or willful violators will be reprimanded and may face termination.

3.1 Site Management Health, Safety, and Environment Responsibilities

Table C-3 Key Personnel and Responsibilities

NAME	POSITION	RESPONSIBILITY
Jamie Oakley	Program Manager	The Program Manager will represent and enforce Brice safety and health policies from the corporate level to the project level. They have authority to address any safety or health issues and take corrective, disciplinary, or any other actions deemed necessary for a safe and healthful workplace. The Program Manager will be aware of any accidents or near accidents and provide follow-up administration that proper filings have been made.
Greg Rutkowski	PM	The PM will oversee the implementation of the project plans, work, and health and safety management process. They will verify site-specific safety procedures are maintained, and health and safety goals are implemented, as well as provide the interface between the client and Brice.
Chris Boese	Field Lead/SSHO	The Field Lead/SSHO will coordinate fieldwork, provide the interface between the field crew and the PM, and verify onsite personnel comply with this APP and have received proper health and safety training. The Field Lead/SSHO will conduct daily safety meetings/site inspections and oversee implementation of the APP.

Table C-3 Key Personnel and Responsibilities

NAME	POSITION	RESPONSIBILITY
Jamey Smith	HSM	The HSM will coordinate corporate policy with project SSHO. He will comply with requirements and oversee implementation of SSHP, conduct periodic audits in coordination with the PM, and participate in incident investigations, corrective action reporting, and other pertinent reporting as required.
Vanessa Ritchie	QA/QC Manager	The QA/QC Manager will review specifications, amendments, plans, and drawings in their entirety. The QA/QC Manager will manage and coordinate the three-phase control and documentation performed by QC specialists, testing laboratory personnel, and other inspection and testing personnel required by the contract. The QA/QC Manager will also coordinate with the USACE representative in the performance of QA/QC audits and inspections. The QA/QC Manager has authority to stop work on all or any project work activity due to non-conformance with this plan. The QA/QC Manager works closely with the SSHO to address potential environmental concerns before those concerns develop.

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

3.2 Competent Persons

The OSHA definition of a Competent Person is one capable of identifying existing and predictable hazards in the surroundings or working conditions that are unsanitary, hazardous, or dangerous to employees, and who has authorization to take prompt corrective measures to eliminate them. Competency qualification documentation is kept on file with the PM and SSHO.

Competent Persons, as defined in EM 385-1-1, Section Q (USACE 2014), must have requisite experience and knowledge in the safety and health aspects of the project activities to be supervised. Qualification requirements will vary depending on the work activity. Examples of activities where supervision by a Competent Person is necessary include safety and health requirements, fire protection and prevention, confined space entry, excavation and trenching, scaffolding, fall protection, electrical safety, lockout/tagout, crane operations, rigging, asbestos abatement, and lead paint removal or stabilization. No one is required to perform a task or work at a site that they believe or know is unsafe or unhealthy.

The following individuals are named on the project's Competent Persons list:

- **Jamey Smith, Brice, HSM** – All work aspects listed in this APP and the attached SSHP
- **Greg Rutkowski, Brice, PM** – Safety and health requirements and the activities included in this APP associated with site-specific activities
- **Vanessa Ritchie Brice, Quality Assurance (QA)/Quality Control (QC) Manager** – Safety and health requirements and the activities included in this APP associated with site-specific activities
- **Chris Boese Brice, Field Lead/SSHO** – Safety and health requirements and the activities included in this APP associated with site-specific activities

Subcontractors can add additional personnel to the Competent Persons list through formal document submittal.

3.3 Pre-Task Safety Analysis

Providing a worksite that is as safe as possible is the responsibility of the PM, first and foremost. Before the start of any work activity, the PM will review the APP and SSHP (Attachment C-1) to fully understand the scope of work and potential hazards that may exist. This understanding will be made known to all workers onsite. Work will not begin until the initial Activity Hazard Analysis (AHA) forms for the work activity have been accepted by the HSM and reviewed onsite by the workers engaged in the activity. A blank AHA form is provided in Attachment C-2.

3.4 Employee Hazard Reporting

The environmental construction industry and related fields have inherent dangers. In daily project operations, potential problems can surface from unexpected events or human error. The size and nature of worksites, as well as the complexities of location and access, make it increasingly difficult to manage hazard and risk controls.

Brice's Employee Hazard Recognition and Safety Observation Reporting Program (discussed in the SSHP) strives to improve site personnel alertness to hazardous situations. This alone can have the biggest impact on the health and safety of each person. The goal of the program is twofold:

- To encourage Brice employees to be alert to worksite situations and conditions that may be unsafe or unhealthy.
- To encourage taking preventive action before anybody gets hurt, any equipment is damaged, or an environmental incident occurs.

Hazard Recognition and Safety Observation Cards (Attachment C-2) will be readily available to employees at each project site. When an employee identifies a hazard during a shift, the front and back sides of this card should be completed and submitted to the supervisor. This reporting can happen immediately (if necessary) or at the end of the shift. The employee can sign the card or leave it anonymous. Anonymity can be a consideration when the issue is related to the actions of an individual.

A verbal report of a hazard is still an option. If this happens, the supervisor must record it and log their own observations. The Hazard Recognition and Safety Observation Card can also be used in this instance, noting "verbal" on the form and leaving the name of the employee blank if anonymity is preferred.

Whether recorded on the Hazard Recognition and Safety Observation Card or reported verbally, the manager or supervisor must complete the back of the card by recording their own observations and the corrective actions to be taken to effectively control the hazardous situation.

4.0 SUBCONTRACTORS AND SUPPLIERS

This section describes the responsibilities of subcontractors and suppliers. Specialty subcontractors are anticipated for drilling, surveying, utility locators, underground construction, investigation-derived waste disposal, and analytical laboratory testing.

Subcontractors at the HFT will be required to review, sign, and comply with the APP. Their signature signifies their understanding of and compliance with its provisions. Subcontractor employees will be required to attend the daily safety meetings. Failure to conform to basic safety procedures and/or to correct issues immediately will result in stopping work, requesting the person/subcontractor to leave the site, and, when appropriate, disciplinary actions.

5.0 TRAINING

Employees will receive safety training regarding hazards associated with their work assignments. Site safety orientation meetings that involve review of pertinent aspects of the APP and SSHP will be completed for personnel before the start of project fieldwork. Daily safety meetings will be conducted for field operations, and attendance will be documented (Section 5.5).

Copies of safety and health training certificates will be reviewed and maintained with the PM and SSHO. These certifications will be available on request. Personnel are not to perform fieldwork until the SSHO has determined this documentation to be complete and sufficient.

Personnel assigned to fieldwork on this project are required to complete the following training (as applicable):

- Site safety orientation briefing (site personnel)
- Daily safety meetings (site personnel)
- First aid and cardiopulmonary resuscitation (CPR) training (when two or more personnel are onsite, a minimum of two of those personnel will be trained in first aid and CPR)
- OSHA 40-hour and 8-hour refresher Hazardous Waste Operations and Emergency Response training

5.1 New Hire Requirements

Employees on this project will be required to participate in a New Employee Orientation, which will include mandatory review of the relevant APP for the project site. The SSHO will conduct daily safety meetings (Section 5.5) as well as weekly safety meetings to advocate safety in the workplace and discuss current project concerns that are pertinent to the well-being of each person employed. Attending safety meetings is mandatory, and participants will be required to sign an attendance form.

5.2 Safety Subjects to be Discussed

The following subjects will be discussed during site safety orientation meetings:

- Site-specific and local concerns
- Weather (cold stress and heat stress)
- Equipment
- Job hazards
- Loading, hauling, and traffic control
- Brice's policies and safety overviews
- Alcohol and drug abuse prevention
- Hazardous communication procedures
- PPE
- Fall protection (primarily off equipment)
- Fire prevention and protection and the Emergency Action Plan
- Environmental compliance
- Safety Recognition Plan
- Accident reporting and investigation
- Lines of authority

5.3 Safety and Health Meeting Procedures

Safety meetings will be conducted daily by the SSHO (Section 5.5), and attendance will be required for employees and subcontractors. Supervisory safety meetings will be held as needed, enabling the SSHO to coordinate the current and upcoming phases of work and analyze the potential hazards associated with them. Information resulting from these project management meetings may be passed along to the crew in the form of employee safety meetings.

5.4 Emergency Response Training Requirements

To keep employees safe in an emergency, response training will be incorporated into employee training and will include the following:

- Escape routes
- Routes to medical facilities
- Muster points and employee accounting
- Rescue and medical duties
- Reporting of emergencies
- Emergency contact numbers
- Fire prevention and firefighting plan

5.5 Daily Safety Meetings

Before the start of daily fieldwork, a daily safety meeting will be conducted by the SSHO or designated Field Lead to address the planned activities. The daily safety briefing will serve to notify individuals of any deficient areas that need to be corrected or operation changes made that will affect fieldwork. The briefing will emphasize the specific concerns associated with the planned field activities. Daily weather reports will be reviewed to determine work/rest regimen. Those in attendance will be required to sign the Daily Site Safety Meeting form.

6.0 SAFETY AND HEALTH INSPECTIONS

The SSHO will conduct daily safety inspections and maintain them with the project files. Deficiencies noted during these inspections will be corrected as soon as possible, depending on the seriousness of the deficiency.

6.1 Internal Inspections

The SSHO will be responsible for worksite safety inspections. The results of the inspections (including any health and safety deficiencies) will be recorded, and any observed deficiencies will be corrected immediately. Follow-up inspections will be conducted to confirm compliance with this APP. These inspections will be conducted before each shift.

6.2 External Inspections

At this time, Brice is not aware of any external inspections or certifications that may be required pertaining to health and safety on this project.

6.3 Equipment Inspections

Machinery and mechanized equipment will be inspected and tested by a Competent Person to verify safe operating condition before use at the project site (before each work shift, if necessary). Inspections and tests will be in accordance with the manufacturer's recommendations. Any piece of equipment that does not pass inspection or is deemed unsafe will be withdrawn from service immediately. The unsafe machine will be reinstated only after repairs to correct the deficiencies have been completed and the equipment has passed reinspection. Records of tests and inspections will be maintained at the project office.

6.4 Vehicle Inspections

Motor vehicles owned or rented by Brice or its subcontractors will be inspected as described in the SSHP (Attachment C-1).

7.0 ACCIDENT REPORTING AND INVESTIGATION

All incidents, accidents, injuries, and "near misses" will be reported to the PM and HSM immediately. An accident report will be completed by the SSHO, and the accident will be further investigated by the HSM. The primary procedures for accident reporting and investigation are outlined in this section and documented in the SSHP (Attachment C-1).

7.1 Accident Reporting

Important requirements for accident reporting and follow up are described below.

- Employees must report all accidents, incidents, near-miss incidents, injuries, illnesses, and performance of first aid to their supervisor, SSHO, and/or PM immediately.
- In the event of an employee injury or illness, supervisors are responsible for notifying the SSHO, who in turn is responsible for notifying the PM and HSM. The HSM should be contacted immediately to assist with coordination of required medical assistance and related workers' compensation case management follow up.
- Should an incident such as a serious injury, explosion, fire, or a spill or release of toxic materials occur during the project, the SSHO will immediately report the incident to the PM, HSM, and the appropriate government agencies. The USACE PM will receive verbal notification immediately after an incident and written notification within 24 hours. The report, to be prepared by the HSM and SSHO, will include the following information:
  - Name, organization, telephone number, and location of the contractor
  - Name and title of the person(s) reporting
  - Date and time of the incident
  - Location of the incident, (i.e., site location, facility name)
  - A brief summary of the incident giving pertinent details, including type of operation occurring at the time of the incident
  - Cause of incident, if known
  - Casualties (i.e., fatalities, disabling injuries)
  - Details of any existing chemical hazard or contamination

  - Estimated property damage, if applicable
  - Nature of the damage and effect on contract damage
  - Action taken to preserve safety and security
  - Other damage or injuries sustained, public or private
- The HSM will notify the Program Manager immediately regarding all serious accidents.
- The HSM and SSHO will complete and file a written *Accident Investigation Report* within the required timeframe (Section 7.2).
- If an accident involves hospitalization of three employees or a fatality, the HSM must be notified immediately and will be responsible for notifying the jurisdictional OSHA office, as soon as possible and no later than 8 hours after the accident. (This notification includes weekend days because 24-hour emergency reporting access is available). The report to OSHA must include the following information:
  - Time and date of accident
  - Employer's name, address, and telephone number
  - Name and job title of person reporting the accident
  - Address of the site of the accident
  - Name of person to contact at the site of the accident
  - Name and address of injured employee(s)
  - Nature of injury
  - Location where injured employee(s) was moved
  - List and identity of other law enforcement agencies present at the site of the accident
  - Description of the accident and whether the accident scene has been altered
- The SSHO, with the assistance of the PM, will obtain a doctor's first report of injury for every injury or illness requiring medical treatment and will forward to the HSM immediately.
- For workers' compensation cases, the PM and SSHO will be responsible for obtaining information for completion of the *Employee's Claim for Workers' Compensation Benefits* form within 1 working day of the injury. This form must be completed by the injured employee (or dependent) and submitted to the HSM who will follow up and send a completed copy of this form to the company insurance carrier within 3 days.
- The HSM will prepare a supplementary record of occupational injuries and illnesses on recordable cases on OSHA Form 101 or OSHA Form 5020 *Workers' Compensation Reports* providing the same information. Necessary information for completion of the *Employer's Report of Occupational Injury or Illness* will be obtained and filed within 5 days of every occupational injury.
- The HSM will record each injury or illness on the OSHA Form 300 *Log of Work-Related Injuries and Illnesses*. Every year, the HSM will review and certify the OSHA Form 300A *Summary of Work-Related Injuries and Illnesses*, post it no later than 1 February, and keep it posted where employees can see it until 30 April.

7.2 Accident Investigation

The SSHO and affected employee supervisor will make a complete investigation of all incidents/accidents and inspect the area or equipment involved. The PM and SSHO will be responsible for completing and filing USACE ENG Form 3394 Accident Investigation Report (Attachment C-2), as applicable, within 24 hours of the accident or on the first workday after the date of the accident. For serious injury or fatality, this must be done immediately.

7.3 Exposure Data

In accordance with the Statement of Work, contractor labor (including subcontractor labor) required for project performance and estimated total cost (if any) incurred to comply with this reporting requirement will be reported annually.

8.0 PLAN PROGRAMS AND PROCEDURES

The primary hazards associated with this project are physical and chemical hazards. This section discusses the hazards anticipated during site operations and the procedures implemented by Brice to eliminate or minimize these hazards. EM 385-1-1 (USACE 2014) recommends inclusion of specific elements in this section. Associated plans and programs are described in the following sections, and those not applicable to the work are listed in Section 8.24.

8.1 Fatigue Management Plan

Brice employees and subcontractors will follow the Fatigue Management Plan described below. This Fatigue Management Plan is consistent with the metrics outlined in EM 385-1-1 (USACE 2014). The SSHO will provide training that relates to recognizing the signs and symptoms of fatigue and how to mitigate it in the workplace. The training will focus on communication methods between coworkers, and between management and employees, so concerns can be raised to maintain a safe environment. The training will also include topics such as creative work scheduling and tracking of work/break hours.

Fatigue management allows for steps to be taken towards ensuring a safe work environment, eliminating unsafe conditions and work practices that could potentially lead to illness, personal injury, equipment, or other property damage. This Fatigue Management Plan applies when there is potential for employees to:

- Exceed 10 hours a day for more than 4 consecutive days
- Exceed 50 hours in a 7-day work week
- Exceed 12 hours a day for more than 3 consecutive days
- Exceed 58 hours a week of sedentary work (to include office work)

Operators of equipment such as hoisting equipment and draglines, mobile construction equipment, electrical power systems, hydropower plants, industrial manufacturing systems, hydraulically operated equipment, powered vessels, and boats will not be permitted to exceed 12 hours of duty time in any 24-hour period, including time worked at another occupation. A minimum of 8 consecutive hours of rest between shifts in a 24-hour period is required.

Rest periods may be interrupted in case of emergency, drill, or other overriding operational necessity.

8.1.1 Signs and Symptoms of Fatigue

Fatigue signs and symptoms include, but are not limited to:

- Blurred vision
- Tiredness, difficulty keeping eyes open, head nodding, drowsy, falling asleep at work
- Irritability

Safety consequences associated with fatigue include, but are not limited to:

- Decreased awareness and higher error rates
- Slowed reaction time; poor hand-eye coordination
- Poor communication
- Reduced vigilance or focus
- Difficulty responding in emergencies
- Inability to recount events sequentially

8.1.2 Responsibilities

Fatigue management is a shared responsibility between management and workers, monitoring each other as well as themselves. Management responsibilities include, but are not limited to:

- Ensuring workers are provided enough time for a continuous 7 to 8 hours of sleep in each 24-hour period
- Ensuring enough cover for workers on annual or sick leave
- Limiting the amount of overtime so workers do not exceed 12 hours per workday
- Developing creative work schedules to prevent repetitive work breaks during critical times in the work cycle, control of environmental factors (heat/cold, use of PPE), buddy check-in for individuals working alone, and alternate transportation for long commutes
- Providing training to employees to better recognize signs and symptoms of fatigue and how to communicate concerns to management
- Employee/contractor responsibilities include, but are not limited to:
- Ensuring they are fit for work and not adversely affected by lack of sleep or physical and mental fatigue
- Raising concerns if they perceive themselves as being affected by fatigue or unable to perform their job functions
- Raising concerns if they perceive their coworkers are being affected by fatigue or unable to perform their job functions

8.2 Emergency Response Plans

Safety awareness meetings and operations in conformance with this APP will be used to prevent accidents. Telephone numbers and routes to local medical facilities will be posted in the field office. Emergency contact telephone numbers are presented in the front of this document and will be available at the project site. Brice personnel will be first aid/CPR-trained and will be equipped with onsite emergency response/first aid spill contaminant cleanup supplies.

In the case of an emergency, 911 will be contacted via cell phone. When calling 911, the following information should be reported:

- Name
- Company name
- Type of emergency and perceived severity
- Location of accident or injury—it is important to specifically tell the 911 dispatcher that the emergency is at the HFT, near Tlegu Beach.
- Time of incident
- Type of first aid or response being given

DO NOT HANG UP until the operator or emergency dispatcher directs you to hang up. Notify the SSHO or your immediate supervisor immediately after hanging up the telephone, and aid in completion of the accident investigation process.

8.3 Spill Plans

The SSHO and PM will be notified immediately when a spill or release occurs. The SSHO or PM will notify the USACE as soon as the site is under control and a plan has been developed and implemented. Regulatory agencies will be notified by the USACE PM. Contact and reporting numbers are listed at the front of this document.

No one will enter the site until a plan is in place and the approach has been approved. Personnel involved with any containment or cleanup will wear appropriate PPE for specific contaminants.

Field personnel will record the following information immediately for a spill of any volume:

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

8.4 Posting of Emergency Numbers

Emergency telephone numbers are included at the front of this document.

8.5 Prevention of Alcohol and Drug Abuse

Brice implements a drug prevention and testing program and maintains a "zero tolerance" policy regarding alcohol or drugs on the job. This program employs pre-hire, reasonable suspicion, and post-accident testing. Any personnel possessing or found to be under the influence of alcohol or illicit drugs on the job will be dismissed immediately. Any employee with prescribed drugs must obtain a medical clearance statement and provide a copy to his supervisor.

8.6 Site Sanitation Plan

Brice will maintain a neat worksite with good housekeeping in project work areas. At individual worksites, common paths of travel will be established and kept free from accumulated materials. Access to paths, exits, and emergency equipment will be kept free from obstructions and slip hazards and adequately illuminated during work. Specific areas will be designated, as appropriate, for the proper storage of materials. Tools, equipment, materials, and supplies will be stored in an orderly manner. As work progresses, scrap and unessential materials will be removed from the work area. Containers will be provided for collecting trash and other debris and emptied at regular intervals. Spills and leaks will be cleaned up quickly.

8.7 Medical Support

The route to the nearest hospital or clinic is presented on Figure C1-1 of the SSHP (Attachment C-1).

8.8 Bloodborne Pathogen Plan

Exposure to bloodborne pathogens may occur when rendering first aid or CPR, or when coming into contact with landfill waste or waste streams containing potentially infectious material. Perform first aid or CPR as follows:

- Observe universal precautions to prevent contact with blood or other potentially infectious materials. Where differentiation between body fluid types is difficult or impossible, consider all body fluids to be potentially infectious materials.
- Always wash your hands and face with soap and running water after contacting potentially infectious material. If washing facilities are unavailable, use an antiseptic cleanser with clean paper towels or moist towelettes.

If necessary, decontaminate all potentially contaminated equipment and surfaces with chlorine bleach as soon as possible. Use 1 part chlorine bleach (5.25 percent sodium hypochlorite solution) diluted with 10 parts water for decontaminating equipment or surfaces after initially removing blood or other potentially infectious materials. Remove contaminated PPE as soon as possible before leaving a work area.

8.9 Site Layout, Access, and Road Plan

The use of traffic control measures is not anticipated. Work will be conducted to enable safe passage of two-way traffic while working on or near roads.

8.10 Hearing Conservation Program

Noise may be generated when heavy equipment is used, such as trucks or a drill rig. Hearing protection is mandatory when working in areas where the noise levels exceed 85 decibels. Hearing conservation is described in greater detail in Section 5 of the SSHP (Attachment C-1).

8.11 Respiratory Protection Plan

Where feasible, exposure to airborne contaminants at concentrations presenting potential health hazards will be eliminated by engineering controls. When effective engineering controls are not feasible, use of respiratory PPE will be required to achieve this goal. When conducting intrusive activities, respiratory equipment may be required. Details of the time-integrated instrument, air monitoring, respiratory protection are presented in Section 9 of the SSHP (Attachment C-1). The Respiratory Protection Plan provides the minimum procedures to be followed when respiratory hazards are encountered. The intent of this program is to enhance the protection of worker health and prevent the inhalation of harmful airborne substances or oxygen-deficient air.

8.12 Health Hazard Control Program

During the site safety orientation meetings, Brice will discuss materials onsite that are potentially harmful to personnel and the health hazards associated with those materials. PPE will be used to prevent contact with harmful material, and AHAs will be used to document hazard evaluations regarding each task that entails handling and working around harmful materials, if necessary.

8.13 Hazard Communication Program

The Brice Hazard Communication Program has been established to inform workers and subcontractors of potential site-specific chemical hazards and to comply with the requirements of CFR Title 29, Section 1910 and EM 385-1-1 (USACE 2014). The purpose of the Hazard Communication Program is to communicate the hazards of workplace chemicals and protective measures to control the hazards.

Hazard communication will be accomplished through the following measures:

- Maintaining a list of workplace chemicals
- Labeling workplace chemical containers
- Maintaining a Safety Data Sheet (SDS) for each workplace chemical and potential workplace chemicals
- Implementing a training program to communicate the hazards of chemicals and appropriate protective measures
- Describing procedures to add SDSs to the site

Upon completion of Hazard Communication Program training, Brice employees and subcontractors will understand the components of hazard communication, the hazards of the chemicals in their workplace, and the protective measures used to control the hazards.

8.14 Lead Compliance Plan

Lead acid batteries and associated impacted soil may be encountered as part of the field activities. To minimize risk from incidental ingestion exposure to lead in batteries and impacted soil, gloves will be required for all handling and proper decontamination of equipment will occur after fieldwork. Additionally, lead batteries and potentially contaminated soil will be stored in appropriate containers to prevent release of material during handling, storage, and transport.

8.15 Heat/Cold Stress Monitoring Plan

Precautions for cool and warm days are addressed in Section 10 of the SSHP (Attachment C-1).

8.16 Fire Prevention Plan

Fire prevention is critical for maintaining a safe work environment. Fire extinguishers (5-pound ABC) will be available in project vehicles. Major potential workplace fire hazards include:

- Damaged electrical cords
- Overloaded circuits
- Wastepaper and other trash clutter
- Flammable liquids
- Combustible liquids
- Improperly stored chemicals
- Smoking in “No Smoking” areas
- Vehicles sparking dry brush while driving off-road
- Mowing grass

8.17 Hazardous Energy Control Plan (Lockout/Tagout)

Brice will incorporate lockout/tagout where the control of hazardous energy is required. In daily operations, this should not be an issue. Any piece of equipment or area deemed unsafe will be locked and tagged to prevent use until repairs are made. Hazardous energy may include electricity, stored pressure, pneumatic pressure, and compressed liquid pressure. Coordination with immediate supervisors and the Contracting Officer’s Representative is mandatory when an energized system requires repair and lockout/tagout is to be employed.

Employees affected by this procedure will be notified before lockout/tagout devices have been applied and before they are removed. Before work can begin, the power will be:

- Controlled
- De-energized
- Secured with a lockout/tagout device
- Tried (attempt to turn on) to release any stored energy

Only the person placing the lock and tag on the system may remove it. Locks and tags will:

- Be capable of withstanding the environment they are in
- Identify the employee applying the device
- Be constructed in such a way as to prevent removal without excessive force

All employees will be made aware of this program. Those who may be directly involved will receive more extensive training on the process, specifically recognition and magnitude of hazardous energy sources, how to isolate and control the energy, and the purpose and use of the energy control procedures. After being notified of lockout/tagout devices being used, the SSHO will make documented periodic inspections to verify compliance with hazardous energy control procedures.

8.18 Severe Weather Plan for Marine Activities

Types of severe weather that may be encountered in Haines, Alaska in May through October include high winds, high seas, fog, intermittent snow or freezing rain, and occasional sub-freezing temperatures. Mean daily temperatures for May through October range from 43 to 58 degrees Fahrenheit. The SSHO or a designated team member will monitor weather and terrain conditions prior to marine activities and will notify site personnel if they are not advised; contingency plans will be communicated accordingly. The boat captain will be responsible for monitoring weather conditions affecting the vessel and small watercraft. National Oceanic and Atmospheric Administration (NOAA) marine weather broadcasts and other available commercial weather forecasting services will be reviewed before marine activities. The following sections describe the contingency plans for fog, rough seas, and high winds, which are the kinds of severe weather that will most likely affect operations during marine activities.

8.18.1 Fog

Fog is the most common adverse weather condition expected during the spring and summer. Fog can persist for days and may reduce visibility so that navigating around the coast will be difficult. High visibility clothing will be worn while working in foggy conditions. The SSHO or a designated team member will maintain contact, and if weather conditions improve, the SSHO, in consultation with the vessel crew, will determine when marine activities can be completed.

Small watercraft marine activities by will not be initiated if visibility conditions make such activity hazardous. If small watercraft are caught in low-visibility conditions while underway, communication between the watercraft and the vessel will be maintained via marine or two-way radio. If the small watercraft is near shore, it will return to shore and await better visibility. The vessel's foghorn and floodlights will be used to guide the small watercraft to shore.

8.18.2 High Winds, High Waves, or Storms

Wind, rain, and overcast conditions can make the weather in Haines, Alaska unpleasant and navigation hazardous. Gales and williwaws (local, very strong, gusty winds) are possible. If the predicted weather is severe enough to preclude the use of small marine vessels, the storm will be monitored. Any operations on decks exposed to severe weather will require the correct use of USCG-approved personal flotation devices (PFDs)—Types I, II, III, or V—by all personnel on deck, regardless of other safety devices employed. Wind speeds will be measured by field personnel using an anemometer. To ensure the safety of field personnel from hazards posed by high winds (e.g., flying debris), work will be halted at a sustained wind speed of 40 miles per hour.

8.19 Earthquake/Tsunami Plan

In the event of a natural disaster such as an earthquake, all personnel will meet at the designated muster point. As a result of earthquakes, tsunamis can cause damage, flooding, and erosion. All site personnel will be familiar with emergency procedures, which will be covered at site safety orientations and reviewed

periodically during daily tailgate meetings. When the vessel is present, the boat captain will notify site personnel if a tsunami warning has been initiated and the team will muster at the identified high point. The International Tsunami Information Center and field team observations (e.g., earthquakes, sudden rise or fall of ocean, loud roar from ocean) will be used to determine when site personnel should move to the tsunami muster point.

In the event of a severe storm warning, Brice personnel will take the following safety measures:

- Outside equipment and materials will be secured; materials that could be damaged will be placed in protected areas.
- The surrounding area will be checked (including roof of building) for loose material, equipment, debris, and other objects that could be blown away or against existing facilities.
- Temporary erosion controls will be inspected for stability.

8.20 Site-Specific Fall Protection and Prevention Plan

The primary concern regarding fall prevention and protection will be the ascent and descent from equipment. This will be a topic at the orientation emphasizing using the three-point method for climbing in and out of equipment, in addition to stair use. When fall protection is required, a stand-alone Fall Protection Plan will be generated for each case, reviewed, and approved by competent fall protection staff and the SSHO.

8.21 Site Safety and Health Plan

Site safety and security will be maintained by:

- Limiting access at control points to only authorized and essential personnel.
- Assigning the responsibility for enforcing exit and entry requirements.
- Requiring the SSHO/Brice PM to approve all visitors to the site.
- Stopping work immediately if unauthorized personnel attempt to or succeed in accessing the work area or exclusion zone. In this case, the worker will notify the SSHO, the site superintendent, and the Brice PM immediately.

Site security is essential to:

- Prevent unauthorized, unprotected, or unqualified people from being exposed to site hazards.
- Protect established and safe working procedures.
- Protect personnel from wildlife.

An SSHP is provided as Attachment C-1.

8.22 Hot Work

Hot work is not anticipated. If hot work is to be performed, the project PM will be notified, and the equipment necessary to prevent the spread of fire in remote locations will be available onsite. A Welding/Brazing/Hot Work Permit will be completed and approved by the Fire Department and SSHO before the start of hot work. A fire watch will be assigned to the work area while hot work is in progress and will remain at the location for at least 1 hour after exposure has ended.

Good housekeeping is mandatory at Brice worksites. Debris that is potentially combustible will be disposed of promptly. Flammable materials will be stored in accordance with National Fire Protection Association (NFPA) standards NFPA 30 (Flammable and Combustible Liquids Code) and NFPA 30A (Code for Motor Fuel Dispensing Facilities and Repair Garages in closed containers). Unopened containers of flammable and combustible liquids will be kept in a well-ventilated location, away from heat, flame, spark, or direct sunlight. Flammable materials will be stored and transported in a proper metal storage cabinet and marked "Flammable." All sources of ignition will be prohibited within 50 feet of operations that have potential fire hazard. "No Smoking, Matches, or Open Flame" signs will be posted in areas of potential fire hazard.

8.23 Boat Safety

To complete sediment sampling, personnel will be transported to site via small watercraft (Zodiac boat or equivalent). The small watercraft will be operated by the vessel subcontractor. Brice will ensure that all subcontractor crew are deemed qualified by the ship's master to operate any vessels that they are assigned to operate. Boat operation and safety adherence procedures will be conducted in accordance with EM 385-1-1 (USACE 2014) and BE-SOP-53 Boat and Watercraft Operations (Appendix D of the Work Plan).

8.24 Inapplicable Programs and Plans

USACE recommends inclusion of certain elements in APPs. The following programs and plans are not applicable to this project, as their associated elements are not included in the scope of work:

- Procedures and Tests
- Man Overboard/Abandon Ship
- Exposure Control Plan
- Automated External Defibrillator Program
- Access/Haul Road Plan
- Process Safety Management Plan
- Asbestos Abatement Plan
- Radiation Safety Program
- Abrasive Blasting Plan
- Indoor Air Quality Management Plan
- Mold Remediation Plan
- Chromium (VI) Exposure Evaluation
- Crystalline Silica Assessment
- Lighting Plan for Night Operations
- Traffic Control Plan
- Wild Land Fire Management Plan
- Arc Flash Hazard Analysis
- Assured Equipment Grounding Control Program
- Hazardous Energy Control Plan
- Standard Pre-Lift Plan
- Critical Lift Plan
- Naval Architectural Analysis
- Floating Plant Inspection and Certification

- Emergency Plan for Marine Activities
- Man Overboard/Abandon Ship Procedures
- Float Plan for Launches, Motorboats, Skiffs
- Demolition/Renovation Plan
- Rope Access Program
- Excavation/Trenching Plan
- Fire Prevention and Protection Plan for Underground Construction
- Compressed Air Plan for Underground Construction
- Erection and Removal Plan for Formwork and Shoring
- Pre-Cast Concrete Plan
- Lift-Slab Plans
- Masonry Bracing Plan
- Steel Erection Plan
- Explosives Safety Site Plan
- Blasting Safety Plan
- Dive Operations Plan
- Safe Practices Manual for Diving Activities
- Emergency Management Plan for Diving
- Tree Felling/Maintenance Program
- Aircraft/Airfield Construction Safety and Phasing Plan
- Aircraft/Airfield Safety Plan Compliance Document
- Confined Space Program
- Confined Space Entry Program

9.0 RISK MANAGEMENT PROCESS AND UNIQUE HAZARD ELEMENTS

Potential chemical hazards that may be found onsite and management of onsite risks are discussed in Section 2.1.5 of the SSHP (Attachment C-1).

9.1 Decontamination Procedures Plan

Decontamination protects workers, the public, and the environment by limiting exposure to harmful substances and by preventing the spread of contamination. Decontamination procedures are discussed in Section 7.0 of the SSHP.

9.2 Waste Management and Containerization

The term “waste” includes investigation-derived waste, PPE, sampling waste, field trash, and office trash. Waste management and disposal is discussed in Section 4.10 of the Work Plan.

10.0 SITE POSTINGS

The required employment-related posters for job sites are discussed in Section 15 of the SSHP.

11.0 REFERENCES

Office of the Federal Register (OFR). 2005. *Hazardous Waste Operations and Emergency Response.* National Archives and Records Administration. *29 CFR 1910.120 and 1926.65*. October.

U.S. Army Corps of Engineers (USACE). 2014. *Engineer Manual 385-1-1, Safety and Health Requirements.* November.

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Attachment C-1
Site Safety and Health Plan

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EMERGENCY INFORMATION

Table C1-1 Emergency Information

Emergency Contacts

ORGANIZATION	NUMBER
Emergency	911
Hospital: Haines Health Center 131 1st Avenue, Haines, Alaska 99827	907-766-6300
Fire: Haines Fire Department 315 Haines Road, Haines, Alaska 99827	907-766-6441
Police: Haines Police Department 315 Haines Road, Haines, Alaska 99827	907-766-2121
Brice Program Manager (Jamie Oakley)	907-275-2912
Brice Project Manager (Greg Rutkowski)	907-350-6742
Brice QA/QC Manager (Vanessa Ritchie)	907-699-6899
Brice Site Safety and Health Officer (Chris Boese)	907-290-8994
Brice Field Scientist (Jill Stockbridge)	907-590-2916
Brice Field Scientist (Kristin Hruska)	907-378-2630
Brice Health and Safety Manager (Jamey Smith)	503-539-9504
USACE Program Manager (Bob Hazlett)	907-753-2623
USACE Contracting Officer Representative (Julie Allan)	907-753-5555
USACE Project Manager (Guy Warren)	907-753-5774
USAG Alaska DPW Primary RPM (Peter Baker)	907-361-6623
USAG Alaska DPW Alternate RPM (Melissa Shippey)	907-361-9622
USAEC (Sam Klein)	210-466-1116

Transport and Evacuation

ORGANIZATION	NUMBER
LifeMED Alaska Air Ambulance	800-478-5433
Alaska Regional LifeFlight Air Ambulance (Anchorage)	800-478-9111
Alaska State Troopers	800-269-5511

Spills and Toxins Contact List

ORGANIZATION	NUMBER
Spill Prevention and Response Division Alaska Department of Environmental Conservation	907-451-2121 After hours: 800-478-9300
National Response Center (Oil and Toxic Chemical Spills)	800-424-8802
Poison Control Center	800-222-1222

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

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1 INCH



HAINES FUEL TERMINAL PFAS REMEDIAL INVESTIGATION

HAINES, ALASKA

HOSPITAL ROUTE

Legend

- Hospital Location
- Project Location
- Hospital Route

Route to Hospital

Start
Haines Fuel Terminal PFAS RI Site
Haines, AK 99827

1. Head southeast on Lutak Rd toward Old Tanani Mil Tank Farm Rd - 3 miles
2. Continue straight onto 2nd Ave - 0.3 miles
3. Turn left onto Willard St – 141 ft
4. Turn right - 302 feet

Finish
Haines Health Center
131st Ave South, Haines, AK 99827

Drive 3.4 miles, 6 minutes

ALASKA STATE PLANE COORDINATE SYSTEM ZONE 1, U.S. SURVEY FEET
HORIZONAL DATUM: NAD83 (2011) | VERTICAL DATUM: NAVD88

2,500 1,250 0 2,500 5,000

Feet

CONTRACT No.:	DATE:	FIGURE:
841402	10/16/2024	C1-1
P.M.: G.R.	DRAWN: T.A.	

Document Path: Q:\BES\5 PROJECTS\Ds0\USACE Alaska IDR ERS MATOC\Task Orders\4502_HainesPFAS_RI\10_Submittals\01_Final_WorkPlan_MED_Suppl_GIS\1_MXD\SSHP\FA1-1_HospRoute.mxd

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ACRONYMS AND ABBREVIATIONS

°F	degrees Fahrenheit
ACGIH	American Conference of Governmental Industrial Hygienists
AHA	Activity Hazard Analysis
Brice	Brice Environmental Services Corporation
BTEX	benzene, toluene, ethylbenzene, xylenes
CDC	Centers for Disease Control and Prevention
CFR	Code of Federal Regulations
CNS	central nervous system
COPC	contaminant of potential concern
CPR	cardiopulmonary resuscitation
DOT	Department of Transportation
DPW	Directorate of Public Works
DRO	diesel range organics
EC	Emergency Coordinator
EDB	ethylene dibromide
EPA	U.S. Environmental Protection Agency
GRO	gasoline range organics
HAZWOPER	Hazardous Waste Operations and Emergency Response
HFT	Haines Fuel Terminal
HMIS	Hazardous Materials Information System
HSM	Health and Safety Manager
mg/m^3	milligrams per cubic meter
NFPA	National Fire Protection Association
NIOSH	National Institute of Occupational Safety and Health
NPCA	National Paint and Coatings Association
OFR	Office of the Federal Register
OSHA	Occupational Safety and Health Administration
PADS	Physical Agent Data Sheets
PFAS	per-and polyfluoroalkyl substances
PID	photoionization detector
PM	Project Manager
PPE	personal protective equipment
ppm	parts per million
QA	quality assurance
QC	quality control
RI	Remedial Investigation
RPM	Remedial Project Manager
RRO	residual range organics
SDS	Safety Data Sheet

ACRONYMS AND ABBREVIATIONS (CONTINUED)

SSHO	Site Safety and Health Officer
SSHP	Site Safety and Health Plan
TCE	trichloroethylene
TWA	time-weighted average
USACE	U.S. Army Corps of Engineers
USAEC	U.S. Army Environmental Command
USAG	U.S. Army Garrison Alaska
UTV	utility task vehicle

1.0 INTRODUCTION

This Site Safety and Health Plan (SSHP) has been prepared by Brice Environmental Services Corporation (Brice) for the U.S Army Corps of Engineers (USACE), Alaska District under Contract W911KB22D0019, Task Order W911KB23F0122. This SSHP complies with the Occupational Safety and Health Administration (OSHA) standards outlined in Title 40 of the Code of Federal Regulations (CFR), Sections 1910 and 1926; Office of the Federal Register (OFR) *Hazardous Waste Operations and Emergency Response* (HAZWOPER; OFR 2005); 29 CFR Sections 1910.120 and 1926.65; and U.S. Environmental Protection Agency (EPA), federal, state, and local health and safety regulations and guidance, as well as the USACE *Engineer Manual 385-1-1, Safety and Health Requirements* (USACE 2014). This SSHP will serve as the basis for health and safety procedures to be followed during the Haines Fuel Terminal (HFT) PFAS Remedial Investigation (RI) in Haines, Alaska.

The purpose of this project is to complete an RI to characterize the nature and extent of per-and polyfluoroalkyl substances (PFAS) contamination present at the site and evaluate the human health and ecological risk. Site contaminants of potential concern (COPCs) include PFAS, fuels and fuel constituents, chlorinated solvents, dioxins and furans, and lead.

This SSHP implements health and safety criteria and defines policies and guidelines contained in the Brice Corporate Health and Safety Plan. A copy of this plan will be kept at the project site to be reviewed as needed. Any amendments or revisions needed will be made when activities or conditions warrant. If any contradictions become apparent between this plan and any federal, state, or local regulations, the more stringent will apply.

The purpose of this SSHP is to create a site health and safety program that effectively identifies, evaluates, controls, and reduces health and safety hazards. The ultimate objective is to complete the work incident- and injury-free. The field crew and visitors to the site will be held accountable and responsible for working safely and following procedures and guidance set forth in this SSHP. This document must be reviewed, and the Accident Prevention Plan (APP)/SSHP Acknowledgement must be signed by all Brice employees who will be working onsite (Table C-1 of the APP).

1.1 Scope of Work

In accordance with the Scope of Work, the following activities will be conducted:

- Mobilization/demobilization
- Utility locates and assessment
- Site inspections/surveys
- Drilling, groundwater well installation, well development, groundwater sampling, sediment sampling, surface water sampling, and surface and subsurface soil sampling
- Decontamination
- IDW handling

1.2 Key Personnel

Key personnel, their responsibilities, and contact information are summarized in Table C1-2.

Table C1-2 Key Personnel and Responsibilities

NAME	POSITION	RESPONSIBILITY
Jamie Oakley	Program Manager	The Program Manager will represent and enforce Brice safety and health policies from the corporate level to the project level. They have authority to address any safety or health issues and take corrective, disciplinary, or any other actions deemed necessary for a safe and healthful workplace. The Program Manager will be aware of any accidents or near accidents and provide follow-up administration that proper filings have been made.
Greg Rutkowski	Project Manager (PM)	The PM will oversee implementation of the project plans, work activities, and health and safety management process; make sure that site-specific safety procedures are maintained and health and safety goals are implemented; and provide the interface between the client and Brice.
Chris Boese	Field Lead/Site Safety and Health Officer (SSHO)	The Field Lead/SSHO will make sure onsite personnel comply with this SSHP and received proper health and safety training. He will conduct daily safety meetings and site inspections and oversee implementation of the site safety plan. The Field Lead/SSHO will assist the PM with overseeing implementation of the work activities and health and the safety management process.
Jamey Smith	Health and Safety Manager (HSM)	The HSM will coordinate corporate policy with project SSHO. He will comply with requirements and oversee implementation of SSHP, conduct periodic audits in coordination with the PM, and participate in incident investigations, corrective action reporting, and other pertinent reporting, as required.
Vanessa Ritchie	QA/QC Manager	The QA/QC Manager will review specifications, amendments, plans, and drawings in their entirety. The QA/QC Manager will manage and coordinate the three-phase control and documentation performed by QC specialists, testing laboratory personnel, and other inspection and testing personnel required by the contract. The QA/QC Manager will also coordinate with the USACE representative in the performance of QA/QC audits and inspections. The QA/QC Manager has authority to stop work on all or any project work activity due to non-conformance with this plan. The QA/QC Manager works closely with the SSHO to address potential environmental concerns before those concerns develop.

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

1.3 Employee Safety Responsibility

Although the employer is responsible for providing a safe and healthful workplace, each employee is responsible for their own safety as well as the safety of those around them. The employee will use equipment provided in a safe and responsible manner. Brice personnel will follow the policies set forth in the Brice Corporate Safety Plan and Policies.

2.0 HAZARD ASSESSMENT AND COMMUNICATION

Brice is committed to protecting the safety of its employees, contractors, and visitors. Brice believes that occupational injuries and illnesses can be prevented, exposures to hazardous materials and hazardous work situations can be controlled, and the prevention of injuries and illnesses is equal in importance to production, quality, cost, and morale. The following sections discuss the hazards associated with working at the project site/location and the hazard communication and procedures in place.

Prior to conducting any activities, Activity Hazard Analysis (AHA) will be conducted with the field team to outline specific hazards and mitigation measures, and to verify that resources required are available to perform tasks safely. AHAs are discussed in Section 2.2.5, and a blank AHA form is provided in Attachment C-2.

2.1 Site Hazards

2.1.1 Remoteness

The HFT is located at Tanani Point, 2 miles north of the city of Haines on the Chilkat Peninsula near the mouth of the Lutak Inlet. The buddy system will be used, and site personnel will be familiar with emergency communication procedures. First aid and limited emergency equipment will be available onsite. In case of an emergency, the team will travel to the Haines Health Center for medical attention (Figure C1-1). In case of severe emergencies, site workers will require transport to Juneau for medical attention.

2.1.2 Communication

Cellular service will be available onsite, allowing communication between onsite and offsite personnel via cellular phone and email. A satellite phone will be available for communication when cellular service may not be available, or when the range of service is diminished. Prior planning and clear, frequent communication between onsite personnel are vital. The emergency contact list provided within this SSHP will be carried by onsite personnel. Additionally, a regular communication schedule between onsite personnel and the Brice office in Anchorage will be maintained to support onsite personnel safety.

Verbal communication can be impaired by onsite background noise caused by heavy equipment and the use of personal protective equipment (PPE). Hand signals that will be used among personnel within the Exclusion Zone will be reviewed during tailgate safety meetings (to be conducted before starting work).

2.1.3 Physical Hazards

Physical hazards may cause varying degrees of accidents and/or injuries resulting in medical treatment, damage to equipment, damage to the jobsite, production delays, and a negative impact on morale. Alaska state law dictates that Physical Agent Data Sheets (PADS) must be available to project personnel. Although not all the listed PADS may be pertinent to this project, they are presented in Attachment C-3 and will be available at the project site. PADS cover the following topics:

- Cold stress
- Hand-arm vibration
- Heat stress
- Ionizing radiation

- Lasers
- Noise
- Radio frequency/microwave radiation
- Ultra-violet radiation

The following physical hazards may be encountered while onsite:

Inclement Weather: Due to the potential for rapidly changing weather, personnel will be fully advised to dress warmly and in layers with a water- and wind-proof outer shell. Adequate footwear is required because of tripping hazards. In addition, safety-toed boots meeting ASTM International Standard F2413 will be required. The need for adequate clothing will be discussed at planning meetings and daily safety meetings.

Lightning/Electrical Storms: Lightning can be unpredictable and may strike many miles in front of, or behind, a thunderstorm. Workers will therefore cease field operations at the first sign of a thunderstorm and suspend activities until at least 30 minutes after the last observed occurrence of lighting or thunder. For purposes of this SSHP, signs of a thunderstorm will include any visible lightning or audible thunder.

In the event of a thunderstorm, workers will take the following actions:

- Get inside a permanent building structure (not a shed or canopy) or fully enclosed metal vehicle (not a convertible or camper shell) with the windows fully up.
- Stay away from tall, isolated objects, such as trees, drill rigs, telephone poles, or flag poles.
- Avoid large open areas, such as fields or parking lots, where a person is the relatively highest object.
- Stay away from lakes, ponds, railroad tracks, fences, and other objects that could transmit current from a distant lightning strike.

Slips, Trips, and Falls: Walking on uneven terrain can be difficult. Caution must be taken when traversing the site by foot. Vegetation is dense throughout the site and may present tripping and slipping hazards to the field crew. Maintain the buddy system to prevent getting lost in dense vegetation and carry a cell/satellite phone.

Back Strain: Lifting and moving equipment improperly can place a great deal of stress on the back, possibly resulting in severe injury. Lifting objects is inherent in performing field investigations; therefore, it is important to use good lifting techniques.

Personnel will adhere to the following basic rules when performing work that requires lifting:

- If a load is heavy or bulky, get help.
- Remember to lift with your legs and keep your back straight.
- Keep the load as close to your body as you can.
- Do not jerk the load. Lift slowly and carefully.
- Make sure the area you will be carrying the load through is clear of obstacles.
- Do not twist or turn your spine when lifting or carrying the load.
- Be sure to have a good grip on the load.
- Be careful when lowering the load (get help, if necessary).

Heat and Cold Stress: Heat and cold stress are discussed in Section 10.

Noise: Noise may be generated when heavy equipment is used, such as trucks or a drill rig. Hearing protection is mandatory when working in areas where the noise levels exceed 85 decibels (Section 5).

Cuts: Materials with sharp edges are likely to be encountered and may pose a potential cutting hazard. Preventative measures will be taken to prevent cuts and scrapes. Personnel will wear task-appropriate gloves (for example, cut-resistant) as part of the PPE requirement (Section 5).

Pressurized Containers: Calibration gases for some field equipment come in pressurized containers (applicable Safety Data Sheets [SDSs] are provided in Attachment C-4). Since these gases are inert, the primary hazard is explosion due to heating of the container. Pressurized containers will be kept away from heat sources that could cause gas expansion.

2.1.4 Biological Hazards

The following biological hazards may be encountered onsite:

Bites and Stings: Animal bites and insect stings can cause localized swelling, itching, and minor pain that can be addressed with first aid treatment. In sensitive and allergic individuals, however, effects can be more serious. Anaphylactic shock can lead to severe reactions in the circulatory, respiratory, and central nervous systems, and in some cases, even death. The Site Safety and Health Officer (SSHO) will identify personnel with a known reaction to bites and stings at the pre-job safety orientation meeting. No attempts should be made to capture any wild or semi-wild animals due to the possibility of a bite or parasitic infection.

Plants: Devil's club can cause discomfort, irritation, and inflammation of the skin. Cow parsnip can cause increased skin sensitivity to ultra-violet radiation, resulting in second-degree burns from sun exposure. Personnel will be warned to prevent contact with unknown plants. Protective clothing worn by site personnel should reduce the probability of such exposure. Cleaning the skin thoroughly with soap and water after contact will also reduce the risk of severe symptoms.

Wildlife: Large animals such as bears or moose may be encountered in the area. Personnel will be instructed to avoid wildlife and retreat inside a vehicle or structure until the animal leaves the area. Harassment of wildlife is strictly prohibited. Brice personnel will carry a firearm as needed in areas posing high potential for bear encounters. Prior to site activities, wildlife safety will be discussed with the field crew. Topics to be covered will include wildlife safety relevant to the area of work, responsibilities and duties while carrying a firearm, reconnaissance and bear watch techniques, along with instruction regarding the use of non-lethal wildlife deterrents.

Onsite personnel will be provided with air horns, pepper spray, and safety whistles. Functionality of these safety tools will be checked periodically and replaced if used in an emergency. Personnel will be trained in the proper and safe operation of the equipment. Pepper spray should be carried on the belt or other quickly accessible location.

Non-lethal methods of deterrence will be used before other options are exercised. If immediate danger to an individual exists, the wild animal may have to be killed. According to Title 5 of the Alaska Administrative Code, Chapter 92.410, *Taking game in defense of life or property*, it is legal to kill a bear or other threatening wildlife in defense of life or property, if the attack was not provoked or the animal was not lured by negligently stored human food, pet food, or garbage, and if everything else had been done to protect life and property.

2.1.5 Chemical Hazards

Table C1-3 presents a chemical hazard assessment. Based on prior investigations, gasoline range organics (GRO), diesel range organics (DRO), residual range organics (RRO), benzene, toluene, ethylbenzene, xylenes (BTEX), naphthalene, ethylene dibromide (EDB), trichloroethylene (TCE), PFAS, and lead are considered the principal COPCs. An SDS for these formulations or chemicals and for other chemicals expected at the site will be supplied at the project site. The SDSs for any additional chemicals found onsite or brought onto the site will be acquired and reviewed with personnel during daily safety meetings and incorporated into the project Hazard Communication Program.

Table C1-3 Chemical Hazard Assessment

CHEMICAL NAME	EXPOSURE LIMIT	ROUTES OF EXPOSURE	SIGNS AND SYMPTOMS OF EXPOSURE	TARGET ORGANS
DRO	100 mg/m³*	Inhalation, ingestion, skin/eye contact	Irritation of eyes, skin, respiratory tract; dizziness, headache, nausea; dry, red skin	Eyes, skin, kidneys
GRO	300 ppm TWA*	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation of eyes, skin, mucous membrane; dermatitis; headache, lassitude (weakness, exhaustion), blurred vision, dizziness, slurred speech, confusion, convulsions	Eyes, skin, respiratory system, central nervous system, liver, kidneys
RRO	10 ppm TWA*	Inhalation, ingestion, skin/eye contact	Irritation of eyes, skin, respiratory tract; dizziness, headache, drowsiness, blurred vision, fatigue, tremors, convulsions	Eyes, skin, respiratory system
Benzene	0.1 ppm**	Inhalation, ingestion, skin/eye contact	Irritation of eyes, skin, respiratory tract; dizziness, headache, nausea; dry, red skin	Eyes, skin, respiratory system, central nervous system (CNS), bone marrow
Ethylbenzene	100 ppm**	Inhalation, ingestion, skin/eye contact, absorption	Irritation of eyes, skin, mucous membrane, headache, dermatitis, narcosis, coma	Eyes, skin, respiratory system, CNS
Toluene	100 ppm**	Inhalation	Lung fibrosis	Respiratory system
Xylenes	NIOSH =100 ppm OSHA = 100 ppm	Inhalation, ingestion, absorption, skin/eye contact	Irritation of eyes, skin, nose, and throat; dizziness; excitement; drowsiness; incoherence; staggering gait; corneal vacuolization; anorexia; nausea; vomiting; abdominal pain; dermatitis.	Eyes, skin, respiratory system, central nervous system, gastrointestinal tract, blood, liver, kidneys
Naphthalene	5 mg/m³*	Inhalation, ingestion, skin/eye contact	Irritation of eyes, skin (allergic reaction), respiratory tract; dizziness, shortness of breath, headache, nausea	Eyes, skin, respiratory system
EDB	20 ppm	Inhalation, skin absorption, ingestion, skin and/or eye contact	Irritation of eyes, skin, respiratory system; dermatitis with vesiculation; liver, heart, spleen, kidney damage; reproductive effects; potential occupational carcinogen	Eyes, skin, respiratory system, liver, kidneys, reproductive system

Table C1-3 Chemical Hazard Assessment

CHEMICAL NAME	EXPOSURE LIMIT	ROUTES OF EXPOSURE	SIGNS AND SYMPTOMS OF EXPOSURE	TARGET ORGANS
TCE	10 ppm*	Inhalation, ingestion, absorption	Irritation of eyes, skin, respiratory tract, dizziness, vomiting	Eyes, skin, respiratory system; may be carcinogenic
PFAS	Not applicable	Inhalation, skin absorption, ingestion, skin and/or eye contact	Strong irritation of eyes, serious eye damage, liver damage, fetal damage; PFAS is carcinogenic	Liver
Lead	0.05 mg/m³*	Inhalation, ingestion, absorption	Irritation of eyes, chloracne, liver damage, reproductive effects	Skin, eyes, liver, reproductive system

Notes:
For definitions, refer to the Acronyms and Abbreviations section.
* ACGIH 2021 Threshold Limit Value
** National Institute of Occupational Safety and Health (NIOSH) recommended exposure limit (NIOSH 2019)

Chemical storage will be consistent with the SDS storage requirements, making sure that incompatible chemicals are segregated. Accidental spills will be contained and cleaned up according to the respective SDS and approved company methods.

Guidelines for storing chemicals and other hazardous materials include:

- Keep acids away from bases; keep oxidizers (nitrates, peroxides, chlorates) away from metals.
- Store flammables and combustibles in appropriate storage cabinets.
- Do not store paper or other combustibles near flammables or heat sources.
- Verify that fire response is available.

PPE requirements, described in Section 5, combined with the requirement to wash arms, hands, face, and neck before eating, drinking, or smoking, will aid in preventing exposure via inhalation, skin contact, or ingestion. In addition, the SSHO will oversee and warn site personnel to be aware of the initial symptoms of chemical exposure. The amount of exposure depends primarily on the specific activities undertaken and the care with which the activities are performed. Any crew member will be removed from the worksite and medically evaluated if the following initial symptoms persist and are unexplained by other causes such as common cold, allergy, or heat stress:

- Dizziness or stupor
- Nausea, headaches, or cramps
- Irritation of the eyes, nose, or throat
- Euphoria
- Chest pains and coughing
- Rashes or burns

2.1.6 Mobile Equipment Safety

This section discusses safety related to operation of project vehicles.

Operation of Project Vehicles: Vehicles likely present onsite include utility task vehicles (UTVs) and a Geoprobe tracked drill rig. Significant hazards associated with working around project vehicles on the jobsite exist, and it is imperative that personnel practice safe driving and operating techniques. Personnel observed driving recklessly may be removed from the project. Basic safe driving strategies include:

- Only licensed or qualified personnel will operate motor vehicles and equipment.
- Personnel will adhere to established speed limits and traffic signs.
- Blind corners and curves will be approached with caution.
- Light vehicles will be properly inspected daily by the operator prior to use.
- Personnel operating project vehicles must have a valid driver's license in their possession, practice defensive driving techniques, and comply with posted speed limits (unless weather conditions dictate slower speeds be maintained).
- Occupants will use seatbelts while project vehicles are in motion.

Site equipment will be operated only by competent personnel with appropriate experience. This determination is to be made by the Site Superintendent/SSHO as required.

Equipment and Operations Hazards: Discussion of daily task hazards, as they apply to daily activities, will be discussed during the safety meetings. Associated hazards and safe practices include:

- Ground personnel must remain alert.
- High-visibility apparel must be worn by ground personnel.
- Equipment and vehicle operators should be encouraged to drive with their lights and beacons on.
- Slips, trips, and falls can occur from uneven ground, debris, open holes, or trenches.
- Falls can occur while getting on or off of equipment. Practice the three-point rule while climbing up and down ladders.
- Equipment must not be used to lift personnel.
- Loads must not be lifted over the heads of personnel.

Light Vehicles and UTVs: Motor vehicles and UTVs have the potential for serious injuries from improper operation, exposure to carbon monoxide, pinch points, burns, and crushing hazards. Personnel are to stay alert in areas of operating equipment. Generally, operating equipment will have the right of way.

- Operators and passengers will ride inside of vehicles and wear seatbelts whenever in motion.
- Vehicles with enclosed cabs should contain, at a minimum, a 5-pound fire extinguisher and first aid kit.
- A rotary beacon will be used if near an active roadway or construction site.

2.2 Hazard Communication and Procedures

2.2.1 Hazard Communication Program

A Hazard Communication Program will be established to inform workers and subcontractors of potential site-specific chemical hazards and comply with the requirements of 29 CFR 1910. The purpose of the Hazard Communication or Employee Right-To-Know program is to make certain that the dangers of hazardous substances and physical agents located or present at the project site are communicated to Brice personnel and subcontractors. For full exposure and hazard information (i.e., flammable or combustible data) on the operational chemicals brought onto the site, see the onsite SDS binder or access the Keller Online website.

If a new hazardous substance or physical agent is introduced or discovered onsite, employees will be given information during daily safety meetings. The SSHO will be responsible for making sure the SDSs or PADS are available onsite.

The SSHO will be present at Hazard Communication Program training, which will be provided before starting work and before entering the site. This training will be documented using the Hazard Communication and Right-to-Know Standards form (Attachment C-2).

The purpose of the Hazard Communication Program is to communicate hazards of workplace chemicals and the protective measures to control the hazards. Hazard communication is accomplished through the following activities:

- Maintaining a list of workplace chemicals
- Labeling workplace chemical containers
- Maintaining an SDS for each workplace chemical and potential workplace chemicals
- Implementing a training program to communicate the hazards of chemicals and appropriate protective measures
- Describing procedures to add SDSs to the site

Upon completion of Hazard Communication Program training, employees and subcontractors will understand the components of hazard communication, the hazards of the chemicals in their workplace, and the protective measures used to control the hazards.

2.2.2 Labeling

Labels and other forms of warnings are to be placed conspicuously on containers so that the contents are easily identified. The chemical manufacturer, importer, or distributor will label, tag, or mark the chemical container identifying the hazardous chemicals; the label will include appropriate hazard warnings and the name and address of the chemical manufacturer, importer, or responsible party.

Labeling Systems: There are multiple labeling systems currently in use including the National Fire Protection Association (NFPA) 704M labeling system, Globally Harmonized System, National Paint and Coatings Association (NPCA) Hazardous Materials Information System (HMIS), Department of Transportation (DOT) labeling system, United Nations Hazard Class Number system, and others.

NPCA HMIS: The NPCA HMIS uses standard labels to communicate hazards with colors, numbers, letters of the alphabet, and symbols. The HMIS is a five-part rectangle that provides identification of the chemical, acute health hazard, flammability, reactivity, PPE designation, and chronic health hazard information. The

chemical identity is conveyed by the chemical name and should be the same as the name on the SDS. The acute health (blue), flammability (red), and reactivity (yellow) hazards are communicated by numerical ratings similar to the NFPA system. An alphabetical designation is used to denote recommended PPE.

Chronic health hazards may be communicated by placing an asterisk or something similar on the label referencing a specific SDS. The full chronic information may also be written on the label, if space allows.

Labels for Transfer Containers: When hazardous materials are transferred from one container to another, the new container will be marked appropriately with the hazard warning.

2.2.3 Hazard Recognition and Safety Observation Program

Worksites pose inherent dangers and in day-to-day project operations, potential hazards can surface from unexpected events or human error. Brice strives to provide a culture where each employee is alert to hazardous situations and employee involvement is commonplace, and to provide another opportunity for the workforce to have a stake in the quality of work and product.

Employees are encouraged to recognize and report both safe and unsafe observations to their supervisor and the company Safety Committee through the Hazard Recognition and Safety Observation Program. An observation card (Attachment C-2) can be filled out during a shift or any time that the employee identifies a hazard or wishes to recognize positive safety behavior. Observation cards allow the employee to describe the observation, the action taken, and follow-up actions to be taken. Cards can be submitted directly to the supervisor or emailed to hazrec@bilista.net with the supervisor copied. The supervisor will review the cards as they are received and take immediate action to mitigate the hazard onsite, if possible and not already completed. If further action beyond onsite mitigation is required, the Safety Committee will recommend further action to the PM and associated management.

The emphasis of this system is:

- Hazard recognition and reporting are everyone's responsibility.
- It is everyone's responsibility to be safe and to have a safe site.
- Management will respond in a timely and efficient manner.
- Corrective actions will be made known to employees. The goal is to fix the underlying causes and eliminate the hazards altogether.

2.2.4 Stop Work Authority

"Stop Work Authority" is the process by which any Brice or subcontractor personnel may stop work due to circumstances in the work area posing a serious and immediate hazard to an employee's safety or to the environment. Additionally, project personnel are authorized to decline to perform an assigned task because of a reasonable belief that under the circumstances the task poses an imminent risk of death or serious bodily harm. If work is stopped, a review by the SSHO/Site Lead and the Health, Safety, and Environment Director is required before restarting an affected activity.

2.2.5 Activity Hazard Analysis

AHAs are required for all tasks. AHAs are used to define the activities to be performed, identify the hazards anticipated with the task, and identify control measures, including resources to mitigate the hazards. As personnel mobilize to the site and encounter actual site conditions, an AHA will be developed to capture actual site conditions and hazards for the activity to verify that protective measures are in place to

mitigate incidents. A blank AHA form is provided in Attachment C-2. In addition, a preliminary hazard evaluation of anticipated activities is summarized in Table C1-4.

Table C1-4 Preliminary Hazard Evaluation

ACTIVITY	HAZARDS	MITIGATION
Mobilization/ Demobilization	Cuts/lacerations/pinch points during packing and unpacking of materials	Wear cut-resistant gloves and cut away from the body.
	Slips, trips, falls	Maintain good housekeeping and keep entrances/exits clear.
	Back strain/injury	Use proper lifting techniques, and use a buddy as needed. Lift boxes and equipment from the legs, and keep boxes and equipment close to the body.
Driving	Unfamiliar vehicle/ unsafe operating condition	Conduct vehicle inspections prior to operation of the motor vehicle.
	Unfamiliar routes/roads	Drive around the vicinity of the worksites and the local town to become familiar with the most effective routes to and from the jobsite.
	Weather/limited visibility	Adjust speed based on road conditions. Maintain adequate stopping distances.
	Parking/egress	Consider the easiest exit from the jobsite when parking the vehicle. Be aware of surroundings (other vehicles, heavy equipment, light poles, etc.).
	Vehicle accident/injury	Obey posted speed limits and traffic laws; use defensive driving techniques; be aware of potentially dangerous road conditions and adjust speed accordingly; and carry a first aid kit and fire extinguisher in the vehicle along with a means of communication. During vehicle operation, use seatbelts and do not use phones.
Air Travel	Airplane crash/ emergency landing	Dress appropriately for possible exposure to inclement weather. Assess whether the plane appears safe to fly. Follow instructions and maintain three points of contact when boarding/deboarding plane. Listen to the safety briefing, ask questions, and locate safety equipment. When applicable, keep satellite phone with you during flight.
	Noise	Use hearing protection.
Marine Transportation	Capsizing	Verify boat is not overloaded. Verify boat is suitable for the conditions.
	Drowning	Wear personal floatation devices in case of emergency. Inspect boat for appropriate lifesaving equipment.
	Man overboard	Follow boat safety procedures provided by the captain. Prior to boat launch, personnel should be made aware of the proper protocol when a person is overboard.
	Fire	Boat will be inspected by qualified personnel prior to launch. Fire extinguishers will be on board.
Site Reconnaissance	Slips, trips, and falls	Maintain good housekeeping.
	Uneven terrain	Be aware of surroundings and thick brush/debris when walking. Wear high-visibility vest, safety-toed boots, safety glasses, and hard hat.

Table C1-4 Preliminary Hazard Evaluation

ACTIVITY	HAZARDS	MITIGATION
Site Reconnaissance (continued)	Working at a remote site	Always work with a buddy and remain aware of increased hazards associated with requiring transport to offsite medical care. Communicate location of muster point prior to beginning work in case of emergency or separation from team members. Pay close attention to location/route; carry project maps and satellite phones.
	Wildlife	Observe the area prior to exiting the vehicle. When entering a site, maintain the buddy system and be cautious of surroundings. Communicate observations to project team. Keep air horns readily available. Remain in or retreat to vehicles if wildlife is encountered.
	Heat/cold stress	Wear layers and remain hydrated. Take cool down/warm-up breaks.
Land Survey	Slips, trips, and falls	Maintain good housekeeping.
	Uneven terrain	Wear safety-toed boots and focus on footing.
	Back strain/injury	Use proper lifting techniques and use a buddy as needed. Lift equipment with legs, and keep equipment close to the body.
Heavy Equipment	Slips, trips, and falls	Maintain adequate footing and three points of contact when entering and leaving heavy equipment.
	Pinch points	Use gloves; maintain vigilant awareness of moving parts.
	Overhead hazards	Wear a hard hat; avoid swing radius; do not enter swing radius when bucket is in motion.
	Communication	Establish hand signals and eye contact to be followed during operations.
	Noise	Wear ear protection.
	Roll-over	Take care on uneven terrain.
Drilling	Slips, trips, and falls	Maintain good housekeeping.
	Uneven terrain	Wear safety-toed boots and create walkways as necessary.
	Pinch points	Wear gloves; maintain vigilant awareness of moving parts.
	Overhead hazards	Move drill rig with mast down. Wear a hard hat.
	Communication	Establish hand signals/gestures.
	Noise	Wear ear protection.
Sampling (General)	Chemical	Use Level D PPE.
	Slips, trips, and falls	Maintain good housekeeping.
	Back strain/injury	Use proper lifting techniques and use a buddy as needed. Lift equipment with legs, and keep equipment close to the body.
	Glass breakage	Wear gloves when handling glassware, and look in container (box, cooler, etc.) prior to reaching inside.
Hand Augering/ Shoveling	Back strain/injury	Use proper twisting/lifting techniques; take breaks to avoid overuse.
	Hand injury	Wear task-appropriate gloves.
	Slips, trips, and falls	Assess site conditions during reconnaissance and be aware of terrain.

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

3.0 EMPLOYEE TRAINING

3.1 First Aid/CPR

Each field crew member will be trained in first aid/cardiopulmonary resuscitation (CPR). This training will be consistent with the requirements of a recognized organization such as American Red Cross, American Heart Association, or other certified training program.

3.2 Project-Specific Training

In addition to first aid/CPR training, the following training is required for this project:

- Initial 40-hour HAZWOPER Course in accordance with 29 CFR 1910.120
- 8-hour HAZWOPER refresher course within the past 12 months in accordance with 29 CFR 1910.134

Visitors to the site, including regulatory agency personnel, must first receive a site-specific briefing by the SSHO. The COPCs are GRO, DRO, RRO, BTEX, naphthalene, EDB, TCE, PFAS, and lead. Personnel overseeing site operations as well as any employee in direct contact with potentially contaminated media will be trained as a precautionary measure.

4.0 ACCESS CONTROLS

The SSHO will establish the physical boundaries of each zone and instruct workers and visitors on the limits of the restricted areas. No one will be allowed to enter a restricted area without the required PPE for that area. Signs conforming to OSHA and EPA requirements will be posted at the access points to the regulated areas. OSHA-approved warning signs will be posted at various points along the work area perimeter and at entrances/exits to decontamination stations and material exits.

Only authorized visitors will be allowed access to the contaminated areas. Each visitor will be required to provide the necessary PPE for use during the visits and must be escorted by the SSHO while onsite.

5.0 PERSONAL PROTECTIVE EQUIPMENT

For this project, the initial level of PPE required is Level D, which includes safety-toed boots, high-visibility vests, and safety glasses. Prescription glasses must have attached side shields when conditions warrant their use. High-visibility apparel must be worn at all project sites. Where entanglement hazards exist, alternative apparel to a safety vest such as a t-shirt or sweatshirt with reflective high-visibility materials will be provided. All field personnel must use proper gloves for project tasks. All field personnel must use proper gloves for project tasks. Field personnel will use work gloves (as needed) during investigation activities to protect against cuts and abrasions. Hard hats will be worn when there is a potential for overhead hazards.

Hearing protection will be used when the noise level is 85 decibels or more. This includes noise generated by power tools or other equipment that generates loud noise. The 3-foot rule will be used: if you cannot speak to a someone in a normal tone of voice 3 feet away, hearing protection must be worn. Based on planned investigation activities, use of hearing protection is only anticipated during drilling activities, but will be available onsite as needed.

If required, Level D PPE may be upgraded to Modified Level D or to Level C. Modified Level D PPE includes the addition of Tyvek coveralls. Level C PPE includes the addition of a half-face purifying respirator with organic vapor cartridges. Based on planned activities, upgrading the PPE level to Level C is not anticipated.

6.0 VEHICLE INSPECTIONS

Motor vehicles will be inspected by Brice prior to use and documented in the Vehicle Inspection Form (Attachment C-2). Any deficiencies will be noted and corrected prior to use. If a vehicle is believed to be unsafe, it will not be operated.

7.0 DECONTAMINATION PROCEDURES

This section describes the procedures necessary to ensure that both personnel and equipment are free from contamination when they leave the worksite. Decontamination procedures of site personnel are provided in Section 7.1. Equipment decontamination procedures are provided in Section 7.2.

7.1 Personnel Decontamination

Decontamination protects workers, the public, and the environment by limiting exposure to harmful substances and by preventing the spread of contamination. The SSHO will oversee decontamination procedures to determine their effectiveness and will take corrective actions to rectify any deficiencies. Equipment decontamination procedures will be conducted in accordance with BE-SOP-14 Equipment Decontamination (Appendix D of the Work Plan).

All personnel exiting the site will follow decontamination procedures when applicable. Under no circumstances (except emergency evacuation) will personnel be allowed to leave the site before decontamination. The SSHO may approve simplification of the procedures in the field when a determination has been made that less-stringent decontamination procedures are required.

Decontamination procedures are as follows:

1. Wipe gross contamination from clothes and equipment.
1. Step across to the next station and remove coveralls, booties (if applicable), and gloves. Deposit in container with plastic liner. Remove gloves after coveralls and booties.
2. Remove respirator (if applicable) and avoid touching face with fingers.
3. Wash hands and face thoroughly.

7.2 Equipment and Vehicle Decontamination

Small instruments and equipment will be protected from contamination by draping, masking, or otherwise covering the instruments with plastic to the degree possible without hindering the operation of the unit. Contaminated protective coverings will be removed from the equipment and disposed in the appropriate containers. Any dirt or obvious contamination on the equipment will be brushed or wiped with damp disposable wipes, and the equipment will be dried. The units will be checked, field calibrated, and recharged, if necessary, for the next day's operation.

Dry decontamination procedures will be conducted on the equipment and trucks in accordance with BE-SOP-14 Equipment Decontamination (Appendix D of the Work Plan). Equipment used onsite will be completely decontaminated when it is no longer required onsite, prior to its return.

8.0 WASTE HANDLING AND DISPOSAL

The term "waste" includes investigation-derived waste, PPE, sampling waste, field trash, and office trash. Waste management and disposal is discussed in Section 4.10 of the Work Plan.

9.0 AIR MONITORING

Air monitoring is not anticipated to be necessary; however, if it becomes necessary the following procedures will be followed.

Under supervision of the SSHO, air monitoring will be conducted where potential contaminant vapors or petroleum, oil, and lubricants may be present. Table C1-5 provides air monitoring requirements and action levels. The extent of monitoring will depend upon site-specific conditions and the contaminants encountered at each site. If a change in conditions is observed at any time or location, additional monitoring may be required. Breathing Zone monitoring will be conducted to verify that the field team is using appropriate levels of PPE. Monitoring instruments will be calibrated in accordance with manufacturer instructions. Air monitoring and calibration will be documented in field logbooks.

Field crews will use a photoionization detector (PID) equipped with a 10.6-electron-volt lamp as the primary method of monitoring. Based on historical monitoring data, the PID is considered protective of site personnel. This method is the most readily available indicator of organic vapors in the atmosphere. Prior to PID use, background levels will be established by monitoring outside the Exclusion Zone or controlled area and upwind of the site. The PID reads in units of parts per million (ppm), and the readings should be sustained for 1 minute to determine exposure. The PID Breathing Zone action limit will be a reading greater than 25 ppm.

Conditions that exceed action levels in Table C1-5 will require an upgrade of PPE until monitoring demonstrates otherwise, or work will be stopped until conditions no longer exceed action levels. The SSHO, with the assistance of trained field personnel, will identify these conditions.

Table C1-5 Air Monitoring Requirements and Action Levels

INSTRUMENT AND TARGET GAS	TASKS	ACTION LEVELS	PPE OR RESPONSE	FREQUENCY	CALIBRATION
PID for volatile organic compounds (except methane), minimum 10.6 electron-volts, calibrated with isobutylene	All tasks	0 to 25 ppm Breathing Zone	Level D	Monitor the Breathing Zone at the beginning of operations and whenever site conditions change. Levels C and B require continuous monitoring.	Daily
		25 to 50 ppm Breathing Zone	Level C; stop work and re-evaluate		
		>50 ppm Breathing Zone	Level B; stop work and re-evaluate		

Notes:
For definitions, refer to the Acronyms and Abbreviations section.

Additionally, dust monitoring will be conducted, as lead dust is a potential concern. Should lead dust become an issue due to dry soil conditions, areas of concern may be sprayed with water to diminish dust.

10.0 HEAT/COLD STRESS MONITORING

The following protocol is to be used in the event of extreme weather. Temperatures below -15 degrees Fahrenheit (°F) will be referred to as extreme cold weather. Although fieldwork is scheduled for spring/summer and fall 2024, and temperatures are generally not extreme during this time of year, the combination of high wind and precipitation in Alaska can cause extreme cold temperatures year-round. Wind effects on skin and threshold temperatures should be considered when assigning work. Efforts will be made to minimize prolonged sitting or standing still in unheated areas. Warm-up areas will be designated when the temperature and/or wind chill drops below -15°F and will be used at the onset of the following signs and symptoms:

- Heavy shivering
- Frostnip (minor frostbite)
- Feelings of excessive fatigue
- Drowsiness
- Irritability
- Euphoria

The frequency and duration of warm-up time will be dictated by the severity of the exposure to extreme cold conditions. Non-emergency work in unheated spaces should cease when temperatures reach -45°F.

In addition to extreme cold, site personnel should be prepared for warmer temperatures in case of unseasonably warm temperatures during fieldwork. Field personnel wearing additional PPE during survey or magnetometer activities may be more susceptible to heat stress. Additionally, hiking for extended periods of time or walking over uneven terrain may increase the likelihood of heat stress, even in mild conditions for some personnel. Four environmental factors affect the amount of stress workers experience in hot work areas: temperature, humidity, sun (radiant heat), and wind.

Additional stress levels are associated with age, weight, fitness, medical condition, and acclimation to heat. The symptoms of heat stress are:

- Heat rash (prickly heat)
- Increased heart rate
- Loss of concentration
- Irritability

These symptoms may lead to fainting or death. The following steps are recommended to reduce the risk of heat stress:

- Move to a cooler location.
- Reduce workload or pace.
- Rest in cool areas.
- Wear lightweight clothing.
- Perform more strenuous activities at times during the day when temperatures are cooler.
- Drink plenty of water (1 quart per hour).

When ambient air temperature falls below 30°F or rises above 80°F, the SSHO will monitor and provide work/rest regimens to the team. Work/rest regimens may vary depending on the person and will be based on American Conference of Governmental Industrial Hygienists guidelines (ACGIH 2021).

Additional information regarding heat and cold stress (including hypothermia) can be found in the corresponding PADS (Attachment C-3).

11.0 DRUG AND ALCOHOL USE

The possession, transportation, and consumption of drugs and alcohol are strictly prohibited onsite and during working hours. Being under the influence of drugs or alcohol is not permitted, and any individual suspected to be under the influence of drugs or alcohol will be removed from the work area immediately.

12.0 MEDICAL SURVEILLANCE

Brice employees participate in a medical surveillance program. This program is initiated when the employee starts work with a complete physical and medical history and is continued on an annual basis. A listing of Brice's worker medical profile for project activities involving hazardous waste (29 CFR 1910.120) is shown in Table C1-6.

Table C1-6 Worker Medical Profile

ITEM	INITIAL	ANNUAL	ITEM	INITIAL	ANNUAL
Medical and Work History	X	X	Chest X-Ray	X	
Visual Acuity Tests	X	X	Complete Blood Counts	X	X
Pulmonary Function Tests	X	X	Blood Chemistry	X	X
Physical Examination	X	X	Urinalysis	X	X
Audiometer Tests	X	X	Dermatology Examination	X	X

13.0 EMERGENCY PROCEDURES

This section provides for the preparedness of personnel in the event of unplanned fires, explosion, or other emergencies that may cause injury to personnel. This section will be part of the orientation process for new workers.

- Emergency contact information and the Hospital Route Map (Figure C1-1) will be kept in field vehicles.
- The travel time from the Haines Health Center to the project site is approximately 6 minutes.

13.1 Pre-Emergency Planning and Responsibilities

The Brice SSHO will be the responsible Emergency Coordinator (EC) with the following duties and responsibilities:

- Determine and verify methods of communication and equipment needed, such as two-way radios, cell phones, satellite phones, and air horn.

- Verify and coordinate methods of transportation of personnel to medical facilities, if needed.
- Verify that required emergency equipment and materials are readily available.
- Review plan with employees to prepare for coordination of emergency procedures for personal injury, exposures, fires, explosions, and releases.
- Determine safe point of assembly at each site if the need for evacuation arises. If this location changes, personnel must be notified of such changes.
- Review site conditions, operations, and personnel for changes that may affect response procedures.

All personnel have the following responsibilities:

- Review emergency procedures and become familiar with the details.
- Report any personal medical conditions that could result in medical emergencies.
- Monitor work colleagues and provide assistance as required (for example, for dehydration or heat/cold stress).

13.2 Emergency Equipment and Supplies

The SSHO will make sure that personnel know the locations of emergency response equipment listed below:

- ABC fire extinguishers – in motor vehicles
- First aid kits – in motor vehicles
- Portable eyewash bottles – in motor vehicles
- Satellite phones – in motor vehicles
- Cell phones – on each person

Satellite phones will be the primary offsite emergency communications device if cell phone use is not available due to lack of reception. Use will be restricted primarily to scheduled calls and emergencies. Prior planning and clear, frequent communication of location are vitally important to the project.

13.3 Emergency Response

In the case of an earthquake, fire, explosion, or chemical release, the following response sequence is to be taken:

- Notify proper emergency response personnel and project management team.
- Notify any agencies as needed.
- Have emergency phone numbers readily available.
- Account for all personnel at designated muster points (to be determined daily based on work area).
- Assess the need for evacuation and evacuate as conditions dictate.
- In the case of an earthquake, evacuate from the site(s) or move to higher ground.
- Submit reports to USACE as required in contract.

A USACE-designated representative will be notified immediately if any of the following events occur:

- A fatal injury
- One or more persons are admitted to a hospital
- Property damage in an amount of $200,000 or more

Smaller incidents that present minimal safety or health hazards may be controlled with equipment available onsite such as fire extinguishers. **If in doubt, evacuate**.

13.4 Emergency Medical Treatment

When a serious injury has occurred, such as severe bleeding, loss of consciousness, difficulty in breathing, or heart has stopped, emergency medical treatment is needed. Do the following:

- Call 911 or other emergency response agency as needed. Emergency phone numbers are listed near the front of this document.
- The EC should assume responsibility until emergency services have arrived.
- Perform medical and lifesaving treatment, if necessary.
- Secure the area and prevent further injury.
- Notify supervisor, SSHO, and corporate office.
- Ensure injured person is accompanied to emergency room.
- Initiate Accident Reporting procedures and submit any required reports to client or prime contractor.
- Apply first aid services, and coordinate follow-up with medical professionals.

13.5 Evacuation

The Hospital Route Map is included on Figure C1-1. If the medical practitioner at the Haines Health Center determines an emergency medevac is warranted, arrangements will be made to fly the individual to a hospital in Juneau, depending on the severity of the injury.

The response time for medevac services is, at a minimum, 90 minutes from Juneau. Personnel should note that severe weather conditions and communication problems may delay air evacuation.

Due to the length of time to respond in emergency injury situations, it is imperative that personnel remain alert at all times and avoid accidents and injuries.

When calling for help, provide sufficient information regarding the following:

1. The location of the emergency and where you are calling from. Be as specific as possible.
2. What happened – type of emergency?
3. How many people need help?
4. What is being done?
5. Be sure that **YOU HANG UP LAST** – let the person you called hang up first.

If site evacuation procedures need to be implemented, the steps detailed below must be followed:

- Evacuation routes and muster points will be specified on the site map and/or designated by the EC.
- When notification of evacuation is given, all personnel will assemble at designated muster points.

- The EC and a "buddy" will remain at the site to help direct emergency response personnel.
- The EC will account for all personnel at muster points.
- An evacuation signal to be used, if necessary, will be a continuous sounding of a horn.

13.6 Emergency Contact Information

Emergency contact information is included in Table C1-1 at the beginning of this document. Directions to the hospital are presented on Figure C1-1 and will be provided at the first daily safety meeting.

14.0 SITE POSTINGS

The following employment-related postings are required and will be accessed in the field files that will be onsite (in vehicles) at all times:

- Employee Polygraph Protection Act
- Notice to Employees-Federal Minimum Wage
- You Have a Right to a Safe and Healthful Workplace
- Equal Employment Opportunity Is the Law
- The Alaska Human Rights Law and Federal Law Prohibit Sexual Harassment
- Brice Sexual Harassment Policy
- Unemployment Insurance
- Family and Medical Leave Act
- Safety and Health Protection on the Job
- Alaska Wage and Hour Act
- Notice of Insurance
- Uniformed Services Employment and Reemployment Rights Act
- Map denoting route to nearest care facility
- Emergency phone numbers
- Copy of this SSHP
- OSHA 300A Form
- Copy of deficiency tracking log
- Safety and health promotional posters
- Date of last lost workday injury

15.0 REFERENCES

American Conference of Governmental Industrial Hygienists (ACGIH). 2021. *Threshold Limit Values for Chemical Substances and Physical Agents and Biological Exposure Indices.* January.

National Institute of Occupational Safety and Health (NIOSH). 2019. *Pocket Guide to Chemical Hazards.* https://www.cdc.gov/niosh/npg/default.html. Accessed December 2023.

Office of the Federal Register (OFR). 2005. *Hazardous Waste Operations and Emergency Response. National Archives and Records Administration.* 29 CFR 1910.120 and 1926.65. October.

U.S. Army Corps of Engineers (USACE). 2014. *Engineer Manual 385-1-1, Safety and Health Requirements.* November.

Attachment C-2
Field Forms

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SITE SAFETY AND HEALTH PLAN ACCEPTANCE

I have had the opportunity to read and ask questions about this Site Safety and Health Plan (SSHP). My signature certifies that I understand the procedures, equipment, and restrictions of this plan and agree to abide by them.

No.	Name	Signature	Date	Company
1	_____	_____	_____	_____
2	_____	_____	_____	_____
3	_____	_____	_____	_____
4	_____	_____	_____	_____
5	_____	_____	_____	_____
6	_____	_____	_____	_____
7	_____	_____	_____	_____
8	_____	_____	_____	_____
9	_____	_____	_____	_____
10	_____	_____	_____	_____
11	_____	_____	_____	_____
12	_____	_____	_____	_____
13	_____	_____	_____	_____
14	_____	_____	_____	_____
15	_____	_____	_____	_____

ACTIVITY HAZARDS ANALYSIS

Date _____ Project _____

Activity _____

Activity Location _____

Prepared By _____

Overall Risk Assessment Code (RAC) (Use Highest Code)	

Risk Assessment Code (RAC) Matrix

E = Extremely High Risk H = High Risk M = Moderate Risk L = Low Risk		Probability				
		Frequent	Likely	Occasional	Seldom	Unlikely
SEVERITY	Catastrophic	E	E	H	H	M
	Critical	E	H	H	M	L
	Marginal	H	M	M	L	L
	Negligible	M	L	L	L	L

Add Identified Hazards

JOB STEPS	HAZARDS	ACTIONS TO ELIMINATE OR MINIMIZE	RAC

Add Items

EQUIPMENT	TRAINING	INSPECTION

Involved Personnel

NAME	POSITION

Acceptance Authority Signature/Title _____

DAILY VEHICLE INSPECTION CHECKLIST

Client		Project	
		Date (Weekly)	
Vehicle Type		Rental Agency	
Make/Model		Year	
Mileage (start)		Mileage (end)	

	MON		TUE		WED		THUR		FRI		SAT		SUN	
BODY AND INTERIOR:	**Ok**	**Fix**	**Ok**	**Fix**	**Ok**	**Fix**	**Ok**	**Fix**	**Ok**	**Fix**	**Ok**	**Fix**	**Ok**	**Fix**
Inspection Sticker / Registration Tag														
Door Locks / Handles														
Lighting System														
Body and Interior														
Upholstery														
Seatbelts														
Heater/defroster														
Air Conditioner														
Floorboards/Mats														
Paint														
Operable Rearview Mirrow														
Operator's Manual														
Other:														
PERFORMANCE:														
Brakes / Parking Brake														
Steering														
Operating Condition														
Oil Leak														
Tire Pressure														
Gauges (Pressure/Elect.)														
Fluids														
Horn														
Brake Lights														
Windshield														
Other:														

OPERATOR REMARKS:

INFORM MECHANICS OF REPAIRS NEEDED BEFORE OPERATING

DAILY EQUIPMENT INSPECTION CHECKLIST

EQ# _____ INSPECTED BY _____

Description _____ FOR WEEK ENDING _____

	MON		TUE		WED		THUR		FRI		SAT		SUN	
EXTERIOR:	Ok	Fix	Ok	Fix	Ok	Fix	Ok	Fix	Ok	Fix	Ok	Fix	Ok	Fix
STRUCTURE/ROPS														
TIRES/WHEELS/TRACKS														
LEAKS(FUEL,COOLANT, LUBE)														
LIGHTS														
WINDOWS/MIRRORS														
HORN/BACK UP ALARM														
INTERIOR:														
FIRE EXT./SEAT BELT														
WINDOWS/MIRRORS														
PERFORMANCE:														
BRAKES														
STEERING														
GAUGES(PRESSURE/ELECT.)														

OPERATOR REMARKS:

MECHANIC REMARKS:

INFORM MECHANICS OF REPAIRS NEEDED BEFORE OPERATING

HAZARD RECOGNITION CARD

NAME: _____ **DATE:** _____

COMPANY NAME: _____

LOCATION (BE SPECIFIC): _____

PROJECT MANAGER/SUPERINTENDENT: _____

☐ **UNSAFE ACT**
Performance of a task or activity that is conducted in a manner that may threaten the health and/or safety of workers

☐ **UNSAFE CONDITION**
Condition in the work place that is likely to cause property damage or injury

Select the best option that describes the UNSAFE ACT that you observed.

	Failure to use		Failure to recognize
	Failure to correct		Failure to prevent

Select the best option that describes the UNSAFE CONDITION that you observed.

	Biological (Animal/human waste, insect nest)		Motion (Equipment, vehicle)
	Chemical (Ventilation)		Pressure (Tank not secure, heat exposure)
	Electrical (Broken outlet, frayed cable)		Radiation (Equipment, heat, sun, gamma)
	Gravity (Trip/fall hazard, overhead risk)		Sound (Noise, equipment)
	Mechanical (Gears moving, not covered)		Temperature (Dry ice, weather)

HAZARD RECOGNITION CARD

What Unsafe Act or Condition did you observe? Provide photos if possible.

What did you do to intervene or correct the Unsafe Act or Condition? Provide photos if possible.

- Once connectivity is available, enter this card electronically using the QR code
- Pictures can be emailed to: HAZREC@Bilista.net

DIRECT SUPERVISOR: _____

DAILY SITE SAFETY MEETING

Date	Project	Site Safety and Health Officer

Activities to be Performed	Tools, Equipment, Materials to be Used	Possible Injury, Hazards	Required PPE, Controls, Plan

Name	Signature	Date	Company
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			

HAZARD COMMUNICATION

AND

RIGHT-TO-KNOW STANDARD TRAINING FORM

Name: _____

Company: _____

By signing this form I acknowledge and accept the following:

1. I have been instructed about the Hazard Communication Program, Safety Data Sheets (SDS), and Physical Data Sheets (PADS), their use, location and procedures for obtaining copies.
2. I have been informed that some of my work may involve exposure to toxic substances.
3. I have been informed about the right of employees to have access to relevant exposure and medical records, and the procedures for requesting access.
4. I understand the employer must act upon a request in a reasonable amount of time to avoid the interruption of normal work operations but within 15 days.

Signature: _____

Date: _____

PID Calibration Log

Project Name/Location:

Project Number:

Equipment Make and Model:

Serial Number:

Calibration Gas: Isobutylene

Date	Zero/Fresh Air (ppm)		Span {ppm)		Initials	Date	Zero/Fresh Air (ppm)		Span (ppm)		Initials
	Standard	Reading	Standard	Reading			Standard	Reading	Standard	Reading	

BRICE ENVIRONMENTAL SERVICE CORPORATION
INCIDENT/INJURY INVESTIGATION & ANALYSIS REPORT

Accident Parameters:

Project:		**Date:**	**Time:**
Employee(s):		**Supervisor:**	
1.	**3.**	**Site of Accident:**	
2.	**4.**		

Investigation:

Type of Incident: ***Internal Record (Near Miss)*** ***1st Aid*** ***Medical Treatment*** ***Property Damage*** ***Equipment Damage*** ***Environmental***

Circle or Highlight one or more of the above:

Process of Investigation:		**Was a UA ordered and taken?**	**Yes**	**No**
1.	Support Documents: ☐ Photos ☐ Eyewitness ☐ Other	***If no, why not?***		
2.	People Interviewed:			
a)	**c)**			
b)	**d)**			
3.	Other:			

Findings:

1.	**Update on Injury(ies) and Treatment Given:**	☐ **As Reported on Incident Event Report?**
2.	**Update on Incident and/or Damage:**	☐ **As Reported on Incident Event Report?**
3.	**Cause of Incident, Accident, or Injury / Conclusion**:	
Trends?		

Corrective Actions / Training / Repairs: Completed: ☐

1.

Name	Signature	Date
Superintendent:		
Investigator:		

DAILY QUALITY ASSURANCE / QUALITY CONTROL REPORT

Contract Number / Delivery Order Number		UPC/Project Title
W911KB-22-D-0019		**Haines Fuel Terminal PFAS Remedial Investigation**
QC/QA Report Number	**Date or Time Period**	**Location**
001		**Haines, Alaska**

Weather

Low Temp: XX° F High Temp: XX° F

Wind Speed: XX mph Conditions: Overcast, partly sunny

Subcontractors:

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

Preparatory ☐ See attached checklist.
Initial ☐ See attached checklist.
Follow-up ☐

Field Sampling and Testing **Yes** ☐ **No** ☐

Type of Test	Method/Matrix	Results

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

Laboratory Analytical Sampling **Yes** ☐ **No** ☐

Type of Test	Test Method/Matrix	Quantity of Samples

Have required amount of QC trip blanks and rinsates been achieved? **NA** ☐ **Yes** ☐ **No** ☐

Have appropriate QC laboratory tests been ordered? (matrix spikes, method blanks, surrogates, reference standards, etc.) **NA** ☐ **Yes** ☐ **No** ☐

Have QA and QC samples been collected in the specified quantity? **NA** ☐ **Yes** ☐ **No** ☐

Have samples been properly labeled and packaged? **NA** ☐ **Yes** ☐ **No** ☐

Notes:

-

Health and Safety

Worker protection levels this date: **Level A** ☐ **Level B** ☐ **Level C** ☐ **Modified Level D** ☐ **Level D** ☐ **N/A** ☐

Was any work activity conducted within a **confined space**? **Yes** ☐ **No** ☐

Was any work activity conducted within an area determined to be **immediately dangerous** to life and health? **Yes** ☐ **No** ☐

Were approved **decontamination** procedures used on workers and equipment as required? **N/A** ☐ **Yes** ☐ **No** ☐

Was a **Job Safety Meeting** held this day? (If yes, attach comments) **Yes** ☐ **No** ☐

Were there any **"Lost Time**" accidents this day? (If YES, attach copy of completed accident report) **Yes** ☐ **No** ☐

Was **hazardous waste**/materials released into the environment? **Yes** ☐ **No** ☐

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

-

DAILY QUALITY ASSURANCE / QUALITY CONTROL REPORT

Work Activities Performed This Date

Prime

-

Subcontractors

-

DAILY QUALITY ASSURANCE / QUALITY CONTROL REPORT

Labor and Equipment Used This Date

CONTRACTOR – Contractor Name

Labor			Equipment		
Classification	**Number**	**Hours**	**Type/Make**	**Number**	**Quantity/Unit**
Total					

SUBCONTRACTOR – Subcontractor Name

Labor			Equipment		
Classification	**Number**	**Hours**	**Type/Make**	**Number**	**Quantity/Unit**
Total					

SUBCONTRACTOR – Subcontractor Name

Labor			Equipment		
Classification	**Number**	**Hours**	**Type/Make**	**Number**	**Hours Used**
Total					

Materials Received to be Used on or Incorporated into Site:

-

Equipment Received to be used on Site:

-

Instructions given by the Government to the Contractor **Verbal ☐ Written ☐**
(Include names, reactions, and remarks.)

-

Instructions Given by Contractor to Subcontractors **Verbal ☐ Written ☐**
(Include names, reactions, and remarks.

- .

Scope of Work/Work Plan Variances **Yes ☐ No ☐**

-

Work Progress

Are there any Contractor caused delays? **Yes ☐ No ☐**
Or potential finding of fact? **Yes ☐ No ☐**
Are there any Government caused delays? **Yes ☐ No ☐**
Or potential finding of fact? **Yes ☐ No ☐**
Are there any unforeseeable or weather-related delays? **Yes ☐ No ☐**

- None.

Comments:

-

DAILY QUALITY ASSURANCE / QUALITY CONTROL REPORT

Deficiencies Noted This Day **(Include corrective actions taken and anticipated date of correction if carried over past COB)** **Yes** ☐ **No** ☐

Deficiencies Corrected This Day **Yes** ☐ **No** ☐

Remarks **(Include any visitors to project and miscellaneous remarks pertinent to work. In addition, provide specific regulatory notifications conducted, including SHPO, ADEC, etc.)**

-

Regulatory notifications conducted this day? **Yes** ☐ **No** ☐

The above report is complete and correct, and all work reported is believed, to the best of my knowledge to be in compliance with State and Federal requirements, and the contract

CQC System Manager Signature _____ **Date** _____

Site Superintendent Review and Comments:

Site Superintendent Signature _____ **Date** _____

DAILY QUALITY ASSURANCE / QUALITY CONTROL REPORT

Government Quality Assurance Comments

Concurs with the QC report? **Yes** ☐ **No** ☐

Additional comments or exceptions:

Government Signature _____ **Date**_____

CQC Report Attachments:

☐	Tailgate Safety Meeting Report	☐	Field notes	☐	
☐	Activity Hazard Analyses	☐	Punchlist	☐	
☐	Preparatory Inspection Form	☐	Site Orientation Sign-in	☐	
☐	Initial Inspection Form	☐		☐	
☐	Equipment Inspections	☐		☐	
☐	Chains of Custody	☐		☐	

U.S. Army Corps of Engineers (USACE)

MISHAP NOTIFICATION AND INVESTIGATION

For use of this form, see instructions in the attachments and USACE ER 385-1-99; the proponent agency is CESO.

Requirement Control Symbol

RCS-CESO-21-0001

DATA REQUIRED BY THE PRIVACY ACT OF 1974

Authority 10 U.S.C. 7013, Secretary of the Army; 5 U.S.C. 7902, Safety Programs; Public Law 91-596, Occupational Safety and Health Act of 1970; DoD Instruction 6055.1, DoD Safety and Occupational Health Program; Army Regulations 385-10, Army Safety Program; DoD Instruction 6055 .07, Mishap Notification, Investigation, Reporting, and Record Keeping; and E.O. 9397 (SSN), as amended.

Principal Purpose Information collected is to provide the USACE leaders, soldiers, families and civilians in injury, illness, and loss data to effectively manage its safety and occupational health program.

Routine Uses In addition to those disclosures generally permitted under 5 U.S.C. 552a(b) of the Privacy Act of 1974, these records or information contained therein may specifically be disclosed outside the DoD as a routine use pursuant to 5 U.S.C. 552a(b) as follows: To the Department of Labor, the Federal Aviation Agency, the National Transportation Safety Board, and to Federal, State, and local agencies and applicable civilian organizations, such as the National Safety Council, for use in a combined effort of accident prevention. In some cases, data must also be disclosed to an employee's representative under the provisions of 29 CFR 1960.29. Records will be made available consistent with applicable laws and regulations. Information will be withheld from the public only if authorized by 5 U.S.C. Section 552 (Freedom of Information Act (FOIA), 5 U.S.C. 552a (Privacy Act)), or other statutory or regulatory authority.

Disclosure Failure to provide all the required information on the report may result in the rejection of report submission.

1. WHO IS REPORTING MISHAP

a. Name:	b. Phone number:
c. Email address:	d. Signature:

e. Report type:	☐ 1. Near Miss Report. *(No injury/illness, or property damage. Complete all fields with underlined text.)*	Date:
	☐ 2. Initial Accident Report. (*For accident notification within 24 hrs, Complete all fields with underlined text.*)	Date:
	☐ 3. Final Accident Report. *(For reporting findings from accident investigation, complete full form.)*	Date:

f. Mishap Type. *(Check all that apply)*

☐ Fatality	☐ Injury/Illness	☐ Property Damage	☐ Near Miss

g. Were any of the following items associated with the mishap ? ☐ Yes ☐ No *(If yes, check all that apply)*

☐ Electrical and/or Hazardous Energy	☐ Working at Heights	☐ Diving	☐ Load Handling Equipment or Rigging	☐ Occupational Health Exposure

2. WHO WAS INVOLVED IN THIS MISHAP?

a. Name:		
b. Personnel Classification:	c. Time employee began work:	
d. Gender:	e. Date of birth (for Government personnel only):	f. Age:
g. Date hired:	h. Primary language:	
i. Is individual a supervisor? ☐ Yes ☐ No	j. Duty status at time of mishap:	k. Years experience in job:

l. What was individual doing when mishap occurred? (*Select activity from the drop downs below.*)

1. General activities:	2. Vehicle/Equipment/Vessel:
3. Sports/Recreation:	4. Other not listed:

m. Did individual utilize all OSHA/EM 385-1-1 required Personal Protective Equipment (PPE) for activity? ☐ Yes ☐ No ☐ N/A

If no, identify missing PPE:

n. Was a Personal Flotation Device used? ☐ Yes ☐ No ☐ N/A	o. Was a seat belt used? ☐ Yes ☐ No ☐ N/A

p. **Government personnel only:**

1. Job series:	2. Rank:	3. Grade:
4. Center/Division/Lab:	5. District:	

q. **Contractor personnel only:**

1. Employer/Contractor name:	
2. Individual's occupation/trade:	Other not listed:

r. If mishap occurred on a contractor site, provide the following:

1. Prime Contractor name:		
2. Contract number:	3. Contract type:	4. Funding type:

3. WHAT TYPE OF INJURY/ILLNESS OCCURRED?

a. Severity of injury/illness?	b. Type of Injury/Illness:
c. Identify body part(s) affected by injury/illness:	
Primary body part affected:	Secondary body part affected:
d. Identify cause and source of injury/illness:	
Cause of injury/illness:	Source of injury/illness:

e. Was employee treated by a physician or health care professional provider? ☐ Yes ☐ No

If yes, provide name of physician or health care professional provider?

f. Was treatment given away from work site? ☐ Yes ☐ No	g. Was employee treated in an emergency room ? ☐ Yes ☐ No ☐ N/A

h. If treatment was given away from the work-site, where was it given? (For Government Personnel Only)

Treatment facility name:

Address:

City: State: Zip: Country:

i. Was employee hospitalized as an in-patient? ☐ Yes ☐ No	If yes, how many nights?	Was OSHA notified? ☐ Yes ☐ No

Note: OSHA requires reporting all work-related fatalities within 8 hours and in-patient hospitalizations, amputations and loss of an eye within 24 hours to OSHA.

j. Estimated days away from work:	k. Estimated days of restricted/transferred duty:

4. WHAT HAPPENED?

a. What was the primary activity occurring at the time of the mishap?

Other, not listed:

b. What happened? Provide a detailed description of the mishap. (Do not include any personally identifiable information (name, etc.).)

Note: Provide supporting photos, charts, diagrams, etc. with this report.

c. What other organizations or agencies have been notified about this mishap?

5. WHAT TYPE OF PROPERTY/MATERIAL WAS INVOLVED?

a. List all property/material involved in the mishap. (Include damaged and undamaged property.)

	Item A	*Item B*	*Item C*
i. Type of item:			
Other not listed:			
ii. Name of item(s):			
iii. Collision type:			
Other not listed:			
iv. Ownership of item:			
v. Dollar cost of damage:			

6. WHEN DID THE MISHAP OCCUR?

a. Date the mishap occurred:	b. Time mishap occurred:
c. What day did mishap occur on?	d. What period of day did mishap occur?

7. WHERE DID THE MISHAP OCCUR?

a. Did the mishap occur on a military Base/Post? ☐ Yes ☐ No

b. USACE Office/Program/Project name:

c. Select the location type most closely associated with the mishap:

d. Identify exact location where mishap occurred:

Address:

City: State: Zip: Country:

e. Latitude:	f. Longitude:

8. WHY DID THE MISHAP OCCUR? (*Recommend completing this section for Near Misses.*)

A. Performance Causal Factors

1. Did a problem with performance contribute to this mishap occurring? ☐ Yes ☐ No

If yes, select the error that contributed most to the mishap:

2. Describe action(s) taken, anticipated or recommended to eliminate cause(s):

B. Support Causal Factors

1. Did a problem with resources contribute to this mishap occurring? ☐ Yes ☐ No

If yes, select the error that contributed most to the mishap:

2. Describe action(s) taken, anticipated or recommended to eliminate cause(s):

C. Standards/Policy/Planning Causal Factors

1. Did an organizational standard/policy/or plan contribute to this mishap occurring? ☐ Yes ☐ No

If yes, select the error that contributed most to the mishap:

2. Was a written Activity Hazard Analysis (AHA) or equivalent completed and accepted by Government Designated Authority (GDA) for task(s) being performed at time of mishap? (If yes, attach a copy to this report) ☐ Yes ☐ No

If yes, was the AHA available and used by worker? ☐ Yes ☐ No

3. Was a written work plan (critical lift plan, fall protection plan, etc.) required, completed and accepted by the GDA for task(s) being performed at time of mishap? ☐ Yes ☐ No

If yes, was the plan available and used by worker? ☐ Yes ☐ No

4. Describe action(s) taken, anticipated or recommended to eliminate cause(s):

D. Training Causal Factors

1. Did a problem with training contribute to this mishap occurring? ☐ Yes ☐ No

If yes, select the error that contributed most to the mishap:

2. Was individual trained to perform the activity/task? ☐ Yes ☐ No

If yes, select type of training: ☐ Classroom ☐ Certification/License ☐ On the job

☐ Other, describe:

What was date of most recent training?

3. Describe action(s) taken, anticipated or recommended to eliminate cause(s):

E. Leader/Supervisor Causal Factors

1. Did any leader/supervisory mistake/task error contribute to this mishap occurring? ☐ Yes ☐ No

If yes, select the error that contributed most to the mishap:

2. Did the safety climate/culture contribute to the mishap? ☐ Yes ☐ No

3. Did challenges with teamwork contribute to the mishap? ☐ Yes ☐ No

4. Describe action(s) taken, anticipated or recommended to eliminate cause(s):

F. Individual Causal Factors

1. Did any individual mistakes/task errors contribute to this mishap occurring? ☐ Yes ☐ No

If yes, select the error that contributed most to the mishap:

2. Describe action(s) taken, anticipated or recommended to eliminate cause(s):

G. Physical Environment Causal Factors

1. Did any physical environment contribute to this mishap occurring? ☐ Yes ☐ No

If yes, select the error that contributed most to the mishap:

2. Describe action(s) taken, anticipated or recommended to eliminate cause(s):

H. Material Causal Factors

1. Did any material failure contribute to this mishap occurring? ☐ Yes ☐ No

If yes, select the error that contributed most to the mishap:

2. Which failure is most closely associated with the material failure/malfunction?

3. Describe action(s) taken, anticipated or recommended to eliminate cause(s):

I. Environmental Causal Factors

1. Did any environmental condition contribute to this mishap occurring? ☐ Yes ☐ No

If yes, select the factor that contributed most to the mishap:

2. Describe action(s) taken, anticipated or recommended to eliminate cause(s):

J. Facility/Building Design
1. Did the design of the facility/building contribute to the mishap? ☐ Yes ☐ No
If yes, describe:
2. Describe action(s) taken, anticipated or recommended to eliminate hazard:
K. Existing Hazard
1. Did a hazard(s) contribute to the mishap? ☐ Yes ☐ No
If yes, describe the hazard(s):
2. Describe action(s) taken, anticipated or recommended to eliminate hazard(s):
9. Corrective Action plan
a. Have all corrective action(s) to prevent mishap recurrence been completed? ☐ Yes ☐ No
b. Who is responsible for the corrective action plan?
c. What date will/have all corrective action(s) be/been completed by:
d. Additional information:
10. Additional Information

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Attachment C-3
Physical Agent Data Sheets

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Alaska Department of Labor and Workforce Development
Labor Standards and Safety
3301 Eagle Street/PO Box 107022
Anchorage, Alaska 99510-7022
(907) 269-4955

PHYSICAL AGENT DATA SHEET

COLD STRESS

HYPOTHERMIA

FROSTBITE

Alaska Department of Labor and Workforce Development
Labor Standards and Safety
3301 Eagle Street/PO Box 107022
Anchorage, 99510-7022
(907) 269-4955

Physical Agent Data Sheet

HYPOTHERMIA

Hypothermia is a temperature-related disorder. Therefore it is necessary to understand human physiology as it pertains to temperature stress.

Man is considered a tropical animal. Normal functioning of the human animal requires a body temperature of 37 degrees Celsius (98.6 degrees Fahrenheit). The body can self-compensate for small upward or downward variations in temperature through the activation of built-in thermoregulatory system, controlled by temperature sensors in the skin. The response to an upward variation in body temperature is the initiation of perspiration, which moves moisture from the body tissues to the body surface. When the moisture reaches the surface it evaporates, carrying with it a quantity of heat. The response to downward variation in body temperature is shivering, which is the body's attempt to generate heat. Shivering is an involuntary contraction and expansion of muscle tissue occurring on a large scale. This muscle action creates heat through friction.

THE DISORDER

Hypothermia is defined as a core temperature of the body less than 35 degrees Celsius (95 degrees Fahrenheit). Hypothermia is also considered the clinical state of sub-normal temperature when the body is unable to generate sufficient heat to efficiently maintain functions.

Many variables contribute to the development of hypothermia. Age, health, nutrition, body size, exhaustion, exposure, duration of exposure, wind, temperature, and wetness of body or clothes, medication and intoxicants (alcohol) may decrease heat production or increase heat loss.

The healthy individual's compensatory responses to heat loss via conduction, convection, radiation, evaporation and respiration may be overwhelmed by exposure. Medication may also interfere with heat generation or regulation. Children will have different symptoms than adults depending on the severity of the cold.

Definitions:

Conduction: Direct transfer of heat by contact with a cooler object
Convection: Cool air moving across the surface of the body, heat is transferred to the cool air warming the air.
Radiation: Heat radiated outward from the warm body to the cooler environment.
Evaporation: The process of losing heat from the body by vaporization of water from the body surface.
Respiration: Inspired air raised to body temperature that is then exhaled.

Each of these causes of heat loss can play a large or small role in the development of hypothermia, depending on clothing, head cover, wind, weather, etc.

Once hypothermia develops, two body compartments, the shell (skin) and the core (the remainder of the body) share the heat deficit. The skin constitutes about 10% of a 150 pound mass.

Hypothermia can be recognized as impending, mild, moderate and severe. Below is a brief description of the various stages:

> Impending: Person's core temperature has decreased to 96.8 degrees Fahrenheit (36 degrees C). Individual will increase exercise in an attempt to warm up. The skin may become pale, numb and waxy. Muscles can become tense and shivering may begin. Fatigue and weakness may begin to show.
>
> Mild: Core temperature has dropped to 93.2 degrees Fahrenheit (34 degrees C). Intense, uncontrolled shivering has begun. The individual may still be alert and able to help self; however, movements become less coordinated and the coldness is causing some pain and discomfort.
>
> Moderate: Core temperature has dropped to 87.7 degrees Fahrenheit (31 degrees C). Shivering slows or stops completely, mental confusion and apathy set in. Speech is slow and slurred. Breathing becomes slow and shallow followed by with drowsiness.
>
> Severe: Core temperature is below 87.7 degrees Fahrenheit (31 degrees C). Skin may have a blue-gray color; iris of the eyes may be dilated, may appear drunk, denies problems and may refuse help. This leads to a gradual loss of consciousness. There may be little or no breathing, lack of response to verbal or painful stimuli and may appear dead.

(Temperatures used in above descriptions are approximate. Symptoms may start at different temperatures depending on the individual and circumstances.)

Treatment Preface

Always act on the fact that **"no one is dead until warm and dead."**

Think ABCD – Airway, Breathing, Circulation and Degrees.

In sudden exposure to cold water there is a greater chance for resuscitation with sudden submersion and with prolonged exposure to cold water. Quick onset of hypothermia, easy to reverse. Slow onset, the harder to reverse the process.

The sole consensus regarding prehospital treatment is that all patients at some point should be rewarmed. Core first then extremities. The best way to rewarm the core is by warm air and warm IV solutions.

Initial management principles emphasize prevention of further heat loss, rewarnimg as soon as is safely possible at a "successful" rate and rewarming the core before the shell, in an attempt to avoid inducing lethal side effects during rewarming. This treatment goal is important, since hypothermia itself may not be fatal above 77 degrees Fahrenheit (25 degrees C) core temperature.

The person must be handled very carefully and gently and not be allowed to exercise, as muscular action can pump cold blood to the heart.

Cold blood going to the heart can cause ventricular fibrillation

Hypothermia causes several reactions within the body as it tries to protect itself and retain its heat. The most important of these is vasoconstriction, which halts blood flow to the extremities in order to conserve heat in the core of the body.

Treatment of Hypothermia

Be able to recognize the symptoms of hypothermia in yourself and others. The victim may deny he/she is in trouble. Even mild symptoms demand attention:

Impending: Seek or build a shelter to get the person out of the cold, windy, wet environment.
Start a fire or get a cookstove going to provide warmth. Provide the person with a hot drink (no alcohol, coffee or tea). Insulate the person with extra clothes.

Mild: Remove or insulate the patient from the cold ground, protect from the wind, eliminate evaporative heat loss with a vapor barrier. Keep the head and neck covered, remove to a warm environment. Consider covering patient's mouth and nose with a light fabric to reduce heat loss through breathing. Provide the person with a warm, sweetened drink (no alcohol, coffee or tea) and some high-energy food. Limited exercise may help to generate some internal heat, but it depletes energy reserves.

Moderate: Remove the person from the cold environment, keeping the head and neck covered. Apply mild heat (comfortable to your elbow) to the head, neck chest, armpits and groin of the patient. Use hot water bottles, wrapped Thermo-pads, or warm moist towels. Do not place the hot water bottles next to the skin, wrap in cloth first. Offer sips of warm, sweetened liquids (no alcohol, coffee or tea) if the patient is fully conscious, beginning to rewarm and is able to swallow. Patient should be seen by a physician ASAP.

Severe: Place person in a prewarmed sleeping bag with one or two other people. Skin to skin contact in the areas of the chest (ribs) and neck is effective. Exhale warm air near the patient's nose and mouth, or introduce steam into the area. Keep the patient awake. Apply mild heat, with the aim of stopping temperature drop, not rewarming. If patient has lost consciousness be very gentle, as the heart is extremely sensitive. Check for pulse at the carotid artery. If there is any breathing or pulse, no matter how faint, do not give CPR but keep a very close watch for changes in breathing and heart beat (vital signs). If no pulse can be found begin CPR immediately, stopping only when the heart begins to beat or the person applying CPR cannot carry on any longer without endangering themselves.

In all of the above, it is imperative that the victim be removed out of the wet and windy weather, remove all wet clothing, and put the victim into dry clothing and a warm sleeping bag.

Recent research has concluded that the safest and most effective method of treating hypothermia is through inhalation rewarming. Equipment is available; however, out in the field, alternative methods which have been described must be used where equipment is lacking.

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Physical Agent Data Sheet

FROSTBITE

GENERAL INFORMATION

Frostbite is the freezing of some part of the body. Fingers, toes, and even whole arms and legs can be lost as a result of frostbite. Injuries can happen at home, in the cities and also in more isolated areas of the State.

In extreme cold it is important to prevent heat loss from as many areas of the body as possible. Exposed limbs and head are major areas of heat loss, but keeping enough blood flowing to the hands and feet is the key to preventing frostbite. The trunk and the head should be warm enough so that the brain is able to command the blood vessels in the hands and feet to open up and keep the extremities warm.

ESSENTIAL CLOTHING

This includes thermal underwear, insulated footwear or mukluks with liners; double mittens and a parka, preferably down-filled with a good ruff. A parka that can be opened at the neck to allow heat to escape will prevent overheating and sweating. Quilted or skin pants are necessary if no warm shelter is immediately available. Tight cloths, especially tight gloves or tight boots should not be worn. The tightness interferes with good circulation in the hands and feet. If there is a reduction in blood flow to these areas, then the possibility of frostbite increases as the extremity cools down.

FACTORS LEADING TO FROSTBITE

Tall thin persons are more likely to get frostbite than those of stocky build.

People in poor physical condition are more susceptible than those in good health.

Certain diseases slow down the blood flow in the hands and feet especially in elderly people.

Heavy smokers often have poor circulation in the vital organs and decreased circulation in the arms and legs.

Children and elderly people who cannot produce large amounts of body heat for long periods of time can experience a lowering of deep body temperature and frostbite.

Alcohol causes the blood vessels to dilate (become larger). This leads to a false sense of warmth. This also leads to faster loss of heat from the body because of dilation of blood vessels. More important, people act with poor judgment after drinking.

Don't touch cold metal with bare or wet hands. You will freeze to the metal and tear the skin if pulled away without proper thawing with warm water, heat or urine.

Be careful when handling gasoline, kerosene or liquids other than water. Contact with bare skin in cold temperatures can cause instant frostbite.

> *Frostbite is more likely to occur when you are injured, frightened or careless.*

HOW TO RECOGNIZE FROSTBITE

Exposed parts of the body should be inspected routinely. This is done best with a partner. Just before freezing, the skin, especially the face with its many blood vessels, becomes bright red. Then small patches of white appear, as freezing actually occurs.

The loss of the sensations of touch, pressure and pain may occur without awareness of any numbness or other sensations. Therefore, it is important to test these sensations often. Wear clothing that is not restrictive but loose.

There may be no pain associated with frostbite if the freezing or temperature change is slow. Only if there is a rapid change in temperature does the body register pain.

The skin becomes less elastic. This is best noted in the finger pads. If touched or squeezed the pads will remain pitted. Any further cooling will result in frostbite.

Serious freezing is most common in the feet, followed by the hands and then the head (nose, ears). This is because of the poorer circulation in the feet and hands. Also with the poorer circulation there is in conjunction less sensation to these areas. Exposed head areas are less likely to freeze because of a better blood supply.

EARLY TREATMENT OF FROSTBITE

Early rewarming.

Thawing and refreezing should always be avoided.

Limbs should be rewarmed in stirred water just above normal body temperature (100 – 105 degrees Fahrenheit). Always use a thermometer to get accurate temperatures. Never try to thaw in cold water or snow. Since feeling is lost, fires, stoves, exhaust pipes, etc., should never be used. Serious damage to the skin could result.

Rewarming is an acutely painful experience and medication to alleviate pain should be given if available. After thawing, a deep aching pain may persist for several days, depending upon severity of the injury. Pain is a good sign; this tells us that the nerves are still alive and functioning.

A dull purple color, swelling and/or blistering of the extremity after thawing indicate a more serious injury and require medical attention.

SUMMARY

Poor circulation and poor production of body heat will lower resistance to frostbite.

Most cases of frostbite occur as a result of lack of knowledge, careless preparation, unavoidable accident, or the effects of alcohol on judgment. Forethought can prevent injury.

If freezing does occur, proper rewarming in warm water will give maximum benefit. The injured limb should be handled gently and a medical judgment made of the extent of injury and the need for further treatment.

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Alaska Department of Labor and Workforce Development
Labor Standards and Safety Division

Physical Agent Data Sheet (PADS) - Heat Stress

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1. Description

Heat stress is caused by working in hot environments like laundries, bakeries, or around boilers or incinerators. Four environmental factors affect the amount of heat stress felt by employees in hot work areas: temperature, humidity, radiant heat (such as from the sun or a furnace), and air velocity. How well or how poorly an individual reacts to heat stress is dependent on personal characteristics such as age, weight, fitness, medical condition, and acclimatization.

The body has several methods of maintaining the proper internal body temperature. When internal body temperature increases, the circulatory system reacts by increasing the amount of blood flow to the skin so the extra heat can be given off.

Sweating is another means the body uses to maintain stable internal temperatures. When sweat evaporates, cooling results. However, sweating is effective only if the humidity level is low enough to permit evaporation and if the fluids and salts lost are replaced.

2. Health Effects—Heat Disorders

Heat stroke, the most serious health problem for workers in hot environments is caused by the failure of the body's internal mechanism to regulate its core temperature. Sweating stops and the body can no longer rid itself of excess heat. Signs include: mental confusion, delirium, loss of consciousness, convulsions or coma; a body temperature of 106 degrees Fahrenheit or higher; and hot dry skin which may be red, mottled or bluish. Victims of heat stroke will die unless treated promptly. While medical help should be called, the victim must be removed immediately to a cool area and his/her clothing soaked with cool water. He/she should be fanned vigorously to increase cooling. Prompt first aid can prevent permanent injury to the brain and other vital organs.

Heat exhaustion develops as a result of loss of fluid through sweating when a worker has failed to drink enough fluids or take in enough salt, or both. The worker with heat exhaustion still sweats, but experiences extreme weakness or fatigue, giddiness, nausea, or headache. The skin is clammy and moist, the complexion pale or flushed, and the body temperature normal or slightly higher. Treatment is usually simple: the victim should rest in a cool place and drink salted liquids. Salt tablets are not recommended. Severe cases involving victims who vomit or lose consciousness may require longer treatment under medical supervision.

Heat cramps, painful spasms of the bone muscles, are caused when workers drink large quantities of water but fail to replace their bodies' salt loss. Tired muscles, those used for performing the work, are usually the ones most susceptible to cramps. Cramps may occur during or after working hours and may be relieved by taking salted liquids by mouth or saline solutions intravenously for quicker relief, if medically determined to be required.

Fainting may be a problem for the worker unacclimatized to a hot environment who simply stands still in the heat. Victims usually recover quickly after a brief period of lying down. Moving around, rather that standing still, will usually reduce the possibility of fainting.

Heat rash, also known as prickly heat, may occur in hot and humid environments where sweat is not easily removed from the surface of the skin by evaporation. When extensive or complicated by infection, heat rash can be so uncomfortable that it inhibits sleep and impairs a worker's performance or even results in temporary total disability. It can be prevented by showering, resting in a cool place, and allowing the skin to dry.

3. Medical Conditions Aggravated By Exposure to Heat

Persons with heart or circulatory diseases or those who are on "low salt" diets should consult with their physicians prior to working in hot environments.

4. Preventing Heat Disorders

One of the best ways to reduce heat stress on workers is to minimize heat in the workplace. However, there are some work environments where heat production is difficult to control, such as when furnaces or sources of steam or water are present in the work area, or when the workplace itself is outdoors and exposed to varying warm weather conditions.

5. Acclimatization

Humans are, to a large extent, capable of adjusting to the heat. This adjustment to heat, under normal circumstances, usually takes about 5 to 7 days, during which time the body will undergo a series of changes that will make continued exposure to heat more endurable.

On the first day of work in a hot environment, the body temperature, pulse rate, and general discomfort will be higher. With each succeeding daily exposure, all of these responses will gradually decrease, while the sweat rate will increase. When the body becomes acclimated to the heat, the worker will find it possible to perform work with less strain and distress.

Gradual exposure to heat gives the body time to become accustomed to higher environmental temperatures. Heat disorders in general are more likely to occur among workers who have not been given time to adjust to working in the heat or among workers who have been away from hot environments and who have gotten accustomed to lower temperatures. Hot weather conditions of the summer are likely to affect the worker who is not acclimatized to heat. Likewise, workers who return to work after a leisurely vacation or extended illness may be affected by the heat in the work environment. Whenever such circumstances occur, the worker should be gradually reacclimatized to the hot environment.

6. Lessening Stressful Conditions

Many industries have attempted to reduce the hazards of heat stress by introducing engineering controls, training workers in the recognition and prevention of heat stress, and implementing work-rest cycles. Heat stress depends, in part, on the amount of heat the worker’s body produces while a job is being performed. The amount of heat produced during hard, steady work is much higher than that produced during intermittent or light work. Therefore, one way of reducing the potential for heat stress is to make the job easier or lessen its duration by providing adequate rest time. Mechanization of work procedures can often make it possible to isolate workers from the heat source (perhaps in an air-conditioned booth) and increase overall productivity by decreasing the time needed for rest. Another approach to reducing the level of heat stress is the use of engineering controls which include ventilation and heat shielding.

7. Number and Duration of Exposures

Rather than be exposed to heat for extended periods of time during the course of a job, workers should, wherever possible, be permitted to distribute the workload evenly over the day and incorporate work-rest cycles. Work-rest cycles give the body an opportunity to get rid of excess heat, slow down the production of internal body heat, and provide greater blood flow to the skin.

Workers employed outdoors are especially subject to weather changes. A hot spell or a rise in humidity can create overly stressful conditions. The following practices can help to reduce heat stress:

- Postponement of nonessential tasks
- Permit only those workers acclimatized to heat to perform the more strenuous tasks, or
- Provide additional workers to perform the task keeping in mind that all workers should have the physical capacity to perform the task and that they should be accustomed to the heat.

8. Thermal Conditions in the Workplace

A variety of engineering controls can be introduced to minimize exposure to heat. For instance, improving the insulation on a furnace wall can reduce its surface temperature and the temperature of the area around it. In a laundry room, exhaust hoods installed over those sources releasing moisture will lower the humidity in the work area. In general, the simplest and least expensive methods of reducing heat and humidity can be accomplished by:

- Opening windows in hot work areas,
- Using fans, or
- Using other methods of creating airflow such as exhaust ventilation or air blowers.

9. Rest Areas

Providing cool rest areas in hot work environments considerably reduces the stress of working in those environments. There is no conclusive information available on the ideal temperature for a rest area. However, a rest area with a temperature near 76 degrees Fahrenheit appears to be adequate and may even feel chilly to a hot, sweating worker, until acclimated to the cooler environment. The rest area should be as close to the workplace as possible. Individual work periods should not be lengthened in favor of prolonged rest periods. Shorter but frequent work-rest cycles are the greatest benefit to the worker.

10. Drinking Water

In the course of a day's work in the heat, a worker may produce as much as 2 to 3 gallons of sweat. Because so many heat disorders involve excessive dehydration of the body, it is essential that water intake during the workday be about equal to the amount of sweat produced.

Most workers exposed to hot conditions drink less fluids than needed because of an insufficient thirst drive. A worker, therefore, should not depend on thirst to signal when and how much to drink. Instead, the worker should drink 5 to 7 ounces of fluids every 15 or 20 minutes to replenish the necessary fluids in the body. There is no optimum temperature of drinking water, but most people tend not to drink warm or very cold fluids as readily as they will cool ones. Whatever the temperature of the water, it must be palatable and readily available to the worker. Individual drinking cups should be provided, never use a common drinking cup.

Heat acclimatized workers lose much less salt in their sweat than do workers who are not adjusted to the heat. The average American diet contains sufficient salt for acclimatized workers even when sweat production is high. If, for some reason, salt replacement is required, the best way to compensate for the loss is to add a little extra salt to the food. Salt tablets <u>should not</u> be used. CAUTION: PERSONS WITH HEART PROBLEMS OR THOSE ON A "LOW SODIUM" DIET WHO WORK IN HOT ENVIRONMENTS SHOULD CONSULT A PHYSICIAN ABOUT WHAT TO DO UNDER THESE CONDITIONS.

11. Protective Clothing

Clothing inhibits the transfer of heat between the body and the surrounding environment. Therefore, in hot jobs where the air temperature is lower than skin temperature, wearing clothing reduces the body's ability to lose heat into the air.

When air temperature is higher than skin temperature, clothing helps to prevent the transfer of heat from the air to the body. The advantage of wearing clothing, however, may be nullified if the clothes interfere with the evaporation of sweat.

In dry climates, adequate evaporation of sweat is seldom a problem. In a dry work environment with very high air temperatures, the wearing of clothing could be an advantage to the worker. The proper type of clothing depends on the specific circumstance. Certain work in hot environments may require insulated gloves, insulated suits, reflective clothing, or infrared reflecting face shields. For extremely hot conditions, thermally-conditioned clothing is available. One such garment carries a self-contained air conditioner in a backpack, while another is connected to a compressed air source which feeds cool air into the jacket or coveralls through a vortex tube. Another type of garment is a plastic jacket which has pockets that can be filled with dry ice or containers of ice.

12. Recommended Exposure Limits

These Threshold Limit Values (TLVS) refer to heat stress conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse health effects. The TLVs shown in Table I are based on the assumption that nearly all acclimatized, fully clothed workers with adequate water and salt intake should be able to function effectively under the given working conditions without exceeding a deep body temperature of 38 degrees Celsius (100.4 degrees Fahrenheit).

Since measurement of deep body temperature is impractical for monitoring the workers' heat load, the measurement of environmental factors is required which most nearly correlate with deep body temperature and other physiological responses to heat. At the present time, Wet Bulb Globe Temperature Index (WBGT) is the simplest and most suitable technique to measure the environmental factors. WBGT values are calculated by the following equations:

Outdoors with solar load: WBGT = 0.7 NWB + 0.2 GT + 0.1 DB

Indoors or Outdoors with no solar load: WBGT = 0.7 NWB + 0.3 GT

Where: WBGT = Wet Bulb Globe Temperature Index
NWB = Natural Wet Bulb Temperature
DB = Dry Bulb Temperature
GT = Globe Temperature

The determination of WBGT requires the use of a black globe thermometer, a natural (static) wet-bulb thermometer, and a dry bulb thermometer.

Higher heat exposures that shown in Table I are permissible if the workers have been undergoing medical surveillance and it has been established that they are more tolerant at work in heat than the average worker. Workers should not be permitted to continue their work when their deep body temperature exceeds 38.0 degrees Celsius (100.4 degrees Fahrenheit).

Table 1: Permissible Heat Exposure Threshold Limit Values

(Values are given in degrees Centigrade WBGT (Fahrenheit)]			
Work- Rest Regimen	**Work Load**		
	Light	**Moderate**	**Heavy**
Continuous work	30.0 (86.0)	26.7 (80.1)	25.0 (77.0)
75% Work, 25% Rest/Hour	30.6 (87.1)	28.0 (82.4)	25.9 (78.6)
50% Work, 50% Rest/Hour	31.4 (88.5)	29.4 (85.0)	27.9 (82.2)
25% Work, 75% Rest/Hour	32.2 (90.0)	31.1 (88.0)	30.0 (86.0)

13. References

- "Working in Hot Environments," US Department of Health and Human Services, Public Health Service, Centers for Disease Control, National Institute for Occupational Safety and Health, 1986.
- "Threshold Limit Values and Biological Exposure Indices for 1986 - 1987," American Conference of Governmental Industrial, Hygienists, 6500 Glenway Avenue, Building D-7, Cincinnati, OH 45211-4438.

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Labor Standards and Safety Division

Physical Agent Data Sheet (PADS) - Hand-Arm Vibration

Description
Health Hazards
Vibration Syndrome
Vibration Induced White Finger
Stages
Carpal Tunnel Syndrome
Preventing Hand-Arm Vibration Diseases
Recommended Exposure Limits

Description

Hand-arm vibration is caused by the use of vibrating hand-held tools, such as pneumatic jack hammers, drills, gas powered chain saws, and electrical tools such as grinders. The nature of these tools involves vibration (a rapid back and forth type of motion) which is transmitted from the tool to the hands and arms of the person holding the tool.

Health Hazards

Vibration Syndrome and Vibration-Induced White Finger (VWF) are the major health hazards related to the use of vibrating tools. Carpal Tunnel Syndrome is another health problem that has been linked in one study to the use of smaller hand-held vibrating tools.

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Vibration Syndrome

Vibration Syndrome is a group of symptoms related to the use of vibrating tools and includes -some or all of the following: muscle weakness, muscle fatigue, pain in the arms and shoulders, and vibration-induced white finger. Many researchers believe that other symptoms--headaches, irritability, depression, forgetfulness, and sleeping problems--should also be included in descriptions of Vibration Syndrome.

Vibration-Induced White Finger

Vibration-Induced White Finger (VWF), also known as "Dead Finger" or "Dead Hand" is the result of impaired circulation (poor blood supply in the fingers, caused by the prolonged use of vibrating tools. VWF may appear after only several months on the job, or may not appear until twenty to forty years on the job.

The harmful health effects of vibrating tools are related to the length of time that a worker has been using vibrating tools and to the frequency of the vibration (how fast the tool goes back and forth). The longer a person uses a vibrating tool, and the faster the tool vibrates, the greater the risk of health effects. The length of the initial symptom-free period of vibration exposure (i.e., from first exposure to the first appearance of a white finger) is known as the latent interval. It is related to the intensity of the vibration - the shorter the latent period, the more severe the resulting VWF if vibration exposure continues.

Temporary tingling or numbness during or soon after use of a vibrating hand tool is not considered to be VWF, however tingling and numbness in the fingers lasting more than an hour after finishing work may indicate early stages of VWF. Table 1 lists the stages that Vibration White Finger may progress through if exposure continues.

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Table 1
Stages of Vibration White Finger
(Taylor-Pelmear System)

Stage	Condition of Fingers	Work & Social Interference
00	No tingling, numbness or blanching of fingers	No complaints
OT	Intermittent tingling	No interference with activities
ON	Intermittent numbness	No interference with activities
TN	Intermittent tingling and numbness	No interference with activities
1	Blanching of a fingertip with or without tingling and/or numbness	No interference with activities
2	Blanching of one or more fingers beyond tips, usually during winter	Possible interference with activities outside work, no interference at work
3	Extensive blanching of fingers; frequent episodes in both summer and winter	Definite interference at work, at home, and with social activities; restriction of hobbies
4	Extensive blanching of most fingers; frequent episodes in both summer and winter	Occupation usually changed because of severity of signs and symptoms

The technical name for VWF is Raynaud's Syndrome of Occupational Origin. Raynaud's Syndrome may also occur in people who do not use vibrating hand-held tools. Several different kinds of medical illnesses can cause Raynaud's Syndrome. Raynaud's Syndrome also appears in some people who are otherwise entirely healthy.

It is important that people with Raynaud's Syndrome avoid the extensive use of vibrating tools because they can develop the most severe complications of VWF very quickly.

Many of the symptoms of Vibration Syndrome will disappear shortly after a worker stops using the types of tools which transmit vibration to the hands and arms. Fatigue and muscular pain in the arms and shoulders will generally disappear. In the early stages, if a worker stops using vibrating tools, VWF will not get any worse and may get slightly better.

Carpal Tunnel Syndrome

Carpal Tunnel Syndrome (CTS) is a group of symptoms in the hand which arise from pressure on one of the nerves which passes through the palm side of the wrist. The early symptoms are similar to the early symptoms of white finger and consist of tingling in the fingers. For the most part only the thumb, index, and middle fingers are affected in CTS. Later, symptoms can progress to numbness. Pain in the wrist and fingers may also develop. CTS may occur in people using small hand tools like pneumatic screwdrivers. Carpal Tunnel Syndrome also occurs among people having repetitive motion of the wrist or fingers, such as using a cash register, or picking fish from a net; or with forceful motion of the wrist, such as in using a wrench. Pinching or flexing with the wrist bent upwards, downwards, or sideways increases the occurrence of CTS.

The symptoms of CTS are frequently worse at night and a person may be awakened from sleep by pain or the feeling of pins and needles in fingers, hand or wrist.

Carpal Tunnel Syndrome may improve if diagnosed in the early stages and exposure to the type of activity which caused it is stopped. In moderate cases most of the symptoms of CTS can be relieved by a surgical operation which relieves the pressure on the nerve which causes the CTS symptoms. If the surgery is performed too late, only some of the symptoms may be relieved. In very severe cases the symptoms are irreversible and may include weakness of the hand due to loss of muscle function.

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Preventing Hand-Arm Vibration Diseases

Job Modification to Reduce Vibration Exposure

Wherever possible, jobs should be redesigned to minimize the use of hand-held vibrating tools. Where job redesign is not feasible, ways to reduce tool vibration should be found. Where practical, substitute a manual tool for a vibrating tool. Whenever possible, high vibration tools should be replaced by improved, low vibration tools designed to absorb vibration before it reaches the handgrip.

Determine vibration exposure times and introduce work breaks to avoid constant, continued vibration exposure. A worker who is using a vibrating tool continuously should take a 10 minute break after each hour of using the tool.

Medical Evaluation

Workers whose occupations place them at risk for developing VWF should have pre-employment physicals and thereafter should be checked at least annually by doctors who know about the diagnosis and treatment of VWF. Diagnostic tests which can be used include plethysmography, arteriography, skin thermography, and sensory tests,, such as two point discrimination depth sense, pinprick touch and temperature sensation. X-rays may also be useful.

Workers that have a past history of abnormalities in blood circulation and especially workers who have Raynaudis Syndrome should not be permitted to use vibrating hand-held tools. Workers who have moderate to severe symptoms of VWF should be reassigned to work which removes them from further direct exposure to vibrating tools.

If workers develop symptoms of tingling or numbness, or if their fingers occasionally become white or blue, or painful especially when cold, they should be examined by a doctor who knows about the diagnosis and treatment of VWF and CTS.

Work Practices

Workers using vibrating hand-held tools should wear multiple layers of warm gloves and should wear anti-vibration gloves whenever possible. Before starting the job, warm the hands. This is especially important when it is cold. workers using vibrating tools should not allow the hands to become chilled. If the hands of a worker using vibrating tools become wet or chilled, he should dry them and put on dry, warm gloves before resuming exposure to vibration. Workers exposed to cold should dress adequately to keep the whole body warm because low body temperature can make a worker more susceptible to VWF.

A worker using a vibrating hand-held tool should let the tool do the work by grasping it as lightly as possible, consistent with safe work practice. The tighter the tool is held, the more vibration is transmitted to the fingers and hand. The tool should rest on a support or on the workpiece as much as possible. The tool should be operated only when necessary and at the minimum speed (and impact force) to reduce vibration exposure.

Tools should be regularly maintained to keep vibration to a minimum. Keeping chisels and chainsaws sharp, for example, will reduce vibration. Using new grinder wheels will also reduce vibration.

Education

Employees who use or will be using vibrating hand-held tools should receive training about the hazards of vibration and they should be taught how to minimize the ill effects of vibration.

Smokers are much more susceptible to VWF that non-smokers, and the VWF in smokers is usually more severe, therefore workers who use vibrating hand-held tools should not smoke.

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Recommended Exposure Limits

Table 2 contains the American Conference of Governmental Industrial Hygienists (ACGIH) recommendations on the limits for exposure of the hand to vibration.

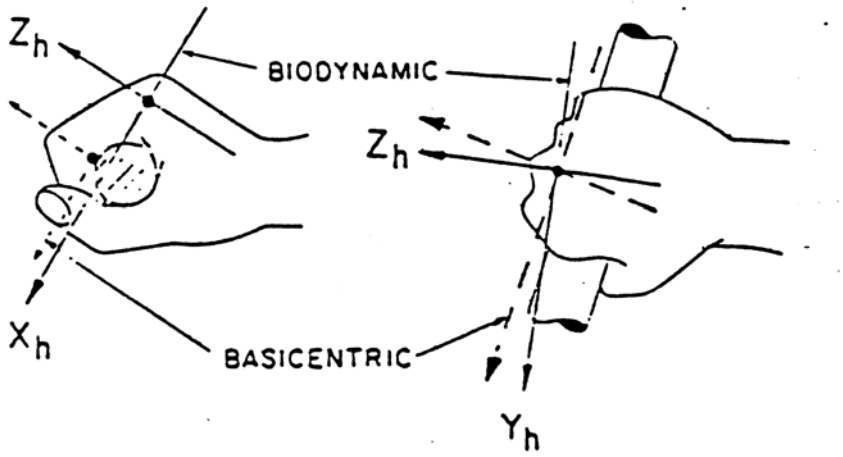
Table 2
Threshold Limit Values for Exposure of the Hand to Vibration in Either X_h, Y_h, Z_h, Directions

Total Daily Exposure Duration[a]	Values of the Dominant,[b] Frequency-Weighted, rms, Component Acceleration Which Shall Not be Exceeded a_k, (a_{keg})	
	m/s^2	g[c]
4 hours and less than 8	4	0.40
2 hours and less than 4	6	0.61
1 hour and less than 2	8	0.81
less than 1 hour	12	1.22

a The total time vibration enters the hand per day, whether continuously or intermittently.

b Usually one axis of vibration is dominant over the remaining two axes. If one or more vibration axes exceeds the Total Daily Exposure then the TLV has been exceeded.

c g = 9.81 m/s . d



Biodynamic and basicentric coordinate systems for the hand, showing the directions of the acceleration components (ISO 5349 and ANSI S3.34-1986).

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Alaska Department of Labor & Workforce Development
Occupational Safety and Health

Revised: September 2004

Physical Agent Data Sheet (PADS)
- Ionizing Radiation

- Description
- Occupations with Exposure to Ionizing Radiation
- Health Effects
- Emergency Procedures
  - Spills
  - Loss of a sealed source
  - Rupture or broken sealed source
  - Major Calamity
- Medical Treatment
- Safety Procedures and Control Measures
- Licensing, Registration, Consultation
- Personal Protective Equipment
- Permissible Exposure Limit
- References and Resources

Description

Ionizing Radiation is the name given to a band of energy on the electromagnetic spectrum. X-rays and radioactive substances are examples of ionizing radiation. In order to understand the difference between ionizing and non-ionizing radiation it is necessary to review the structure of an atom.

All matter is made up of atoms. Molecules are collections of atoms hooked together in various combinations and shapes. An atom is the smallest unit of an element (like helium, oxygen or carbon) that still has all the properties of that element. Atoms are so small they cannot be seen with even the most powerful microscope.

All atoms are made up of three major subatomic particles: protons, neutrons, and electrons. Protons and neutrons make up the nucleus or center of the atom. Protons have a positive electric charge but neutrons have no electric charge. Electrons circle the nucleus and have a negative charge. In the neutral atom the negative charges of the electrons exactly balance the positive charges of the protons in the nucleus. If an atom has too many or too few electrons in orbit to balance the charge of the protons, the atom is called an ion.

The number of protons in the nucleus of an atom determines which element it is. Isotopes of the same element have the same number of protons but varying numbers of neutrons. The helium atom ($^{4}He_{2}$) has two protons and two neutrons in the nucleus. The carbon atom ($^{12}C_{6}$) has six protons and six neutrons in the nucleus. An example of

an unstable isotope of carbon is carbon-14 ($^{14}C_6$). The superscript indicates the atomic weight while the subscript number indicates the number of protons. If the atom has too many or too few neutrons for the number of protons, the atom may be unstable. If unstable the nucleus will give off bursts of energy (radiation) in an attempt to become stable.

These bursts of energy or disintegrations may be in the form of alpha particles (two protons and two neutrons - positively charged), beta particles (a negatively-charged electron), x-rays, or gamma rays (types of high energy electromagnetic waves). If these charged particles or waves interact with another atom, they have enough energy to knock an electron out of its orbit, creating an ion. That is why this type of radiation is called ionizing radiation.

Other forms of energy, like visible light, radio waves, and infrared light, do not have enough power to knock electrons out of their orbits so they are called non-ionizing radiation.

Amounts of ionizing radiation can be expressed in several different units. A **roentgen** (R) is an amount of x-rays or gamma radiation that causes a specified amount of ionization among the atoms and molecules in a cubic centimeter of air. Another unit is the **rad**, which applies to all ionizing radiation. It is a measure of the amount of energy absorbed from radiation in a specific volume of material.

A third unit, which is more useful and used more commonly, is the **REM** (Roentgen Equivalent Man). Measuring radiation in rems or millirems (one thousandth of a rem) allows direct comparison of the biological effects of different types of radiation. Alpha particles, beta particles, and x-rays or gamma radiation, differ in their ability to cause damage in tissues due to their differences in ionizing and penetrating ability. Alpha particles are 20 times more damaging in tissue then the same amount of x-rays. Measuring radiation in rems takes this difference into account so that one rem of alpha radiation in tissues has the same effect as one rem of beta radiation or one rem of x-rays. A rem is a relatively large quantity of radiation so most human exposures are measured in millirems. An easy way to remember the difference between these units is that a roentgen is a measure of how much you are exposed to, the rad is how much you absorb, and the rem is how much damage it does.

All people receive ionizing radiation from naturally occurring sources. Depending on where you live, most people receive an exposure in the range of 100 millirems per year from cosmic radiation from outer space and from naturally occurring isotopes (excluding radon) in the ground, air, food, and water. Radon is estimated to add another 200 millirems per year to our background. Medical and dental uses of x-rays can also contribute to a person's yearly radiation exposure. A typical well-conducted chest x-ray involves an exposure of 30 milliroentgens.

OCCUPATIONS WITH EXPOSURE TO IONIZING RADIATION	
With the use of radioactive isotopes in industry and the increasing use of x-ray sources, ionizing radiation exposures may occur in a wide variety of occupations. The following examples show the diversity of occupations potentially exposed to ionizing radiation.	
Aircraft workers	Military personnel
Atomic energy plant workers	Nuclear medicine workers with exposure to energetic radiation from selected radioisotopes (e.g. technetium-99m, iodine-131, tritium-3, etc.)
Biologists	Nurses
Cathode ray tube makers	Oil well loggers
Ceramic workers	Ore assayers
Chemists	Pathologists
Density testers	Petroleum refinery workers
Dental assistants	Physicians
Dentists	Physicists
Dermatologists	Pipeline oil flow testers
Drug makers	Pipeline weld radiographers
Drug sterilizers	Plasma torch operators
Electron microscope makers	Plastic technicians
Electron microscopists	Prospectors
Electrostatic eliminator operators	Radar tube makers
Embalmers	Radiologists
Fire alarm makers	Radium laboratory workers
Food preservers	Radium refinery workers
Food sterilizers	Research workers
Gas mantle makers	Television tube makers
High voltage television repairmen	Thickness gauge operators
High voltage vacuum tube makers	Thorium-aluminum alloy workers
High voltage vacuum tube users	Thorium-magnesium alloy workers
Industrial fluoroscope operators	Thorium ore producers
Industrial radiographers	Tile glaziers
Inspectors using, and workers in proximity to, sealed gamma ray Uranium sources (e.g. cesium-137, cobalt-60, and iridium-192)	Uranium dye workers
Klystron tube operators	Uranium mill workers
Liquid level gauge operators	Veterinarians
Luminous dial painters	X-ray technicians / aides
Machinists	X-ray diffraction apparatus operators
	X-ray tube makers, fabricated metal product

Health Effects
The health risks and effects of exposure to ionizing radiation are dependent on the type of radiation (alpha, beta, gamma or x-ray), the energy, the dose rate, the quantity, and the body part exposed.

Alpha particles, due to their relatively large size and mass, do not travel very far in air (a few centimeters) and cannot pass through skin or even a sheet of paper. Alpha radiation is only hazardous if inhaled or ingested. It is the most damaging to tissue if it is inhaled or ingested. Beta particles are more penetrating than alpha; a thin sheet of aluminum will stop beta radiation, but beta radiation is not as damaging to tissue.

X-rays (and gamma rays) are the most penetrating and least damaging to tissue. Their penetrating capability makes them useful for medical diagnoses.

Some body parts are more sensitive to damage from ionizing radiation than other body parts. The reproductive and blood-forming organs and the eyes are the most sensitive while the extremities such as arms, hands, and feet are less sensitive.

The quantity of ionizing radiation to which a person is exposed is the greatest factor in the risk and severity of a radiation-related injury. Information on the health effects of a single large dose of ionizing radiation is readily available from studies of the casualties and survivors of the atomic explosions in Hiroshima and Nagasaki, from studies of people exposed to radioactive fallout from the early atom bomb testing and from accidents involving ionizing radiation.

Health effects of a single acute dose of whole body radiation.	
Dose	**Acute Effects**
less than 25 rems	No detectable effect
25 - 50 rems	Drop in white blood cell count, no serious injury
50 - 100 rems	Possible injury and sickness; no disability
100 - 200 rems	Acute radiation sickness (nausea, vomiting, diarrhea, weakness, shock, skin sores, hair loss); possible disability
200 - 400 rems	Acute radiation sickness; disability certain, possible death without treatment
400 - 500 rems	50% death rate without treatment
> 600 rems	100% death rate

Occupational exposure to ionizing radiation is usually limited to a small area of the body such as the hands, resulting in reddening of the skin or dermatitis. Whole body radiation and acute radiation sickness occurs very rarely in occupational settings.

The health effects of long-term exposure to low levels of ionizing radiation are less easily studied and documented. The concern about possible health effects, cancer and genetic effects in particular, from low level radiation stems from the known health effects of high doses of radiation and the assumption that the degree of risk is directly related to the degree of exposure. It is assumed (not proven) for safety sake, that any exposure to radiation above natural background levels contributes to small increases in the risk of developing cancer. Reducing exposure to the lowest level possible will, therefore, reduce the risk to the lowest level possible.

Emergency Procedures

The following emergency procedures were developed for medical facilities but can be generally applied to any workplace where radioactive substances are used.

Initial report: All incidents involving environmental contamination should be reported first to the Alaska Department of Environmental Conservation Area Response Team (SOSC).

Southeast Alaska:	Bob Mattson (Juneau) Bob_mattson@dec.state.ak.us	907-465-5349
Central Alaska:	Gary Folley (Soldotna) Gary_folley@dec.state.ak.us	907-262-5210 ext 234
Northern Alaska:	Ed Meggert (Fairbanks) Ed_meggert@dec.state.ak.us	907-451-2124
Secondary report:	Doug Dasher (Fairbanks) Doug_dasher@dec.state.ak.us	907-451-2172

A. Spills

Accidental spillage of radioactive material is rare, but cannot be prevented absolutely, and may occur in any laboratory, in any hall or passageway traversed by messengers transporting such material.

Except for a major accident to a shipping container or a serious spill in the hot laboratory, the amount of radioactive material involved in a spill will usually be small and the radiation from it will not constitute a serious hazard. The real danger is the spread of the contamination on shoes or other contaminated garments. The following is a general outline of the procedure to be followed in the event of a spill.

- Confine the spill immediately by dropping paper towels or other absorbent material onto it.

- Put on waterproof gloves.

- Check shoes for visible signs of contamination. If it appears
- possible that they are contaminated, remove shoes when leaving the contaminated region.

- If fans, ventilators, or air conditioners are operating in the area, they should be shut off. Preferably this should be done by someone not involved in the spill and therefore not likely to spread contamination.

- Mark off or isolate in some way the entire suspect area and police it to be sure that no one walks through it.

- **CALL THE RADIATION PROTECTION SUPERVISOR (RPS)** (aka Radiological Safety Officer) designated by the employer. If the number is not posted in a convenient place, and you do not know it, call the company telephone operator, report an emergency and ask the operator to find the supervisor.

- In general, inexperienced personnel should not attempt to clean up a spill. It is better to wait a little while for the RPS than to risk spreading the contamination by erroneous procedures. If the spilled material is covered and bystanders are kept a few feet away, there is little or no danger from the radiation.

- If any of the spilled material has splashed onto a person or clothing, immediate steps should be taken to remove it. Laboratory coats or outer garments should be taken off and left in the contaminated area. Hands or other skin areas should be washed thoroughly with soap. If it is certain that shoes or feet are not contaminated, it is permissible to walk to a washing facility, which subsequently, however, must be treated as a contaminated area until cleared by the RPS. If there is doubt about contamination of the feet, a washbowl and soap should be brought to the suspect area for cleaning them.

- The RPS should bring decontamination materials and a survey meter, and the clean-up operation will proceed under the supervision of the RPS.

- If the RPS is not immediately available, or cleanup must proceed without him or her, one person should do the work. This person should put on waterproof

gloves, shoe covers and a surgical facemask if it is available. He will then take up the spilled material with absorbent paper, which must be handled with forceps or tongs, and deposit it immediately in a waterproof container. After as much as possible has been removed in this way, the surface should be washed with damp, not wet, rags held in forceps, always working toward the center of the contaminated area rather than away from it.

- A survey meter should have been obtained from the office of the RPS, and careful monitoring carried out during this procedure, on area and personnel. Preferably, the meter should be operated by someone not involved in the spill, so that the instrument is not likely to be contaminated.

- Reduction of counting rate to five times background, over an area of 1 or 2 square feet or to ten times background over a few square inches is usually satisfactory, especially for short-lived nuclides. Eventually, the RPS should check the area and give it clearance.

- When the operation is finished, gloves and other protective garments should be carefully checked for residual contamination. If any is found, the garments should be left with the other contaminated material for ultimate clearance or disposal by the RPS.

B. Loss of a Sealed Source

The following is a general outline of the procedure to be followed in the event of loss of a sealed source:

- Call the Radiation Protection Supervisor (RPS).

- If all sources are supposed to have been removed from the patient, he or she should be checked with a survey meter to make sure that none has inadvertently been left behind.

- Try to make sure that all bandages, linen, and bedding have been kept in the patient's room. If this is not the case, try to stop them on the way to the laundry or the incinerator.

- Check all this material, a little at a time. Then check the room, to be sure the source is not on the floor or furniture.

- Check the drain tap of any accessible plumbing facility.

- Check the incinerator.

- Check all barrels of ashes or garbage. The more active the source, the easier it should be to find it.

C. A Ruptured or Broken Sealed Source

- Shut off all fans and ventilators.
- Drop damp towels on the suspect material; throw nothing away.
- Call the Radiation Protection Supervisor. The RPS will remove the questionable material and check the area for contamination.
- If possible, evacuate the room. If not, keep all personnel several feet from the suspect material until the RPS arrives.

D. A Major Calamity: Fire, Earthquake, A Massive Spill

- Call the Radiation Protection Supervisor.
- Report the incident to the Alaska Department of Environmental Conservation Area Response Team (SOSC)
- Prevent access to suspect areas, or removal of anything from them. Shut off ventilating system; close drains if possible.
- Do not try to do anything until the RPS arrives. The RPS must be given complete charge.
- If for any reason the RPS cannot take charge, wait for the Alaska Department of Environmental Conservation Area Response Team (SOSC) or follow their instructions.

Medical Treatment

Medical treatment of a person who has been accidentally over exposed to ionizing radiation will depend on the dose. Exposures less than 25 rems generally do not require treatment. The treatment will also depend on whether the source of the radiation is outside the body such as from x-ray equipment or a gamma emitter, or from inside the body such as when a radioactive dust is inhaled or ingested.

When the source of radiation is outside the body, and treatment is considered necessary, it is started after the entire radiation dose has been received. The dose cannot be lessened, therefore the objective of the treatment is to lessen the acute effects of radiation sickness, prevent secondary infections and provide transfusions to supplement weakened and damaged blood cells.

When the source of the radiation (the emitter) has been inhaled or swallowed, radiation exposure will continue and the goal of treatment is to reduce the quantity of the emitter in the body. This may be accomplished by speeding up the excretion of the emitter by chelating therapy. A chelating agent is a chemical which binds with radioactive heavy metals enabling the body to excrete them faster. Chelating therapy is effective for internal emitters which are soluble in body fluids. Insoluble emitting substances which have been inhaled can be removed to some extent by bronchopulmonary lavage, a procedure which rinses out the lung's air sacs and airways.

Safety Procedures and Control Measures

The specific aspects, equipment, and procedures of a workplace radiation safety program will depend on the nature of the source, the type of radiation emitted, and the circumstances of its use. Only general concepts of protection and control can be covered in a data sheet of this scope. The National Council on Radiation Protection and Measurements (NCRP) offers recommendations for specific uses of radiation emitting substances and equipment. Publications from NCRP are available from their website: http://www.ncrp.com

Restricted Access: Only authorized trained personnel should be allowed in work areas where radiation emitting substances or equipment are used. Signs and warning notices using the standard radiation symbol must be posted.

Shielding: The selection of materials and designs for shielding will depend on the type of radiation, the use factor of the equipment, occupancy times, and workload.

Ventilation: Operations that routinely produce airborne contamination should utilize engineered containment and ventilation systems to prevent airborne releases. Appropriate respirators may be used but only when effective engineering controls are not feasible.

Radiation Monitoring: Radiation survey equipment appropriate for the type of radiation to be measured must be maintained and used to evaluate exposure conditions for employees. Working areas must be monitored at a frequency that will ensure safe working conditions. Individuals working in most industrial settings and many medical facilities must wear appropriate radiation monitoring devices to measure actual occupational exposures. Records of results for area and personal monitoring must be maintained.

Licensing and Registration: All by-product radioactive material and special nuclear material must be licensed by the Nuclear Regulatory Commission, and conditions of that license must be met by the user. Radioactive materials not under the jurisdiction of the Nuclear Regulatory commission and all x-ray sources must be registered with the

Alaska Department of Health and Social Services (H&SS), Radiological Health program. Use must meet requirements of the Alaska Radiation Protection Regulations, H&SS, in addition to the Occupational Safety and Health regulations of the Alaska Department of Labor & Workforce Development and the Environmental regulations of the Department of Environmental Conservation. The NRC and the state may conduct inspections of licensees and registrants to ensure compliance.

Consultation: Radiological Health is a program within the Department of Health and Social Services, State Public Health Laboratories. This program is responsible for safe use of radiation sources within the State of Alaska. Under Alaska statute, the program is responsible for Radiation Protection including the development of policies for evaluating radiation hazards, conducting surveys/investigations and training. This includes measurement and safe use of radiation, reviewing plans and shielding specifications for radiation sources, inspecting facilities where radiation sources are used, and contracting with other agencies where a cooperative effort is required in order to address radiation hazards. These responsibilities include both ionizing and non-ionizing sources, and radiation producing devices as well as radioactive materials. The main office is in Anchorage, however radon related activities are conducted out of the University of Alaska Fairbanks.

Contact: Clyde E. Pearce, RHS
Telephone: (907) 334-2107
Facsimile: (907) 334-2161
E-mail: clyde_pearce@health.state.ak.us

Emergency Response: Environmental surveys and disaster response to radiation in the environment are the responsibility of the Department of Environmental Conservation.

Initial report: All incidents involving environmental contamination should be reported first to the Alaska Department of Environmental Conservation Area Response Team (SOSC).

Southeast Alaska:	Bob Mattson (Juneau) Bob_mattson@dec.state.ak.us	907-465-5349
Central Alaska:	Gary Folley (Soldotna) Gary_folley@dec.state.ak.us	907-262-5210 ext 234
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Personal Protective Equipment
Respirators used for protection against airborne contamination should be approved by the National Institute of Occupational Safety and Health (NIOSH). If air-purifying respirators are used, only high efficiency (HEPA) cartridges approved for dusts, fumes, mists, and radionuclides or radon daughters (progeny) may be used. A good respirator program must include consideration of respirator type, fit, maintenance, testing, and training.

Protective clothing must be provided if the potential for skin or clothing contamination exists. Selection must be based on the nature of the contaminant (liquid or dry material) and the type of radiation emitted. Appropriate methods of laundering or disposal are also required. Contaminated clothing must not be taken home.

Permissible Exposure Limit
The US DOL Occupational Safety and Health Administration (OSHA) regulations 29 CFR 1910.1096, adopted by reference by the State of Alaska under Alaska Administrative Code 8 AAC 61.1010(b), state that:

. . . (b) Exposure of individuals to radiation in restricted areas.

(1) No employer shall possess, use, or transfer sources of ionizing radiation in such a manner as to cause any individual in a restricted area to receive in any period of one calendar quarter from sources in the employer's possession or control a dose in excess of the limits specified in Table 1-18.

Table 1-18 **Rems per calendar quarter**	
Whole body: Head and trunk; active blood-forming organs; lens of eyes; or gonads	1 1/4
Hands and forearms; feet and ankles	18 3/4
Skin of whole body	7 1/2

(2) An employer may permit an individual in a restricted area to receive doses to the whole body greater that those permitted under 29 CFR 1910.1096 (b) (1) so long as:

(A) During any calendar quarter the dose to the whole body shall not exceed three rems; and

(B) The dose to the whole body, when added to the accumulated occupational dose to the whole body, shall not exceed five (N-18) rems, where "N" equals the individual's age in years at his last birthday; and

(C) The employer maintains adequate past and current exposure records that show that the addition of such a dose will not cause the individual to exceed the amount authorized in this form. "Dose to the whole body" shall be deemed to include any dose to the whole body, gonad, active blood forming organs, head and trunk, or lens of the eye.

(3) No employer shall permit any employee who is under 18 years of age to receive in any period of one calendar quarter a dose in excess of 10 percent of the limits specified in Table 1-18.

These regulations (29 CFR 1910.1096) also cover definitions, exposure to airborne radioactive material, precautionary measures and personal monitoring, caution signs, labels and symbols, evacuation warnings, instruction of personnel, waste disposal, notification of incidents, reports of overexposure, records and disclosure.

References and Resources

1. Occupational Diseases - A Guide to Their Recognition, DHEW (NIOSH) Publication No. 77-181. 1978.

2. Radiation Protection for Medical and Allied Health Personnel, National Council on Radiation Protection and Measurements (NCRP) Report No. 48. 1986. Access NCRP publications at: http://www.ncrp.com

3. Cralley, Lewis J. and Cralley, Lester V. Patty's Industrial Hygiene and Toxicology Volume III, pg. 359 - 404, John Wiley and Sons, Inc. 1979.

4. OSHA General Industry Regulations, 29 CFR 1910, as amended, and adopted by the State of Alaska in Alaska Administrative Code, 8 AAC 61.1010(b) under the authority of AS 18.60.030, and specifically 29 CFR 1910.1096

   http://www.osha.gov/pls/oshaweb/owastand.display_standard_group?p_toc_level=1&p_part_number=1910

Physical Agent Data Sheet (PADS) - Lasers

A laser is a device which produces a concentrated beam of electromagnetic energy. The beam of energy can be in the form of visible light or in the form of invisible infrared or ultraviolet radiation.

Lasers differ in many ways, but there are certain characteristics which all lasers have in common. For all lasers, the production of the concentrated beam of energy requires three basic processes. First, an energy source is applied to a solid, gaseous or liquid substance called the lasing material. The lasing material then produces radiation having a specific wavelength. Then by using mirrors, lenses and shutters, the light or infrared waves or ultraviolet rays are magnified and focused to produce the laser beam.

Lasers may be different from one another in several specific ways. The basic categories are:

1. Type of lasing material used.

   The lasing material may be solid, like ruby crystals or glass; may be a gas or mixture of gases, such as carbon dioxide or a helium-neon mixture; or liquid containing special dyes.
2. Source of energy applied.

   The energy applied to the lasing material may come from a powerful light source, electric current, or a chemical reaction.
3. Continuous or pulsed emission of the laser beam.

   The energy applied to the lasing material may be continuous or applied on pulses. Some lasers can produce hundreds of thousands of pulses per second.

1.0 Hazards

The hazards related to the use of lasers vary depending on the type of laser, the power of the laser, the purpose and manner in which the laser is used, and the safety features of the laser.

Health Hazards

Eye injuries are the most serious danger from laser beams. The cornea of the eye is like a glass window that allows light to enter the eye. It is located in the very front part of the eyeball. The cornea is very sensitive and injuries to the cornea can be very painful. most injuries to the cornea heal without permanent damage. If the deep layers of the cornea are affected, permanent injuries can occur. The types of eye injuries which occur from improper use of lasers depend on the wavelengths of the laser beams. Laser injuries to the cornea are usually caused by lasers having short wavelengths in the ultraviolet and long wavelengths in the infrared ranges.

The lens of the eye is located toward the front of the eyeball but behind the cornea. Injuries to the lens can result in loss of transparency of the lens. The lens becomes cloudy and then blocks some of the light rays entering the eye, thus making it hard to create clear images on the retina. When the lens of the eye becomes cloudy, it is called a cataract. While damage to the cornea usually heals completely in a day or two, damage to the lens almost always persists. Very slight damage to the lens may go unnoticed, but repeated minimal damage can add up to serious damage later on. Damage to the lens may not cause problems until many years after the injuries to the lens occurred. Lens damage is most likely to occur with certain lasers that produce beams in the near-ultraviolet and near-infrared wavelength range.

The retina of the eye is the surface upon which visual images are produced. It is located in the back of the eyeball. Certain lasers in the wavelength ranges of visible light and near-infrared wavelength ranges can burn permanent blind spots in the retina causing partially or totally obscured vision.

Skin burns may also occur from the use of lasers but are less likely to occur and are less serious than eye injuries. When skin is exposed to a potentially dangerous laser beam, a person will usually feel the heat and remove the exposed part of the body from the path of the laser beam.

Electrical Hazards

Some lasers require high voltage power supplies and some workers have received electrical shock because of carelessness while working around these power supplies. Almost all laser power supplies under certain circumstances, could possible cause electrical shock or electrocution. Following the general safety standards for other electrical or electronic equipment provides protection against the dangers of electrical shock or electrocution.

Chemical Hazards

Laser welding or cutting of metals will cause formation of many of the same metal oxides and other fumes that are produced in conventional welding processes. Explosions can occur when ice collects in valves or connectors in lasers which require very cold liquids, such as liquid nitrogen.

Lasers are commonly used in the workplace to perform the following functions:

Welding and machining
Surgery
Communication: via fiber optic technology
Shock hardening, glazing, drilling
Cutting textiles
Leveling and alignment of building sites

2.0 Safety Classifications of Lasers

For safety purposes, lasers are divided into Classes I, II, III, and IV; Class I being least hazardous and Class IV most hazardous. Almost all reported eye injuries have been from Class IV lasers.

Almost all lasers that produce visible light beams are so bright that they can produce eye injuries. Therefore, to reduce risk of health hazards to the eye, many are designed in a way, such as enclosing the laser beam in a box, which prevents direct eye exposure to the beam.

Any laser which by itself is in Class II, III, or IV may be reclassified to a lower risk category if the laser beam is enclosed in such a way to decrease the risk of hazardous exposure to people.

Class I lasers are considered entirely safe even if used improperly. Class I lasers do not require any warning labeling. Some more hazardous lasers may be placed in the Class I category when they are part of a consumer or office machine which shields the user from the hazards of the laser beam. These machines, however, must have some type of warnings which are visible if the shields are removed.

Class II lasers are often referred to as "low-power" or "low-risk" lasers. These lasers are hazardous only when someone stares directly into the laser beam even though the beam hurts the eyes. Class II lasers require warnings to avoid staring directly into the beam.

Class III lasers are Moderate Risk or Medium Power lasers. They can produce eye injuries when the laser beams are viewed directly or when a sharp reflection is viewed directly. Class III is subdivided into Class IIIA and IIIB. Class IIIA is considered to be hazardous only when the laser beam is collected and focused by optical instruments, for example when surveyors look into a laser beam with a telescope-like instrument. Class IIIA lasers require warnings to prevent such hazardous practices. These lasers can cause serious eye injuries before someone who accidentally looks directly into the beam has a chance to blink.

Class IV lasers produce beams that when reflected, even if it is not a sharp reflection, may cause serious eye and skin injuries, and where the beam may be a fire hazard. It is critical that the dangers of Class IV lasers are clearly marked with warning signs.

3.0 Safety Precautions

Class I Controls

No user safety rules are necessary.

Class II Controls

1. Never permit a person to continuously stare into the laser source if exposure levels exceed the applicable permissible exposure level for the duration of intended staring.
2. Never point the laser at an individual's eye unless a useful purpose exists and the exposure level and duration will not exceed the permissible limit.

Class III Controls

1. Do not aim the laser at an individual's eye.
2. Permit only experienced personnel to operate the laser.
3. Enclose as much of the beam path as possible. Even a transparent enclosure will prevent individuals from placing their head or reflecting objects within the beam path. Terminations should be used at the end of the useful path of the direct and any secondary beams.
4. Shutters, polarizers and optical filters should be placed at the laser exit port to reduce the beam power to the minimal useful level.
5. Control spectators.
6. A warning light or buzzer should indicate laser operation. This is especially needed if the beam is not visible, e.g., for infrared lasers.
7. Do not permit laser tracking of nontarget vehicles or aircraft.
8. Operate the laser only in a restricted area, for example, in a closed room without windows, and place a warning sign on the door.
9. Place the laser beam path well above or well below the eye level of any sitting or standing observers whenever possible. The laser should be mounted firmly to assure that the beam travels only along its intended path.
10. Always use proper laser eye protection if a potential hazard exists for the direct beam or a specular reflection.
11. A key switch should be installed to minimize tampering by unauthorized individuals.
12. The beam or its specular reflection should never be directly viewed with optical instruments such as binoculars or telescopes without sufficient protective filters.
13. Remove all unnecessary mirror-like surfaces from within the vicinity of the laser beam path.

Class IV Controls

Fortunately, these high-power lasers are seldom used outside of research laboratories and restricted industrial environments where personnel access is carefully controlled.

These lasers should only be operated within a localized enclosure, or in a controlled workplace, or where the beam is directed into outer space. If a complete local enclosure is not possible, laser operation indoors should be in a light-tight room with interlocked entrances to assure that the laser cannot emit while a door is open.

1. Eye protection is needed for all individuals working within the controlled area. If the laser beam irradiance is sufficient to be a serious skin or fire hazard, a suitable shielding should be used between the laser beam and any personnel.
2. Remote firing with video monitoring or other remote (safe) viewing techniques should be chosen when feasible.
3. Outdoor high-power laser devices such as satellite laser transmission systems and laser radar (LIDAR) should have positive stops on the azimuth and elevation transverse to assure that the beam cannot intercept occupied areas or nontarget aircraft.
4. Beam shutters, beam polarizers, and beam filters should always be used to limit use to authorized personnel only. The flashlamps in optical pump systems should be shielded to eliminate any direct viewing.
5. Backstops should be diffusely reflecting-fire resistant target materials where feasible. Safety enclosures should be used around microwelding and microdrilling work pieces to contain hazardous reflections from the work area. Microscopic viewing systems used to study the work piece should ensure against hazardous levels of reflection of laser irradiation back through the optics.

4.0 Emergency Procedures

Anyone who is suspected of having a laser-related eye injury should be examined as soon as possible by an ophthalmologist, a physician who specializes in the care of eye injuries and diseases.

Laser-related skin burns should be treated as any other skin burns. Cold water should be applied immediately to the burn area for first and second degree burns (reddened skin or blistering skin). Third degree burns (open wound) should be covered with a sterile dressing and the person taken to a medical facility. Never put ointments, creams or butter on burns.

5.0 Permissible Exposure Limits

Lasers used in construction shall comply with the Alaska Construction Code, Section 05.040(e):

Nonionizing radiation

1. Only qualified and trained employees shall be assigned to install, adjust, and operate laser equipment.
2. Proof of qualification of the laser equipment operator shall be available and in posession of operator at all times.
3. The employer shall provide antilaser eye protection as specified in section 50 of this subchapter for employees working in areas where a potential exposure to direct or reflected laser light greater than 5 milliwatts exist.
4. Areas in which lasers are used shall be posted with standard laser warning placards.
5. Beam shutters or caps shall be utilized, or the laser turned off, when laser transmission is not actually required. The laser shall be turned off whenever the laser is left unattended.
6. Only mechanical or electronic means shall be used as a detector for guiding the internal alignment of the lasers.
7. The laser beam shall not be directed at employees.

8. Under conditions of rain, snow, fog or dust the use of laser systems is prohibited.
9. Laser equipment shall bear a label to indicate maximum output.
10. Employees shall not be exposed to light intensities above:
    a. Direct staring: one microwatt per square centimeter.
    b. Incidental observing: two and one-half watts per square centimeter.
    c. Diffused reflected light: two and one-half watts per square centimeter.
11. Laser units in operation shall be set up above the heads of the employees.

6.0 References

1. Sliney, D. & Walbarsht, M., Safety with Lasers and Other Optical Sources. Plenum Press, New York, NY 10013.

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PHYSICAL AGENT DATA SHEET

Noise

Sound is created when a vibrating source (like a bell, motor or a stereo speaker) sends sound waves through the air to your ear. Every sound has two aspects: its pitch (frequency) and its loudness (intensity). On a stereo, frequency is determined by the bass/treble control. Intensity is determined by the volume control. Noise (unwanted sound) is usually made up of many frequencies. The disturbing and harmful effects of noise depend both on the loudness and the frequency of the tones making up noise.

Loudness is measured in units called decibels (dB). A conversational voice is about 65 dB. A shout is 90 dB or greater.

Frequency is measured in units called Hertz (Hz). The frequency of a locomotive horn is about 250 Hz. The frequency of a table saw is about 4,000 Hz.

Health Effects

Excessive noise can destroy the ability to hear, and may also put stress of other parts of the body, including the heart.

For most effects of noise, there is no cure, so that prevention of excessive noise exposure is the only way to avoid health damage.

Hearing

The damage done by noise depends mainly on how loud it is and on the length of exposure. The frequency or pitch can also have some effect, since high-pitched sounds are more damaging than low-pitched sounds.

Noise may tire out the inner ear, causing temporary hearing loss. After a period of time away from the noise hearing may be restored. Some workers who suffer temporary hearing loss may find that by the time their hearing returns to normal, it is time for another work shift so, in that sense, the problem is "permanent."

With continual noise exposure, the ear will lose its ability to recover from temporary hearing loss, and the damage will become permanent. Permanent hearing loss results from the destruction of cells in the inner ear, cells which can never be replaced or repaired. Such damage can be caused by long-term exposure to loud noise or, in some cases" by brief exposures to very loud noises.

Normally, workplace noise first affects the ability to hear high frequency (high-pitched) sounds. This means that even though a person can still hear some noise, speech or other sounds may be unclear or distorted.

Workers suffering from noise-induced hearing loss may also experience continual ringing in their ears, called "tinnitus." At this time, there is no cure for tinnitus, although some doctors are experimenting with treatment.

Other Effects

Although research on the effects of noise is not complete, it appears that noise can cause quickened pulse rate, increased blood pressure and a narrowing of the blood vessels over a long period of time, these may place an added burden on the heart.

Noise may also put stress on other parts of the body by causing the abnormal secretion of hormones and tensing of the muscles.

Workers exposed to noise sometimes complain of nervousness, sleeplessness and fatigue. Excessive noise exposure also can reduce job performance and may cause high rates of absenteeism.

Permissible Exposure Limit

The Action level for noise is an average noise level of 85 dB for an eight-hour day. When employees are exposed to noise levels, which exceed the Permissible Exposure Limit, the employer must install or use engineering or administrative controls to lower the noise levels. While these controls are being designed or installed employees must wear hearing protection. If the controls still do not reduce noise exposures to below 90 dB, hearing protection must continue to be worn.

Protective Measures

Suitable hearing protectors (earplugs or muffs) must be made available at no cost to employees who are exposed to an average of 85 dB or greater for an eight-hour day. Employees must be given the opportunity to select from three different types of appropriate hearing protectors.

Hearing tests (audiometric exams) must be given to employees who are exposed to an average of 85 dB or greater for an eight-hour day. Hearing tests will show whether employees are experiencing any hearing losses. Hearing tests are also useful in showing how well the earplugs and earmuffs are working. Hearing tests must be given annually.

Employees should also receive training in the effects of noise on hearing, an explanation of the hearing tests, and instruction on the proper fitting and care of earplugs or muffs.

Noise away from work can also cause hearing loss. Hearing protectors should be worn when operating noisy equipment or tools such as chain saws, brush cutters, power lawn mowers, or when using firearms.

Refer to Alaska Administrative Code, Occupational Health and Environmental Control 04.0104 for specific regulations on Noise Exposure and Hearing Conservation Programs.

Labor Standards and Safety Division

Physical Agent Data Sheet (PADS) - Radio Frequency/Microwave Radiation

Other PADS:
Cold Stress
Hand-Arm Vibration
Heat
Ionizing Radiation (PDF)
Lasers
Noise
Radio Waves
Ultraviolet Radiation

- Health Hazards
- Safety and Health Precautions
- Permissible Exposure Limits
- Microwave Ovens

Description

Radiofrequency and microwave radiation are both forms of energy called electromagnetic radiation. Sunshine contains three other forms of electromagnetic radiation: ultraviolet rays, infrared (heat) waves, and visible light waves.

These forms of energy are transmitted by waves. The distance between wave peaks is the "wavelength." The number of wave peaks passing a given point in one second is the "frequency."

Radiofrequency or radiowaves have a range of frequencies and wavelengths. Very High Frequency (VHF) radiowaves are used for TV and FM radio. Medium Frequency (MF) radiowaves are used for AM radio. Radiofrequency is used in heat sealers and glue driers.

Microwaves are actually just radiowaves of higher frequencies. Microwaves are used for radar and satellite communications, for telephone and TV transmissions, for microwave ovens, and for diathermy in medical clinics.

Electromagnetic radiation can interact with objects (or people) in three different ways. The energy waves can pass through an object without being changed, like light through a window. It can be reflected, like light off a mirror, or it can be absorbed and cause the object to heat up, like a sidewalk in the sun.

The health hazards of electromagnetic radiation are related only to the absorption of energy. The effects of absorbed energy depend on many different factors such as its wavelength and frequency, its intensity and duration. Different materials also absorb energy differently.

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Health Hazards

When microwaves or radiowaves are absorbed by body tissues, localized or spot heating can occur. The increased temperature can damage tissues, especially those with poor temperature control such as the lens of the eye.

Cataracts, clouding of the lens of the eye, may occur at the very high energy levels encountered close to radiating radar antennas. Heat damage to tissues is caused by high levels of exposure for short periods of time.

The health effects of low levels of exposure to radiowaves or microwaves for long periods of time are much harder to find and to prove. Some scientific studies show health effects from long-term, lowlevel exposure, other studies do not.

The following list includes health effects which some researchers suspect may be related to excessive radiofrequency/microwave exposure:

- Psychological changes, e.g., insomnia, irritability, mood swings,
- depression
- Headaches
- Nervous system abnormalities
- Hormonal changes
- Miscarriages and birth defects
- Male Infertility
- Altered immunity
- Leukemia

Of course, many of these health effects are relatively common, and most people having these problems have NOT had excessive exposure to radiofrequency/microwave radiation.

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Safety and Health Precautions

Employers who have people working around devices which produce radiofrequency/microwave radiation need to be sure that those devices are properly shielded to prevent leakage of radiation. Safety information regarding proper use and shielding of those devices can usually be obtained from owner/operators manuals, manufacturers, and the Alaska Department of Labor Occupational Safety and Health Section.

Radiofrequency sealers and heaters have been among the major sources of employee exposure to radiofrequency/microwave radiation. When these machines are used, employees should use mechanical or electrical devices that allow them to stay as far away form the source of radiation as possible. Whenever possible, these sealers should be turned off when not being used. Maintenance and adjustment of this type of equipment should be performed only by trained technicians and only when the machines are turned off.

Warnings should be posted to keep everyone away from the source of radiation except for those workers who are absolutely essential to performing the job.

People who are regularly exposed to significant levels of radiofrequency/microwave radiation should have preemployment and annual physical exams. The doctors should pay careful attention to the eyes to look for cataracts, to the nervous system for any abnormalities to the blood, to detect any early evidence of leukemia, and to the reproductive system to detect any abnormalities. Information concerning the frequency and intensity of the radiation exposures and duration of exposures should be provided to the physician.

In work areas where there is known or suspected to be significant amounts of radiofrequency/microwave radiation present, specialists should measure the amounts of radiation present. If excessive radiofrequency/microwave radiation is detected, modifications in the workplace should be made to reduce radiation exposure of workers. Afterwards, additional measurements should be made to determine if the radiation exposure has been reduced.

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Permissible Exposure Limits

The State of Alaska's permissible exposure limit is specified in Article I of Subchapter 4, Occupational Health and Environmental Control Code [04.0106 (a)], Alaska Occupational Safety and Health Standards. For normal environmental conditions and for incident electromagnetic energy of frequencies from 10 MHz to 100 GHz, the radiation protection guide is 10 mW/cm (milliwatts per square centimeter) as averaged over any possible six-minute period.

Further information can be obtained from the Alaska Department of Labor, Occupational Safety and Health Section.

Microwave Cooking Ovens

Microwave ovens used for heating food, when used in accordance with manufacturer's instructions, do not expose personnel to microwave radiation.

Microwave ovens do not need to be included in an employer's Hazard Communication program.

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Labor and Workforce Development || Job Seeker || Employer || Worker

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Labor Standards and Safety Division

Physical Agent Data Sheet (PADS) - Ultraviolet Radiation

Other PADS:
Cold Stress
Hand-Arm Vibration
Heat
Ionizing Radiation (PDF)
Lasers
Noise
Radio Waves
Ultraviolet Radiation

Description
Health Hazards
Skin Safety and Health Precautions
First Aid Procedures
Recommended Exposure Limits
Recommended Values
Reference

Description

Ultraviolet (UV) is the name for a band of energy on the electromagnetic spectrum that lies between visible light and x-rays. UV has some of the properties of visible light and other properties of the x-rays. Like visible light, some UV is actually visible but most is invisible like x-rays. UV, like light, cannot penetrate very far into most solids. Some UV, like x-rays, can ionize atoms or molecules which visible light cannot do.

Common sources of UV include the sun (especially when reflected by water, snow or ice), sun tanning lamps, mercury discharge lamps, welding arcs, plasma torches, and some lasers.

Health Hazards

The nature and seriousness of UV injuries depend on the length of exposure, the intensity of the UV, the type or wavelength of UV, the sensitivity of the individual, and the presence of certain chemicals (photosensitizers).

Skin

UV from the sun causes sunburns and skin cancer. UV from other sources can also cause skin burns varying in degree from mild reddening of the skin (first degree burns) to more severe and painful blistering (second degree burns). Long-term skin exposure to UV can cause actinic skin (a dry, brown, inelastic wrinkled skin) and skin cancer. Fair skinned individuals are more likely to develop both sunburns and skin cancer.

Some drugs, such as the antibiotic tetracycline, can cause skin burns from UV to happen faster and to be more severe. Products containing coal tar can also cause this reaction. These substances are called photosensitizers.

UV exposure may trigger cold sores (Herpes Simplex) in some individuals.

Eyes

When UV is absorbed by the eyes and eyelids, it can cause keratoconjunctivitis or "welders' flash." This is a very painful condition that feels like grit in the eyes and may make the eyes water and very sensitive to light. The condition usually occurs 6-12 hours after exposure and may last 6-24 hours. The painful injury may make a person unwilling or unable to open his/her eyes during this time period, but most discomfort is gone within 48 hours with no lasting injury. The maximum sensitivity of the eye occurs at a UV wavelength of 270 manometers. Cataracts or clouding of the lens of the eye can occur during high exposures to wavelengths in the range of 295-300 nanometers.

Skin Safety and Health Precautions

Skin burns from high, short-term exposure to UV and skin cancer from long-term exposure can be prevented by covering exposed skin with clothing and protective equipment such as gloves and face shields.* Barrier creams or lotions with sun protection factors (SPF) of 15-18 will also help prevent skin burns.

* Welders' helmets should provide protection for the neck area as well as the face and eyes.

Eyes

Tinted goggles and/or face shields should be worn to prevent burns of the cornea and eyelids. Selection of the appropriate degree of tint should be based on the anticipated wavelength and intensity of the UV source. (see Table 1)

Table 1
Shade No. 3.0: is for glare of reflected sunlight from snow, water, sand, etc.; stray light from cutting and welding, metal pouring and work around furnaces and foundries; and soldering (for goggles or spectacles with side shields worn under helmets in arc welding operations, particularly gas-shielded arc welding operations).
Shade Nos. 4.0 and 5.0: are for light acetylene cutting and welding; light electric spot welding.
Shade Nos. 6.0 and 7.0: are for gas cutting, medium gas welding, and non-gas-shielded arc welding using current values up to 30 amperes.
Shade Nos. 8.0 and 9.0: are for heavy gas cutting and nongas-shielded arc welding and cutting using current values from 30 to 75 amperes.
Shade Nos. 10.0 and 11.0: are for arc welding and cutting using current values from 75 to 200 amperes.
Shade Nos. 12.0 and 13.0: are for arc welding and cutting using current values from 200 to 400 amperes.

Shade No. 14.0: is for arc welding and cutting using current values over 400 amperes (including carbon arc welding and cutting), and for atomic hydrogen welding.

NOTE: ordinary window glass, 1/811 in thickness, is sufficient protection for the eyes and skin against the ultraviolet radiation from ordinary sources such as sunlight. In cases of extremely intense sources of ultraviolet and visible radiation, it is not adequate.

In sunny conditions on water, snow and ice, extra precautions should be taken to protect against reflected sunlight. Sunglasses with side shields should be worn. When applying protective ointments or lotions, special attention should be paid to the nose, lips, underside of the chin, and tops of the ears.

In workplaces, operations such as welding which produce high levels of UV should be performed behind enclosures or barriers to absorb the radiation and shield nearby workers.

UV sources like mercury discharge lamps should be operated only with all safety devices in place and in accordance with manufacturer's instructions.

First Aid Procedures

Skin burns: immediate application of cold (cold water, ice, cold clean cloths) to the affected area will reduce the severity and relieve pain associated with first and second degree burns. Do not apply any burn ointments, creams, or butter to skin burns.

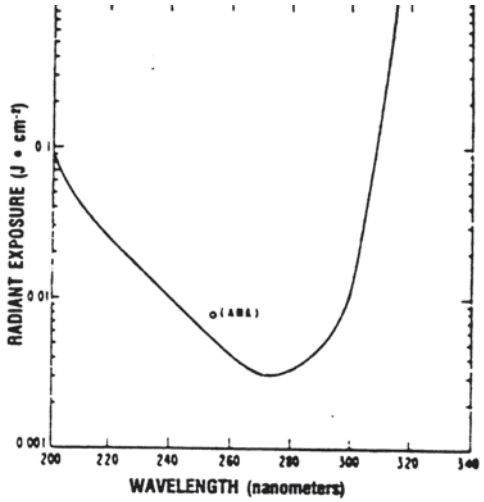
Eyes: place sterile dressings over the eyes of a person suffering from UV burns of the eyes and seek medical attention.

Recommended Exposure Limits[2]

The following section is very technical and is included for the use of safety and health professionals who have the skills and equipment to measure UV levels.

These threshold limit values (TLVS) refer to ultraviolet radiation in the spectral region between 200 and 400 nm and represent conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse effect. These values for exposure of the eye or skin apply to ultraviolet radiation from arcs, gas and vapor discharges, flourescent and incandescent sources, and solar radiation, but do not apply to ultraviolet lasers. These values do not apply to ultraviolet radiation exposure of photosensitive individuals or of individuals concomitantly exposed to photosensitizing agents. These values should be used as guides in the control of exposure to continuous sources where the exposure duration shall not be less that 0.1 sec (Figure 1).

Figure 1



These values should be used as guides in the control of exposure to ultraviolet sources and should not be regarded as a fine line between safe and dangerous levels.

Recommended Values

The threshold limit value for occupational exposure to ultraviolet radiation incident upon skin or eye where irradiance values are known and exposure time is controlled are as follows:

1. For the near ultraviolet spectral region (320 to 400 nm), total radiance incident upon the unprotected skin or eye should not exceed 1 mW/cm for periods greated than 110 seconds (approximately 16 minutes) and for exposure times less than 10 seconds should not exceed one J/cm.

2. For the actinic ultraviolet spectral region (200 to 315 nm), radiant exposure incident upon the unprotected skin or eye should not exceed the values given in Table 2 within an 8-hour period.

Table 2
Relative Spectral Effectiveness by Wavelength*

Wavelength (nm)	TLV (mJ/cm^2)	Relative Special Effectiveness S
200	100	0.03
210	40	0.075
220	25	0.12
230	16	0.19
240	10	0.30
250	7	0.43

254	6	0.5
260	4.6	0.65
270	3.0	1.0
280	3.4	0.88
290	4.7	0.64
300	10	0.30
305	50	0.60
310	200	0.015
315	1000	0.003

* See Laser TLVS.

3. To determine the effective irradiance of a broadband source weighted against the peak of the spectral effectiveness curve (270 nm), the following weighting formula should be used:

$$E_{eff} = \Sigma\, E\lambda\, S\lambda\, \Delta\, \lambda$$

where:

E_{eff} = effective irradinace relative to a monochromatic source at 270 nm in W/cm^2 [J/ (s cm^2)]

$E\lambda$ = spectral irradiance in W/(cm nm)

$S\lambda$ = relative spectral effectiveness (unitless)

$\Delta\, \lambda$ = band width in manometers

4. Permissible exposure time in seconds for exposure to actinic ultraviolet radiation incident upon the unprotected skin or eye may be computed by dividing 0.003 J/cm^2 by E_{eff} in W/cm^2. The exposure time may also be determined using Table 3 which provides exposure times corresponding to effective irradiances in μ W/cm^2.

Table 3
Permissible Ultraviolet Exposures

Duration of Exposure Per Day	Effective Irradiance E_{eff} (W/cm^2)
8 hrs	0.1
4 hrs	0.2
2 hrs	0.4

1 hr	0.8
30 min	1.7
15 min	3.3
10 min	5.0
5 min	10.0
1 min	50.0
30 sec	100.0
10 sec	300.0
1 sec	3,000.0
0.5 sec	6,000.0
0.1 sec	30,000.0

5. All the preceding TLVs for ultraviolet energy apply to sources which subtend an angle less than 80 degrees. Sources which subtend a greater angle need to be measured only over an angle of 80 degrees.

Conditioned (tanned) individuals can tolerate skin exposure in excess of the TLV without erythemal effects. However, such conditioning may not protect persons against cancer.

Reference

1. Sunlight and Man. Fitzpatrick et all Eds. University of Tokyo Press, Tokyo, Japan (1974).

2. Threshold Limit Values and Biological Exposures Indices for 1986 - 1987. American Conference of Governmental Industrial Hygienists, 6500 Glenway Avenue, Building D-7, Cincinnati, Ohio 45211-4438.

Attachment C-4
Safety Data Sheets

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Safety Data Sheet

Issue Date: 30-Jan-2009 **Revision Date:** 23 January 2018 **Version** 2

1. IDENTIFICATION

Product Identifier
Product Name Lens Cleaning Towelette (LCT)

Other means of identification
SDS # HLC-007W

Product Code 70, 70-1, 70-10, 70BP, 75

Recommended use of the chemical and restrictions on use
Recommended Use Lens cleaner. Instrument care. Water based cleaner.

Details of the supplier of the safety data sheet
Supplier Address
MCR Safety
1255 Schilling Blvd. West
Collierville, TN 38017

Emergency Telephone Number
Company Phone Number 1-508-699-4406
Emergency Telephone (24 hr) INFOTRAC 1-352-323-3500 (International)
1-800-535-5053 (North America)

2. HAZARDS IDENTIFICATION

Appearance Liquid absorbed onto a towelette **Physical State** Solid containing liquid **Odor** Mild alcohol odor

Classification

The information below is for the liquid absorbed onto the wipe when used in an industrial setting. The wipe itself is considered a consumer good and when used as intended is unlikely to present a hazard.

Serious eye damage/eye irritation	Category 2
Specific target organ toxicity (single exposure)	Category 3
Flammable Liquids	Category 2

Hazards Not Otherwise Classified (HNOC)
Causes mild skin irritation

Signal Word
Danger

Hazard Statements
Causes serious eye irritation
May cause respiratory irritation. May cause drowsiness or dizziness
Highly flammable liquid and vapor



Precautionary Statements - Prevention
Wash face, hands and any exposed skin thoroughly after handling
Wear eye/face protection
Avoid breathing dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Keep away from heat/sparks/open flames/hot surfaces. — No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use explosion-proof equipment
Use only non-sparking tools
Take precautionary measures against static discharge
Wear protective gloves/protective clothing/eye protection/face protection

Precautionary Statements - Response
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
IF ON SKIN (or hair): Remove/Take off immediately all contaminated clothing. Rinse skin with water/shower
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a poison center or doctor/physician if you feel unwell
IN CASE OF FIRE: Use CO2, dry chemical, or foam for extinction

Precautionary Statements - Storage
Store locked up
Store in a well-ventilated place. Keep container tightly closed
Keep cool

Precautionary Statements - Disposal
Dispose of contents/container to an approved waste disposal plant

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS No	Weight-%
Isopropyl Alcohol	67-63-0	20-30
Ethylene Glycol Monobutyl Ether	111-76-2	1-10

If Chemical Name/CAS No is "proprietary" and/or Weight-% is listed as a range, the specific chemical identity and/or percentage of composition has been withheld as a trade secret.

4. FIRST-AID MEASURES

First Aid Measures

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. If eye irritation persists: Get medical advice/attention.

Skin Contact Wash with soap and water. If irritation persists or an allergic reaction occurs, call a physician.

Inhalation Remove victim to fresh air and keep at rest in a position comfortable for breathing. If breathing is difficult, give oxygen. If breathing has stopped, give artificial respiration. If symptoms persist, call a physician.

Ingestion Do not induce vomiting. Rinse mouth. Drink plenty of water. Never give anything by mouth to a person who is unconscious or convulsing. Consult a physician.

Most important symptoms and effects

Symptoms Causes serious eye irritation. Causes mild skin irritation. May cause respiratory irritation. May cause drowsiness or dizziness. May cause nausea, vomiting, stomach ache, and diarrhea. Ingestion may cause central nervous system depression.

Indication of any immediate medical attention and special treatment needed

Notes to Physician Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable Extinguishing Media Not determined.

Specific Hazards Arising from the Chemical
Flammable.

Hazardous Combustion Products Carbon oxides.

Sensitivity to Mechanical Impact Not sensitive.
Sensitivity to Static Discharge Yes.

Protective equipment and precautions for firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal Precautions Use personal protective equipment as required. Avoid contact with eyes and skin. Remove all sources of ignition.

Environmental Precautions See Section 12 for additional Ecological Information.

Methods and material for containment and cleaning up

Methods for Containment Prevent further leakage or spillage if safe to do so.

Methods for Clean-Up Use personal protective equipment as required. Wipe or soak up with absorbent material for disposal. Pick up and transfer to properly labeled containers.

7. HANDLING AND STORAGE

Precautions for safe handling

Advice on Safe Handling Handle in accordance with good industrial hygiene and safety practice. Avoid contact with skin, eyes or clothing. Wear appropriate personal protective equipment. Keep away from heat, sparks, flame and other sources of ignition (i.e., pilot lights, electric motors and static electricity). Keep out of the reach of children.

Conditions for safe storage, including any incompatibilities

Storage Conditions Keep away from incompatible materials, open flames, and high temperatures. Keep container tightly closed and store in a cool, dry and well-ventilated place. Keep out of the reach of children.

Incompatible Materials Strong oxidizing agents. Acids. Chlorinated compounds.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Isopropyl Alcohol 67-63-0	STEL: 400 ppm TWA: 200 ppm	TWA: 400 ppm TWA: 980 mg/m^3 (vacated) TWA: 400 ppm (vacated) TWA: 980 mg/m^3 (vacated) STEL: 500 ppm (vacated) STEL: 1225 mg/m^3	IDLH: 2000 ppm TWA: 400 ppm TWA: 980 mg/m^3 STEL: 500 ppm STEL: 1225 mg/m^3
Ethylene Glycol Monobutyl Ether 111-76-2	TWA: 20 ppm	TWA: 50 ppm TWA: 240 mg/m^3 (vacated) TWA: 25 ppm (vacated) TWA: 120 mg/m^3 (vacated) S* S*	IDLH: 700 ppm TWA: 5 ppm TWA: 24 mg/m^3

Appropriate engineering controls

Engineering Controls Showers. Eyewash stations. Ventilation systems.

Individual protection measures, such as personal protective equipment

Eye/Face Protection Avoid contact with eyes.

Skin and Body Protection Protective gloves.

Respiratory Protection If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn. Positive-pressure supplied air respirators may be required for high airborne contaminant concentrations. Respiratory protection must be provided in accordance with current local regulations.

General Hygiene Considerations Do not eat, drink or smoke when using this product. Remove and wash contaminated clothing before reuse. Provide regular cleaning of equipment, work areas and clothing.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Physical State	Solid containing liquid		
Appearance	Liquid absorbed onto a towelette	**Odor**	Mild alcohol odor
Color	Colorless	**Odor Threshold**	No information available

Property	Values	Remarks • Method
pH	7	
Melting Point/Freezing Point	No information available	
Boiling Point/Boiling Range	No information available	
Flash Point	12 °C / 54 °F	
Evaporation Rate	No information available	
Flammability (Solid, Gas)	Not determined	
Upper Flammability Limits	No information available	
Lower Flammability Limit	No information available	
Vapor Pressure	No information available	
Vapor Density	No information available	
Specific Gravity	No information available	
Water Solubility	No information available	
Solubility in other solvents	No information available	
Partition Coefficient	Not determined	
Auto-ignition Temperature	No information available	
Decomposition Temperature	No information available	
Kinematic Viscosity	Not determined	
Dynamic Viscosity	Not determined	
Explosive Properties	Not determined	
Oxidizing Properties	Not determined	
VOC Content	No information available	

10. STABILITY AND REACTIVITY

Reactivity
Not reactive under normal conditions.

Chemical Stability
Stable under recommended storage conditions.

Possibility of Hazardous Reactions
Hazardous polymerization does not occur.

Hazardous Polymerization Hazardous polymerization does not occur.

Conditions to Avoid
Heat, flames and sparks. Incompatible Materials.

Incompatible Materials
Strong oxidizing agents. Acids. Chlorinated compounds.

Hazardous Decomposition Products
Carbon oxides.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information

Eye Contact Causes serious eye damage.

Skin Contact Causes mild skin irritation.

Inhalation Do not inhale.

Ingestion Do not ingest.

Component Information

Chemical Name	Oral LD50	Dermal LD50	Inhalation LC50
Isopropyl Alcohol 67-63-0	= 4396 mg/kg (Rat)	= 12800 mg/kg (Rat) = 12870 mg/kg (Rabbit)	= 72.6 mg/L (Rat) 4 h
Ethylene Glycol Monobutyl Ether 111-76-2	= 470 mg/kg (Rat)	= 2270 mg/kg (Rat) = 220 mg/kg (Rabbit)	= 2.21 mg/L (Rat) 4 h = 450 ppm (Rat) 4 h

Information on physical, chemical and toxicological effects

Symptoms Please see section 4 of this SDS for symptoms.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen. However, the product as a whole has not been tested.

Chemical Name	ACGIH	IARC	NTP	OSHA
Isopropyl Alcohol 67-63-0		Group 3		X
Ethylene Glycol Monobutyl Ether 111-76-2	A3	Group 3		

Legend

ACGIH (American Conference of Governmental Industrial Hygienists)
A3 - Animal Carcinogen
IARC (International Agency for Research on Cancer)
Group 3 IARC components are "not classifiable as human carcinogens"
OSHA (Occupational Safety and Health Administration of the US Department of Labor)
X - Present

STOT - single exposure May cause respiratory irritation. May cause drowsiness or dizziness.

Chronic toxicity Avoid repeated exposure. Contains a known or suspected reproductive toxin.

Numerical measures of toxicity
Not determined

12. ECOLOGICAL INFORMATION

Ecotoxicity
The product is not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

Component Information

Chemical Name	Algae/aquatic plants	Fish	Toxicity to microorganisms	Crustacea
Isopropyl Alcohol 67-63-0	1000: 96 h Desmodesmus subspicatus mg/L EC50 1000: 72 h Desmodesmus subspicatus mg/L EC50	9640: 96 h Pimephales promelas mg/L LC50 flow-through 11130: 96 h Pimephales promelas mg/L LC50 static 1400000: 96 h Lepomis macrochirus µg/L LC50		13299: 48 h Daphnia magna mg/L EC50
Ethylene Glycol Monobutyl Ether 111-76-2		1490: 96 h Lepomis macrochirus mg/L LC50 static 2950: 96 h Lepomis macrochirus mg/L LC50		1698 - 1940: 24 h Daphnia magna mg/L EC50 1000: 48 h Daphnia magna mg/L EC50

Persistence/Degradability
Not determined.

Bioaccumulation
Not determined.

Mobility

Chemical Name	Partition Coefficient
Isopropyl Alcohol 67-63-0	0.05
Ethylene Glycol Monobutyl Ether 111-76-2	0.81

Other Adverse Effects
Not determined

13. DISPOSAL CONSIDERATIONS

Waste Treatment Methods

Disposal of Wastes This material, as supplied, is not a hazardous waste according to Federal regulations (40 CFR 261). This material could become a hazardous waste if it is mixed with or otherwise comes in contact with a hazardous waste, if chemical additions are made to this material, or if the material is processed or otherwise altered. Consult 40 CFR 261 to determine whether the altered material is a hazardous waste. Consult the appropriate state, regional, or local regulations for additional requirements.

Contaminated Packaging Disposal should be in accordance with applicable regional, national and local laws and regulations.

California Hazardous Waste Status

Chemical Name	California Hazardous Waste Status
Isopropyl Alcohol 67-63-0	Toxic Ignitable

14. TRANSPORT INFORMATION

Note Please see current shipping paper for most up to date shipping information, including exemptions and special circumstances.

DOT Not regulated

IATA Not regulated

IMDG Not regulated

15. REGULATORY INFORMATION

International Inventories

Chemical Name	TSCA	DSL	NDSL	EINECS	ELINCS	ENCS	IECSC	KECL	PICCS	AICS
Isopropyl Alcohol	Present	X		Present		Present	X	Present	X	X
Ethylene Glycol Monobutyl Ether	Present	X		Present		Present	X	Present	X	X

Legend:

TSCA *- United States Toxic Substances Control Act Section 8(b) Inventory*

DSL/NDSL *- Canadian Domestic Substances List/Non-Domestic Substances List*

EINECS/ELINCS *- European Inventory of Existing Chemical Substances/European List of Notified Chemical Substances*

ENCS *- Japan Existing and New Chemical Substances*

IECSC *- China Inventory of Existing Chemical Substances*

KECL *- Korean Existing and Evaluated Chemical Substances*

PICCS *- Philippines Inventory of Chemicals and Chemical Substances*

AICS *- Australian Inventory of Chemical Substances*

US Federal Regulations

CERCLA

This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355).

SARA 311/312 Hazard Categories

Acute Health Hazard	Yes
Chronic Health Hazard	Yes
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

SARA 313

Chemical Name	CAS No	Weight-%	SARA 313 - Threshold Values %
Isopropyl Alcohol - 67-63-0	67-63-0	27	1.0
Ethylene Glycol Monobutyl Ether - 111-76-2	111-76-2	3.72	1.0

CWA (Clean Water Act)

This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

US State Regulations

California Proposition 65

This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

Chemical Name	New Jersey	Massachusetts	Pennsylvania
Isopropyl Alcohol 67-63-0	X	X	X
Ethylene Glycol Monobutyl Ether 111-76-2	X	X	X

16. OTHER INFORMATION

NFPA	**Health Hazards**	**Flammability**	**Instability**	**Special Hazards**
	2	3	Not determined	Not determined
HMIS	**Health Hazards**	**Flammability**	**Physical Hazards**	**Personal Protection**
	2	3	0	B- Safety Glasses, Gloves

Issue Date: 30-Jan-2009
Revision Date: 23-Jan-2018
Revision Note: Update

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet

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SAFETY DATA SHEET
ANTIFREEZE

SECTION 1: IDENTIFICATION OF THE SUBSTANCE/MIXTURE AND OF THE COMPANY/UNDERTAKING

1.1. Product identifier

Product name	ANTIFREEZE
Product No.	BSA001, BSA002, BSA005, BSA025, NBS001, NBS002, SFD127, BSA199, SAG001, SAG002, SAG005, SAG025, SAG199, GFA025, DRP001, DRP002, DRP005, DRP025, DRP199

1.2. Relevant identified uses of the substance or mixture and uses advised against

1.3. Details of the supplier of the safety data sheet

Supplier	TETROSYL LIMITED BEVIS GREEN WORKS WALMERSLEY BURY BL9 6RE 0161 764 5981 0161 797 5899 info@tetrosyl.com
Manufacturer	TETROSYL LIMITED BEVIS GREEN WORKS WALMERSLEY BURY BL9 6RE 0161 764 5981 0161 797 5899 info@tetrosyl.com

1.4. Emergency telephone number

0161 764 5981

SECTION 2: HAZARDS IDENTIFICATION

2.1. Classification of the substance or mixture

Classification (1999/45/EEC) Xn;R22, R48/22.
Human health
See section 11 for additional information on health hazards.
Environment
The product contains a substance which may cause long term adverse effects in the aquatic environment.

2.2. Label elements

Contains MONO ETHYLENE GLYCOL

Labelling



Harmful

Risk Phrases

R22	Harmful if swallowed.
R48/22	Harmful: danger of serious damage to health by prolonged exposure if swallowed.

Safety Phrases

S2	Keep out of the reach of children.
S13	Keep away from food, drink and animal feeding stuffs.
S36	Wear suitable protective clothing.
S46	If swallowed, seek medical advice immediately and show this container or label.
S56	Dispose of this material and its container to hazardous or special waste collection point.

2.3. Other hazards

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

3.2. Mixtures

DISODIUM TETRABORATE PENTAHYDRATE		1-5%
CAS-No.: 12179-04-3	EC No.: 215-540-4	

Classification (EC 1272/2008)	Classification (67/548/EEC)
Repr. 1A - H360FD	Repr. Cat. 1;R60,R61.

MONO ETHYLENE GLYCOL		60-100%
CAS-No.: 107-21-1	EC No.: 203-473-3	Registration Number: 01-2119456816-28

Classification (EC 1272/2008)	Classification (67/548/EEC)
Acute Tox. 4 - H302 STOT RE 2 - H373	Xn;R22,R48/22.

The Full Text for all R-Phrases and Hazard Statements are Displayed in Section 16.

Composition Comments
The data shown are in accordance with the latest EC Directives.

SECTION 4: FIRST AID MEASURES

4.1. Description of first aid measures

General information
Remove affected person from source of contamination. Get medical attention if any discomfort continues.
Inhalation
Move injured person into fresh air and keep person calm under observation. If necessary, seek hospital and bring these instructions.
Ingestion
Immediately rinse mouth and drink plenty of water. Keep person under observation. If person becomes uncomfortable take to hospital along with these instructions.

Skin contact
Remove affected person from source of contamination. Remove contaminated clothing and flush with plenty of water until pain disappears. If discomfort persists transport to hospital and bring these instructions.
Eye contact
Immediately flush with plenty of water for up to 15 minutes. Remove any contact lenses and open eyes wide apart. Get medical attention if any discomfort continues.

4.2. Most important symptoms and effects, both acute and delayed

General information
The severity of the symptoms described will vary dependant of the concentration and the length of exposure.
NOTE! Effects may be delayed. Keep affected person under observation.
Inhalation.
Irritation of nose, throat and airway.
Ingestion
May cause discomfort if swallowed. Ingestion may result in unconsciousness, blindness and death. Central nervous system depression.
Skin contact
Prolonged skin contact may cause redness and irritation.
Eye contact
Irritation, burning, lachrymation, blurred vision after liquid splash.

4.3. Indication of any immediate medical attention and special treatment needed

No recommendation given, but first aid may still be required in case of accidental exposure, inhalation or ingestion of this chemical. If in doubt, GET MEDICAL ATTENTION PROMPTLY!

SECTION 5: FIREFIGHTING MEASURES

5.1. Extinguishing media

Extinguishing media
Use fire-extinguishing media appropriate for surrounding materials.
Unsuitable extinguishing media
Do not use water jet as an extinguisher, as this will spread the fire.

5.2. Special hazards arising from the substance or mixture

Hazardous combustion products
Thermal decomposition or combustion may liberate carbon oxides and other toxic gases or vapours.
Unusual Fire & Explosion Hazards
No unusual fire or explosion hazards noted.

5.3. Advice for firefighters

Special Fire Fighting Procedures
No specific fire fighting procedure given.
Protective equipment for fire-fighters
Leave danger zone immediately.

SECTION 6: ACCIDENTAL RELEASE MEASURES

6.1. Personal precautions, protective equipment and emergency procedures

For personal protection, see section 8. In case of spills, beware of slippery floors and surfaces.

6.2. Environmental precautions

The product should not be dumped in nature but collected and delivered according to agreement with the local authorities.

6.3. Methods and material for containment and cleaning up

For waste disposal, see section 13. When dealing with a spillage, please consult the section relating to suitable protective measures. Provide ventilation and confine spill. Do not allow runoff to sewer. Absorb spillage with non-combustible, absorbent material. Contact Health and Safety department on 6147 or 6695 for further assistance.

6.4. Reference to other sections

Wear protective clothing as described in Section 8 of this safety data sheet. For waste disposal, see section 13.

SECTION 7: HANDLING AND STORAGE

7.1. Precautions for safe handling

Read and follow manufacturer's recommendations. Always remove grease with soap and water or skin cleaning agent, never use organic solvents. Good personal hygiene is necessary. Wash hands and contaminated areas with water and soap before leaving the work site. Do not eat, drink or smoke when using the product.

7.2. Conditions for safe storage, including any incompatibilities

Keep away from heat, sparks and open flame. Store in tightly closed original container in a dry, cool and well-ventilated place.

7.3. Specific end use(s)

The identified uses for this product are detailed in Section 1.2.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

8.1. Control parameters

Name	STD	TWA - 8 Hrs		STEL - 15 Min		Notes
MONO ETHYLENE GLYCOL	WEL		10 mg/m3		104 mg/m3	Sk

WEL = Workplace Exposure Limit.
Sk = Can be absorbed through skin.

8.2. Exposure controls

Protective equipment





Process conditions
Use engineering controls to reduce air contamination to permissible exposure level. Provide eyewash station.
Engineering measures
Provide adequate ventilation, including appropriate local extraction, to ensure that the defined occupational exposure limit is not exceeded.
Respiratory equipment
Wear suitable respiratory protection.
Hand protection
Protective gloves and goggles must be used if there is a risk of direct contact or splash.
Eye protection
Wear tight-fitting goggles or face shield.
Other Protection
Wear appropriate clothing to prevent any possibility of liquid contact and repeated or prolonged vapour contact.
Hygiene measures
Wash contaminated clothing before reuse. Wash hands at the end of each work shift and before eating, smoking and using the toilet.
Skin protection
Wear apron or protective clothing in case of contact.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

9.1. Information on basic physical and chemical properties

Appearance	Liquid
Colour	Blue.
Odour	Odourless.
Solubility	Miscible with: Acetone Alcohol Miscible with water
Initial boiling point and boiling range	165°C 760 mm Hg
Melting point (°C)	Scientifically unjustified. -12°C
Relative density	1.13 20°C
Vapour density (air=1)	Scientifically unjustified. 2.14
Vapour pressure	Scientifically unjustified. 0.05 kPa 20°C
Evaporation rate	Scientifically unjustified.
pH-Value, Diluted Solution	6-7.5 100g/l
Viscosity	21 cps 20°C
Solubility Value (G/100G H2O@20°C)	100
Decomposition temperature (°C)	Scientifically unjustified.
Odour Threshold, Lower	Scientifically unjustified.
Odour Threshold, Upper	Scientifically unjustified.
Flash point	111 CC (Closed cup).
Auto Ignition Temperature (°C)	Scientifically unjustified. 400°C
Flammability Limit - Lower(%)	Scientifically unjustified. 3.2
Flammability Limit - Upper(%)	Scientifically unjustified.
Partition Coefficient (N-Octanol/Water)	Scientifically unjustified.
Oxidising properties	Not available.

9.2. Other information

None.

SECTION 10: STABILITY AND REACTIVITY

10.1. Reactivity

Reaction with: Oxidising materials.

10.2. Chemical stability

No particular stability concerns.

10.3. Possibility of hazardous reactions

Not determined.

10.4. Conditions to avoid

Avoid excessive heat for prolonged periods of time. Avoid heat, flames and other sources of ignition.

10.5. Incompatible materials

Materials To Avoid
Acids, oxidising.

10.6. Hazardous decomposition products

In case of fire, toxic gases (CO, CO2, NOx) may be formed.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1. Information on toxicological effects

Toxic Dose 1 - LD 50
5890 - 13400 mg/kg (oral rat)
Toxic Dose 2 - LD 50
5010 mg/kg (ipr-rat)
Toxicological information
No information available.

Specific target organ toxicity - single exposure:
Target Organs
Central nervous system Heart & cardiovascular system Kidneys

Inhalation
Unlikely to be hazardous by inhalation because of the low vapour pressure of the substance at ambient temperature. Vapours may irritate throat and respiratory system and cause coughing.

Ingestion
May cause liver and/or renal damage. Irritating. May cause nausea, stomach pain and vomiting. Harmful: possible risk of irreversible effects if swallowed.

Skin contact
Slightly irritating.

Eye contact
May cause temporary eye irritation.

Health Warnings
This chemical can be hazardous when inhaled and/or touched.

Route of entry
Ingestion.

Target Organs
Central nervous system Heart & cardiovascular system Kidneys

Medical Symptoms
Allergic rash. Delayed, often serious breathing problems. Tachycardia, (excessively rapid heart beat, including rapid and weak pulse). Unconsciousness, possibly death.
Specific effects
May cause damage to the kidneys. Contains a substance/a group of substances with possible risk of harm to the unborn child and with possible risk of impaired fertility.

SECTION 12: ECOLOGICAL INFORMATION

Ecotoxicity
The product components are not classified as environmentally hazardous. However, this does not exclude the possibility that large or frequent spills can have a harmful or damaging effect on the environment.

12.1. Toxicity

LC 50, 96 Hrs, Fish mg/l 22810 mg/l
Acute Toxicity - Fish
Not available.
EC 50, 48 Hrs, Daphnia, mg/l 41000 mg/l
Acute Toxicity - Aquatic Invertebrates
Not available.

12.2. Persistence and degradability

Degradability
The product is expected to be biodegradable.

12.3. Bioaccumulative potential

Bioaccumulative potential
The product is not bioaccumulating.
Partition coefficient
Scientifically unjustified.

12.4. Mobility in soil

Mobility:
The product is soluble in water.
Adsorption/Desorption Coefficient
Not available.

12.5. Results of PBT and vPvB assessment

Not Classified as PBT/vPvB by current EU criteria.

12.6. Other adverse effects

Not applicable.

SECTION 13: DISPOSAL CONSIDERATIONS

General information
When handling waste, consideration should be made to the safety precautions applying to handling of the product.

13.1. Waste treatment methods

Dispose of waste and residues in accordance with local authority requirements. Absorb in vermiculite or dry sand and dispose of at a licenced hazardous waste collection point.

SECTION 14: TRANSPORT INFORMATION

General — The product is not covered by international regulation on the transport of dangerous goods (IMDG, IATA, ADR/RID).

14.1. UN number

14.2. UN proper shipping name

14.3. Transport hazard class(es)

14.4. Packing group

14.5. Environmental hazards

14.6. Special precautions for user

14.7. Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code

SECTION 15: REGULATORY INFORMATION

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

Uk Regulatory References
The Control of Substances Hazardous to Health Regulations 2002 (S.I 2002 No. 2677) with amendments.
Chemicals (Hazard Information & Packaging) Regulations.
EU Legislation
Dangerous Substance Directive 67/548/EEC. Dangerous Preparations Directive 1999/45/EC. System of specific information relating to Dangerous Preparations. 2001/58/EC.

15.2. Chemical Safety Assessment

No chemical safety assessment has been carried out.

SECTION 16: OTHER INFORMATION

General information
Only trained personnel should use this material.
Revision Comments
NOTE: Lines within the margin indicate significant changes from the previous revision.

Revision Date	02/07/2008
Revision	2
Supersedes date	01/02/2011 v4
Safety Data Sheet Status	Approved.

Risk Phrases In Full

R22	Harmful if swallowed.
R48/22	Harmful: danger of serious damage to health by prolonged exposure if swallowed.
R61	May cause harm to the unborn child.
R60	May impair fertility.

Hazard Statements In Full

H302	Harmful if swallowed.
H373	May cause damage to organs <<Organs>> through prolonged or repeated exposure.
H360FD	May damage fertility or the unborn child.

Disclaimer

The information provided in this document has been compiled on the basis of our current knowledge and is believed to be in accordance with the requirements of the Dangerous Substances Directive, Dangerous Preparations Directive and Safety Data Sheets Directive. The information relates to the specific material designated and may not be valid for such material used in combination with any other materials or in any particular conditions or process. The conditions and extent of storage and use of material are outside of our control and within the control of the possessor or user. Consequently it is the responsibility of the possessor or user to satisfy themselves as to the completeness of such information and the suitability of the material for their own particular circumstances, conditions or use.

SAFETY DATA SHEET (SDS)
BENZENE

1. Identification

SDS Record Number	:	PCS 95004
Date of SDS	:	11 February 2015
Identity of the substance	:	Benzene
Product Description	:	Aromatic hydrocarbon.
Other names/synonyms	:	Benzol, Phenyl hydride, Benzene and mixtures having 10% benzene or more (IBC code)
Name of the supplier	:	Petrochemical Corporation of Singapore (Private) Limited
Recommended uses	:	Chemical feedstock.
Contact detail of the supplier	:	100 Ayer Merbau Road, Singapore 628277
	:	+65 68672102
24-Hour Emergency contact	:	Asia Pacific +65 3158 1074 (Singapore) China +86 10 5100 3039 (Beijing) Europe, Israel & Americas +44 (0) 1235 239 670 (UK) Middle East & Africa +44 (0) 1235 239 671 (UK)

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2. Hazards Identification

GHS Classification

Hazard Class	Hazard Category
• Flammable Liquid	2
• Acute Toxicity (Oral)	4
• Skin Corrosion/Irritation	2
• Serious Eye Damage/ Irritation	2A
• Germ Cell Mutagenicity	2
• Toxic to reproduction	2
• Carcinogenicity	1A
• STOST (Single exposure)	1 (respiratory organs)
• STOST (Single exposure)	3 (narcotic effects)
• STOST (Repeated exposure)	1 (central nervous system, hematopoietic organs)
• Aspiration hazard	1
• Acute hazards to the aquatic environment	2

Pictograms



Signal Word: Danger

Hazard Statements

- Highly Flammable liquid and vapour
- Harmful if swallowed
- Causes skin irritation
- Causes serious eye irritation
- Suspected of causing genetic defects

- Suspected of damaging fertility or the unborn child
- May cause cancer
- Causes damage to organs
- May cause drowsiness or dizziness
- Causes damage to organs through prolonged or repeated exposure May be fatal if swallowed and enters airways
- Toxic to aquatic life

Precautionary Statements

Prevention

- Keep container tightly closed.
- Keep away from heat/sparks/open flames/hot surfaces. – No smoking.
- Wear protective gloves/protective clothing/eye protection/face protection
- Ground/Bond container and receiving equipment
- Use explosion-proof electrical/ventilating/lighting equipment.
- Take precautionary measures against static discharge.
- Use only non-sparking tools.
- Wash thoroughly after handling.
- Obtain special instructions before use.
- Do not handle until all safety precautions have been read and understood.
- Use personal protective equipment as required.
- Do not eat, drink or smoke when using this product.
- Avoid breathing dust/fume/gas/mist/vapours/spray.
- Avoid release to the environment
- Use only outdoors or in well-ventilated area.

Response

- IF ON SKIN (or hair): Remove/take off immediately all contaminated clothing. Rinse skin with water/ shower.
- IF exposed: Call a POISON CENTER/doctor/physician.
- In case of fire: Use appropriate media for extinction.
- IF ON SKIN: Wash with plenty of soap and water. Take off contaminated clothing and wash before re-use. If skin irritation occurs, seek medical advice/attention.
- Take of contaminated clothing and wash before re-use.
- IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists, get medical advice/attention.
- IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. Rinse mouth. Do NOT induce vomiting.
- IF exposed or concerned: Get medical attention/advice.
- IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing. Call a POISON CENTER/doctor/physician. if you feel unwell.

Storage

- Store in a well-ventilated place. Keep cool.
- Store locked up.
- Store container in a well-ventilated place. Keep container tightly closed.

Disposal

- Dispose of the contents/container in accordance to the local mandatory rules and regulations

3. Composition/Information On Ingredients

Chemical identification	:	C_6H_6
Common name(s) / synonym(s)	:	Benzene, Bicarburet of hydrogen, carbon oil, coal naphtha, cyclohexatriene, mineral naphtha, phenyl hydride, pyrobenzol
CAS number / EC number	:	71-43-2 /601-020-00-8

4. First-Aid Measures

Eye:
Irrigate immediately. If this chemical contacts the eyes, immediately wash (irrigate) the eyes with large amounts of water, occasionally lifting the lower and upper lids. Get medical attention immediately.

Skin:
Soap wash immediately. If this chemical contacts the skin, immediately wash the contaminated skin with soap and water. If this chemical penetrates the clothing, immediately remove the clothing, wash the skin with soap and water, and get medical attention promptly.

Breathing:
Respiratory support. If a person breathes large amounts of this chemical, move the exposed person to fresh air at once. If breathing has stopped, perform artificial resuscitation. Keep the affected person warm and at rest. Get medical attention as soon as possible.

Swallow:
Medical attention immediately. If this chemical has been swallowed, get medical attention immediately. **Do not** induce vomiting. Keep at rest.

5. Fire-Fighting Measures

Extinguishing media: Water spray, foam or dry chemical based on situation.

Small Fires
- Dry chemical, CO2, water spray or regular foam.

Large Fires
- Water spray, fog or regular foam.
- Do not use straight streams.
- Move containers from fire area if you can do it without risk.

Fire involving Tanks or Car/Trailer Loads
- Fight fire from maximum distance or use unmanned hose holders or monitor nozzles.
- Cool containers with flooding quantities of water until well after fire is out.
- Withdraw immediately in case of rising sound from venting safety devices or discoloration of tank.
- **Always** stay away from tanks engulfed in fire.
- For massive fire, use unmanned hose holders or monitor nozzles; if impossible, withdraw from area and let fire burn.

Specific hazards arising from the chemical:
- This is a Flammable Liquid and may release vapours that form flammable mixtures at or above the flash point.

Special protective equipment and precautions for fire fighters:

- Use water spray to cool fire exposed surfaces and to protect personnel.
- Shut off fuel to fire if possible to do so without hazard.
- If a leak or spill has not ignited use water spray to disperse the vapours.
- Either allow fire to burn out under controlled conditions or extinguish with foam or dry chemical.
- Try to cover liquid spills with foam.
- A self-contained breathing apparatus (SCBA) is recommended for indoor fires and any significant outdoor fires.
- For small outdoor fires, which may easily be extinguished with a portable fire extinguisher, use of an SCBA is optional.

Caution: All these products have a very low flash point: Use of water spray when fighting fire may be inefficient.

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6. Accidental Release Measures

Call Emergency Response Telephone Number on Shipping Paper first. If Shipping Paper not available or no answer, refer to appropriate telephone number.

- As an immediate precautionary measure, isolate spill or leak area for at least 50 meters (150 feet) in all directions.
- Keep unauthorized personnel away.
- Stay upwind.
- Keep out of low areas.
- Ventilate closed spaces before entering.
- Remove all ignition sources.
- Dike far ahead of liquid spill for later disposal.
- Water spray may reduce vapor; but may not prevent ignition in closed spaces.
- Warn occupants and shipping in downwind areas of fire and explosion hazard and request all to stay clear.
- Collect leaking and spilled liquid in sealable containers as far as possible.
- Prevent additional discharge of material, if possible to do so without hazard.
- Absorb remaining liquid in sand or inert absorbent and remove to safe place.
- Recover by pumping (use an explosion proof motor or hand pump), or by using a suitable absorbent.
- Do not use combustible materials such as sawdust.
- **Do not** wash away into sewer. Do NOT let this chemical enter the environment.
- Notify the appropriate authorities immediately.
- Ensure disposal in compliance with government requirements and ensure conformity to local disposal regulations.
- Personal protection: Wear complete protective clothing including self-contained breathing apparatus.

Evacuation

Large Spill

- Consider initial downwind evacuation for at least 300 meters (1000 feet).

Fire

- If tank, rail car or tank truck is involved in a fire, ISOLATE for 800 meters (1/2 mile) in all directions; also, consider initial evacuation for 800 meters (1/2 mile) in all directions.

7. Handling And Storage

- Keep container closed. Use with adequate ventilation. Handle and open containers with care.
- Store in a cool, well-ventilated place away from incompatible materials.
- **Do not** handle or store near an open flame, heat, or other sources of ignition.
- Protect material from direct sunlight.
- Material will accumulate static charges, which may cause an electrical spark (ignition source). Use proper grounding procedures.
- **Do not** pressurize, cut, heat, or weld containers. Empty product containers may contain product residue.
- **Do not** reuse empty containers without commercial cleaning or reconditioning.
- Wash thoroughly after handling. Remove contaminated clothing and wash before reuse.
- Avoid contact with eyes, skin, and clothing.
- Keep away from sources of ignition. Store in a tightly closed container. Keep from contact with oxidizing materials.

8. Exposure Controls/Personal Protection

Appropriate Engineering Controls: The use of local exhaust ventilation is recommended to control emissions near the source. Laboratory samples should be handled in a fume hood. Provide mechanical ventilation of confined spaces. Use explosion-proof ventilation equipment.

Personal Protective Equipment (PPE)

- The selection of personal protective equipment varies depending upon conditions of use. Where prolonged and/or repeated skin and eye contact is likely to occur, wear chemical resistant gloves, rubber boots a chemical jacket, and a face shield. Where skin and eye contact is unlikely, but may occur as a result of short and/or periodic exposures, wear long sleeves, chemical resistant gloves, and a face shield.
- **Skin:** Prevent skin contact. Wear appropriate personal protective clothing to prevent skin contact.
- **Eyes:** Prevent eye contact. Wear appropriate eye protection to prevent eye contact.
- **Wash skin:** When contaminated the worker should immediately wash the skin when it becomes contaminated.
- **Remove:** When wet (flammable). Work clothing that becomes wet should be immediately removed due to its flammability hazard (i.e., for liquids with a flash point <100°F).
- **Change:** No recommendation. No recommendation is made specifying the need for the worker to change clothing after the work shift.
- **Provide Eyewash:** Quick drench Facilities for quickly drenching the body should be provided within the immediate work area for emergency use where there is a possibility of exposure. [Note: It is intended that these facilities provide a sufficient quantity or flow of water to quickly remove the substance from any body areas likely to be exposed. The actual determination of what constitutes an adequate quick drench facility depends on the specific circumstances. In certain instances, a deluge shower should be readily available, whereas in others, the availability of water from a sink or hose could be considered adequate.]

Respirator Recommendations (NIOSH)

Airborne Concentration or Condition of Use	Required Respirator
< or = 10 ppm (parts per million)	Half-mask air-purifying respirator with organic vapor cartridge.
< or = 50 ppm	**(1)** Full-facepiece respirator with organic vapor cartridges; or

	2) Full-facepiece gas mask with chin-style canisters*.
< or = 100 ppm	Full-facepiece powered air-purifying espirator with organic vapor canister*.
< or = 1,000 ppm	Supplied-air respirator with full facepiece in positive-pressure mode.
> 1,000 ppm or unknown concentration	**(1)** Self-contained breathing apparatus with full facepiece in positive-pressure mode; or **(2)** Full-facepiece positive-pressure supplied-air respirator with auxiliary self-contained air supply.
Escape	**(1)** Any organic vapor gas mask; or **(2)** Any self-contained breathing apparatus with full facepiece.
Firefighting	Full-facepiece self-contained breathing apparatus in positive-pressure mode.

* Canisters must have a minimum service life of four (4) hours when tested at 150 ppm benzene, at a flow rate of 64 liters per minute (LPM), 25°C, and 85% relative humidity for non-powered air-purifying respirators. The flow rate shall be 115 LPM and 170 LPM, respectively, for tight-fitting and loose-fitting powered air-purifying respirators.

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9. Physical And Chemical Properties

Property	Value, Description
Appearance (physical state, colour etc);	Liquid, Clear colorless liquid.
Odour;	Characteristic aromatic odor.
Odour threshold;	Not available
pH;	Not applicable
Melting point/freezing point;	6 deg C
Initial boiling point and boiling range;	80 deg C
Flash point;	-11 deg C ASTM D56
Evaporation rate;	5.1 (diethyl ether = 1)
Upper/lower flammability or explosive limits;	1.3 to 7.1 % by volume
Vapour pressure;	21.9 kPa at 38 deg C
Vapour density;	2.7
Relative density;	0.89 at 15.5 deg C
Solubility(ies);	0.18% at 25 deg C
Partition coefficient: n-octanol/water;	Not available
Auto-ignition temperature;	561 deg C
Decomposition temperature;	Not available
Viscosity.	0.71 cST at 16 deg C

10. Stability And Reactivity

Reactivity/Chemical stability: This product is stable under normal temperatures and pressures. Possibility of hazardous reactions: Hazardous polymerisation will not occur.

Conditions to avoid: Keep away from ignition sources (e.g. heat, sparks, and open flames).

Incompatible materials: Strong oxidising agents, fluorine, chlorine concentrated mineral acids, halogens, molten sulfur, pure oxygen Hazardous decomposition products: carbon monoxide, carbon dioxide

11. Toxicological Information

LC50 (rat): 13,700 ppm (4 hour exposure) (26); 9,980 ppm (7 hour exposure); (13,200 ppm - equivalent 4 hour exposure) (18)
LD50 (oral, rat): 930-mg/kg (19); 5,600-mg/kg (2); 11.4 ml/kg (10,032 mg/kg) (21)
LD50 (oral, mouse): 4,700 mg/kg (11; unconfirmed)
LD50 (skin, rabbit and guinea pig): Greater than 9,400-mg/kg (20).

Eye Irritation (rabbit):
Application of 2 drops produced moderate irritation with very slight, temporary injury to the cornea. (2) Application of 0.1 ml (88 mg) in a Standard Draize test produced moderate eye irritation. (21).

Skin Irritation (rabbit):
In a Standard Draize test, slight to moderate irritation and moderate tissue death (necrosis) was produced. (2) In an Open Draize test, 0.01 ml (8.8 mg) produced mild skin irritation. (21).

Skin Sensitization (guinea pig):
One report of skin sensitization cannot be confirmed. (4).

Effects Of Short-Term (Acute) Exposure:
The immediately noticeable effect is depression of the central nervous system (CNS) with drowsiness, incoordination and unconsciousness, eventually leading to death.(1) On autopsy, slight liver, and sometimes kidney, changes were noted. (2) In many studies, short-term exposure to very low levels by inhalation or ingestion has caused very harmful changes to the blood and immune systems. All major types of blood cells, including red blood cells, platelets and white blood cells are susceptible. Two common effects are a decreased number of lymphocytes (cells which produce antibodies) (lymphocytopenia) and a reduced number of red blood cells (anemia). Mice exposed continuously by inhalation to 21 ppm for 4 to 10 days showed significant changes in all blood parameters tested. Concentrations as low as 10 ppm have caused immunological changes in rats. Some effects may be reversible once exposure stops. (1,13)

A few studies have been reported regarding potential behavioral effects of benzene. Increased behavioral activity (sleeping, grooming, locomotion and fighting) was observed in mice following exposure to 300 or 900 PPM for 5 days. (1) The significance of these changes is not known.

Effects Of Long-Term (Chronic) Exposure:

Effects On The Blood And Blood-Forming Organs:
Extensive studies have conclusively proven that oral and inhalation exposure to benzene causes severe effects on the blood system, including damaging the bone marrow where new blood cells are

formed. Most studies report a decrease in hemoglobin, hematocrit, red and white blood cells, platelets and/or changes in the cells. Effects of varying severity have been demonstrated with both intermittent and continuous exposures to concentrations as low as 10 ppm for 24 weeks. (1,3)

Effects On The Immune System:
Studies have also conclusively shown that benzene causes harmful changes to the immune system, which protects the body from disease. Benzene has decreased the number of mature B- and T-lymphocytes (white blood cells which produce disease-fighting antibodies). Exposure of mice to 300 ppm for 6 to 23 weeks resulted in a decrease in the number of mature B- and T-lymphocytes. Rats and mice exposed orally to 25 to 200 mg/kg/day for 2 years had significantly reduced white blood cells and lymphocytes. (1)

Carcinogenicity:
The International Agency for Research on Cancer (IARC) has concluded that there is sufficient evidence for the carcinogenicity of benzene in animals. Benzene is known to be carcinogenic in humans. (12) Inhalation and ingestion studies with rats and mice have shown cancer of the lymph system (lymphoma), the blood (leukemia), and the bone marrow (myeloma), as well as tumors of the liver, zymbal gland, mammary gland, lungs, thymus, nasal and oral cavities. Inhalation exposures were in the range of 100 to 1,200 ppm while ingestion exposures were 25 to 500 mg/kg,
usually for the lifetime of the animal. (1,12,13)

Teratogenicity/Embryotoxicity:
Many studies have been conducted on rats, mice and rabbits, primarily with inhalation exposures and with concentrations ranging up to 2,200 ppm. Results show that benzene is not teratogenic or embryotoxic even at levels that caused maternal toxicity. Fetal toxicity (reduced birth weight and/or minor skeletal variations) was observed at exposures above 50 ppm. In these studies, mild maternal toxicity was also seen (reduced weight gain). (1,3,22,23)

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Reproductive Toxicity:
Benzene does not appear to cause reproductive toxicity. Effects on reproductive organs (testes and ovaries) have been shown at doses, which caused other significant signs of toxicity in the animals. (2.24)
Female rats were exposed to up to 300 ppm, 6 hours per day, from 10 weeks pre-mating through nursing of the offspring with no effect on female reproductive performance. (5) In another study, where female rats were exposed continuously to 210 ppm 10 to 15 days before and 3 weeks after mating, there were no litters. There are no further details available for
interpretation of this study. (1)

Mutagenicity:
Benzene has been extensively examined in mutagenicity studies with rats and mice with positive results in virtually all tests reported. Analyses of bone marrow and lymphocytes of animals exposed to concentrations as low as 1 ppm have found increases in chromosomal aberrations, sister chromatic exchanges and micronuclei. Other studies have shown changes in DNA in certain cell types. (1) Recent studies have focused on mutagenesis with low-level short-term exposures. Prolonged exposure of mice to levels at or below 1 ppm (40, 100 and 1000 ppb for 22 hours per day for 6 weeks) produced an increase in mutations in lymphocytes at the two lower exposure levels. (6,7)

Inhalation:
Vapour concentrations above recommended exposure levels are irritating to the eyes and the respiratory tract, may cause headaches and dizziness, are anaesthetic and may have other central nervous system effects. This product contains benzene. High concentrations may lead to central nervous system effects (drowsiness, dizziness, nausea, headaches, convulsions, paralysis and loss of consciousness). Death due to breathing failure may occur almost immediately or may be delayed several hours to several days if the exposure is extremely high. May cause blood or blood producing system disorder and/or damage.

Eye Contact: I
rritating, but will not injure eye tissue.

Skin Contact:

Brief contact with the liquid will not result in significant irritation unless evaporation is prevented. Frequent or prolonged contact may irritate the skin and cause a skin rash (dermatitis). Evidence does not clearly indicate whether benzene can be easily absorbed through the skin; however, damaged skin may allow the absorption of benzene. Exposure under these circumstances could add to the toxic effects caused by breathing benzene vapours.

Ingestion:
Small amounts of this liquid drawn into the lungs from swallowing or vomiting may cause severe health effects (e.g. bronchopneumonia or pulmonary oedema).

Chronic:
Human health studies (epidemiological) indicate that prolonged and/or repeated overexposures of benzene may cause damage to the blood producing system (particularly the bone marrow) and serious blood disorders including leukaemia. Animal tests indicate that benzene does not cause malformations but may be toxic to the embryo/foetus.The relationship of the results to humans has not been established.

The International Agency for Research on Cancer (IARC) has evaluated benzene and found it to be a human carcinogen.

The National Toxicology Program (NTP) has evaluated benzene and found it to be a human carcinogen.

Other human data:
- It has been stated that 3,000 ppm is endurable for 0.5 to 1 hour [Flurry 1928].
- It has also been stated that exposure at 19,000 to 20,000 ppm for 5 to 10 minutes is fatal;
- Exposure at 7,500 ppm for 30 minutes is dangerous;
- Exposure at 1,500 ppm for 60 minutes induces serious symptoms;
- Exposure at 500 ppm for 60 minutes leads to symptoms of illness;
- Exposure at 50 to 150 ppm for 5 hours produces headache, lassitude, and weakness; and
- Exposure at 25 ppm for 8 hours has no effect [Gerarde 1960].

Revised IDLH: 500 ppm
Basis for revised IDLH: The revised IDLH for benzene is 500 ppm based on acute inhalation toxicity data in humans [Gerarde 1960]. [Note: NIOSH recommends as part of its carcinogen policy that the "most protective" respirators be worn for benzene at concentrations above 0.1 ppm. OSHA currently requires in 29 CFR 1919.1028 that workers be provided with and required to wear and use the "most protective" respirators in concentrations exceeding 1,000 ppm (i.e., 1,000 x the PEL).]

12. Ecological Information

Acute Toxicity
Fish: Toxic: 1 < LC/EC/IC50 <= 10 mg/l
Aquatic Invertebrates: Harmful: 10 < LC/EC/IC50 <= 100 mg/l
Algae: Harmful: 10 < LC/EC/IC50 <= 100 mg/l
Microorganisms: Harmful: 10 < LC/EC/IC50 <= 100 mg/l
Mobility: Floats on water.
Persistence/degradability: Readily biodegradable meeting the 10-day window criterion.
Bioaccumulation: Does not bioaccumulate significantly.
Other Adverse Effects: In view of the high rate of loss from solution, the product is unlikely to pose a significant hazard to aquatic life.

13. Disposal Considerations

Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations.
Disposal should be in accordance with applicable regional, national, and local laws and regulations.

14. Transport Information

WHMIS Information:
Class B, Division 2: Flammable Liquids
Class D, Division 2, Subdivision A: Very Toxic Material
Class D, Division 2, Subdivision B: Toxic Material

TDG Information (Rail/Road):
PIN Number: UN 1114
Shipping Name: Benzene (Benzol)
Packing Group: II
Primary TDG: Class 3
Subsidiary TDG: Class 9.2
Do not transport with food and feed stuff.
Note: E
F symbol
T symbol
R: 45-46-11-36/38-48/23/24/25-65
S: 53-45
Transport Emergency Card: TEC (R)-30S1114 / 30GF1-II

IMDG
Identification number UN 1114
Proper shipping name BENZENE
Class / Division 3
Packing group II
Marine pollutant: No

IATA (Country variations may apply)
UN No. : 1114
Proper shipping name : Benzene
Class / Division : 3
Packing group : II

Transport in Bulk (Annex II of MARPOL 73/78 and the IBC code)
Pollution Category : Y
Ship Type : 3
Product Name : Benzene and mixtures having 10% benzene or more

15. Regulatory Information

Permissible Exposure Level (Long Term) in Singapore: 1ppm (3.18mg/m^3)
CAS # 71-43-2
UN # 1114
EC # 601-020-00-8
NFPA Code: H2; F3; R0

16. Other Information

Prepared By: Material Safety Committee
SDS Prepared on: 1/10/2010
Reviewed 1 on 1/10/2013
Revised 2 on 11/2/2015

Revision (2) Notes	
1	Sect. 14: Added information for Transport in Bulk according to MARPOL 73/78 Annex II

CAUTION: The information given above ("**the Information**") relates only to the substance or mixture listed herein. The Information may not be valid when used in combination with any other substance or mixture or in any process. If the substance or mixture is to be used for a purpose other than that stated herein or under conditions other than specified herein, the Information cannot be relied upon as being complete or accurate, and the user is advised to consult the supplier before using the substance or mixture for such other purpose or under such other conditions. The Information is given based on information available at the indicated date of preparation and no representation or warranty is given that it will be correct as of any time after the indicated date of preparation.

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SAFETY DATA SHEET

NAPA DOT 3 BRAKE FLUID

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

Issue Date: March 5, 2014 **Revised: April 2, 2015**

Product Name: NAPA DUTY DOT 3 BRAKE FLUID
Synonyms: Brake Fluid
CAS Number: Mixture, see Section 3
Chemical Formula: Mixture
General Use: Brake Fluid
Manufacturer: Warren Unilube, Inc., 915 E. Jefferson, West Memphis, AR 72301

24-HOUR EMERGENCY NUMBER – CHEMTREC: 1-800-424-9300
WARREN UNILUBE PHONE: (800) 428-9284
FAX: (870) 400-3070

Restrictions on Use:

***FOR LABELS FOR THE GENERAL PUBLIC*:** If medical advice is needed, have product container or label at hand.

Keep out of reach of children and animals.

Read label before use.

***FOR THE INDUSTRIAL WORKER*:** Industrial use only.

SECTION 2: HAZARD(S) IDENTIFICATION

Hazard Classification:

OSHA Hazards: Target Organ Effect, Harmful by ingestion, Irritant, Teratogen, Reproductive hazard

Target Organs: Kidney, Liver, Central nervous system, Female reproductive system, Male reproductive system, Blood.

GHS Classification:

Acute toxicity, dermal (Category 5)
Acute toxicity, oral (Category 4)
Skin Irritation (Category 3)
Serious eye damage (Category 1)
Reproductive toxicity (Category 2)



Signal Word: WARNING

Hazard Statements:

H302	Harmful if swallowed
H313	May be harmful in contact with skin
H316	Causes mild skin irritation
H318	Causes serious eye damage
H361	Suspected of damaging fertility or the unborn child

Precautionary Statements:

P201	Obtain special instructions before use.
P202	Do not handle until all safety instructions have been read and Understood.
P264	Wash thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P280	Wear eye protection / face protection.
P301 +P312	IF SWALLOWED: Call a POISON CENTER or doctor / physician immediately.
P330	IF SWALLOWED: Rinse mouth.
P312	IF ON SKIN: Call a POISON CENTER or doctor / physician if you feel unwell.
P332 + P313	If skin irritation occurs: Get medical advise / attention.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing.
P310	IF IN EYES: Immediately call a POISON CENTER or doctor / physician.
P308 + P313	If exposed or concerned: Get medical advice / attention.

20-80% of the mixture consists of ingredients of unknown acute toxicity.

HMIS Classification

Health hazard:	1
Chronic Health Hazard	
Flammability	1
Physical hazards	0

NFPA Rating

Health hazard:	1
Fire:	1
Reactivity	0

Description of Any Other Hazards Not Otherwise Classified: none known.

SECTION 3: COMPOSITION / INFORMATION ON INGREDIENTS

INGREDIENT Name:	**CAS NUMBER**	**%wt. or %V**
Triethylene Glycol Monomethyl Ether	112-35-6	5-50
Triethylene Glycol Monoethyl Ether	112-50-5	5-50
Triethylene Glycol Monobutyl Ether	143-22-6	5-50
Tetrathylene Glycol Monobutyl Ether	1559-34-8	5-20
Polyethylene Glycol	25322-68-3	5-20
Diethylene Glycol Monobutyl Ether	112-34-5	5-20
Diethylene Glycol	111-46-6	5-15
Diethylene Glycol Monomethyl Ether	111-77-3	<5
Diethylene Glycol Monoethyl Ether	111-90-0	<5
Polyalkylene Glycol Monobutyl Ether	9004-77-7	5-20
Polyalkylene Glycol Monomethyl Ether	23783-42-8	5-20
Polyalkylene Glycols	9038-95-3	5-20
Trade Secret Inhibitor Package	Trade Secret	3

3% of the composition of this material has been withheld as a trade secret.

SECTION 4: FIRST AID MEASURE

EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do. Continue rinsing. If eye irritation continues or persists, get medical advice / attention.

SKIN: Wash with plenty of soap and water. If skin irritation occurs, get medical advice / attention.

INGESTION: Never give anything by mouth to an unconscious person. Rinse mouth with water. Consult a physician.

INHALATION: Remove victim to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Consult a physician.

NOTES TO PHYSICIANS OR FIRST AID PROVIDERS: Treatment should be directed at the control of symptoms and the clinical condition of the patient.

SECTION 5: FIRE-FIGHTING MEASURES

SUITABLE EXTINGUISHING MEDIA: Dry chemical, foam or carbon dioxide. Water spray may be used to keep fire exposed containers cool, dilute spills to nonflammable mixtures, protect personnel attempting to stop leak, and disperse vapors.

UNSUITABLE EXTINGUISHING MEDIA: Direct water stream.

SPECIAL FIRE FIGHTING PROCEDURES: Evacuate area. Do not use direct water stream to extinguish fires. Do not release runoff from fire control methods to sewers or waterways.

UNUSUAL FIRE AND EXPLOSION HAZARDS: None known.

HAZARDOUS COMBUSTION PRODUCTS: Carbon monoxide, carbon dioxide, and unidentified organic compounds.

SPECIAL PROTECTIVE EQUIPMENT AND PRECAUTIONS FOR FIRE FIGHTERS: Wear full protective clothing and NIOSH – approved self-contained breathing apparatus with full face piece operated in the pressure demand or other positive breathing mode.

SECTION 6: ACCIDENTAL RELEASE MEASURES

PERSONAL PRECAUTIONS: Use appropriate personal protective equipment. Avoid breathing vapors, mist or gas. Avoid contact with spilled material. Insure adequate ventilation. Remove all sources of ignition. Use non-sparking tools and equipment.

PROTECTIVE CLOTHING: Standard work uniform. Impervious gloves. Safety glasses. Personnel should increase PPE level as deemed appropriate in any given situation.

EMERGENCY PROCEDURES:

SMALL SPILLS: Contain and recover liquid when possible. Collect liquid in appropriate container or absorb with an inert material (such as vermiculite or dry sand) and place in chemical waste container. Do not use combustible materials such as sawdust for the cleanup.

LARGE SPILLS:
Containment: Shut off source of leak if safe to do so. Dike far ahead of liquid spill for later disposal. Do not allow material to enter sewers or waterways.
Cleanup: Contain and recover liquid when possible. Collect liquid in appropriate container. Absorb residue with an inert material (such as vermiculite or dry sand) and place in chemical waster container. Do not use combustible materials such as sawdust for the cleanup.

SECTION 7: HANDLING AND STORAGE

HANDLING PRECAUTIONS: May be harmful or fatal if swallowed.

STORAGE REQUIREMENTS: Store in a cool dry, ventilated area.

SECTION 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

ENGINEERING CONTROLS: Controls should be such that adequate ventilation is provided.

VENTILATION: Provide general or local exhaust ventilation systems to maintain airborne concentrations below OSHA PELs. Local exhaust ventilation is preferred because it prevents contaminant dispersion into the work place by controlling it at its source.

RESPIRATORY PROTECTION: Seek professional advice prior to respirator selection and use. Follow OSHA respirator regulations (29 CFR 1910.134) and, if necessary, wear a MSHA / NIOSH approved respirator. Select respirator based on its suitability to provide adequate worker protection for given working conditions, level of airborne contamination, and presence of sufficient oxygen. For emergency or non-routine operations (e.g. cleaning spills, reactor vessels, or storage tanks), wear an SCBA. ***Warning!*** *Air purifying respirators do not protect workers in oxygen-deficient atmospheres.* If respirators are used, OSHA requires a written respiratory protection program that includes at least: medical certification, training, fit testing, periodic environmental monitoring, maintenance, inspection, cleaning, and convenient, sanitary storage areas.

EYE PROTECTION: Wear protective eyeglasses or chemical safety goggles, per OSHA eye-and face-protection regulations (29 CFR 1910.133). Contact lenses are not eye protective devices. Appropriate eye protection must be worn instead of, or in conjunction with, contact lenses.

SKIN PROTECTION: Wear chemically protective gloves, boots, aprons and gauntlets to prevent prolonged or repeated skin contact.

OTHER PROTECTIVE CLOTHING OR EQUIPMENT: Make emergency eyewash stations, safety / quick drench showers and washing facilities available in work areas.

WORK HYGIENIC PRACTICES: Never eat, drink or smoke in work areas. Practice good personal hygiene after using this material especially before eating, drinking or smoking, using the toilet, or applying cosmetics. Separate contaminate work clothes from street clothes. Launder before reuse. Remove this material from your shoes and clean personal protective equipment. Discard belts and shoes that cannot be cleaned.

EXPOSURE GUIDELINES:

	OSHA PEL		ACGIH TLV		NIOSH REL		
Ingredient	**TWA**	**STEL**	**TWA**	**STEL**	**TWA**	**STEL**	**USA WEEL**
Triethylene Glycol Monomethyl Ether	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.

Triethylene Glycol Monoethyl Ether	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.
Triethylene Glycol Monobutyl Ether	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.
Tetraethylene Glycol Monobutyl Ether	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.
Polyethylene Glycol	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.	10 mg/m3
Diethylene Glycol Monobutyl Ether	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.
Diethylene Glycol	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.	10 mg/m3
Diethylene Glycol Monomethyl Ether	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.	25 ppm
Diethylene Glycol Monoethyl Ether	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.
Diethylene Glycol Monobutyl Ether	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.
Polyalkylene Glycol Monobutyl Ether	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.
Polyalkylene Glycol Monomethyl Ether	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.
Polyalkylene Glycols	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.
Inhibitor Package	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.	none estab.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: Liquid
APPEARANCE AND COLOR: Yellow to amber
ODOR: Mild
FLASH POINT: >275°F (>135°C)
UPPER / LOWER FLAMMABILITY OR EXPLOSIVE LIMITS: not available
AUTO IGNITION TEMPERATURE: not available
DECOMPOSITION TEMPERATURE: not available
VAPOR PRESSURE: not available
ODOR THRESHOLD: not available

VAPOR DENSITY (air = 1): >1
pH: 10.0 – 11.5
RELATIVE DENSITY: 8.33 – 9.02 lb/gal
SPECIFIC GRAVITY (H2O = 1 AT 4 C): 1.000 – 1.070
MELTING POINT / FREEZING POINT: not available
WATER SOLUBILITY: soluble
OTHER SOLUBILITIES: not available
INITIAL BOILING POINT AND BOILING RANGE: 480°F (248.9°C), boiling range not available
EVAPORATION RATE (BuAc = 1): <0.01
PARTITION COEFFICIENT: n-OCTANOL/WATER: not available
VISCOSITY: not available
REFRACTIVE INDEX: not available
FORMULA WEIGHT: mixture

SECTION 10: STABILITY AND REACTIVITY

REACTIVITY: none under normal handling.

STABILITY: stable at room temperature in closed containers under normal storage and handling conditions.
CONDITIONS TO AVOID (STABILITY): none known.

INCOMPATIBILITY (MATERIAL TO AVOID): none known.

HAZARDOUS DECOMPOSITION BY-PRODUCTS: Thermal oxidative decomposition can produce carbon monoxide, carbon dioxide and unknown organic compounds.

HAZARDOUS POLYMERIZATION: Hazardous polymerization will not occur.

CONDITIONS TO AVOID (POLYMERIZATION): Hazardous polymerization will not occur.

HAZARDOUS POLYMERICATION BY-PRODUCTS: Hazardous polymerization will not occur.

SECTION 11: TOXICOLOGICAL INFORMATION

SIGNS AND SYMPTOMS OF OVEREXPOSURE: Swallowing larger amounts may cause nausea and vomiting, abdominal discomfort or diarrhea. May cause dizziness and drowsiness.

ACUTE EFFECTS:

EYE CONTACT: May cause slight eye irritation. May cause slight corneal injury.

SKIN CONTACT: Brief contact is essentially nonirritating to skin.

INHALATION: At room temperature, exposure to vapor is minimal due to low volatility. Mist may cause irritation of the upper respiratory tract.

INGESTION: Toxic or fatal if ingested. For diethylene glycol, a component of this mixture, a lethal dose can be as little as two ounces. Symptoms of diethylene glycol poisoning include severe abdominal cramping, diarrhea, vomiting, sweating, confusion, cardiac abnormalities, neurological abnormalities, infrequent urination, intoxication or CNS depression. If left untreated, product will metabolize to cause metabolic acidosis, renal failure, hyperkalemia, hyponatremia, paralysis, cardiac failure or death. Seek medical attention immediately for poisoning. If ingested, DO NOT wait for symptoms to develop before getting treatment.

TARGET ORGAN EFFECTS: Product is toxic to kidneys, liver, central nervous system and heart. Metabolic products of diethylene glycol produce acidosis and organ toxicity effects.

CHRONIC EFFECTS: May cause dryness or defatting of the skin, dermatitis, or may aggravate existing skin conditions.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE: Various skin conditions.

ACUTE TOXICITY VALUES

Triethylene Glycol Monomethyl Ether
ORAL LD50 (rat): 11,842 mg/kg
DERMAL LD50 (rabbit): 7,441 mg/kg
INHALATION LC50 (state animal): data unavailable

Triethylene Glycol Monoethyl Ether
ORAL LD50 (state animal): data unavailable
DERMAL LD50 (state animal): data unavailable
INHALATION LC50 (state animal): data unavailable

Tetraethylene Glycol Monobutyl Ether
ORAL LD50 (rat): 5,300 mg/kg
DERMAL LD50 (rabbit): 3,505 mg/kg
INHALATION LC50 (state animal): data unavailable

Polyethylene Glycol
ORAL LD50 (state animal): data unavailable
DERMAL LD50 (state animal): data unavailable
INHALATION LC50 (state animal): data unavailable

Diethylene Glycol Monobutyl Ether
ORAL LD50 (rat): 5,660 mg/kg
DERMAL LD50 (rabbit): 2,700 mg/kg
INHALATION LC50 (state animal): data unavailable

Diethylene Glycol
ORAL LD50 (rat): 12,565 mg/kg
DERMAL LD50 (rabbit): 11,890 mg/kg
INHALATION LC50 (state animal): data unavailable

Diethylene Glycol Monomethyl Ether

ORAL LD50 (rat): >7,000 mg/kg
DERMAL LD50 (rabbit): >20,400 mg/kg
INHALATION LC50 (state animal): data unavailable

Diethylene Glycol Monoethyl Ether

ORAL LD50 (rat): 10,502 mg/kg
DERMAL LD50 (rabbit): 9,143 mg/kg
INHALATION LC50 (state animal): data unavailable

Polyalkylene Glycol Monobutyl Ether

ORAL LD50 (rat): >2,000 mg/kg
DERMAL LD50 (rat): >2,000 mg/kg
INHALATION LC50 (state animal): data unavailable

Polyalkylene Glycol Monomethyl Ether

ORAL LD50 (state animal): data unavailable
DERMAL LD50 (state animal): data unavailable
INHALATION LC50 (state animal): data unavailable

Polyalkylene Glycols

ORAL LD50 (state animal): data unavailable
DERMAL LD50 (state animal): data unavailable
INHALATION LC50 (state animal): data unavailable

LISTED CARCINOGEN:

NATIONAL TOXICOLOGY PROGRAM REPORT ON CARCINOGENS: No component of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.

IARC LISTED AS POTENTIAL CARCINOGEN: No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

OSHA LISTED AS POTENTIAL CARCINOGEN: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

SECTION 12: ECOLOGICAL INFORMATION

DATA FROM TOXICITY TESTS ON AQUATIC AND/OR TERRESTERIAL ORGANISMS:

Triethylene Glycol Monoethyl Ether: data unavailable
Triethylene Glycol Monobutyl Ether: data unavailable

Tetraethylene Glycol Monobutyl Ether: data unavailable

Polyethylene Glycol

Fish: LC50 – Leuciscus idus (Golden orfe) <500 mg/l
Daphnia: data unavailable

Diethylene Glycol Monobutyl Ether

Fish: LC50 – Lepomis macrochirus – 1,300 mg/l – 96h
LC50 – Leuciscus idus (Golden orfe) – >1,000 mg/l – 48h
Daphnia: data unavailable

Diethylene Glycol

Fish: LC50 – Pimephales promelas (fathead minnow) – 75,200 mg/l – 96h
LC50 – Carassius auratus (goldfish) – 5,000 mg/l – 24h
Daphnia: EC50 – Daphnia magna (Water flea) - >10,000 mg/l – 24h

Diethylene Glycol Monomethyl Ether

Fish: LC50 – Lepomis macrochirus – 7,500 mg/l – 96h
Daphnia: data unavailable

Diethylene Glycol Monoethyl Ether

Fish: LC50 – Pimephales promelas (fathead minnow) – 9,650 mg/l – 96h
Daphnia: EC50 – Daphnia magna (Water flea) - >3,340 mg/l – 24h

Polyalkylene Glycol Monobutyl Ether: data unavailable

Polyalkylene Glycol Monomethyl Ether: data unavailable

Polyalkylene Glycols: data unavailable

ENVIRONMENTAL FATE: data unavailable for mixture

BIOACCUMULATION POTENTIAL: data unavailable for mixture

POTENTIAL TO MOVE FROM SOIL TO GROUNDWATER: data unavailable for mixture

OTHER ADVERS ENVIRONMENTAL EFFECTS: data unavailable for mixture

SECTION 13: DISPOSAL CONSIDERATIONS

CONTAINERS TO USE: No specific recommendations

RECOMMENDED DISPOSAL METHODS: Whatever cannot be saved for recovery or recycling should be disposed of in an approved waste facility in accordance with Federal, State/Provincial and Local requirements.

PHYSICAL AND CHEMICAL PROPERTIES THAT MAY AFFECT DISPOSAL ACTIVITIES: No specific information available.

WHENEVER POSSIBLE, MATERIAL SHOULD NOT BE ALLOWED TO ENTER SEWAGE DISPOSAL SYSTEMS.

SPECIAL PRECAUTIONS FOR LANDFILL OR INCINERATION ACTIVITIES: No specific information available.

SECTION 14: TRANSPORT INFORMATION

U.S. DEPARTMENT OF TRANSPORTATION (49 CFR 172.101)

PROPER SHIPPING NAME: DOT 3 Brake Fluid
DOT Non-Bulk: Not Regulated
DOT Bulk: Not Regulated

IATA

Not Dangerous Goods

IMDG

Not Dangerous Goods

SECTION 15: REGULATORY INFORMATION

U.S. FEDERAL REGULATIONS

TSCA (TOXIC SUBSTANCE CONTROL ACT): all components are listed on the TSCA Inventory

CERCLA (COMPREHENSIVE RESPONSE COMPENSATION, AND LIABILITY ACT): None. However, this product contains various ethylene glycols and glycol ethers which are each included as a broad category on the CERCLA Hazardous Substances list.

SARA TITLE III (SUPERFUND AMENDMENTS ANDA REAUTHORIZATION ACT): No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

311/312 HAZARD CATEGORIES:

Immediate Hazard: yes / no
Delayed Hazard: yes / no
Fire Hazard: yes / no
Pressure Hazard: yes / no
Reactivity Hazard: yes / no

313 REPORTABLE INGREDIENTS: The following components are subject to reporting levels established by SARA Title III, Section 313:

2-(2-Ethoxyethoxy) ethanol	CAS Number: 111-90-0
2-(2-methoxyethoxy) ethanol	CAS Number: 111-77-3
2-(2-Butoxyethoxy) ethanol	CAS Number: 112-34-5

CLEAN WATER ACT (CWA): None of the chemicals in this product are listed as Hazardous Substances under the CWA. None of the chemicals in this product are listed as Toxic Pollutants under the CWA.

CLEAN AIR ACT (CAA): None of the chemicals in the product are listed as Hazardous Air Pollutants.

STATE REGULATIONS:

California: This product does not contain any chemicals known to the State of California to cause cancer, birth defects, or any other reproductive harm.

Massachusetts:

2-(2-Methoxyethoxy) ethanol	CAS Number: 111-77-3

New Jersey:

Triethylene glycol monobutyl ether	CAS Number: 143-22-6
Polyethylene glycol	CAS Number: 25322-68-3
2-(2-Butoxyethoxy) ethanol	CAS Number: 112-34-5
Diethylene glycol	CAS Number: 111-46-6
2-(2-Methoxyethoxy) ethanol	CAS Number: 111-77-3
2-(2-Ethoxyethoxy) ethanol	CAS Number: 111-90-0

Pennsylvania:

Triethylene glycol monobutyl ether	CAS Number: 143-22-6
Polyethylene glycol	CAS Number: 25322-68-3
2-(2-Butoxyethoxy) ethanol	CAS Number: 112-34-5
Diethylene glycol	CAS Number: 111-46-6
2-(2-Methoxyethoxy) ethanol	CAS Number: 111-77-3
2-(2-Ethoxyethoxy) ethanol	CAS Number: 111-90-0

INTERNAL REGULATIONS:

Persistent Organic Pollutants (United Nations): not listed
Initial List of Prior Informed Consent Chemicals (United Nations): not listed
Ozone Depleting Substances (Montreal Protocol): not listed
Greenhouse Gases (Intergovernmental Panel on Climate Change): not listed

AUSTRALIAN INVENTORY OF CHEMICAL SUBSTANCES: All components are listed.

CANADA: DOMESTIC SUBSTANCES LIST: All components are listed.

CANADA WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM (WHMIS): D2B - Toxic Material at >1%.

CANADIAN ENVIRONMENTAL PROTECTION AGENCY TOXICS LIST: None of the components of this mixture are listed.

EUROPEAN INVENTORY OF EXISTING COMMERCIAL CHEMICAL SUBSTANCES: This material contains components not listed on the EINECS Inventory: Polyalkylene glycols, CAS Number 9038-95-3.

NEW ZEALAND: All components are listed.

PHILLIPPINE INVENTORY OF CHEMICALS AND CHEMICAL SUBSTANCES: All components are listed.

SECTION 16: REGULATORY INFORMATION

Disclaimer: This product is FOR INDUSTRIAL USE ONLY. KEEP OUT OF REACH CHILDREN AND ANIMALS. DO NOT TAKE INTERNALLY.

Warren Unilube, Inc. believes that the information and recommendations contained herein (including data and statements) are accurate as of the date hereof. No warranty of fitness for any particular purpose, warranty of merchantability, or any other warranty expressed or implied, is made concerning the information provided herein. The information provided herein relates only to the specific product designated and may not be valid where such products is used in combination with any other materials or in any process. Further, since the conditions and methods of use of the product and of the information referred to herein are beyond the control of Warren Unilube, Warren Unilube expressly disclaims any and all liability as to any results obtained or arising from any of the product or reliance on such information.

For additional product information, please contact Warren Unilube, Inc. at (800) 428-9284.

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Safety Data Sheet
According to the (US) Hazard Communication Standard (29 CFR 1910.1200)

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

Product Name Buffer Solution pH 4.00

Catalog Number **YSI 3821**

Product Description Laboratory chemical, for use in calibrating pH probes.

Supplier

YSI, a Xylem brand
Telephone: 937-767-7241
Emergency: CHEMTREC
US/Can: 800-424-9300
International: 001 703-572-3997

1725 Brannum Lane
Yellow Springs, OH 45387
MSDSinfo@ysi.com
YSI.com
Collect calls accepted

Manufacturer

NCL of Wisconsin, Inc.
Telephone: 1-800-648-7836
Email: nclabs@nclabs.com

PO Box 8, Birnamwood, WI 54414
Fax: 715-449-2454
Emergency Contact: 1-800-424-9300 (Chemtrec)

SECTION 2: HAZARDS IDENTIFICATION

GHS Classification Not classified

Signal Word Not applicable

Pictograms None

Hazard Statements Not applicable

Precautionary Statements Not applicable

Other Hazards Not Contributing to the Classification None under normal conditions.

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Identity Not applicable

Common Name Not applicable

Mixture

Name	CAS #	Approximate %
Water	7732-18-5	>98.8
Potassium Hydrogen Phthalate	877-24-7	1.1
Red Food Coloring	Not found	<0.001

SECTION 4: FIRST AID MEASURES

Description of First Aid Measures

General First Aid Measures Never give anything by mouth to an unconscious person. Seek medical advice if you feel unwell.

If Inhaled Remove person to fresh air and keep comfortable for breathing. Allow victim to rest.

In Case of Skin Contact Remove contaminated clothing and wash exposed skin with mild soap and water. Rinse with warm water.

In Case of Eye Contact Immediately flush eyes with plenty of water. Remove contact lenses, if present and easy to do. Get medical attention if irritation develops.

If Swallowed Rinse mouth. Do NOT induce vomiting. Get medical attention if you feel unwell.

Most Important Symptoms/Effects Acute and Delayed

Not expected to present a significant hazard under normal use.

Indication of Immediate Medical Attention and Special Treatment Needed

No additional information available.

SECTION 5: FIRE-FIGHTING MEASURES

Extinguishing Media

Suitable Extinguishing Media	Foam. Dry powder. Sand. Carbon dioxide. Water spray.
Unsuitable Extinguishing Media	Do not use high pressure water stream.
Special Hazards Arising from the Chemical	No additional information available.
Special Protective Actions for Fire-Fighters	Wear self-contained breathing apparatus and protective clothing. Keep exposed containers cool with water spray.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures

Personal Precautions	Use personal protective equipment (see section 8). Evacuate area of non-essential personnel. Eliminate ignition sources.
Environmental Precautions	Prevent entry to surface and ground waters.
Methods and Materials for Containment and Cleaning Up	Clean up spills with inert solids. Collect spillage. Store away from other materials. Ensure compliance with federal, state, and local regulations.

SECTION 7: HANDLING AND STORAGE

Precautions for Safe Handling	Avoid contact with eyes and skin. Avoid breathing vapors. Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Provide good ventilation in process area to prevent formation of vapor.
Conditions for Safe Storage Including any Incompatibilities	Keep in a tightly closed container, stored in a cool, dry, ventilated area. Store away from strong oxidizers.

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Control Parameters	Not applicable
Appropriate Engineering Controls	Provide adequate general ventilation. Maintain eye-wash fountain and quick-drench facilities in work area.
Individual Protection Measures	Avoid all unnecessary exposure.
Eye/Face Protection	Use chemical safety goggles and /or a full face shield where splashing is possible. Contact lenses should not be worn when working with this material. Maintain eye-wash fountain and quick-drench facilities in work area.
Skin Protection	Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure to prevent skin contact.
Respiratory Protection	Wear appropriate mask.
Other Information	Do not eat, drink, or smoke when using this product.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State	Liquid
Color	Red to pink
Odor	Odorless
Odor Threshold	Not determined
pH	4
Melting Point/Freezing Point	Not determined
Initial Boiling Point and Boiling Range	Not determined
Flash Point	Not determined
Evaporation Rate	Not determined
Flammability (Solid, Gas)	Not determined
Upper/Lower Flammability/Explosive Limits	Not determined
Vapor Pressure	Not determined
Vapor Density	Not determined

Relative Density	1.00
Solubility	Soluble in water.
Partition Coefficient: n-octanol/water	Not determined
Auto-Ignition Temperature	Not determined
Decomposition Temperature	Not determined
Viscosity	Not determined

SECTION 10: STABILITY AND REACTIVITY

Reactivity	No data available
Chemical Stability	Stable under ordinary conditions of use and storage.
Possibility of Hazardous Reactions	No data available
Conditions to Avoid	Extremely high or low temperatures.
Incompatible Materials	Strong oxidizers.
Hazardous Decomposition Products	When heated to decomposition, can emit toxic gases, carbon dioxide, and carbon monoxide.

SECTION 11: TOXICOLOGICAL INFORMATION

Acute Toxicity Not classified

Potassium Hydrogen Phthalate (877-24-7)	
LD50 oral rat	≥3200 mg/kg
Water (7732-18-5)	
LD50 oral rat	≥90000 mg/kg

Skin Corrosion/Irritation	Not classified
Serious Eye Damage/Irritation	Not classified
Respiratory or Skin Sensitization	Not classified
Germ Cell Mutagenicity	Not classified
Carcinogenicity	Not classified
Reproductive Toxicity	Not classified
Specific Target Organ Toxicity (Single Exposure)	Not classified
Specific Target Organ Toxicity (Repeated Exposure)	Not classified
Aspiration Hazard	Not classified
Potential Adverse Human Health Effects and Symptoms	No data available
Other Information	Not available

SECTION 12: ECOLOGICAL INFORMATION

Toxicity	Not applicable
Persistence and Degradability	Not applicable
Bioaccumulative Potential	Not applicable
Mobility in Soil	Not applicable
Other Adverse Effects	Not applicable

SECTION 13: DISPOSAL CONSIDERATIONS

Methods of Disposal

Disposal Recommendations	Dispose of contents/containers in accordance with federal, state, and local regulations.
Other Information	Avoid release to the surrounding environment.

SECTION 14: TRANSPORT INFORMATION

UN Number	Not applicable
UN Shipping Name	Not applicable
Transport Hazard Class(es)	Not applicable
Packing Group	Not applicable
Environmental Hazards	Not applicable
Transport in Bulk	Not applicable
Other Precautions	Not applicable

SECTION 15: REGULATORY INFORMATION

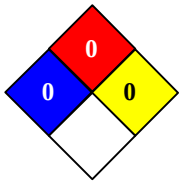
Potassium Hydrogen Phthalate (877-24-7)
Listed on the United States TSCA (Toxic Substances Control Act) inventory
Water (7732-18-5)
Listed on the United States TSCA (Toxic Substances Control Act) inventory

SECTION 16: OTHER INFORMATION

Revision Date: 12/10/2014

NFPA Hazards

Health Hazard	0: Exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials.
Fire Hazard	0: Materials that will not burn.
Instability/Reactivity	0: Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health	0: No significant risk to health.
Flammability	0: Materials that will not burn.
Physical Hazard	0: Materials that are normally stable.
Personal Protection	A

YSI 3821	
Health	0
Flammability	0
Physical Hazard	0
Personal Protection	A

The information contained herein is provided in good faith and is believed to be correct as of the date hereof. However, NCL of Wisconsin, Inc. makes no representation as to the comprehensiveness or accuracy of the information. It is expected that individuals receiving the information will exercise their independent judgment in determining its appropriateness for their conditions of use. Accordingly, NCL of Wisconsin, Inc. will not be responsible for damages of any kind resulting from the use of or reliance upon such information.

END OF SAFETY DATA SHEET

Material Safety Data Sheet

NCL of Wisconsin, Inc.
PO Box 8
Birnamwood, WI 54414
Emergency Telephone No: 800-424-9300 (Chemtrec)

Date of this revision: 11-02-2004

Product Identification

Product Name: YSI 3822 Buffer Solution, pH = 7.00
Synonyms: None. Molecular Weight: NA
Chemical Name: NA Chemical Family: NA
Product CAS#: NA Formula: NA

Ingredients

1. Potassium Phosphate Monobasic CAS# 7778-77-0
   Percent: <1 SARA: Not Listed.
   TLV: Not established. PEL: Not Established
   Hazard: Moderately toxic - May cause Irritation.

2. Sodium Hydroxide CAS# 1310-73-2.
   Percent: <1 SARA: Not listed
   TLV: 2 mg/m³ PEL: 2 mg/m³

3. Yellow Food Coloring CAS# Not listed.
   Percent: <0.02 SARA: Not listed.
   TLV: Not established. PEL: Not established.
   Hazard: None Known.

4. Deionized Water CAS# 7732-18-5
   Percent: >98 SARA: Not listed.
   TLV: Not applicable PEL: Not applicable
   Hazard: None.

Precautionary Measures

Avoid contact with eyes, skin, and clothing. Wash thoroughly after handling. Minimal contact, as with all chemicals, is a good policy to follow.

Emergency/First Aid

In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes. If swallowed, give two glasses of water or milk to dilute. Call a physician.

DOT Hazard Class: Not Regulated

Physical Data Section One

Appearance: Clear yellow solution
Odor: Odorless
Solubility: Infinitely soluble in water.
Boiling Point: 100° C (212° F)
Melting Point: 0° C (32° F)
Specific Gravity: 1.0

Vapor Density (Air=1): Essentially the same as water.
Vapor Pressure (mm Hg): Essentially the same as water.
Evaporation Rate: Essentially the same as water.

Fire and Explosion Information — Section Two

Fire: Not considered to be a fire hazard.
Explosion: Not considered to be and explosion hazard
Fire Extinguishing Media: Use any suitable means for extinguishing surrounding fire.

Reactivity Data — Section Three

Stability: Stable under ordinary conditions of use and storage
Hazardous Decomposition Products: None known.
Hazardous Polymerization: This substance does not polymerize.
Incompatibilities: None known.

Leak/Spill/Disposal Information — Section Four

Flush to sewer with large amounts of water.
Ensure compliance with Federal, State, and local regulations
Reportable Quantity: 5000 lbs.

Health Hazard Information — Section Five

A. Exposure/Health Effects

Inhalation: No information found.
Ingestion: Large doses may cause diarrhea.
Skin Contact: Prolonged contact may cause irritation.
Eye Contact: May cause irritation and damage.
Chronic Exposure: Potassium phosphate, one of the ingredients, may sequester calcium and cause calcium phosphate deposits in the kidneys.
Cancer information: No information found for any ingredient
Aggravation of Pre-existing Conditions: No information found

B. First Aid

Inhalation: Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.
Ingestion: If swallowed, give two glasses of water to dilute. Give medical attention immediately.
Skin Exposure: Immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing. Get medical attention if irritation develops or persists.
Eye Exposure: Wash eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attentions immediately.

Occupational Control Measures — Section Six

Ventilation System: In general, dilution ventilation is a satisfactory health hazard control for this material. However, if conditions of use create discomfort to a worker, a local exhaust should be considered.

Personal Respirators (NIOSH Approved): For conditions of use where exposure to mist exists, a dust/mist respirator may be worn. For emergencies, a self-contained breathing apparatus may be necessary.

Skin Protection: Rubber gloves and lab coat, apron or overalls.

Eye Protection: Use chemical safety goggles and/or a full face shield where splashing is possible. Contact lenses should not be worn when working with this material.

Maintain eye-wash fountain and quick-drench facilities in work areas.

Storage and Special Information — Section Seven

Keep in a tightly closed container. Protect container from physical damage.

The information contained herein is provided in good faith and is believed to be correct as of the date hereof. However, NCL of Wisconsin, Inc. makes no representation as to the comprehensiveness or accuracy of the information. It is expected that individuals receiving the information will exercise their independent judgment in determining its appropriateness for a particular purpose. Accordingly, NCL of Wisconsin, Inc will not be responsible for damages of any kind resulting from the use of or reliance upon such information. NO REPRESENTATIONS, OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO THE INFORMATION SET FORTH HEREIN OR TO THE PRODUCT TO WHICH THE INFORMATION REFERS.

END OF MATERIAL SAFETY DATA SHEET

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Safety Data Sheet
According to the (US) Hazard Communication Standard (29 CFR 1910.1200)

SECTION 1: PRODUCT AND COMPANY IDENTIFICATION

Product Name Buffer Solution pH 10.00

Catalog Number **YSI 3823**

Product Description Laboratory chemical, for use in calibrating pH probes

Supplier

YSI, a Xylem brand
Telephone: 937-767-7241
Emergency: CHEMTREC
US/Can: 800-424-9300
International: 001 703-572-3997

1725 Brannum Lane
Yellow Springs, OH 45387
MSDSinfo@ysi.com
YSI.com
Collect calls accepted

Manufacturer

NCL of Wisconsin, Inc.
Telephone: 1-800-648-7836
Email: nclabs@nclabs.com

PO Box 8, Birnamwood, WI 54414
Fax: 715-449-2454
Emergency Contact: 1-800-424-9300 (Chemtrec)

SECTION 2: HAZARDS IDENTIFICATION

GHS Classification

Reproductive Toxicity — Category 1B



Signal Word Danger

Hazard Statements

H360 — May damage fertility or the unborn child

Precautionary Statements

P201	Obtain special instructions before use
P202	Do not handle until all safety precautions have been read and understood
P280	Wear protective gloves and eye protection
P308+P313	IF exposed or concerned: Get medical advice/attention
P405	Store locked up
P501	Dispose of contents/container to comply with local, state, and federal regulations

Other Hazards Not Contributing to the Classification None under normal conditions

SECTION 3: COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Identity Not applicable

Common Name Not applicable

Mixture

Name	CAS #	Approximate %
Water	7732-18-5	>96
Potassium Hydroxide	1310-58-3	<1
Disodium EDTA dihydrate	6381-92-6	<1
Potassium Carbonate	584-08-7	<1
Potassium Borate	1332-77-0	<1
Bromphenol Blue, Sodium Salt	62625-28-9	<0.01
Bromcresol Green, Sodium Salt	62625-32-5	<0.01

SECTION 4: FIRST AID MEASURES

Description of First Aid Measures

General First Aid Measures Never give anything by mouth to an unconscious person. Seek medical advice if you feel unwell.

If Inhaled Remove person to fresh air and keep comfortable for breathing. Allow victim to rest.

In Case of Skin Contact Remove contaminated clothing and wash exposed skin with mild soap and water. Rinse with warm water.

In Case of Eye Contact Immediately flush eyes with plenty of water. Remove contact lenses, if present and easy to do. Get medical attention if irritation develops.

If Swallowed Rinse mouth. Do NOT induce vomiting. Get medical attention if you feel unwell.

Most Important Symptoms/Effects Acute and Delayed

May damage fertility or the unborn child

Indication of Immediate Medical Attention and Special Treatment Needed

No additional information available.

SECTION 5: FIRE-FIGHTING MEASURES

Extinguishing Media

Suitable Extinguishing Media Foam. Dry powder. Sand. Carbon dioxide. Water spray.

Unsuitable Extinguishing Media Do not use high pressure water stream.

Special Hazards Arising from the Chemical No additional information available.

Special Protective Actions for Fire-Fighters Wear self-contained breathing apparatus and protective clothing. Keep exposed containers cool with water spray.

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures

Personal Precautions Use personal protective equipment (see section 8). Evacuate area of non-essential personnel. Eliminate ignition sources.

Environmental Precautions Prevent entry to surface and ground waters.

Methods and Materials for Containment and Cleaning Up Clean up spills with inert solids. Collect spillage. Store away from other materials. Ensure compliance with federal, state, and local regulations.

SECTION 7: HANDLING AND STORAGE

Precautions for Safe Handling Avoid contact with eyes and skin. Avoid breathing vapors. Wash hands and other exposed areas with mild soap and water before eating, drinking or smoking and when leaving work. Provide good ventilation in process area to prevent formation of vapor. Do not handle until all safety precautions have been read and understood. Obtain special instructions before use.

Conditions for Safe Storage Including any Incompatibilities Keep in a tightly closed container, stored in a cool, dry, ventilated area. Store away from heat sources, strong oxidizers and strong acids

SECTION 8: EXPOSURE CONTROLS/PERSONAL PROTECTION

Control Parameters

Potassium Hydroxide (1310-58-3)		
USA ACGIH	ACGIH Ceiling (mg/m^3)	2 mg/m^3

Appropriate Engineering Controls Provide adequate general ventilation. Maintain eye-wash fountain and quick-drench facilities in work area.

Individual Protection Measures Avoid all unnecessary exposure.

Eye/Face Protection Use chemical safety goggles and /or a full face shield where splashing is possible. Contact lenses should not be worn when working with this material. Maintain eye-wash fountain and quick-drench facilities in work area.

Skin Protection Rubber or neoprene gloves and additional protection including impervious boots, apron, or coveralls, as needed in areas of unusual exposure to prevent skin contact.

Respiratory Protection Wear appropriate mask.

Other Information Do not eat, drink, or smoke when using this product.

SECTION 9: PHYSICAL AND CHEMICAL PROPERTIES

Physical State Liquid

Color Blue

Odor Odorless

Odor Threshold Not determined

pH 10

Melting Point/Freezing Point Not determined

Initial Boiling Point and Boiling Range	Not determined
Flash Point	Not determined
Evaporation Rate	Not determined
Flammability (Solid, Gas)	Not determined
Upper/Lower Flammability/Explosive Limits	Not determined
Vapor Pressure	Not determined
Vapor Density	Not determined
Relative Density	1.00
Solubility	Soluble in water
Partition Coefficient: n-octanol/water	Not determined
Auto-Ignition Temperature	Not determined
Decomposition Temperature	Not determined
Viscosity	Not determined

SECTION 10: STABILITY AND REACTIVITY

Reactivity	No data available
Chemical Stability	Stable under ordinary conditions of use and storage.
Possibility of Hazardous Reactions	No data available
Conditions to Avoid	Extremely high or low temperatures.
Incompatible Materials	Strong oxidizers and strong acids
Hazardous Decomposition Products	When heated to decomposition, can emit toxic gases, carbon dioxide, and carbon monoxide.

SECTION 11: TOXICOLOGICAL INFORMATION

Acute Toxicity Not classified

Potassium Hydroxide (1310-58-3)	
LD50 oral rat	333 mg/kg, Rat; experimental value
Water (7732-18-5)	
LD50 oral rat	≥90000 mg/kg

Skin Corrosion/Irritation	Not classified
Serious Eye Damage/Irritation	Not classified
Respiratory or Skin Sensitization	Not classified
Germ Cell Mutagenicity	Not classified
Carcinogenicity	Not classified
Reproductive Toxicity	May damage fertility or the unborn child
Specific Target Organ Toxicity (Single Exposure)	Not classified
Specific Target Organ Toxicity (Repeated Exposure)	Not classified
Aspiration Hazard	Not classified
Potential Adverse Human Health Effects and Symptoms	No data available
Other Information	Not available

SECTION 12: ECOLOGICAL INFORMATION

Toxicity	Not applicable
Persistence and Degradability	Not applicable
Bioaccumulative Potential	Not applicable
Mobility in Soil	Not applicable
Other Adverse Effects	Not applicable

SECTION 13: DISPOSAL CONSIDERATIONS

Methods of Disposal

Disposal Recommendations	Dispose of contents/containers in accordance with federal, state, and local regulations.
Other Information	Avoid release to the surrounding environment.

UN Number	Not applicable
UN Shipping Name	Not applicable
Transport Hazard Class(es)	Not applicable
Packing Group	Not applicable
Environmental Hazards	Not applicable
Transport in Bulk	Not applicable
Other Precautions	Not applicable

SECTION 15: REGULATORY INFORMATION

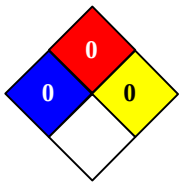
Potassium Hydroxide (1310-58-3)
Listed on the United States TSCA (Toxic Substances Control Act) inventory
Disodium EDTA Dihydrate (6381-92-6)
Listed on the United States TSCA (Toxic Substances Control Act) inventory
Water (7732-18-5)
Listed on the United States TSCA (Toxic Substances Control Act) inventory
Potassium Carbonate (584-08-7)
Listed on the United States TSCA (Toxic Substances Control Act) inventory
Potassium Borate (1332-77-0)
Listed on the United States TSCA (Toxic Substances Control Act) inventory
Bromphenol Blue, Sodium Salt (62625-28-9)
Listed on the United States TSCA (Toxic Substances Control Act) inventory
Bromcresol Green, Sodium Salt (62625-32-5)
Listed on the United States TSCA (Toxic Substances Control Act) inventory

SECTION 16: OTHER INFORMATION

Revision Date: 12/10/2014

NFPA Hazards

Health Hazard	0: Exposure under fire conditions would offer no hazard beyond that of ordinary combustible materials.
Fire Hazard	0: Materials that will not burn.
Instability/Reactivity	0: Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health	0: No significant risk to health.
Flammability	0: Materials that will not burn.
Physical Hazard	0: Materials that are normally stable.
Personal Protection	A

YSI 3821	
Health	0
Flammability	0
Physical Hazard	0
Personal Protection	A

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END OF SAFETY DATA SHEET

SAFETY DATA SHEET

Issuing Date January 5, 2015 **Revision Date** New **Revision Number** 0

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND OF THE COMPANY/UNDERTAKING

Product identifier

Product Name **Clorox Commercial Solutions® Clorox® Disinfecting Wipes - Fresh Scent**

Other means of identification

EPA Registration Number 67619-9

Recommended use of the chemical and restrictions on use

Recommended use Moistened disinfecting wipes

Uses advised against No information available

Details of the supplier of the safety data sheet

Supplier Address
Clorox Professional Products Company
1221 Broadway
Oakland, CA 94612

Phone: 1-510-271-7000

Emergency telephone number

Emergency Phone Numbers For Medical Emergencies call: 1-800-446-1014
For Transportation Emergencies, call Chemtrec: 1-800-424-9300

2. HAZARDS IDENTIFICATION

Classification

This product is not considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

GHS Label elements, including precautionary statements

Emergency Overview

This product is not considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200).

Appearance Clear, colorless liquid absorbed into white, non-woven wipes | **Physical State** Thin liquid absorbed into non-woven wipes | **Odor** Fruity, apple, floral

Precautionary Statements - Prevention
None

Precautionary Statements - Response
None

Precautionary Statements - Storage
None

Precautionary Statements - Disposal
None

Hazards not otherwise classified (HNOC)
Not applicable

Unknown Toxicity
21.5% of the mixture consists of ingredient(s) of unknown toxicity

Other information
No information available

Interactions with Other Chemicals
No information available.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical Name	CAS No.	Weight %	Trade Secret
Ethylene glycol monohexyl ether	112-25-4	1 - 5	*
n-Alkyl (68% C12, 32% C14) dimethyl ethylbenzyl ammonium chloride	85409-23-0	0.1 - 0.2	*
n-Alkyl (5% C12, 60% C14, 30% C16, 5% C18) dimethyl benzyl ammonium chloride	53516-76-0	0.1 - 0.2	*

* The exact percentage (concentration) of composition has been withheld as a trade secret.

4. FIRST AID MEASURES

First aid measures

General Advice Show this safety data sheet to the doctor in attendance.

Eye Contact Hold eye open and rinse slowly and gently with water for 15 - 20 minutes. If present, remove contact lenses after the first 5 minutes of rinsing, then continue rinsing eye. Call a poison control center or doctor for further treatment advice.

Skin Contact Rinse skin with plenty of water. If irritation persists, call a doctor.

Inhalation Move to fresh air. If breathing problems develop, call a doctor.

Ingestion Drink a glassful of water. Call a doctor or poison control center.

Most important symptoms and effects, both acute and delayed

Most Important Symptoms and Effects Liquid may cause eye irritation.

Indication of any immediate medical attention and special treatment needed

Notes to Physician Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media
Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.

Unsuitable Extinguishing Media
CAUTION: Use of water spray when fighting fire may be inefficient.

Specific Hazards Arising from the Chemical

Hazardous Combustion Products
Oxides of carbon.

Explosion Data

Sensitivity to Mechanical Impact No.

Sensitivity to Static Discharge No.

Protective equipment and precautions for firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures

Personal Precautions Avoid contact with eyes.

Other Information Refer to protective measures listed in Sections 7 and 8.

Environmental precautions

Environmental Precautions See Section 12 for additional ecological information.

Methods and material for containment and cleaning up

Methods for Containment Prevent further leakage or spillage if safe to do so.

Methods for Cleaning Up Containerize. Wash residual down to sanitary sewer. Contact the sanitary treatment facility in advance to assure ability to process washed-down material.

7. HANDLING AND STORAGE

Precautions for safe handling

Handling Handle in accordance with good industrial hygiene and safety practice. Avoid contact with eyes, skin, and clothing. Do not eat, drink, or smoke when using this product.

Conditions for safe storage, including any incompatibilities

Storage Keep containers tightly closed in a dry, cool, and well-ventilated place.

Incompatible Products None known.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines

Chemical Name	ACGIH TLV	OSHA PEL	NIOSH IDLH
Ethylene glycol monohexyl ether 112-25-4	None	None	None
n-Alkyl (68% C12, 32% C14) dimethyl ethylbenzyl ammonium chloride 85409-23-0	None	None	None
n-Alkyl (5% C12, 60% C14, 30% C16, 5% C18) dimethyl benzyl ammonium chloride 53516-76-0	None	None	None

ACGIH TLV: American Conference of Governmental Industrial Hygienists - Threshold Limit Value. OSHA PEL: Occupational Safety and Health Administration - Permissible Exposure Limits. NIOSH IDLH: Immediately Dangerous to Life or Health.

Appropriate engineering controls

Engineering Measures	Showers Eyewash stations Ventilation systems

Individual protection measures, such as personal protective equipment

Eye/Face Protection	No special protective equipment required.
Skin and Body Protection	No special protective equipment required.
Respiratory Protection	No protective equipment is needed under normal use conditions. If irritation is experienced, ventilation and evacuation may be required.
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.

9. PHYSICAL AND CHEMICAL PROPERTIES

Physical and Chemical Properties

Physical State	Thin liquid absorbed into non-woven wipes		
Appearance	Clear liquid absorbed into non-woven wipes	**Odor**	Fruity, apple, floral
Color	Colorless liquid - white non-woven wipes	**Odor Threshold**	No information available

Property	**Values**	**Remarks/ Method**
pH	6 - 9 (liquid)	None known
Melting/freezing point	No data available	None known
Boiling point / boiling range	No data available	None known
Flash Point	No data available	None known
Evaporation rate	No data available	None known
Flammability (solid, gas)	No data available	None known
Flammability Limits in Air		
Upper flammability limit	No data available	None known
Lower flammability limit	No data available	None known
Vapor pressure	No data available	None known
Vapor density	No data available	None known
Specific Gravity	~1.0 (liquid)	None known
Water Solubility	Complete (liquid)	None known
Solubility in other solvents	No data available	None known
Partition coefficient: n-octanol/water	No data available	None known
Autoignition temperature	No data available	None known
Decomposition temperature	No data available	None known
Kinematic viscosity	No data available	None known
Dynamic viscosity	No data available	None known
Explosive Properties	Not explosive	
Oxidizing Properties	No data available	

Other Information

Softening Point	No data available
VOC Content (%)	No data available
Particle Size	No data available
Particle Size Distribution	No data available

10. STABILITY AND REACTIVITY

Reactivity

No data available.

Chemical stability
Stable under recommended storage conditions.

Possibility of Hazardous Reactions
None under normal processing.

Conditions to avoid
None known based on information supplied.

Incompatible materials
None known.

Hazardous Decomposition Products
None known.

11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure

Product Information .

Inhalation Exposure to vapor or mist may irritate respiratory tract.

Eye Contact Liquid may cause irritation.

Skin Contact Liquid may cause slight irritation.

Ingestion Ingestion of liquid may cause slight irritation to mucous membranes and gastrointestinal tract.

Component Information

Chemical Name	LD50 Oral	LD50 Dermal	LC50 Inhalation
Ethylene glycol monohexyl ether 112-25-4	739 mg/kg (Rat)	721 mg/kg (Rabbit)	>0.5 mg/L (Rat, 4 h)

Information on toxicological effects

Symptoms Liquid may cause redness and tearing of eyes.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Sensitization No information available.

Mutagenic Effects No information available.

Carcinogenicity None of the ingredients in this product are on the IARC, OSHA, or NTP carcinogen lists.

Reproductive Toxicity No information available.

STOT - single exposure No information available.

STOT - repeated exposure No information available.
Chronic Toxicity No known effect based on information supplied.
Target Organ Effects Respiratory system, eyes, skin, gastrointestinal tract (GI).

Aspiration Hazard No information available.

Numerical measures of toxicity - Product Information

ATEmix (oral)
40.1 g/kg

ATEmix (dermal)
59.8 g/kg

12. ECOLOGICAL INFORMATION

Ecotoxicity
No information available.

Persistence and Degradability
No information available.

Bioaccumulation
No information available.

Other adverse effects
No information available.

13. DISPOSAL CONSIDERATIONS

Disposal methods
Dispose of in accordance with all applicable federal, state, and local regulations.

Contaminated Packaging
Do not reuse empty containers. Dispose of in accordance with all applicable federal, state, and local regulations.

14. TRANSPORT INFORMATION

DOT Not regulated.

TDG Not regulated.

ICAO Not regulated.

IATA Not regulated

IMDG/IMO Not regulated

15. REGULATORY INFORMATION

Chemical Inventories

TSCA All components of this product are either on the TSCA 8(b) Inventory or otherwise exempt from listing.

DSL/NDSL All components are on the DSL or NDSL.

TSCA - United States Toxic Substances Control Act Section 8(b) Inventory
DSL/NDSL - Canadian Domestic Substances List/Non-Domestic Substances List

U.S. Federal Regulations

SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product contains a chemical which is subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372.

Chemical Name	CAS No.	Weight %	Threshold Value (%)
Ethylene glycol monohexyl ether	112-25-4	1 - 5	1.0

SARA 311/312 Hazard Categories

Acute Health Hazard	No
Chronic Health Hazard	No
Fire Hazard	No
Sudden Release of Pressure Hazard	No
Reactive Hazard	No

CWA (Clean Water Act)
This product does not contain any substances that are regulated pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA
This product does not contain any substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material.

EPA Statement
This chemical is a pesticide product registered by the Environmental Protection Agency and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the classification criteria and hazard information required for safety data sheets and for workplace labels of non-pesticide chemicals. Following is the hazard information as required on the pesticide label:

> **CAUTION:** Causes moderate eye irritation. Avoid contact with eyes or clothing. Wash thoroughly with soap and water after handling. Wear gloves for prolonged or frequent use.

US State Regulations

California Proposition 65
This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations

Chemical Name	New Jersey	Massachusetts	Pennsylvania	Rhode Island	Illinois
Ethylene glycol monohexyl ether 112-25-4			X	X	X
Isopropyl alcohol 67-63-0	X	X	X	X	

International Regulations

Canada
WHMIS Hazard Class
D2B Toxic materials



16. OTHER INFORMATION

NFPA	**Health Hazard**	1	**Flammability**	0	**Instability**	0	**Physical and Chemical Hazards** -
HMIS	**Health Hazard**	1	**Flammability**	0	**Physical Hazard**	0	**Personal Protection** A

Prepared By
Product Stewardship
23 British American Blvd.
Latham, NY 12110
1-800-572-6501

Preparation/Revision Date January 5, 2015

Revision Note New

Reference 1102043/174189.002

General Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information, and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal, and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

End of Safety Data Sheet

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Section 1 - Product and Company Identification

Product Identifiers:

Product name:	**Repel Insect Repellent Sportsmen Max Formula 40% DEET**
EPA reg. number:	305-46
Recommended product use:	Insect Repellent - Aerosol

Details of the Supplier of the Safety Data Sheet:

Manufacturer/Supplier:	Chemsico Div. of United Industries Corp. P.O. Box 142642 St. Louis, MO 63114
For product information:	1-800-880-1181
For medical emergencies:	1-800-633-2873

Section 2 - Hazards Identification

Conforms to Hazard Communication Standard 29 CFR 1910.1200.

GHS Classification of Substance or Mixture: Flammable aerosol - Category 2

GHS Label Elements:

Hazard pictogram(s):



Signal word: WARNING

Hazard statements:

- Flammable aerosol
- Compressed gas – contents under pressure; may burst if heated
- Causes eye irritation
- Harmful if swallowed
- May cause an allergic skin reaction

Precautionary Statements:

- Contents under pressure.
- Do not use or store near heat or open flame.
- Do not puncture or incinerate container.
- Exposure to temperatures above 130°F may cause bursting.
- If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention.
- Wash hands with soap and water after handling. Do not eat, drink or smoke when using this product. If swallowed: Call a poison control center or doctor for treatment advice if you feel unwell. Rinse mouth.
- If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash before reuse.

Section 3 - Composition / Information on Ingredients

Chemical Name	CAS#	Weight Percent
DEET (N,N-Diethyl-m-toluamide)	134-62-3	40.0%
Ethanol	64-17-5	20.0%
Isobutane	75-28-5	10.0%

Note: Ingredients not identified are proprietary or non-hazardous. Values are not product specifications.

Section 4 - First Aid Measures

Eye contact: Hold eye open and rinse slowly and gently with water for 15-20 minutes. Remove contact lenses, if present, after the first 5 minutes, then continue rinsing. Call a poison control center or doctor for treatment advice.

Skin contact: After returning indoors, wash treated skin with soap and water. Discontinue use if irritation or rash occurs.

Inhalation: No special requirements

Ingestion: Call a poison control center or doctor immediately for treatment advice. Have person sip if able to swallow. Do not induce vomiting unless told to do so by a poison control center or doctor. Do not give anything by mouth to an unconscious person.

Note to Physician: None

General advice: If you feel unwell, seek medical advice (show the label where possible). Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Keep out of reach of children.

Section 5 - Fire Fighting Measures

Flammable properties: Pressurized aerosol container

NFPA classification: NFPA level 1 aerosol

Suitable extinguishing media: Water fog, foam, CO_2, dry chemical

Unsuitable extinguishing media: Not available

Specific hazards arising from the chemical: Contents under pressure – container may burst in heat of fire.

Protective equipment for firefighters: Firefighters should wear full protective clothing including self-contained breathing apparatus.

Hazardous combustion products: None known

Explosion data: Not available

Sensitivity to static discharge: Not available

Personal precautions: Keep unnecessary personnel away. Do not touch or walk through spilled material.

Section 6 - Accidental Release Measures

Personnel precautions: Remove all sources of ignition. Wear personnel protective equipment as recommended in Section 8. Wash thoroughly after handling.

For emergency responders: If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials.

Environmental precautions: Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Methods for containment and cleaning up: Stop leak if without risk. Move containers from spill area. Before attempting clean up, refer to hazard data given above. Small spills may be absorbed with earth, sand or absorbent material swept up and placed in suitable, covered, and labeled containers. Prevent large spills from entering sewers or waterways. Contact emergency services and supplier for advice. Never return spills in original containers for re-use.

Section 7 - Handling and Storage

Precautions for safe handling: Put on appropriate personal protective equipment as recommended in Section 8. Pressurized container: protect from sunlight and do not expose to temperatures exceeding 50°C (122°F). Do not pierce or burn, even after use. Do not ingest. Avoid contact with skin, eyes and clothing. Avoid breathing vapor or mist. Use only with adequate ventilation. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical equipment. Use only non-sparking tools. Empty containers retain product residue and can be hazardous.

Storage: Store in a cool, dry area away from open flame. Do not store above 50°C (122°F).

Section 8 - Exposure Controls / Personal Protection

Exposure guidelines:

Components with Occupational Exposure Limits							
		Exposure Limits					
		OSHA PEL		ACGIH TLV		SupplierOEL	
Chemical name		**ppm**	**mg/m³**	**ppm**	**mg/m³**	**ppm**	**mg/m³**
DEET	TWA	None		None		None	
Ethanol	TWA	1000	1900	1000	------	1000	1900
Isobutane	TWA	Not established		1000	------	Not established	

Engineering controls: General ventilation normally adequate.

Personal protective equipment:

Eye/Face protection: During application, prevent entry into eyes. Wear safety glasses with side shields if using in large applications.

Skin and body protection:	After returning indoors, wash treated skin with soap and water.
Respiratory protection:	Where exposure guideline levels may be exceeded, use an approved NIOSH respirator.
General hygiene considerations:	Handle in accordance with good industrial hygiene and safety practices. When using, do not eat or drink. Wash hands before breaks and immediately after handling the product.

Section 9 - Physical & Chemical Properties

Appearance:	Clear
Color:	Colorless to pale yellow
Physical state:	Pressurized liquid
Odor:	Ethanol & DEET
Odor threshold:	No data available
pH:	8.3 (liquid portion)
Melting point:	No data available
Freezing point:	No data available
Boiling point:	No data available
Flash point:	85°F (liquid portion)
Flame Extension	18" (level 1 aerosol)
Flammability limits in air, lower, % by volume:	No data available
Flammability limits in air, upper, % by volume:	No data available
Vapor pressure:	No data available
Vapor density:	No data available
Relative density @ 20°C:	0.922 (liquid portion)
Octanol/water coefficient:	No data available
Auto-ignition temperature:	No data available
Decomposition temperature:	No data available
Solubility:	Miscible in water
Evaporation rate:	No data available
% Volatile organic compounds:	30.2

Section 10 - Chemical Stability & Reactivity Information

Reactivity

Conditions to avoid:	Do not mix with other chemicals.
Incompatible materials:	Avoid strong oxidizers.

Chemical stability

Product stability:	Stable under recommended storage conditions.

Other

Hazardous decomposition products: None known

Possibility of hazardous reactions: Hazardous polymerization does not occur.

Section 11 - Toxicological Information

Primary eye irritation: Causes substantial but temporary eye injury (EPA tox. category II)

Primary skin irritation: Non-irritating (EPA tox. category IV)

Acute dermal: LD_{50} > 5000 mg/kg (EPA tox. category IV)

Acute inhalation: LC_{50} > 2 mg/L (EPA tox. category IV)

Acute oral: LD_{50} > 2000 mg/kg (EPA tox. category III)

Sensitization: Not a skin sensitizer.

Chronic effects/ Carcinogenicity: No data available

Mutagenicity: No data available

Reproductive effects: No data available

Teratogenicity: No data available

Ecotoxicity: No data available

Section 12 - Ecological Information

Environmental effects: No data available

Aquatic toxicity: None

Persistence / degradability: No data available

Bioaccumulation / accumulation: No data available

Partition coefficient: No data available

Mobility in environmental media: No data available

Chemical fate information: No data available

Section 13 - Disposal Considerations

Waste codes: Not available

Disposal instructions: Dispose in accordance with all applicable regulations.

Waste from residues / unused products: Not available

Contaminated packaging: Not available

Section 14 - Transportation Information

U.S. Department of Transportation (DOT): UN-1950, Aerosols, Flammable, 2.1, Limited Quantity

IATA: UN-1950, Aerosols, 2.1

IMDG: UN-1950, Aerosols, Flammable, Limited Quantity

Section 15 - Regulatory Information

29 CFR 1910.1200 hazardous chemical Occupational Safety and Health Administration (OSHA): No

CERCLA (Superfund) reportable quantity: Not available

Hazard categories

Superfund Amendments and Reauthorization Act of 1986 (SARA):

Immediate Hazard	No
Delayed Hazard	No
Fire Hazard	No
Pressure Hazard	No
Reactivity Hazard	No

Section 302 extremely hazardous Substance: No

Section 311 hazardous chemical: No

Clean Air Act (CAA): Not available

Clean Water Act (CWA): Not available

State regulations:

FIFRA labeling: This chemical is a pesticide product registered by the Environmental Protection Agency and is subject to certain labeling requirements under federal pesticide law. These requirements differ from the classification criteria and hazard information required for safety data sheets, and for workplace non-pesticide chemicals. Following is the hazard information as required on the pesticide label:

Signal word: CAUTION

Precautionary statements: Causes substantial but temporary eye injury. Do not get in eyes. Harmful if swallowed. Use of this product may cause skin reactions in rare cases. Wash hands before eating, drinking, chewing gum, using tobacco or using the toilet.

FLAMMABLE. Contents under pressure. Keep away from heat, sparks and open flame. Do not puncture or incinerate container. Exposure to temperatures above 130°F may cause bursting. Do not apply to synthetic fabrics such as acetate, rayon or spandex. Will not damage cotton, wool or nylon. May damage furniture finishes, leather, plastics and painted and varnished surfaces, including watch crystals, guns, bows and automobiles.

Notification status: All ingredients of this product are listed or are excluded from listing on the U.S. Toxic Substances Control Act (TSCA) Chemical Substance Inventory.

California Prop. 65: This product does not contain any chemicals known to the state of California to cause cancer, birth defects or any other reproductive harm.

Disclaimer: Information contained herein was obtained from sources considered technically accurate and reliable. While every effort has been made to ensure full disclosure of product hazards, in some cases data is not available and is so stated. Since conditions of actual product use are beyond control of the supplier, it is assumed that users of this material have been fully trained according to the requirements of all applicable legislation and regulatory instruments. No warranty, expressed or implied, is made and supplier will not be liable for any losses, injuries or

consequential damages which may result from the use of or reliance on any information contained in this document.

Section 16 - Other Information

HMIS ratings:	Health Hazard 1 Flammability 3 Physical Hazard 0
Item numbers:	HG-33801; HG-83801; HG-94102
Issue date:	2/22/2016
Prepared by:	WPC Brands, Inc. P.O. Box 4406 Bridgeton, MO 63044-0406 (800) 242-1166

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Safety Data Sheet

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY/UNDERTAKING

Material Name	:	**Diesel (ULSD/Gasoil)**
Recommended Use / Restrictions of Use	:	Fuel for on-road diesel-powered engines. Fuel for use in off-road diesel engines, boilers, gas turbines and other combustion equipment.
Supplier	:	**Shell Eastern Trading (PTE) Ltd** 9 North Buona Vista Drive, #07-01, Tower 1, The Metropolis Singapore 138588 Singapore
Telephone	:	+65-6384 8000
Emergency Telephone Number	:	+44 (0) 151 350 4595

2. HAZARDS IDENTIFICATION

GHS Classification	:	Flammable liquids, Category 3 Aspiration hazard, Category 1 Acute toxicity, Category 4, Inhalation Skin corrosion/irritation, Category 2 Carcinogenicity, Category 2 Specific target organ toxicity - repeated exposure, Category 2, Blood., Thymus., Liver Hazardous to the aquatic environment - Long-term Hazard, Category 2 Acute hazards to the aquatic environment, Category 2
GHS Label Elements Symbol(s)	:	
Signal Words	:	Danger
Hazard Statement	:	PHYSICAL HAZARDS: H226: Flammable liquid and vapour. HEALTH HAZARDS:

H304: May be fatal if swallowed and enters airways.
H315: Causes skin irritation.
H332: Harmful if inhaled.
H351: Suspected of causing cancer.
H373: May cause damage to organs or organ systems through prolonged or repeated exposure.

ENVIRONMENTAL HAZARDS:
H411: Toxic to aquatic life with long lasting effects.
H401: Toxic to aquatic life.

GHS Precautionary Statements

Prevention : P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
P261: Avoid breathing dust/fume/gas/mist/vapours/spray.
P280: Wear protective gloves/protective clothing/eye protection/face protection.

Response : P301+P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
P331: Do NOT induce vomiting.

Disposal: : P501: Dispose of contents and container to appropriate waste site or reclaimer in accordance with local and national regulations.

Other Hazards which do not result in classification : Vapour in the headspace of tanks and containers may ignite and explode at temperatures exceeding auto-ignition temperature, where vapour concentrations are within the flammability range.
May ignite on surfaces at temperatures above auto-ignition temperature.
This material is a static accumulator. Even with proper grounding and bonding, this material can still accumulate an electrostatic charge. If sufficient charge is allowed to accumulate, electrostatic discharge and ignition of flammable air-vapour mixtures can occur.

Additional Information : This product is intended for use in closed systems only.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Mixture Description : Complex mixture of hydrocarbons consisting of paraffins, cycloparaffins, aromatic and olefinic hydrocarbons with carbon

numbers predominantly in the C9 to C25 range. May also contain several additives at <0.1% v/v each. May contain cetane improver (Ethyl Hexyl Nitrate) at <0.2% v/v.

May contain catalytically cracked oils in which polycyclic aromatic compounds, mainly 3-ring but some 4- to 6-ring species are present.

Classification of components according to GHS

Chemical Identity	Synonyms	CAS	Hazard Class (category)	Hazard Statement	Conc.
Fuels, diesel	Fuels, diesel	68334-30-5	Flam. Liq., 3; Asp. Tox., 1; Acute Tox., 4; Skin Corr., 2; Carc., 2; STOT RE, 2; Aquatic Chronic, 2; Aquatic Acute, 2;	H226; H304; H332; H315; H351; H373; H411; H401;	60.00 - 100.00 %
Distillates (Fischer-Tropsch) C8-26 - Branched and Linear	Distillates (Fischer-Tropsch) C8-26 - Branched and Linear	848301-67-7	Asp. Tox., 1; Flam. Liq., 4;	H304; H227;	0.00 - 30.00 %
Kerosine (Fischer Tropsch), Full range, C8-C16 branched and linear alkanes	Kerosine (Fischer Tropsch), Full range, C8-C16 branched and linear alkanes	848301-66-6	Asp. Tox., 1; Flam. Liq., 3;	H304; H226;	0.00 - 10.00 %

Additional Information : Dyes and markers can be used to indicate tax status and prevent fraud. Contains Cumene, CAS# 98-82-8 Contains Naphthalene, CAS # 91-20-3.

Refer to Ch 16 for full text of H phrases.

4. FIRST-AID MEASURES

Inhalation : Remove to fresh air. If rapid recovery does not occur, transport to nearest medical facility for additional treatment.

Skin Contact : Remove contaminated clothing. Immediately flush skin with

		large amounts of water for at least 15 minutes, and follow by washing with soap and water if available. If redness, swelling, pain and/or blisters occur, transport to the nearest medical facility for additional treatment. When using high pressure equipment, injection of product under the skin can occur. If high pressure injuries occur, the casualty should be sent immediately to a hospital. Do not wait for symptoms to develop.
Eye Contact	:	Flush eye with copious quantities of water. If persistent irritation occurs, obtain medical attention.
Ingestion	:	If swallowed, do not induce vomiting: transport to nearest medical facility for additional treatment. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. If any of the following delayed signs and symptoms appear within the next 6 hours, transport to the nearest medical facility: fever greater than 101° F (38.3°C), shortness of breath, chest congestion or continued coughing or wheezing. Give nothing by mouth.
Most Important Symptoms/Effects, Acute & Delayed	:	If material enters lungs, signs and symptoms may include coughing, choking, wheezing, difficulty in breathing, chest congestion, shortness of breath, and/or fever. The onset of respiratory symptoms may be delayed for several hours after exposure. Skin irritation signs and symptoms may include a burning sensation, redness, or swelling.
Immediate medical attention, special treatment	:	Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Clear fire area of all non-emergency personnel.

Specific hazards arising from Chemicals	:	Hazardous combustion products may include: A complex mixture of airborne solid and liquid particulates and gases (smoke). Oxides of sulphur. Unidentified organic and inorganic compounds. Carbon monoxide may be evolved if incomplete combustion occurs. Will float and can be reignited on surface water. Flammable vapours may be present even at temperatures below the flash point. The vapour is heavier than air, spreads along the ground and distant ignition is possible.
Suitable Extinguishing Media	:	Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
Unsuitable Extinguishing Media	:	Do not use direct water jets on the burning product as they could cause a steam explosion and spread of the fire. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.

Protective Equipment & Precautions for Fire Fighters	:	Proper protective equipment including chemical resistant gloves are to be worn; chemical resistant suit is indicated if large contact with spilled product is expected. Self-Contained Breathing Apparatus must be worn when approaching a fire in a confined space. Select fire fighter's clothing approved to relevant Standards (e.g. Europe: EN469).
Additional Advice	:	Keep adjacent containers cool by spraying with water. If possible remove containers from the danger zone. If the fire cannot be extinguished the only course of action is to evacuate immediately. Contain residual material at affected sites to prevent material from entering drains (sewers), ditches, and waterways.

6. ACCIDENTAL RELEASE MEASURES

Avoid contact with spilled or released material. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. See Chapter 13 for information on disposal. Observe the relevant local and international regulations. Evacuate the area of all non-essential personnel. Ventilate contaminated area thoroughly. Take precautionary measures against static discharges.

Personal Precautions, Protective Equipment and Emergency Procedures	:	Do not breathe fumes, vapour. Do not operate electrical equipment. Shut off leaks, if possible without personal risks. Remove all possible sources of ignition in the surrounding area and evacuate all personnel. Attempt to disperse the gas or to direct its flow to a safe location for example by using fog sprays. Take precautionary measures against static discharge. Ensure electrical continuity by bonding and grounding (earthing) all equipment. Monitor area with combustible gas meter.
Environmental Precautions	:	Take measures to minimise the effects on groundwater. Contain residual material at affected sites to prevent material from entering drains (sewers), ditches, and waterways. Prevent from spreading or entering into drains, ditches or rivers by using sand, earth, or other appropriate barriers.
Methods and Material for Containment and Cleaning Up	:	Take precautionary measures against static discharges. For small liquid spills (< 1 drum), transfer by mechanical means to a labelled, sealable container for product recovery or safe disposal. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely. Remove contaminated soil and dispose of safely. For large liquid spills (> 1 drum), transfer by mechanical means such as vacuum truck to a salvage tank for recovery or safe disposal. Do not flush away residues with water. Retain as contaminated waste. Allow residues to evaporate or soak up with an appropriate

absorbent material and dispose of safely. Remove contaminated soil and dispose of safely. Shovel into a suitable clearly marked container for disposal or reclamation in accordance with local regulations.

Additional Advice : Notify authorities if any exposure to the general public or the environment occurs or is likely to occur. Local authorities should be advised if significant spillages cannot be contained. Maritime spillages should be dealt with using a Shipboard Oil Pollution Emergency Plan (SOPEP), as required by MARPOL Annex 1 Regulation 26.

7. HANDLING AND STORAGE

General Precautions : Avoid breathing vapours or contact with material. Only use in well ventilated areas. Wash thoroughly after handling. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for safe handling, storage and disposal of this material. Air-dry contaminated clothing in a well-ventilated area before laundering. Prevent spillages. Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols. Never siphon by mouth. Contaminated leather articles including shoes cannot be decontaminated and should be destroyed to prevent reuse.
Maintenance and Fuelling Activities - Avoid inhalation of vapours and contact with skin.

Precautions for Safe Handling : Avoid inhaling vapour and/or mists. Avoid prolonged or repeated contact with skin. When using do not eat or drink. Extinguish any naked flames. Do not smoke. Remove ignition sources. Avoid sparks. Earth all equipment. Properly dispose of any contaminated rags or cleaning materials in order to prevent fires. Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols. The vapour is heavier than air, spreads along the ground and distant ignition is possible.

Conditions for Safe Storage : Drum and small container storage: Drums should be stacked to a maximum of 3 high. Use properly labelled and closeable containers. Tank storage: Tanks must be specifically designed for use with this product. Bulk storage tanks should be diked (bunded). Locate tanks away from heat and other sources of ignition. Must be stored in a diked (bunded) well-ventilated area, away from sunlight, ignition sources and other sources of heat. Vapours from tanks should not be released to

atmosphere. Breathing losses during storage should be controlled by a suitable vapour treatment system. The vapour is heavier than air. Beware of accumulation in pits and confined spaces. Keep container tightly closed and in a cool, well-ventilated place. Keep in a cool place. Electrostatic charges will be generated during pumping. Electrostatic discharge may cause fire. Ensure electrical continuity by bonding and grounding (earthing) all equipment to reduce the risk. The vapours in the head space of the storage vessel may lie in the flammable/explosive range and hence may be flammable. Refer to section 15 for any additional specific legislation covering the packaging and storage of this product. Keep in a bunded area with a sealed (low permeability) floor, to provide containment against spillage. Prevent ingress of water.

Product Transfer : Avoid splash filling. Wait 2 minutes after tank filling (for tanks such as those on road tanker vehicles) before opening hatches or manholes. Wait 30 minutes after tank filling (for large storage tanks) before opening hatches or manholes. Keep containers closed when not in use. Contamination resulting from product transfer may give rise to light hydrocarbon vapour in the headspace of tanks that have previously contained gasoline. This vapour may explode if there is a source of ignition. Partly filled containers present a greater hazard than those that are full, therefore handling, transfer and sampling activities need special care. Even with proper grounding and bonding, this material can still accumulate an electrostatic charge. If sufficient charge is allowed to accumulate, electrostatic discharge and ignition of flammable air-vapour mixtures can occur. Be aware of handling operations that may give rise to additional hazards that result from the accumulation of static charges. These include but are not limited to pumping (especially turbulent flow), mixing, filtering, splash filling, cleaning and filling of tanks and containers, sampling, switch loading, gauging, vacuum truck operations, and mechanical movements. These activities may lead to static discharge e.g. spark formation. Restrict line velocity during pumping in order to avoid generation of electrostatic discharge (<= 1 m/s until fill pipe submerged to twice its diameter, then <= 7 m/s). Avoid splash filling. Do NOT use compressed air for filling, discharging, or handling operations.

Recommended Materials : For containers, or container linings use mild steel, stainless steel. Aluminium may also be used for applications where it does not present an unnecessary fire hazard. Examples of suitable materials are: high density polyethylene (HDPE) and Viton (FKM), which have been specifically tested for compatibility with this product. For container linings, use

amine-adduct cured epoxy paint. For seals and gaskets use: graphite, PTFE, Viton A, Viton B.

Unsuitable Materials : Some synthetic materials may be unsuitable for containers or container linings depending on the material specification and intended use. Examples of materials to avoid are: natural rubber (NR), nitrile rubber (NBR), ethylene propylene rubber (EPDM), polymethyl methacrylate (PMMA), polystyrene, polyvinyl chloride (PVC), polyisobutylene. However, some may be suitable for glove materials.

Container Advice : Containers, even those that have been emptied, can contain explosive vapours. Do not cut, drill, grind, weld or perform similar operations on or near containers.

Other Advice : Ensure that all local regulations regarding handling and storage facilities are followed. See additional references that provide safe handling practices for liquids that are determined to be static accumulators: American Petroleum Institute 2003 (Protection Against Ignitions Arising out of Static, Lightning and Stray Currents) or National Fire Protection Agency 77 (Recommended Practices on Static Electricity). CENELEC CLC/TR 50404 (Electrostatics – Code of practice for the avoidance of hazards due to static electricity).

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

If the American Conference of Governmental Industrial Hygienists (ACGIH) value is provided on this document, it is provided for information only.

Occupational Exposure Limits

Material	Source	Type	ppm	mg/m3	Notation
Naphthalene	ACGIH	TWA	10 ppm		
	ACGIH	STEL	15 ppm		
	ACGIH	SKIN_DES			Can be absorbed through the skin.
	SG OEL	TWA	10 ppm	52 mg/m3	
	SG OEL	STEL	15 ppm	79 mg/m3	

Fuels, diesel	ACGIH	SKIN_DES(Inhalable fraction and vapor.)			Can be absorbed through the skin.as total hydrocarbons
	ACGIH	TWA(Inhalable fraction and vapor.)		100 mg/m3	as total hydrocarbons
Cumene	ACGIH	TWA	50 ppm		
	SG OEL	TWA	50 ppm	246 mg/m3	

Additional Information : Skin notation means that significant exposure can also occur by absorption of liquid through the skin and of vapour through the eyes or mucous membranes.

Biological Exposure Index (BEI)

Material	Determinant	Sampling Time	BEI	Reference
Naphthalene	1-Naphthol, with hydrolysis + 2-Naphthol, with hydrolysis	Sampling time: End of shift.		ACGIH BEL (02 2013)

Appropriate Engineering Controls : The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include: Use sealed systems as far as possible. Adequate explosion-proof ventilation to control airborne concentrations below the exposure guidelines/limits. Local exhaust ventilation is recommended. Eye washes and showers for emergency use. Always observe good personal hygiene measures, such as washing hands after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping. Define procedures for safe handling and maintenance of controls.

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		Educate and train workers in the hazards and control measures relevant to normal activities associated with this product. Ensure appropriate selection, testing and maintenance of equipment used to control exposure, e.g. personal protective equipment, local exhaust ventilation. Firewater monitors and deluge systems are recommended. Drain down system prior to equipment break-in or maintenance. Retain drain downs in sealed storage pending disposal or for subsequent recycle.
Individual Protection Measures	:	Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers.
Respiratory Protection	:	If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation. Check with respiratory protective equipment suppliers. Where air-filtering respirators are suitable, select an appropriate combination of mask and filter. Where air-filtering respirators are unsuitable (e.g. airborne concentrations are high, risk of oxygen deficiency, confined space) use appropriate positive pressure breathing apparatus. All respiratory protection equipment and use must be in accordance with local regulations. Select a filter suitable for combined particulate/organic gases and vapours [boiling point >65°C(149 °F)].
Hand Protection	:	Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturizer is recommended. Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced. For continuous contact we recommend gloves with breakthrough time of more than 240 minutes with preference for > 480 minutes where suitable gloves can be identified. For short-term/splash protection we recommend the same, but recognise that suitable gloves offering this level of protection may not be available and in this case a lower breakthrough time may be acceptable so long as appropriate maintenance and replacement regimes are followed. Glove thickness is not a good predictor of glove resistance to a chemical as it is dependent on the exact composition of the glove material. Select gloves tested to a relevant standard (e.g. Europe EN374, US F739). When prolonged or frequent repeated contact occurs, Nitrile gloves may be suitable. (Breakthrough

		time of > 240 minutes.) For incidental contact/splash protection Neoprene, PVC gloves may be suitable.
Eye Protection	:	Chemical splash goggles (chemical monogoggles). If a local risk assessment deems it so, then chemical splash goggles may not be required and safety glasses may provide adequate eye protection.
Protective Clothing	:	Chemical resistant gloves/gauntlets, boots, and apron (where risk of splashing).
Thermal Hazards	:	Not applicable.
Monitoring Methods	:	Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate. Validated exposure measurement methods should be applied by a competent person and samples analysed by an accredited laboratory. Examples of sources of recommended exposure measurement methods are given below or contact the supplier. Further national methods may be available. National Institute of Occupational Safety and Health (NIOSH), USA: Manual of Analytical Methods http://www.cdc.gov/niosh/ Occupational Safety and Health Administration (OSHA), USA: Sampling and Analytical Methods http://www.osha.gov/
Environmental Exposure Controls	:	Local guidelines on emission limits for volatile substances must be observed for the discharge of exhaust air containing vapour. Information on accidental release measures are to be found in section 6. Take appropriate measures to fulfil the requirements of relevant environmental protection legislation. Avoid contamination of the environment by following advice given in Chapter 6. If necessary, prevent undissolved material from being discharged to waste water. Waste water should be treated in a municipal or industrial waste water treatment plant before discharge to surface water.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Colourless to yellowish. Liquid.
Odour	:	May contain a reodorant
Odour threshold	:	Data not available
pH	:	Not applicable
Initial Boiling Point and Boiling Range	:	170 - 390 °C / 338 - 734 °F
Pour point	:	<= 6 °C / 43 °F
Flash point	:	> 55 °C / 131 °F
Upper / lower Flammability or	:	1 - 6 %(V)

Explosion limits		
Auto-ignition temperature	:	> 220 °C / 428 °F
Vapour pressure	:	1 hPa at 20 °C / 68 °F
Relative Density	:	Data not available
Density	:	0.8 - 0.89 g/cm3 at 15 °C / 59 °F
Water solubility	:	Data not available
Solubility in other solvents	:	Data not available
n-octanol/water partition coefficient (log Pow)	:	3 - 6
Dynamic viscosity	:	Data not available
Kinematic viscosity	:	1.5 - 6 mm2/s at 40 °C / 104 °F
Vapour density (air=1)	:	Data not available
Electrical conductivity	:	Low conductivity: < 100 pS/m, The conductivity of this material makes it a static accumulator., A liquid is typically considered nonconductive if its conductivity is below 100 pS/m and is considered semi-conductive if its conductivity is below 10 000 pS/m., Whether a liquid is nonconductive or semi-conductive, the precautions are the same., A number of factors, for example liquid temperature, presence of contaminants, and anti-static additives can greatly influence the conductivity of a liquid.
Evaporation rate (nBuAc=1)	:	Data not available
Decomposition Temperature	:	Data not available
Flammability	:	Not applicable.

10. STABILITY AND REACTIVITY

Chemical stability	:	Stable under normal use conditions.
Possibility of Hazardous Reactions	:	No hazardous reaction is expected when handled and stored according to provisions.
Conditions to Avoid	:	Avoid heat, sparks, open flames and other ignition sources.
Incompatible Materials	:	Strong oxidising agents.
Hazardous Decomposition Products	:	Hazardous decomposition products are not expected to form during normal storage. Thermal decomposition is highly dependent on conditions. A complex mixture of airborne solids, liquids and gases, including carbon monoxide, carbon dioxide and other organic compounds will be evolved when this material undergoes combustion or thermal or oxidative degradation.
Sensitivity to Static Discharge	:	Yes, in certain circumstances product can ignite due to static electricity.

11. TOXICOLOGICAL INFORMATION

Information on Toxicological effects

Basis for Assessment	:	Information given is based on product data, a knowledge of the components and the toxicology of similar products. Unless indicated otherwise, the data presented is representative of the product as a whole, rather than for individual component(s).
Likely Routes of Exposure	:	Exposure may occur via inhalation, ingestion, skin absorption, skin or eye contact, and accidental ingestion.
Acute Oral Toxicity	:	Low toxicity: LD50 > 5000 mg/kg , Rat
Acute Dermal Toxicity	:	Low toxicity: LD50 >2000 mg/kg , Rabbit
Acute Inhalation Toxicity	:	Harmful if inhaled. LC50 > 1.0 - <= 5.0 mg/l , 4 h, Rat High concentrations may cause central nervous system depression resulting in headaches, dizziness and nausea; continued inhalation may result in unconsciousness and/or death.
Skin corrosion/irritation	:	Irritating to skin.
Serious eye damage/irritation	:	Expected to be slightly irritating.
Respiratory Irritation	:	Inhalation of vapours or mists may cause irritation to the respiratory system.
Respiratory or skin sensitisation	:	Not expected to be a sensitiser.
Aspiration Hazard	:	Aspiration into the lungs when swallowed or vomited may cause chemical pneumonitis which can be fatal.
Germ cell mutagenicity	:	Positive in in-vitro, but negative in in-vivo mutagenicity assays.
Carcinogenicity	:	Limited evidence of carcinogenic effect. Repeated skin contact has resulted in irritation and skin cancer in animals.

Material	:	**Carcinogenicity Classification**
Naphthalene	:	ACGIH Group A4: Not classifiable as a human carcinogen.
Naphthalene	:	NTP: Reasonably Anticipated to be a Human Carcinogen.
Naphthalene	:	IARC 2B: Possibly carcinogenic to humans.
Naphthalene	:	GHS / CLP: Carcinogenicity Category 2

Fuels, diesel	:	ACGIH Group A3: Confirmed animal carcinogen with unknown relevance to humans.
Fuels, diesel	:	GHS / CLP: Carcinogenicity Category 2
Distillates (Fischer-Tropsch) C8-26 - Branched and Linear	:	GHS / CLP: No carcinogenicity classification
Kerosine (Fischer Tropsch), Full range, C8-C16 branched and linear alkanes	:	GHS / CLP: No carcinogenicity classification
Cumene	:	IARC 2B: Possibly carcinogenic to humans.
Cumene	:	GHS / CLP: No carcinogenicity classification

Reproductive and Developmental Toxicity : Not expected to impair fertility. Not expected to be a developmental toxicant.

Specific target organ toxicity - single exposure : Not classified.

Specific target organ toxicity - repeated exposure : May cause damage to organs or organ systems through prolonged or repeated exposure. Blood. Thymus. Liver.

Additional Information : Classifications by other authorities under varying regulatory frameworks may exist.

12. ECOLOGICAL INFORMATION

Basis for Assessment : Information given is based on a knowledge of the components and the ecotoxicology of similar products. Fuels are typically made from blending several refinery streams. Ecotoxicological studies have been carried out on a variety of hydrocarbon blends and streams but not those containing additives. Unless indicated otherwise, the data presented is representative of the product as a whole, rather than for individual component(s).

Acute Toxicity : Expected to be toxic: LL/EL/IL50 > 1 <= 10 mg/l (to aquatic organisms) LL/EL50 expressed as the nominal amount of product required to prepare aqueous test extract.

Fish : Expected to be toxic: LL/EL/IL50 > 1 <= 10 mg/l

Aquatic crustacea : Expected to be toxic: LL/EL/IL50 > 1 <= 10 mg/l

Algae/aquatic plants : Expected to be toxic: LL/EL/IL50 > 1 <= 10 mg/l

Microorganisms : Expected to be practically non toxic: LL/EL/IL50 > 100 mg/l

Chronic Toxicity

Fish : NOEC/NOEL expected to be > 0.01 - <= 0.1 mg/l (based on

		modeled data)
Aquatic crustacea	:	NOEC/NOEL expected to be > 0.1 - <= 1.0 mg/l (based on modeled data)
Mobility	:	Partly evaporates from water or soil surfaces, but a significant proportion will remain after one day. If product enters soil, one or more constituents will be mobile and may contaminate groundwater. Large volumes may penetrate soil and could contaminate groundwater. Floats on water.
Persistence/degradability	:	Major constituents are inherently biodegradable. The volatile constituents will oxidize rapidly by photochemical reactions in air.
Bioaccumulative Potential	:	Contains constituents with the potential to bioaccumulate. Log Kow > =4
Other Adverse Effects	:	Films formed on water may affect oxygen transfer and damage organisms.

13. DISPOSAL CONSIDERATIONS

Material Disposal	:	Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations. Do not dispose into the environment, in drains or in water courses. Do not dispose of tank water bottoms by allowing them to drain into the ground. This will result in soil and groundwater contamination. Waste arising from a spillage or tank cleaning should be disposed of in accordance with prevailing regulations, preferably to a recognised collector or contractor. The competence of the collector or contractor should be established beforehand.
Container Disposal	:	Send to drum recoverer or metal reclaimer. Drain container thoroughly. After draining, vent in a safe place away from sparks and fire. Residues may cause an explosion hazard if heated above the flash point. Do not puncture, cut or weld uncleaned drums. Do not pollute the soil, water or environment with the waste container. Comply with any local recovery or waste disposal regulations.
Local Legislation	:	Disposal should be in accordance with applicable regional, national, and local laws and regulations. Local regulations may be more stringent than regional or national requirements and must be in compliance.

14. TRANSPORT INFORMATION

Land (as per ADR classification): Regulated

Class	:	3
Packing group	:	III
Hazard indentification no.	:	30
UN number	:	1202
Danger label (primary risk)	:	3
Proper shipping name	:	DIESEL FUEL
Environmentally Hazardous	:	Yes

IMDG

Identification number	UN 1202
Proper shipping name	DIESEL FUEL
Class / Division	3
Packing group	III
Environmental hazards:	Yes

IATA (Country variations may apply)

UN number	:	1202
Proper shipping name	:	Diesel fuel
Class / Division	:	3
Packing group	:	III

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Pollution Category	:	Not applicable.
Ship Type	:	Not applicable.
Product Name	:	Not applicable.
Special Precaution	:	Not applicable.
Additional Information	:	MARPOL Annex 1 rules apply for bulk shipments by sea.

15. REGULATORY INFORMATION

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material.

Local Regulations

Workplace Safety and Health Act & Workplace Safety and Health (General Provision) Regulations	:	This product is subject to the requirement in the Act/ Regulations.
Environmental Protection and Management Act and Environmental Protection and Management	:	This product is subject to the requirement in the Act/ Regulations.

(Hazardous Substances) Regulations		
Maritime and Port Authority of Singapore (Dangerous Goods, Petroleum and Explosives) Regulations	:	This product is subject to the requirement in the Act/ Regulations.
Fire Safety Act and Fire Safety (Petroleum & Flammable Materials) Regulations	:	This product is subject to the requirement in the Act/ Regulations.
Classification triggering components	:	Contains fuels, diesel.
Other Information	:	IARC has classified diesel exhaust emissions as a Class 1 carcinogen - carcinogenic to humans. Steps should be taken to prevent personal exposure to diesel exhaust emissions.

16. OTHER INFORMATION

Hazard Statement

H226	Flammable liquid and vapour.
H227	Combustible liquid.
H304	May be fatal if swallowed and enters airways.
H315	Causes skin irritation.
H332	Harmful if inhaled.
H351	Suspected of causing cancer.
H373	May cause damage to organs or organ systems through prolonged or repeated exposure.
H401	Toxic to aquatic life.
H411	Toxic to aquatic life with long lasting effects.

Additional Information	:	This document contains important information to ensure the safe storage, handling and use of this product. The information in this document should be brought to the attention of the person in your organisation responsible for advising on safety matters.
SDS Version Number	:	1.1
SDS Effective Date	:	10.03.2014
SDS Revisions	:	A vertical bar (|) in the left margin indicates an amendment from the previous version.
Uses and Restrictions	:	This product must not be used in applications other than those recommended in Section 1, without first seeking the advice of the supplier. This product is not to be used as a solvent or cleaning agent;

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for lighting or brightening fires; as a skin cleanser.

SDS Distribution : The information in this document should be made available to all who may handle the product.

Key/Legend to Abbrevations used in this SDS : The standard abbreviations and acronyms used in this document can be looked up in reference literature (e.g. scientific dictionaries) and/or websites.

Flam. Liq.	Flammable liquids
Asp. Tox.	Aspiration hazard
Acute Tox.	Acute toxicity
Skin Corr.	Skin corrosion/irritation
Carc.	Carcinogenicity
STOT RE	Specific target organ toxicity - repeated exposure

Key Literature References : The quoted data are from, but not limited to, one or more sources of information (e.g. toxicological data from Shell Health Services, material suppliers' data, CONCAWE, EU IUCLID date base, EC 1272 regulation, etc).

Disclaimer : This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

Safety Data Sheet

Revision Date: 07/01/14
www.restek.com

1. IDENTIFICATION

Catalog Number / Product Name:	**31064, 31064-5XX, & 31164 / Diesel Range Organics Standard (EPA/WISC)**
Company:	Restek Corporation
Address:	110 Benner Circle Bellefonte, Pa. 16823
Phone#:	814-353-1300
Fax#:	814-353-1309
Emergency#:	800-424-9300 (CHEMTREC) 703-527-3887 (Outside the US)
Email:	sds@restek.com
Revision Number:	6
Intended use:	For Laboratory use only

2. HAZARD(S)IDENTIFICATION

Emergency Overview:

GHS Hazard Symbols:



GHS Classification:	Carcinogenicity Category 2
GHS Hazard:	Suspected of causing cancer.
GHS Precautions:	
Safety Precautions:	Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Use personal protective equipment as required.
First Aid Measures:	IF exposed or concerned: Get medical advice/attention.
Storage:	Store locked up.
Disposal:	Dispose of contents/container according to section 13 of the SDS.
Single Exposure Target Organs:	No data available.
Repeated Exposure Target Organs:	No data available.

3. COMPOSITION / INFORMATION ON INGREDIENTS

Chemical Name	CAS #	EINEC #	% Composition
Dichloromethane	75-09-2	200-838-9	98.000000
Hexadecane	544-76-3		0.200000
n-tetracosane	646-31-1		0.200000
eicosane	112-95-8		0.200000
n-hexacosane	630-01-3		0.200000

n-Tetradecane	629-59-4		0.200000
decane	124-18-5		0.200000
docosane	629-97-0		0.200000
n-Dodecane	112-40-3		0.200000
octadecane	593-45-3		0.200000
octacosane	630-02-4		0.200000

4. FIRST-AID MEASURES

Inhalation: Remove to fresh air. If breathing is difficult, have a trained individual administer oxygen. If not breathing, give artificial respiration and have a trained individual administer oxygen. Get medical attention immediately

Eyes: Immediately flush eyes with plenty of water for at least 20 minutes retracting eyelids often. Tilt the head to prevent chemical from transferring to the uncontaminated eye. Get immediate medical attention and monitor the eye daily as advised by your physician. Serious harm (damage) may result if treatment is delayed. Continue to flush eyes while awaiting medical attention

Skin Contact: Wash with soap and water. Remove contaminated clothing, launder immediately, and discard contaminated leather goods. Get medical attention immediately.

Ingestion: Do not induce vomiting and seek medical attention immediately. Drink two glasses of water or milk to dilute. Provide medical care provider with this SDS. Never give anything by mouth to an unconscious person

5. FIRE- FIGHTING MEASURES

Extinguishing Media: Use methods suitable to fight surrounding fire.

Fire Fighting Methods and Protection: Use methods for the surrounding fire.

Hazardous Combustion Products: Carbon dioxide, Carbon monoxide

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions and Equipment: Exposure to the spilled material may be severely irritating or toxic. Follow personal protective equipment recommendations found in Section 8 of this SDS. Personal protective equipment needs must be evaluated based on information provided on this sheet and the special circumstances created by the spill including; the material spilled, the quantity of the spill, the area in which the spill occurred, and the expertise of employees in the area responding to the spill. Never exceed any occupational exposure limits.

Methods for Clean-up: Prevent the spread of any spill to minimize harm to human health and the environment if safe to do so. Wear complete and proper personal protective equipment following the recommendation of Section 8 at a minimum. Dike with suitable absorbent material like granulated clay. Gather and store in a sealed container pending a waste disposal evaluation.

7. HANDLING AND STORAGE

Handling Technical Measures and Precautions: Toxic or severely irritating material. Avoid contacting and avoid breathing the material. Use only in a well ventilated area.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

United States:

Chemical Name	CAS No.	IDLH	ACGIH STEL	ACGIH TLV-TWA	OSHA Exposure Limit
Dichloromethane	75-09-2	2300 ppm IDLH		50 ppm TWA	25 ppm TWA; 125 ppm STEL (15 min. TWA)
Hexadecane	544-76-3	ND		No TLV	No PEL established
n-tetracosane	646-31-1	ND		No TLV	No data available.
eicosane	112-95-8	ND		No TLV	No data available.
n-hexacosane	630-01-3	ND		No TLV	No data available.
n-Tetradecane	629-59-4	ND		No TLV	No data available.

decane	124-18-5	ND	No TLV	No data available.
docosane	629-97-0	ND	No TLV	No data available.
n-Dodecane	112-40-3	ND	No TLV	No data available.
octadecane	593-45-3	ND	No TLV	No data available.
octacosane	630-02-4	ND	No TLV	No data available.

Personal Protection:

Engineering Measures: Local exhaust ventilation or other engineering controls are normally required when handling or using this product to avoid overexposure.

Respiratory Protection: Respiratory protection may be required to avoid overexposure when handling this product. General or local exhaust ventilation is the preferred means of protection. Use a respirator if general room ventilation is not available or sufficient to eliminate symptoms.

Eye Protection: Wear chemically resistant safety glasses with side shields when handling this product. Wear additional eye protection such as chemical splash goggles and/or face shield when the possibility exists for eye contact with splashing or spraying liquid, or airborne material. Do not wear contact lenses. Have an eye wash station available.

Skin Protection: Avoid skin contact by wearing chemically resistant gloves, an apron and other protective equipment depending upon conditions of use. Inspect gloves for chemical break-through and replace at regular intervals. Clean protective equipment regularly. Wash hands and other exposed areas with mild soap and water before eating, drinking, and when leaving work.

Medical Conditions Aggravated By Exposure: Eye disease Skin disease including eczema and sensitization Respiratory disease including asthma and bronchitis

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance, color:	Colorless
Odor:	Strong
Physical State:	No data available.
pH:	No data available
Vapor Density:	2.93 (air = 1)
Melting Point:	-96.7 °C
Flash Point:	No data available.
Upper Flammable/Explosive Limit, % in air:	No data available.
Lower Flammable/Explosive Limit, % in air:	No data available.
Autoignition Temperature:	556 deg C
Decomposition Temperature:	No data available.
Specific Gravity:	1.3254 - 1.3258 g/cm3 at 20 °C
Evaporation Rate:	No data available.
Odor Threshold:	ND
Solubility:	Moderate; 50-99%
Partition Coefficient: n-octanol in water:	No data available.
VOC % by weight:	0.00
Molecular Weight:	No data available.

10. STABILITY AND REACTIVITY

Stability:	Stable under normal conditions.
Conditions to Avoid:	No data available.Contamination High temperatures
Materials to Avoid / Chemical Incompatiability:	Strong oxidizing agents Caustics (bases)
Hazardous Decomposition Products:	Carbon dioxide Carbon monoxide

11. TOXICOLOGICAL INFORMATION

Routes of Entry:	Inhalation Absorption Ingestion Skin contact Eye contact
Target Organs Potentially Affected By Exposure:	Skin, Cardiovascular System, Eyes, Liver
Chemical Interactions That Change Toxicity:	None Known

Immediate (Acute) Health Effects by Route of Exposure:

Inhalation Irritation: Can cause moderate respiratory irritation, dizziness, weakness, fatigue, nausea and headache.

Inhalation Toxicity: Harmful! Can cause systemic damage (see "Target Organs)Inhalation may cause severe central nervous system depression (including unconsciousness).

Skin Contact: Contact causes severe skin irritation and possible burns.

Skin Absorption: Harmful if absorbed through the skin. May cause severe irritation and systemic damage.

Eye Contact: Contact with the eyes may cause moderate to severe eye injury. Eye contact

may result in tearing and reddening, but not likely to permanently injure eye tissue. Temporary vision impairment (cloudy or blurred vision) is possible.

Ingestion Irritation: Irritating to mouth, throat, and stomach. Can cause abdominal discomfort, nausea, vomiting and diarrhea.

Ingestion Toxicity: Harmful if swallowed. May cause systemic poisoning.

Long-Term (Chronic) Health Effects:

Carcinogenicity: Contains a probable or known human carcinogen.

Reproductive and Developmental Toxicity: No data available to indicate product or any components present at greater than 0.1% may cause birth defects.

Inhalation: Upon prolonged and/or repeated exposure, can cause moderate respiratory irritation, dizziness, weakness, fatigue, nausea and headache.Harmful! Can cause systemic damage upon prolonged and/or repeated exposure (see "Target Organs)

Skin Absorption: Upon prolonged or repeated exposure, harmful if absorbed through the skin. May cause severe irritation and systemic damage

Component Toxicological Data:

NIOSH:

Chemical Name	CAS No.	LD50/LC50
Methane, dichloro-	75-09-2	Oral LD50 Rat >2000 mg/kg

Component Carcinogenic Data:

OSHA:

Chemical Name	CAS No.	
Methylene chloride	75-09-2	25 ppm TWA (8 hr.); 125 ppm STEL (15 min.); 12.5 ppm Action Level (see 29 CFR 1910.1051); effective date for respiratory protection for certain employers to acheive the 8-hour TWA PEL is August 31, 1998; the start up date to install engineering controls is December 10, 1998.; {OSHA - 29 CFR 1910 Specifically Regulate

ACGIH:

Chemical Name	CAS No.	
Dichloromethane	75-09-2	A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans

NIOSH:

Chemical Name	CAS No.	
Methylene chloride	75-09-2	potential occupational carcinogen

NTP:

Chemical Name	CAS No.
No data available.	

IARC:

Chemical Name	CAS No.	Group No.
No data.		Group 1
No data.		Group 2A
Dichloromethane	75-09-2	Group 2B

12. ECOLOGICAL INFORMATION

Overview: Moderate ecological hazard. This product may be dangerous to plants and/or wildlife.Keep out of waterways.

Mobility: No data

Persistence: No data

Bioaccumulation: No data

Degradability: No data

Ecological Toxicity Data: No data available.

13. DISPOSAL CONSIDERATIONS

Waste Description of Spent Product: Spent or discarded material is a hazardous waste.

Disposal Methods: Incinerate spent or discarded material a permitted hazardous waste facility.

Waste Disposal of Packaging: Comply with all Local, State, Federal, and Provincial Environmental Regulations.

14. TRANSPORTATION INFORMATION

United States:

DOT Proper Shipping Name: Toxic, liquids, organic, n.o.s. (Dichloromethane)
UN Number: UN2810
Hazard Class: 6.1
Packing Group: III

International:

IATA Proper Shipping Name: Toxic, liquids, organic, n.o.s. (Dichloromethane)
UN Number: UN2810
Hazard Class: 6.1
Packing Group: III

Marine Pollutant: No

15. REGULATORY INFORMATION

United States:

Chemical Name	CAS#	CERCLA	SARA 313	SARA EHS 313	TSCA
Dichloromethane	75-09-2	X	X	-	X
Hexadecane	544-76-3	-	-	-	X
n-tetracosane	646-31-1	-	-	-	X
eicosane	112-95-8	-	-	-	X
n-hexacosane	630-01-3	-	-	-	X
n-Tetradecane	629-59-4	-	-	-	X
decane	124-18-5	-	-	-	X
docosane	629-97-0	-	-	-	X
n-Dodecane	112-40-3	-	-	-	X
octadecane	593-45-3	-	-	-	X
octacosane	630-02-4	-	-	-	X

The following chemicals are listed on CA Prop 65:

Chemical Name	CAS #	Regulation
Dichloromethane	75-09-2	Prop 65 Cancer
Dichloromethane (Methylene chloride)		

State Right To Know Listing:

Chemical Name	CAS#	New Jersey	Massachusetts	Pennsylvania	California
Dichloromethane	75-09-2	X	X	X	X
Hexadecane	544-76-3	-	-	-	-
n-tetracosane	646-31-1	-	-	-	-
eicosane	112-95-8	-	-	-	-
n-hexacosane	630-01-3	-	-	-	-
n-Tetradecane	629-59-4	-	-	-	-
decane	124-18-5	X	-	X	-
docosane	629-97-0	-	-	-	-
n-Dodecane	112-40-3	-	-	-	-
octadecane	593-45-3	-	-	-	-
octacosane	630-02-4	-	-	-	-

16. OTHER INFORMATION

Prior Version Date: 12/22/11

Disclaimer: Restek Corporation provides the descriptions, data and information contained herein in good faith but makes no representation as to its comprehensiveness or accuracy. It is provided for your guidance only. Because many factors may affect processing or application/use, Restek Corporation recommends you perform an assessment to determine the suitability of a product for your particular purpose prior to use. No warranties of any kind, either expressed or implied, including fitness for a particular purpose, are made regarding prodcuts described, data or information set forth. In no case shall the descriptions, information, or data provided be considered a part of our terms and conditions of sale. Further, the descriptions, data and information furnished hereunder are given gratis. No obligation or liability for the description, data and information given are assumed. All such being given and accepted at your risk.

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Article Information Sheet (AIS)

This Article Information Sheet (AIS) provides relevant battery information to retailers, consumers, OEMs and others users requesting a GHS-compliant SDS. Articles, such as batteries, are exempt from GHS SDS classification criteria. The GHS criteria is not designed or intended to be used to classify the physical, health and environmental hazards of an article. Branded consumer batteries are defined as electro-technical devices. The design, safety, manufacture, and qualification of branded consumer batteries follow ANSI and IEC battery standards. This document is based on principles set forth in the following hazard communication approaches: ANSI Z-400.1, GHS, JAMP AIS, and IEC 62474.

1. Document Information	
Document Name	**Duracell Alkaline Batteries (Major and Specialty Cells)**
Document ID	AIS-ALK
Issue Date	1-May-15
Version	1
Preparer	Global Product Stewardship
Last Revision	New
Information Contact	moquet.l@pg.com
2. Company Information	
Name & Address	P&G Duracell Global Business Unit, 14 Research Drive, Bethel, CT USA 06801
Telephone	(203) 796- 4430
Website	www.duracell. com
Consumer Relations	North America: 1-800-551-2355 (9:00 AM - 5:00 PM EST)
3. Article Information	
Description	Duracell branded consumer alkaline battery
Product Category	Electro-technical device
Use	Portable power source for electronic devices
Global sub-brands (Retail)	Coppertop, Plus, Quantum, Simply, Turbo, Ultra, Basic, TurboMax
Global sub-brands (B2B)	Procell, Industrial, OEM/OEA
Sizes	Major Cells: AA,AAA, C, D & 9V
Sizes	Specialty Cells: AAAA, MN11. MN21, MN27, MN175, PX76 (LR44), PX28, PX625, (LR09), LR43, LR54, N, J, 4.5V, 625A
Sizes	Lanterns: MN903, MN908, MN915, MN918; MN1203
Principles of Operation	A battery powers a device by converting stored chemical energy into electrical energy.
Representative Product Images	   
	Major Cells **Major Cells** **Lantern** **Specialty**
4. Article Construction	
Applicable Battery Industry Standards	ANSI C18.1M Part 1, ANSI C18.1M Part 2, ANSI C18.4, IEC 60086,1, IEC 60086-2, IEC 60086-5
Electro-technical System	Alkaline Manganese Dioxide
Electrode - Negative	Zinc (CAS # 7440-66-6)
Electrode - Positive	Manganese Dioxide (CAS # 1313-13-9)
Electrolyte	Alkali Metal Hydroxide (aqueous potassium hydroxide - CAS # 1310-58-3)
Materials of Construction - Can	Nickel Plated Steel
Declarable Substances (IEC 62474 Criteria 1)	None
Mercury Free Battery (ANSI C18.4M <5ppm)	Yes
Small Cell or Battery (ANSI C18.1M Part 2; IEC 60086-5)	Sizes: AAA and Specialty Cells fit inside a specially designed test cylinder 2.25 inches (57.1mm) long by 1.25 inches (31.70 mm) wide.
5. Health & Safety	

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Ingestion/Small Parts Warning	Required for Small Cell or Battery (Sizes: AAA and Specialty Cells): Keep away from children. If swallowed, consult a physician immediately.
Normal Conditions of Use	Exposure to contents inside the sealed battery will not occur unless the battery leaks, is exposed to high temperatures, or is mechanically abused.
Note to Physician	A damaged battery will release concentrated and caustic potassium hydroxide.
First Aid - If swallowed	Do not induce vomiting. Seek medical attention immediately. USA CALLS ONLY - CALL 24-HOUR NATIONAL BATTERY INGESTION HOTLINE: (202) 625-3333 - COLLECT.
First Aid - Eye Contact	Flush with water for at least 15 minutes. Seek medical care if irritation persists.
First Aid - Skin Contact	Remove contaminated clothing. Wash skin with soap and water. Seek medical care if irritation persists.
First Aid - Inhalation	Remove to fresh air.
Battery Safety Standards & Testing	Duracell batteries meet the requirements of ANSI C18. 1M Part 2 and IEC 60086-5. These standards specify tests and requirements for alkaline batteries to ensure safe operation under normal use and reasonably foreseeable misuse. The test regimes assess three conditions of safety. These are: **1-Intended use simulation:** Partial use, vibration, thermal shock, and mechanical shock **2-Reasonably foreseeable misuse:** Incorrect installation, external short-circuit, free fall (user-drop), over-discharge, and crush **3-Design consideration:** Thermal abuse, mold stress
Precautionary Statements	**CAUTION:** Batteries may explode or leak, and cause burn injury, if recharged, disposed of in fire, mixed with a different battery type, inserted backwards or disassembled. Replace all used batteries at the same time. Do not carry batteries loose in your pocket or purse. Do not remove the battery label. Keep small batteries (i.e., AAA) away from children. If swallowed, consult a physician at once.
6. Fire Hazard & Firefighting	
Fire Hazard	Batteries may rupture or leak if involved in a fire.
Extinguishing Media	Use any extinguishing media appropriate for the surrounding area.
Fires Involving Large Quantities of Batteries	Large quantities of batteries involved in a fire will rupture and release caustic potassium hydroxide. Firefighters should wear self-contained breathing apparatus and protective clothing.
7. Handling & Storage	
Handling Precautions	Avoid mechanical and electrical abuse. Do not short circuit or install incorrectly. Batteries may rupture or vent if disassembled, crushed, recharged or exposed to high temperatures. Install batteries in accordance with equipment instructions.
Storage Precautions	Store batteries in a dry place at normal room temperature. Refrigeration does not make them last longer.
Spills of Large Quantities of Loose Batteries (unpackaged)	Notify spill personnel of large spills. Irritating and flammable vapors may be released from leaking or ruptured batteries. Spread batteries apart to stop shorting. Eliminate all ignition sources. Evacuate area and allow vapors to dissipate. Clean-up personnel should wear appropriate PPE to avoid eye and skin contact and inhalation of vapors or fumes. Increase ventilation. Carefully collect batteries and place in appropriate container for disposal. Remove any spilled liquid with absorbent material and contain for disposal.
8. Disposal Considerations (GHS Section 13)	
Collection & Proper Disposal	Dispose of used (or excess) batteries in compliance with federal, state/provincial and local regulations. Do not accumulate large quantities of used batteries for disposal as accumulations could cause batteries to short-circuit. Do not incinerate. In countries, such as Canada and the EU, where there are regulations for the collection and recycling of batteries, consumers should dispose of their used batteries into the collection network at municipal depots and retailers. They should not dispose of batteries with household trash.

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Article Information Sheet (AIS)

USA EPA RCRA (40 CFR 261)	Classified as non-hazardous waste (not ignitable, corrosive, reactive or toxic). Federal Universal Waste Regulations (40 CFR 273) do not apply. State requirements may be more stringent than Federal.
California Universal Waste Rule (Cal. Code Regs. Title 22, Div. 4.5, Ch. 23)	California prohibits disposal of batteries as trash (including household trash).
9. Transport Information (GHS Section 14)	
Regulatory Status	Not regulated. Alkaline batteries (sometimes referred to as “Dry Cell” or “household” batteries) are not listed or regulated as dangerous goods under IATA Dangerous Goods Regulations, ICAO Technical Instructions, IMDG Code, UN Model Regulations, U.S. Hazardous Materials Regulations (49 CFR), and UNECE ADR.
UN Identification Number/ Shipping Name	None - Not Required
Special Provision (SP) Conformance	Special regulatory provisions require batteries to be packaged in a manner that prevents the generation of a dangerous quantity of heat and short circuits. Shippers can prepare batteries by taping the terminals, individually packaging batteries, or otherwise segregating the batteries to prevent risk of creating a short circuit. Batteries shipped in original unopened Duracell packaging is compliant.
US DOT SP	49 CFR 172.102 Special Provision 130
Air Transport (IATA/ICAO) SP	Special Provision A123 (56th Edition - 2015). NOTE: The words "NOT RESTRICTED" and "SPECIAL PROVISION A123" must be included on the description of the substance on the Air Waybill, when air way-bill is issued.
Passenger Air Travel	No restrictions
Emergency Transportation Hotline	**CHEMTREC 24-Hour Emergency Response Hotline** **Within the United States call +703-527-3887** **Outside the United States, call +1 703-527-3887 (Collect)**
10. Regulatory Information (GHS Section 15)	
10a. Battery Requirements	
USA EPA Mercury Containing & Rechargeable Battery Management Act of 1996	During the manufacturing process, no mercury is added.
EU Battery Directive 2006/66/EC & amendment 2013/56/EU	Compliant with marking and substance restrictions for mercury (<0.0005%); cadmium (<0.0020%)l and lead (<0.0040%). Global labels are marked with the special collection symbol and the EU qualifier in accordance with EU Battery Directive 2006/66/EC, Article 11. Paragraph 1 on batteries and accumulators and waste batteries and accumulators
10b. General Requirements	
USA CPSIA 2008 (PL. 11900314)	Exempt
USA CPSC FHSA (16 CFR 1500)	Consumer batteries are not listed as a hazardous product.
USA EPA TSCA Section 13 (40 CFR 707.20)	For customs clearance purpose, batteries are defined as an "Article".
USA EPA RCRA (40 CFR 261)	Classified as non-hazardous waste (not ignitable, corrosive, reactive or toxic). Federal Universal Waste Regulations (40 CFR 273) do not apply. State requirements may be more stringent than Federal.
California Prop 65	No warning required per 3rd party assessment.
CANADA Products Containing Mercury Regulations SOR/20140254	Mercury free
EU REACH SVHC's (161 Substances) Candidate List December 2014)	No listed substances are present (>0.01% w/w)
EU REACH Article 31	SDS is not required consumer alkaline batteries.

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Article Information Sheet (AIS)

10c. Regulatory Definitions - Articles	
USA OSHA	29 CFR 1910.1200(b)(6)(v)
USA TSCA	40 CFR 704.3; 710.2(3)(c); and [19 CFR 12.1209a)]
EU REACH	Title 1 - Chapter 2 - Article 3(3)
GHS	Section 1.3.2.1
11. Other Information	
11a. Certification & 3rd Party Approvals	
UL (UTGT2.S50939 Single Multiple Station Smoke Alarms - Component)	AA, 9V Certification Standard: ANSI/UL 217 Single & Multiple Station Smoke Alarms
11b. AIS Hazard Communication Approaches (consulted in developing this document):	
Globally Harmonized System (GHS)	GHS SDS requirements and classification criteria do not apply to articles or products (such as batteries) that have a fixed shape, which are not intended to release a chemical. The article exemption is found in Section 1.3.2.1.1 of the GHS and reads: ***The GHS applies to pure substances and their dilute solutions and to mixtures. "Articles" as defined by the Hazard Communication Standard (29 CFR 1900.1200) of the OSHA of the USA, or by similar definition, are outside the scope of the system."***
Joint Article Management Promotion Consortium JAMP	JAMP is a Japanese Industry Association who developed the concept of an Article Information Sheet as a supply chain tool to share and communicate chemical information in articles. The AIS authoring process is based on "declarable" substances to meet global regulatory requirements as well as substances to be reported by GADSL, JIG, etc.
IEC 62474 Ed. 1.0 B:2012 Material Declaration for Products of and for the Electro-technical Industry	An international standard that came into effect in March 2012 concerning declaration for electrical and electronic products. IEC 6274 replaces the defunct Joint Industry Guide – Material Declaration for Electro-technical Products (JIG-101-Ed 4.1 (May 21, 2012)
IEC 62474 Database - Publically available online (maintained by TC11: Environmental Standardization for electrical and electronic products and systems.	The general principle for a substance to be included in the database as a declarable substance is: 1) existing national laws or regulations in an IEC member country that are relevant to Electro-technical products and that prohibit or restrict substances, or that have a labeling, communication, reporting or notification requirement, and 2) applying IEC 62474 criteria results in identification of declarable substance.
ANSI Z 400.1/Z19.1 (2010)	2.1 Scope: Applies to preparation of SDSs for hazardous chemicals used under occupational conditions. Does not address how the standard may be applied to articles. It presents basic information on how to develop and write a SDS. Additional information is provided to help comply with state and federal environmental and safety laws and regulations. Elements of the standard may be acceptable for International use.

DISCLAIMER: This AIS is intended to provide a brief summary of our knowledge and guidance regarding the use of this material. The information contained here has been compiled from sources considered by Procter & Gamble to be dependable and is accurate to the best of the Company's knowledge. It is not meant to be an all-inclusive document on worldwide hazard communication regulations. This information is offered in good faith. Each user of this material needs to evaluate the conditions of use and design the appropriate protective mechanisms to prevent employee exposures, property damage or release to the environment. Procter & Gamble assumes no responsibility for injury to the recipient or third persons or for any damage to any property resulting from misuse of the product.

SAFETY DATA SHEET

Revision Date 25-Dec-2021 **Revision Number** 4

1. Identification

Product Name **Ethylbenzene-d10**

Cat No. : **AC321360000; AC321360010**

Synonyms No information available

Recommended Use Laboratory chemicals.
Uses advised against Food, drug, pesticide or biocidal product use.

Details of the supplier of the safety data sheet

Company
Fisher Scientific Company
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Flammable liquids	Category 2
Acute Inhalation Toxicity - Vapors	Category 4

Label Elements

Signal Word
Danger

Hazard Statements
Highly flammable liquid and vapor
Harmful if inhaled



Precautionary Statements
Prevention
Avoid breathing dust/fume/gas/mist/vapors/spray
Use only outdoors or in a well-ventilated area
Keep away from heat/sparks/open flames/hot surfaces. - No smoking
Keep container tightly closed
Ground/bond container and receiving equipment
Use explosion-proof electrical/ventilating/lighting equipment
Use only non-sparking tools
Take precautionary measures against static discharge
Wear protective gloves/protective clothing/eye protection/face protection
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell
Skin
IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
Fire
In case of fire: Use CO2, dry chemical, or foam for extinction
Storage
Store in a well-ventilated place. Keep cool
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
None identified

3. Composition/Information on Ingredients

Component	CAS No	Weight %
Benzene-d5, ethyl-d5-	25837-05-2	100

4. First-aid measures

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Skin Contact Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Get medical attention.

Inhalation Remove from exposure, lie down. Remove to fresh air. If not breathing, give artificial respiration. Get medical attention.

Ingestion Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Drink plenty of water. If possible drink milk afterwards.

Most important symptoms and effects Difficulty in breathing. Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting

Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Carbon dioxide (CO_2). Dry chemical. Water mist may be used to cool closed containers. Chemical foam. Water mist may be used to cool closed containers.

Unsuitable Extinguishing Media No information available

Flash Point 15 °C / 59 °F

Method - No information available

Autoignition Temperature 432 °C / 809.6 °F

Explosion Limits

Upper	6.8%
Lower	1.2%
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Flammable. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Containers may explode when heated. Vapors may form explosive mixtures with air.

Hazardous Combustion Products
Carbon monoxide (CO). Carbon dioxide (CO_2).
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	3	1	N/A

6. Accidental release measures

Personal Precautions Remove all sources of ignition. Take precautionary measures against static discharges.
Environmental Precautions See Section 12 for additional Ecological Information.

Methods for Containment and Clean Up Soak up with inert absorbent material (e.g. sand, silica gel, acid binder, universal binder, sawdust). Keep in suitable, closed containers for disposal. Remove all sources of ignition. Use spark-proof tools and explosion-proof equipment. Provide adequate ventilation. Do not flush into surface water or sanitary sewer system.

7. Handling and storage

Handling Avoid contact with skin and eyes. Do not breathe mist/vapors/spray. Take precautionary measures against static discharges. Use spark-proof tools and explosion-proof equipment. Use only non-sparking tools. Keep away from open flames, hot surfaces and sources of ignition. To avoid ignition of vapors by static electricity discharge, all metal parts of the equipment must be grounded.

Storage. Keep in a dry, cool and well-ventilated place. Keep container tightly closed. Keep away from heat, sparks and flame. Flammables area. Keep container tightly closed in a dry and well-ventilated place.

8. Exposure controls / personal protection

Exposure Guidelines This product does not contain any hazardous materials with occupational exposure limitsestablished by the region specific regulatory bodies.

Engineering Measures Ensure adequate ventilation, especially in confined areas. Use explosion-proof electrical/ventilating/lighting equipment.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection No protective equipment is needed under normal use conditions.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	aromatic
Odor Threshold	No information available
pH	No information available
Melting Point/Range	No data available
Boiling Point/Range	134.5 °C / 274.1 °F
Flash Point	15 °C / 59 °F
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	6.8%
Lower	1.2%
Vapor Pressure	9.6 mmHg @ 25 °C
Vapor Density	3.66 (Air = 1.0)
Specific Gravity	0.940
Solubility	No information available
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	432 °C / 809.6 °F
Decomposition Temperature	No information available
Viscosity	No information available
Molecular Formula	C8 D10
Molecular Weight	116.25

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Stable under normal conditions. Hygroscopic.

Conditions to Avoid Keep away from open flames, hot surfaces and sources of ignition. Incompatible products. Exposure to moist air or water.

Incompatible Materials Strong oxidizing agents

Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO_2)

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information
Component Information
Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation No information available

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS No	IARC	NTP	ACGIH	OSHA	Mexico
Benzene-d5, ethyl-d5-	25837-05-2	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure None known
STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed Inhalation of high vapor concentrations may cause symptoms like headache, dizziness, tiredness, nausea and vomiting

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity
Do not empty into drains.

Persistence and Degradability Soluble in water Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its water solubility.

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT
UN-No UN1175
Hazard Class 3
Packing Group II

TDG

UN-No	UN1175
Hazard Class	3
Packing Group	II

IATA

UN-No	UN1175
Proper Shipping Name	ETHYLBENZENE
Hazard Class	3
Packing Group	II

IMDG/IMO

UN-No	UN1175
Proper Shipping Name	ETHYLBENZENE
Hazard Class	3
Packing Group	II

15. Regulatory information

United States of America Inventory

Component	CAS No	TSCA	TSCA Inventory notification - Active-Inactive	TSCA - EPA Regulatory Flags
Benzene-d5, ethyl-d5-	25837-05-2	X	ACTIVE	-

Legend:
TSCA US EPA (TSCA) - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed

TSCA 12(b) - Notices of Export Not applicable

International Inventories
Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Japan (ISHL), Australia (AICS), China (IECSC), Korea (KECL).

Component	CAS No	DSL	NDSL	EINECS	PICCS	ENCS	ISHL	AICS	IECSC	KECL
Benzene-d5, ethyl-d5-	25837-05-2	-	X	247-292-8	-	-		-	-	-

KECL - NIER number or KE number (http://ncis.nier.go.kr/en/main.do)

U.S. Federal Regulations

SARA 313 Not applicable

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act) Not applicable

Clean Air Act Not applicable

OSHA - Occupational Safety and Health Administration Not applicable

CERCLA Not applicable

California Proposition 65 This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations Not applicable

U.S. Department of Transportation

Reportable Quantity (RQ): N
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

Authorisation/Restrictions according to EU REACH

Safety, health and environmental regulations/legislation specific for the substance or mixture

Component	CAS No	OECD HPV	Persistent Organic Pollutant	Ozone Depletion Potential	Restriction of Hazardous Substances (RoHS)
Benzene-d5, ethyl-d5-	25837-05-2	Not applicable	Not applicable	Not applicable	Not applicable

Component	CAS No	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Major Accident Notification	Seveso III Directive (2012/18/EC) - Qualifying Quantities for Safety Report Requirements	Rotterdam Convention (PIC)	Basel Convention (Hazardous Waste)
Benzene-d5, ethyl-d5-	25837-05-2	Not applicable	Not applicable	Not applicable	Not applicable

16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Revision Date 25-Dec-2021
Print Date 25-Dec-2021
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS).

Disclaimer
The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

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Ethylene Dibromide (Dibromoethane)

106-93-4

Hazard Summary

Exposure to ethylene dibromide primarily occurs from its past use as an additive to leaded gasoline and as a fumigant. Ethylene dibromide is extremely toxic to humans. The chronic (long-term) effects of exposure to ethylene dibromide have not been well documented in humans. Animal studies indicate that chronic exposure to ethylene dibromide may result in toxic effects to the liver, kidney, and the testis, irrespective of the route of exposure. Limited data on men occupationally exposed to ethylene dibromide indicate that long-term exposure to ethylene dibromide can impair reproduction by damaging sperm cells in the testicles. Several animal studies indicate that long-term exposure to ethylene dibromideincreases the incidences of a variety of tumors in rats and mice in both sexes by all routes of exposure. EPA has classified ethylene dibromide as a Group B2, probable human carcinogen.

Please Note: The main sources of information for this fact sheet are EPA's Integrated Risk Information System (IRIS) (4), which contains information on the carcinogenic effects of ethylene dibromide including the unit cancer risk for inhalation exposure, and the Agency for Toxic Substances and Disease Registry's (ATSDR's) Toxicological Profile for 1,2-Dibromoethane. (1)

Uses

- Ethylene dibromide was used in the past as an additive to leaded gasoline; however, since leaded gasoline is now banned, it is no longer used for this purpose. (1)
- Ethylene dibromide was used as a fumigant to protect against insects, pests, and nematodes in citrus, vegetable, and grain crops, and as a fumigant for turf, particularly on golf courses. In 1984, EPA banned its use as a soil and grain fumigant. (1)
- Ethylene dibromide is currently used in the treatment of felled logs for bark beetles and termites, and control of wax moths in beehives. (1)
- Ethylene dibromide is also used as an intermediate for dyes, resins, waxes, and gums. (1)

Sources and Potential Exposure

- Possible sources of ethylene dibromide emissions to the ambient air are production and processing facilities. (1)
- Exposure could occur from inhalation of ambient air near industries that use ethylene dibromide or through the ingestion of contaminated drinking water. (1)

Assessing Personal Exposure

- There is no known reliable medical test to determine whether someone has been exposed to ethylene dibromide. (1)

Health Hazard Information

Acute Effects:

- Clinical signs in humans and animals related to acute inhalation exposure to ethylene dibromide are depression and collapse. Ethylene dibromide is a severe skin irritant that can cause blistering. (1,2)
- Exposure to high concentrations of ethylene dibromide through inhalation, ingestion, or skin contact can result in death. Changes in the liver and kidney are reported in humans who died from ingestion of ethylene dibromide. (1,2)
- Tests involving acute exposure of rats have shown ethylene dibromide to have high acute toxicity from oral exposure, while moderate acute toxicity resulted from inhalation exposure. (3)

Chronic Effects (Noncancer):

- The chronic effects of exposure to ethylene dibromide have not been extensively documented in humans. In one case in which a worker breathed ethylene dibromide for several years, he developed bronchitis, headache, and depression. His health improved after he stopped breathing air contaminated with ethylene dibromide. (1,2)
- Animal studies indicate that prolonged exposure to ethylene dibromide may result in toxic effects to the liver, kidney, and the testis whether by inhalation, ingestion, or skin contact. (1,2)
- EPA has not established a Reference Dose (RfD) or a Reference Concentration (RfC) for ethylene dibromide. (4)
- EPA has calculated a provisional RfC of 0.0002 milligrams per cubic meter (mg/m^3) for ethylene dibromide based on reproductive effects in humans. The RfC is an estimate (with uncertainty spanning perhaps an order of magnitude) of a continuous inhalation exposure to the human population (including sensitive subgroups) that is likely to be without appreciable risk of deleterious noncancer effects during a lifetime. It is not a direct estimator of risk but rather a reference point to gauge the potential effects. At exposures increasingly greater than the RfC, the potential for adverse health effects increases. Lifetime exposure above the RfC does not imply that an adverse health effect would necessarily occur. The provisional RfC is a value that has had some form of Agency review, but it does not appear on IRIS. (5)

Reproductive Effects/Developmental:

- Developmental effects have not been documented in humans. Limited data on men occupationally exposed to ethylene dibromide indicate that long-term exposure to ethylene dibromide can impair reproduction by damaging sperm cells in the testicles. (1,2)
- Animals that breathed or ate food containing ethylene dibromide for short or long periods were less fertile than control animals or had abnormal sperm. Pregnant animals that were sick from exposure to ethylene dibromide have had pups with birth defects. (1,2)

Cancer Risk:

- Two cancer studies on workers exposed to ethylene dibromide have been carried out. Neither study reported a statistically significant increase in cancer mortality; however these studies are considered inadequate due to confounding factors. (4)
- Several animal studies indicate that long-term exposure to ethylene dibromide increases the incidences of a variety of tumors in rats and mice in both sexes by inhalation, by gavage (the placing of ethylene dibromide experimentally in the stomach), or by administration to the skin. (4)
- EPA has classified ethylene dibromide as a Group B2, probable human carcinogen. (4)
- EPA uses mathematical models, based on animal studies, to estimate the probability of a person developing cancer from breathing air containing a specified concentration of a chemical. EPA has calculated an inhalation unit risk estimate of 2.2×10^{-4} $(\mu g/m^3)^{-1}$. EPA estimates that, if an individual were to continuously breathe air containing ethylene dibromide at an average of 0.005 $\mu g/m^3$ (5×10^{-6} mg/m^3) over his or her entire lifetime, that person would theoretically have no more than a one-in-a-million increased chance of developing cancer as a direct result of breathing air containing this chemical. Similarly, EPA estimates that continuously breathing air containing 0.05 $\mu g/m^3$ (5×10^{-5} mg/m^3) would result in not greater than a one-in-hundred thousand increased chance of developing cancer, and air containing 0.5 $\mu g/m^3$ (5×10^{-4} mg/m^3) would result in not greater than a one-in-ten thousand increased chance of

developing cancer in their lifetime. For a detailed discussion of confidence in the potency estimates, please see IRIS. (4)

- EPA has calculated an oral cancer slope factor of 85 $(mg/kg/d)^{-1}$. (4)

Physical Properties

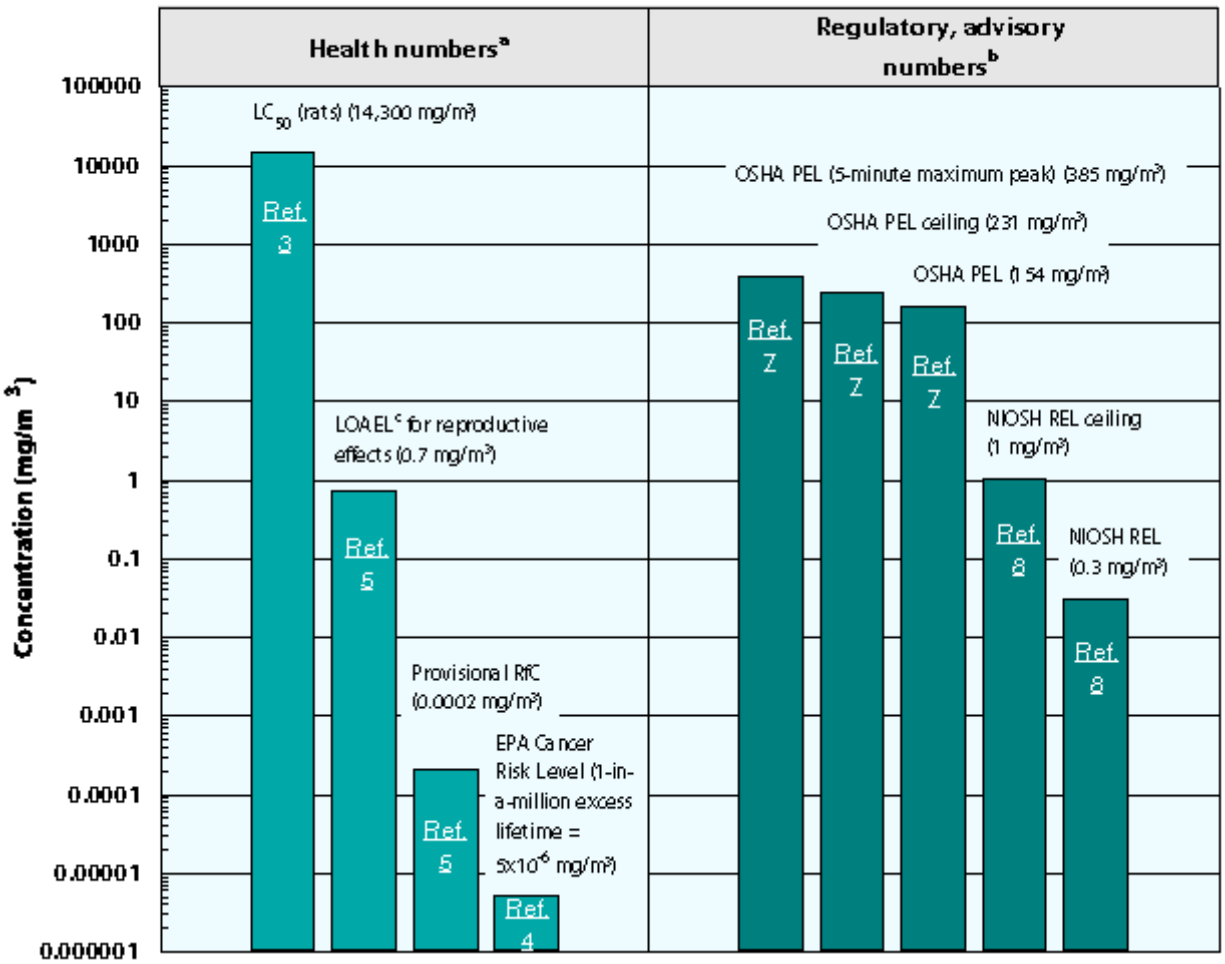
- Ethylene dibromide is a colorless liquid with a mild sweet odor, like chloroform. It is also known as 1,2-dibromomethane. (1,7)
- Ethylene dibromide is slightly soluble in water. (1,7)
- The chemical formula for ethylene dibromide is $C_2H_4Br_2$, and it has a molecular weight of 187.88 g/mol. (1,7)
- The vapor pressure for ethylene dibromide is 11.0 mm Hg at 25 °C, and it has a log octanol/water partition coefficient (log K_{ow}) of 86. (1).

  Ethylene dibromide reacts with hydroxyl radicals in the atmosphere, with a half-life for this reaction of approximately 40 days. In water, its half-life ranges from 2.5 to 13.2 years, and in soil it was detected 19 years after it had been applied. (1)

Conversion Factors (only for the gaseous form):
To convert concentrations in air (at 25°C) from ppm to mg/m^3: mg/m^3 = (ppm) × (molecular weight of the compound)/(24.45). For ethylene dibromide: 1 ppm = 7.7 mg/m^3.
To convert concentrations in air from $\mu g/m^3$ to mg/m^3: mg/m^3 = ($\mu g/m^3$) × (1 mg/1,000 µg).

Health Data from Inhalation Exposure

Ethylene Dibromide



LC50 (Lethal Concentration 50)--A calculated concentration of a chemical in air to which exposure for a specific length of time is expected to cause death in 50% of a defined experimental animal population.

NIOSH ceiling --National Institute of Occupational Safety and Health's ceiling limit; NIOSH--recommended 15-min exposure limit, which should not be exceeded.

NIOSH REL--NIOSH's recommended exposure limit; NIOSH-recommended exposure limit for an 8- or 10-h time-weighted-average exposure and/or ceiling.

OSHA PEL--Occupational Safety and Health Administration's permissible exposure limit expressed as a time-weighted average; the concentration of a substance to which most workers can be exposed without adverse effect averaged over a normal 8-h workday or a 40-h workweek.

The health and regulatory values cited in this factsheet were obtained in December 1999.

[a] Health numbers are toxicological numbers from animal testing or risk assessment values developed by EPA.

[b] Regulatory numbers are values that have been incorporated in Government regulations, while advisory numbers are nonregulatory values provided by the Government or other groups as advice. OSHA numbers are regulatory, whereas NIOSH numbers are advisory.

[c] The LOAEL is from the critical study used as the basis for the EPA provisional RfC.

Summary created in April 1992, updated January 2000

References

1. Agency for Toxic Substances and Disease Registry (ATSDR). Toxicological Profile for 1,2-Dibromoethane. Public Health Service, U.S. Department of Health and Human Services, Atlanta, GA. 1992.
2. U.S. Department of Health and Human Services. Hazardous Substances Data Bank (HSDB, online database). National Toxicology Information Program, National Library of Medicine, Bethesda, MD. 1993.

3. U.S. Department of Health and Human Services. Registry of Toxic Effects of Chemical Substances (RTECS, online database). National Toxicology Information Program, National Library of Medicine, Bethesda, MD. 1993.
4. U.S. Environmental Protection Agency. Integrated Risk Information System (IRIS) on 1,2-Dibromoethane. National Center for Environmental Assessment, Office of Research and Development, Washington, DC. 1999.
5. U.S. Environmental Protection Agency. Health Effects Assessment Summary Tables. FY-1997 Update. National Center for Environmental Assessment, Office of Research and Development, Office of Emergency and Remedial Response, Washington, DC. 1997.
6. The Merck Index. An Encyclopedia of Chemicals, Drugs, and Biologicals. 11th ed. Ed. S. Budavari. Merck and Co. Inc., Rahway, NJ. 1989.
7. Occupational Safety and Health Administration (OSHA). Occupational Safety and Health Standards, Toxic and Hazardous Substances. Code of Federal Regulations. 29 CFR 1910.1000. 1998.
8. National Institute for Occupational Safety and Health (NIOSH). Pocket Guide to Chemical Hazards. U.S. Department of Health and Human Services, Public Health Service, Centers for Disease Control and Prevention. Cincinnati, OH. 1997.

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MATERIAL SAFETY DATA SHEET

by Tyco Fire Suppression & Building Products

ABC Fire Extinguisher

Issue Date: 04-13-2011

1. Product and Company Identification

Material name	**ABC Fire Extinguisher**
Version #	02
Revision date	04-13-2011
CAS #	Mixture
Product use	Fire Extinguisher
Manufacturer / Importer / Supplier	
Name	Tyco Fire Protection Products
Address	One Stanton Street Marinette, WI 54143-2542
Phone	715-735-7411
Internet	http://www.ansul.com
Emergency Phone Number	CHEMTREC 800-424-9300 or 703-527-3887

2. Hazards Identification

Emergency overview	WARNING Irritating to eyes and skin.
OSHA regulatory status	This product is considered hazardous under 29 CFR 1910.1200 (Hazard Communication).
Potential health effects	
Routes of exposure	Eye contact. Skin contact. Inhalation. Ingestion.
Eyes	Avoid contact with eyes. Contact with eyes may cause irritation.
Skin	Avoid contact with the skin. May cause skin irritation.
Inhalation	Inhalation of dusts may cause respiratory irritation.
Ingestion	Not a likely route of entry.
Target organs	Eyes. Respiratory system. Skin.
Signs and symptoms	Irritation of eyes and mucous membranes.

3. Composition / Information on Ingredients

Hazardous components	**CAS #**	**Percent**
CALCIUM CARBONATE	471-34-1	1 - 2.5
Non-hazardous components	**CAS #**	**Percent**
Ammonium Sulfate	7783-20-2	10 - 20
Ammonium Phosphate	7722-76-1	60 - 80
Other components below reportable levels		2.5 - 10

4. First Aid Measures

First aid procedures	
Eye contact	Immediately flush eyes with plenty of water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get medical attention if irritation persists after washing.
Skin contact	Wash off with warm water and soap. Get medical attention if irritation develops and persists.
Inhalation	Move to fresh air. Get medical attention, if needed.
Ingestion	Rinse mouth. Do not induce vomiting without advice from poison control center. If vomiting occurs, keep head low so that stomach content doesn't get into the lungs.
Notes to physician	Symptoms may be delayed.

General advice If you feel unwell, seek medical advice (show the label where possible). Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves. Show this safety data sheet to the doctor in attendance.

5. Fire Fighting Measures

Flammable properties No unusual fire or explosion hazards noted.

Extinguishing media

Suitable extinguishing media This product is not flammable. Use extinguishing agent suitable for type of surrounding fire.

Protection of firefighters

Specific hazards arising from the chemical None known.

Hazardous combustion products Carbon monoxide and carbon dioxide.

6. Accidental Release Measures

Personal precautions Local authorities should be advised if significant spillages cannot be contained. Avoid inhalation of dust from the spilled material. Wear a dust mask if dust is generated above exposure limits.

Environmental precautions Prevent further leakage or spillage if safe to do so. Do not contaminate water.

Methods for containment If sweeping of a contaminated area is necessary use a dust suppressant agent which does not react with the product. Prevent entry into waterways, sewer, basements or confined areas.

Methods for cleaning up Should not be released into the environment. Sweep up or vacuum up spillage and collect in suitable container for disposal. Collect dust using a vacuum cleaner equipped with HEPA filter. Avoid dust formation. Following product recovery, flush area with water.

Other information Clean up in accordance with all applicable regulations.

7. Handling and Storage

Handling Keep formation of airborne dusts to a minimum. Do not breathe dust. Avoid contact with eyes. Do not use in areas without adequate ventilation. Wear personal protective equipment. Wash thoroughly after handling.

Storage Keep container tightly closed. Guard against dust accumulation of this material. Use care in handling/storage.

8. Exposure Controls / Personal Protection

Occupational exposure limits

U.S. - OSHA

Components	Type	Value	Form
CALCIUM CARBONATE (471-34-1)	PEL	5.0000 mg/m3	Respirable fraction.
		15.0000 mg/m3	Total dust.
	TWA	5.0000 mg/m3	Respirable fraction.
		15.0000 mg/m3	Total dust.

Engineering controls Ensure adequate ventilation, especially in confined areas.

Personal protective equipment

Eye / face protection Do not get in eyes. Chemical goggles are recommended.

Skin protection No special protective equipment required.

Respiratory protection When workers are facing concentrations above the exposure limit they must use appropriate certified respirators.

General hygiene considerations Do not get in eyes.

9. Physical & Chemical Properties

Appearance

Form Powder.

Color Yellow.

Odor Odorless.

Physical state Solid.

pH	Not available.
Melting point	Not available.
Freezing point	Not available.
Boiling point	Not available.
Flash point	Not available.
Evaporation rate	Not available.
Flammability limits in air, upper, % by volume	Not available.
Flammability limits in air, lower, % by volume	Not available.
Vapor pressure	Not available.
Vapor density	Not available.
Specific gravity	Not available.
Relative density	Not available.
Solubility (water)	Not available.
Partition coefficient (n-octanol/water)	Not available
Auto-ignition temperature	Not available.
Decomposition temperature	Not available.
VOC	Not available.

10. Chemical Stability & Reactivity Information

Chemical stability	Material is stable under normal conditions.
Incompatible materials	Strong acids.
Hazardous decomposition products	Carbon oxides.

11. Toxicological Information

Toxicological information The toxicity of this product has not been tested.

Toxicological data

Components	Test Results
CALCIUM CARBONATE (471-34-1)	Acute Oral LD50 Rat: 6450 mg/kg

Local effects	Components of the product may be absorbed into the body through the skin. Contact may irritate or burn eyes.
Chronic effects	Hazardous by OSHA criteria. Prolonged inhalation may be harmful.
Carcinogenicity	This product is not considered to be a carcinogen by IARC, ACGIH, NTP, or OSHA.

12. Ecological Information

Ecotoxicological data

Components	Test Results
CALCIUM CARBONATE (471-34-1)	LC50 Western mosquitofish (Gambusia affinis): > 56000 mg/l 96.00 Hours
Ammonium Sulfate (7783-20-2)	EC50 Water flea (Ceriodaphnia dubia): 52 - 67 mg/l 48.00 hours
	LC50 Pink salmon (Oncorhynchus gorbuscha): 0.068 mg/l 96.00 hours

Ecotoxicity	This material is not expected to be harmful to aquatic life.
Environmental effects	An environmental hazard cannot be excluded in the event of unprofessional handling or disposal.
Persistence and degradability	Not available.

13. Disposal Considerations

Disposal instructions
This product, in its present state, when discarded or disposed of, is not a hazardous waste according to Federal regulations (40 CFR 261.4 (b)(4)). Under RCRA, it is the responsibility of the user of the product to determine, at the time of disposal, whether the product meets RCRA criteria for hazardous waste. Dispose of waste material according to Local, State, Federal, and Provincial Environmental Regulations.

Waste from residues / unused products
Dispose of in accordance with local regulations.

14. Transport Information

DOT

Basic shipping requirements:

UN number UN1044
Proper shipping name Fire extinguishers
Hazard class 2.2
Additional information:
Special provisions 18, 110
Packaging exceptions 309
Packaging non bulk 309
Packaging bulk None
ERG number 126



DOT

15. Regulatory Information

US federal regulations
This product is a "Hazardous Chemical" as defined by the OSHA Hazard Communication Standard, 29 CFR 1910.1200.
All components are on the U.S. EPA TSCA Inventory List.

CERCLA/SARA Hazardous Substances - Not applicable.

US EPCRA (SARA Title III) Section 313 - Toxic Chemical: De minimis concentration

Ammonium Phosphate (CAS 7722-76-1)	1.0 %
Ammonium Sulfate (CAS 7783-20-2)	1.0 %

US EPCRA (SARA Title III) Section 313 - Toxic Chemical: Listed substance

Ammonium Phosphate (CAS 7722-76-1)	Listed.
Ammonium Sulfate (CAS 7783-20-2)	Listed.

CERCLA (Superfund) reportable quantity

None

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories
Acute Health - Yes
Chronic Health - Yes
Fire Hazard - No
Pressure Hazard - Yes
Reactivity Hazard - No

Section 302 extremely hazardous substance No

Section 311 hazardous chemical No

Inventory status

Country(s) or region	Inventory name	On inventory (yes/no)*
Australia	Australian Inventory of Chemical Substances (AICS)	Yes
Canada	Domestic Substances List (DSL)	Yes
Canada	Non-Domestic Substances List (NDSL)	No
China	Inventory of Existing Chemical Substances in China (IECSC)	Yes
Europe	European Inventory of Existing Commercial Chemical Substances (EINECS)	Yes
Europe	European List of Notified Chemical Substances (ELINCS)	No
Japan	Inventory of Existing and New Chemical Substances (ENCS)	No
Korea	Existing Chemicals List (ECL)	Yes
New Zealand	New Zealand Inventory	Yes
Philippines	Philippine Inventory of Chemicals and Chemical Substances (PICCS)	Yes
United States & Puerto Rico	Toxic Substances Control Act (TSCA) Inventory	Yes

*A "Yes" indicates that all components of this product comply with the inventory requirements administered by the governing country(s)

State regulations This product does not contain a chemical known to the State of California to cause cancer, birth defects or other reproductive harm.

US - Pennsylvania RTK - Hazardous Substances: Listed substance

Ammonium Sulfate (CAS 7783-20-2)	Listed.
CALCIUM CARBONATE (CAS 471-34-1)	Listed.

16. Other Information

Further information HMIS® is a registered trade and service mark of the NPCA.

HMIS® ratings
Health: 1*
Flammability: 0
Physical hazard: 0

NFPA ratings
Health: 1
Flammability: 0
Instability: 0

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Issue date 04-13-2011

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APG

Analytical Products Group, Inc.

2730 Washington Blvd., Belpre, OH 45714
740-423-4200 800-272-4442 Fax 740-423-5588

Material Safety Data Sheet

Date prepared on: 9/18/95

Last revised on: 1/20/08

Page **1**

Section I: Product Identification

CATALOG NUMBER: 2700,4250,4252,4253,9180,9680, 4840, 4842, 224840	PRODUCT NAME: Gasoline Range Organics (GRO)

Section II - Hazardous Ingredients/Identity Information

Chemical Name	CAS Reg. No.	OSHA PEL (TWA)	% Composition*
Methanol	67-56-1	200ppm	>99.5%
Total concentration of unleaded gasoline compounds in the standard is less than 0.5%			

Section III - Physical/Chemical Characteristics of Hazardous Ingredients

Methanol

BOILING POINT: 65 C (149 F)	SPECIFIC GRAVITY: 0.7914	
VAPOR PRESSURE: 97 mmHg @ 20 C	SOLUBILITY IN WATER: Very soluble	APPEARANCE/ODOR: Clear, colorless liquid with a pungent odor (methanol).

Section IV - Fire and Explosion Hazard Data

FLASH POINT (Method used): 11 C (52 F) Closed Cup	AUTO IGNITION TEMPERATURE: 385 C (725 F)	FLAMMABLE LIMITS	LEL 6%	UEL 36%
EXTINGUISHING MEDIA: Use extinguisher media appropriate for surrounding fire since sample size is small. Alcohol foam, dry chemical or carbon dioxide (water may be ineffective in most laboratory situations).				
SPECIAL FIRE FIGHTING PROCEDURES: Firefighters should wear proper protective equipment and self contained breathing apparatus with full face piece operated in positive pressure mode. Move containers from fire area if it can be done without risk. Use water to keep fire exposed containers cool.				
UNUSUAL FIRE AND EXPLOSION HAZARDS: Vapors may flow along surfaces to distant ignition sources and flash back. Closed containers exposed to heat may explode. Contact with strong oxidizers may cause fire. Burns with a clear almost invisible flame.				

Section V - Reactivity Data

STABILITY:	Unstable ☐	Stable ☒	Conditions to Avoid: Heat, flame and other sources of ignition.
INCOMPATIBILITY (Materials to avoid): Strong oxidizing agents, strong acids, zinc, aluminum and magnesium.			
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon monoxide, carbon dioxide and formaldehyde.			
HAZARDOUS POLYMERIZATION:	May Occur ☐	Will Not Occur ☒	Conditions to Avoid: None Known

Section VI - Health Hazard Data

ROUTES OF ENTRY	Inhalation? YES	Skin? YES	Ingestion? YES
HEALTH HAZARDS (Acute and Chronic): ACUTE: Yes, see chronic symptoms. CHRONIC: Methanol is a poison by ingestion. Methanol ingestion may be fatal or cause blindness, headache, nausea, vomiting, dizziness, gastrointestinal irritation, central nervous system depression and hearing loss.			
COMPONENTS LISTED AS CARCINOGENS OR POTENTIAL CARCINOGENS: Gasoline is a suspected carcinogen.			
SIGNS AND SYMPTOMS OF EXPOSURE: Irritation of skin, eyes, nose , throat and headache. Prolonged contact may cause dermatitis. Exposure effects may differ between individuals.			
MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE: Eye disorders, skin disorders, liver and kidney damage.			

EMERGENCY AND FIRST AID PROCEDURES: Seek medical assistance for treatment, observation and support if necessary. EYE CONTACT: Flush with water, obtain medical attention. SKIN CONTACT: Wash with soap and water, use protective creams. INHALATION: Remove to fresh air, if not breathing give artificial respiration. If breathing is difficult give oxygen and obtain medical attention. INGESTION: If conscious, give water and baking soda and induce vomiting. Obtain medical assistance immediately.

Section VII - Precautions for Safe Handling and Use

STEPS TO BE TAKEN IN CASE MATERIAL IS RELEASED OR SPILLED: (Sample) shut of ignition sources. No flares, smoking or flames in area. Take up with sand or other non-combustible absorbent material and place into container for later disposal. Flush area with water.
WASTE DISPOSAL METHOD: Dispose in accordance with all applicable federal, state, and local environmental regulations. Excess sample should be placed in a proper waste solvent container.
PRECAUTIONS TO BE TAKEN IN HANDLING AND STORAGE: Keep container tightly closed, store in a cool, dry, well ventilated, flammable liquid storage area.
OTHER PRECAUTIONS* Do not heat or evaporate sample to dryness.

Section VIII - Control Measures

RESPIRATORY PROTECTION (Please specify): Required if airborne concentrations exceed TWA of 200 ppm.	
VENTILATION: Local exhaust (general or local exhausts to meet TLV regulations).	
PROTECTIVE GLOVES: Rubber gloves recommended.	EYE PROTECTION: Safety glasses or goggles.
OTHER PROTECTIVE EQUIPMENT: Impervious Clothing	
EMERGENCY WASH FACILITIES: Maintain eye wash and quick drench showers in work area.	

The information stated in this Material Safety Data Sheet (MSDS) is believed to be correct on the date of publication and must not be considered all conclusive. The information has been obtained only by a search of available literature and is only a guide for handling the chemicals. Persons not specifically and properly trained should not handle this chemical or its container. This MSDS is provided without any warranty expressed or implied, including merchantability or fitness for any particular purpose.

This product is furnished for laboratory use ONLY! Our standards may not be used as drugs, cosmetics, agricultural or pesticidal products, food additives or as house hold chemicals.

* Various Government agencies (i.e., Department of Transportation, Occupational Safety and Health Administration, Environmental Protection Agency, and others) may have specific regulations concerning the transportation, handling, storage or use of this product which may not be contained herein. The customer or user of this product should be familiar with these regulations.

Safety Data Sheet

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY/UNDERTAKING

Material Name	:	**Gasoline**
Other Names / Synonyms	:	MOGAS, ULG 95, 88 RON, 90 RON, 91 RON, 92 RON, 93 RON, 95 RON, 97 UNLD, 91 UNLD
Recommended Use / Restrictions of Use	:	Fuel for spark ignition engines designed to run on unleaded fuel.
Supplier	:	**Shell Eastern Trading (PTE) Ltd** 9 North Buona Vista Drive, #07-01, Tower 1, The Metropolis Singapore 138588 Singapore
Telephone	:	+65-6384 8000
Emergency Telephone Number	:	+44 (0) 151 350 4595

2. HAZARDS IDENTIFICATION

GHS Classification	:	Flammable liquids, Category 1 Skin corrosion/irritation, Category 2 Aspiration hazard, Category 1 Toxic to reproduction, Category 2 Germ cell mutagenicity, Category 1B Carcinogenicity, Category 1B Specific target organ toxicity - single exposure, Category 3, Inhalation, Narcotic effects. Acute hazards to the aquatic environment, Category 2 Hazardous to the aquatic environment - Long-term Hazard, Category 2
GHS Label Elements Symbol(s)	:	
Signal Words	:	Danger
Hazard Statement	:	PHYSICAL HAZARDS:

H224: Extremely flammable liquid and vapour.

HEALTH HAZARDS:
H304: May be fatal if swallowed and enters airways.
H315: Causes skin irritation.
H336: May cause drowsiness or dizziness.
H340: May cause genetic defects.
H350: May cause cancer.
H361: Suspected of damaging fertility or the unborn child.

ENVIRONMENTAL HAZARDS:
H401: Toxic to aquatic life.
H411: Toxic to aquatic life with long lasting effects.

GHS Precautionary Statements

Prevention	:	P201: Obtain special instructions before use. P210: Keep away from heat/sparks/open flames/hot surfaces. - No smoking. P280: Wear protective gloves/protective clothing/eye protection/face protection.
Response	:	P301+P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician.
Storage	:	P403+P233: Store in a well-ventilated place. Keep container tightly closed.
Disposal:	:	P501: Dispose of contents and container to appropriate waste site or reclaimer in accordance with local and national regulations.
Other Hazards which do not result in classification	:	Liquid evaporates quickly and can ignite leading to a flash fire, or an explosion in a confined space. This material is a static accumulator. Even with proper grounding and bonding, this material can still accumulate an electrostatic charge. If sufficient charge is allowed to accumulate, electrostatic discharge and ignition of flammable air-vapour mixtures can occur. Slightly irritating to respiratory system. This product contains benzene which may cause leukaemia (AML - acute myelogenous leukaemia). May cause MDS (Myelodysplastic Syndrome).
Additional Information	:	This product is intended for use in closed systems only.

3. COMPOSITION/INFORMATION ON INGREDIENTS

Mixture Description : Complex mixture of hydrocarbons consisting of paraffins, cycloparaffins, aromatic and olefinic hydrocarbons with carbon numbers predominantly in the C4 to C12 range. Includes benzene at 0.1 - 5% v/v. Contains oxygenated hydrocarbons which may include methyl tertiary butyl ether (MTBE) and other ethers. May also contain several additives at <0.1% v/v each.

Synonyms : MOGAS, ULG 95, 88 RON, 90 RON, 91 RON, 92 RON, 93 RON, 95 RON, 97 UNLD, 91 UNLD

Classification of components according to GHS

Chemical Identity	Synonyms	CAS	Hazard Class (category)	Hazard Statement	Conc.
Gasoline, low boiling point naphtha	Gasoline, low boiling point naphtha	86290-81-5	Flam. Liq., 1; Skin Corr., 2; Asp. Tox., 1; Muta., 1B; Carc., 1B; STOT SE, 3; Aquatic Chronic, 2; Aquatic Acute, 2; Repr., 2;	H224; H315; H304; H340; H350; H336; H411; H401; H361;	85.00 - 100.00 %
Ethyl tertiary butyl ether	Ethyl tertiary butyl ether	637-92-3	Flam. Liq., 2; STOT SE, 3; Asp. Tox., 2; Aquatic Acute, 3;	H225; H336; H305; H402;	0.00 - 15.00 %
Methyl tertiary butyl ether	Methyl tertiary butyl ether	1634-04-4	Flam. Liq., 2; Skin Corr., 3; Acute Tox., 5; Asp. Tox., 2;	H225; H316; H303; H305;	0.00 - 15.00 %
Tertiary amyl methyl ether	Tertiary amyl methyl ether	994-05-8	Flam. Liq., 2; Acute Tox., 4; STOT SE, 3;	H225; H302; H336;	0.00 - 15.00 %

Additional Information : Contains Benzene, CAS # 71-43-2. Contains Toluene, CAS # 108-88-3. Contains Ethylbenzene, CAS # 100-41-4. Contains n-Hexane, CAS # 110-54-3. Contains Xylene (Mixed Isomers), CAS # 1330-20-7. Contains Cyclohexane, CAS# 110-82-7. Contains Cumene, CAS# 98-82-8 Contains Tri-methyl-benzene (all isomers), CAS# 25551-13-7.

Contains Naphthalene, CAS # 91-20-3.

The amount of oxygenated components is limited at 2.7 % m/m calculated as oxygen. Alcohols may be present at <0.1%v. Dyes and markers can be used to indicate tax status and prevent fraud. Refer to Ch 16 for full text of H phrases.

Refer to chapter 16 for full text of EC R-phrases.

4. FIRST-AID MEASURES

Inhalation	:	Remove to fresh air. If rapid recovery does not occur, transport to nearest medical facility for additional treatment.
Skin Contact	:	Remove contaminated clothing. Immediately flush skin with large amounts of water for at least 15 minutes, and follow by washing with soap and water if available. If redness, swelling, pain and/or blisters occur, transport to the nearest medical facility for additional treatment. When using high pressure equipment, injection of product under the skin can occur. If high pressure injuries occur, the casualty should be sent immediately to a hospital. Do not wait for symptoms to develop.
Eye Contact	:	Flush eyes with water while holding eyelids open. Rest eyes for 30 minutes. If redness, burning, blurred vision, or swelling persist transport to the nearest medical facility for additional treatment.
Ingestion	:	If swallowed, do not induce vomiting: transport to nearest medical facility for additional treatment. If vomiting occurs spontaneously, keep head below hips to prevent aspiration. If any of the following delayed signs and symptoms appear within the next 6 hours, transport to the nearest medical facility: fever greater than 101° F (38.3°C), shortness of breath, chest congestion or continued coughing or wheezing.
Most Important Symptoms/Effects, Acute & Delayed	:	Skin irritation signs and symptoms may include a burning sensation, redness, or swelling. Eye irritation signs and symptoms may include a burning sensation and a temporary redness of the eye. If material enters lungs, signs and symptoms may include coughing, choking, wheezing, difficulty in breathing, chest congestion, shortness of breath, and/or fever. The onset of respiratory symptoms may be delayed for several hours after exposure. Breathing of high vapour concentrations may cause central nervous system (CNS) depression resulting in dizziness, light-headedness, headache, nausea and loss of coordination. Continued inhalation may result in unconsciousness and death. Auditory system effects may include temporary hearing loss and/or ringing in the ears.

Immediate medical attention, special treatment	:	Treat symptomatically.

5. FIRE-FIGHTING MEASURES

Clear fire area of all non-emergency personnel.

Specific hazards arising from Chemicals	:	Hazardous combustion products may include: A complex mixture of airborne solid and liquid particulates and gases (smoke). Carbon monoxide may be evolved if incomplete combustion occurs. Unidentified organic and inorganic compounds. The vapour is heavier than air, spreads along the ground and distant ignition is possible. Will float and can be reignited on surface water.
Suitable Extinguishing Media	:	Foam, water spray or fog. Dry chemical powder, carbon dioxide, sand or earth may be used for small fires only.
Unsuitable Extinguishing Media	:	Do not use direct water jets on the burning product as they could cause a steam explosion and spread of the fire. Simultaneous use of foam and water on the same surface is to be avoided as water destroys the foam.
Protective Equipment & Precautions for Fire Fighters	:	Proper protective equipment including chemical resistant gloves are to be worn; chemical resistant suit is indicated if large contact with spilled product is expected. Self-Contained Breathing Apparatus must be worn when approaching a fire in a confined space. Select fire fighter's clothing approved to relevant Standards (e.g. Europe: EN469).
Additional Advice	:	Keep adjacent containers cool by spraying with water. If possible remove containers from the danger zone. If the fire cannot be extinguished the only course of action is to evacuate immediately. Contain residual material at affected sites to prevent material from entering drains (sewers), ditches, and waterways.

6. ACCIDENTAL RELEASE MEASURES

Avoid contact with skin, eyes and clothing. Evacuate the area of all non-essential personnel. Ventilate contaminated area thoroughly. If contamination of sites occurs remediation may require specialist advice. Avoid contact with spilled or released material. Immediately remove all contaminated clothing. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. For guidance on disposal of spilled material see Chapter 13 of this Material Safety Data Sheet. Ensure electrical continuity by bonding and grounding (earthing) all equipment. Observe the relevant local and international regulations. Take precautionary measures against static discharges.

Personal Precautions, Protective Equipment and Emergency Procedures	:	Do not breathe fumes, vapour. Do not operate electrical equipment. Shut off leaks, if possible without personal risks. Remove all possible sources of ignition in the surrounding area. Vapour can travel for considerable distances both above and below the ground surface. Underground services (drains, pipelines, cable ducts) can provide preferential flow paths. Evacuate all personnel. Attempt to disperse vapour or to direct its flow to a safe location for example using fog sprays.
Environmental Precautions	:	Take measures to minimise the effects on groundwater. Contain residual material at affected sites to prevent material from entering drains (sewers), ditches, and waterways. Prevent from spreading or entering into drains, ditches or rivers by using sand, earth, or other appropriate barriers.
Methods and Material for Containment and Cleaning Up	:	Take precautionary measures against static discharges. For large liquid spills (> 1 drum), transfer by mechanical means such as vacuum truck to a salvage tank for recovery or safe disposal. Do not flush away residues with water. Retain as contaminated waste. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely. Remove contaminated soil and dispose of safely. For small liquid spills (< 1 drum), transfer by mechanical means to a labelled, sealable container for product recovery or safe disposal. Allow residues to evaporate or soak up with an appropriate absorbent material and dispose of safely. Remove contaminated soil and dispose of safely.
Additional Advice	:	Notify authorities if any exposure to the general public or the environment occurs or is likely to occur. Local authorities should be advised if significant spillages cannot be contained. Maritime spillages should be dealt with using a Shipboard Oil Pollution Emergency Plan (SOPEP), as required by MARPOL Annex 1 Regulation 26. To the extent that this product, including its chemical components (e.g. methyl tertiary butyl ether) may impact surface or groundwater, appropriate assessment and remediation (if necessary) should be implemented.

7. HANDLING AND STORAGE

General Precautions	:	Avoid breathing vapours or contact with material. Only use in well ventilated areas. Wash thoroughly after handling. For guidance on selection of personal protective equipment see Chapter 8 of this Material Safety Data Sheet. Use the information in this data sheet as input to a risk assessment of local circumstances to help determine appropriate controls for

		safe handling, storage and disposal of this material. Air-dry contaminated clothing in a well-ventilated area before laundering. Prevent spillages. Turn off all battery operated portable electronic devices (examples include: cellular phones, pagers and CD players) before operating gasoline pump. Contaminated leather articles including shoes cannot be decontaminated and should be destroyed to prevent reuse. Do not use as a cleaning solvent or other non-motor fuel uses. Vehicle fueling and vehicle workshop areas - Avoid inhalation of vapours and contact with skin, when filling or emptying a vehicle.
Precautions for Safe Handling	:	When using do not eat or drink. Extinguish any naked flames. Do not smoke. Remove ignition sources. Avoid sparks. Never siphon by mouth. The vapour is heavier than air, spreads along the ground and distant ignition is possible. Avoid exposure. Use local exhaust ventilation if there is risk of inhalation of vapours, mists or aerosols. Properly dispose of any contaminated rags or cleaning materials in order to prevent fires.
Conditions for Safe Storage	:	Drum and small container storage: Keep containers closed when not in use. Drums should be stacked to a maximum of 3 high. Use properly labelled and closeable containers. Packaged product must be kept tightly closed and stored in a diked (bunded) well-ventilated area, away from, ignition sources and other sources of heat. Take suitable precautions when opening sealed containers, as pressure can build up during storage. Tank storage: Tanks must be specifically designed for use with this product. Bulk storage tanks should be diked (bunded). Locate tanks away from heat and other sources of ignition. Cleaning, inspection and maintenance of storage tanks is a specialist operation, which requires the implementation of strict procedures and precautions. Keep in a cool place. Electrostatic charges will be generated during pumping. Electrostatic discharge may cause fire. Ensure electrical continuity by bonding and grounding (earthing) all equipment to reduce the risk. The vapours in the head space of the storage vessel may lie in the flammable/explosive range and hence may be flammable. Refer to section 15 for any additional specific legislation covering the packaging and storage of this product.
Product Transfer	:	Wait 2 minutes after tank filling (for tanks such as those on road tanker vehicles) before opening hatches or manholes. Wait 30 minutes after tank filling (for large storage tanks) before opening hatches or manholes. Even with proper grounding and bonding, this material can still accumulate an electrostatic charge. If sufficient charge is allowed to

		accumulate, electrostatic discharge and ignition of flammable air-vapour mixtures can occur. Be aware of handling operations that may give rise to additional hazards that result from the accumulation of static charges. These include but are not limited to pumping (especially turbulent flow), mixing, filtering, splash filling, cleaning and filling of tanks and containers, sampling, switch loading, gauging, vacuum truck operations, and mechanical movements. These activities may lead to static discharge e.g. spark formation. Restrict line velocity during pumping in order to avoid generation of electrostatic discharge (<= 1 m/s until fill pipe submerged to twice its diameter, then <= 7 m/s). Avoid splash filling. Do NOT use compressed air for filling, discharging, or handling operations.
Recommended Materials	:	For containers, or container linings use mild steel, stainless steel. Aluminium may also be used for applications where it does not present an unnecessary fire hazard. Examples of suitable materials are: high density polyethylene (HDPE), polypropylene (PP), and Viton (FKM), which have been specifically tested for compatibility with this product. For container linings, use amine-adduct cured epoxy paint. For seals and gaskets use: graphite, PTFE, Viton A, Viton B.
Unsuitable Materials	:	Some synthetic materials may be unsuitable for containers or container linings depending on the material specification and intended use. Examples of materials to avoid are: natural rubber (NR), nitrile rubber (NBR), ethylene propylene rubber (EPDM), polymethyl methacrylate (PMMA), polystyrene, polyvinyl chloride (PVC), polyisobutylene. However, some may be suitable for glove materials.
Container Advice	:	Containers, even those that have been emptied, can contain explosive vapours. Do not cut, drill, grind, weld or perform similar operations on or near containers. Gasoline containers must not be used for storage of other products.
Other Advice	:	Ensure that all local regulations regarding handling and storage facilities are followed. See additional references that provide safe handling practices for liquids that are determined to be static accumulators: American Petroleum Institute 2003 (Protection Against Ignitions Arising out of Static, Lightning and Stray Currents) or National Fire Protection Agency 77 (Recommended Practices on Static Electricity). CENELEC CLC/TR 50404 (Electrostatics – Code of practice for the avoidance of hazards due to static electricity).

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Safety Data Sheet

If the American Conference of Governmental Industrial Hygienists (ACGIH) value is provided on this document, it is provided for information only.

Occupational Exposure Limits

Material	Source	Type	ppm	mg/m3	Notation
Gasoline, low boiling point naphtha	ACGIH	TWA	300 ppm		
	ACGIH	STEL	500 ppm		
	SG OEL	TWA	300 ppm	890 mg/m3	
	SG OEL	STEL	500 ppm	1,480 mg/m3	
Trimethylbenzene, all isomers	ACGIH	TWA	25 ppm		
	SG OEL	TWA	25 ppm	123 mg/m3	
Ethylbenzene	ACGIH	TWA	20 ppm		
	SG OEL	TWA	100 ppm	434 mg/m3	
	SG OEL	STEL	125 ppm	543 mg/m3	
n-hexane	ACGIH	TWA	50 ppm		
	ACGIH	SKIN_DES			Can be absorbed through the skin.
	SG OEL	TWA	50 ppm	176 mg/m3	
Benzene	ACGIH	TWA	0.5 ppm		
	ACGIH	STEL	2.5 ppm		
	ACGIH	SKIN_DES			Can be absorbed through the skin.
	SG OEL	TWA	1 ppm	3.18 mg/m3	

	SHELL IS	TWA	0.5 ppm	1.6 mg/m3	
	SHELL IS	STEL	2.5 ppm	8 mg/m3	
Toluene	ACGIH	TWA	20 ppm		
	SG OEL	TWA	50 ppm	188 mg/m3	
Xylene	ACGIH	TWA	100 ppm		
	ACGIH	STEL	150 ppm		
	SG OEL	TWA	100 ppm	434 mg/m3	
	SG OEL	STEL	150 ppm	651 mg/m3	
Cyclohexane	ACGIH	TWA	100 ppm		
	SG OEL	TWA	300 ppm	1,030 mg/m3	
Naphthalene	ACGIH	TWA	10 ppm		
	ACGIH	STEL	15 ppm		
	ACGIH	SKIN_DES			Can be absorbed through the skin.
	SG OEL	TWA	10 ppm	52 mg/m3	
	SG OEL	STEL	15 ppm	79 mg/m3	
Ethyl tertiary butyl ether	ACGIH	TWA	25 ppm		
Methyl tertiary butyl ether	ACGIH	TWA	50 ppm		
	SG OEL	TWA	40 ppm	144 mg/m3	
Tertiary amyl methyl ether	ACGIH	TWA	20 ppm		
Cumene	ACGIH	TWA	50 ppm		
	SG OEL	TWA	50 ppm	246 mg/m3	

Additional Information : SHELL IS is the Shell Internal Standard. Skin notation means that significant exposure can also occur by absorption of liquid through the skin and of vapour through the eyes or mucous membranes.

Biological Exposure Index (BEI)

Material	Determinant	Sampling Time	BEI	Reference
Benzene	t,t-Muconic acid in Creatinine in urine	Sampling time: End of shift.	500 µg/g	ACGIH BEL (2011)
	S-Phenylmercapturic acid in Creatinine in urine	Sampling time: End of shift.	25 µg/g	ACGIH BEL (2011)
n-hexane	2,5-Hexanedion, without hydrolysis in Urine	Sampling time: End of shift at end of work week.	0.4 mg/l	ACGIH BEL (2011)
Toluene	o-Cresol, with hydrolysis in Creatinine in urine	Sampling time: End of shift.	0.3 mg/g	ACGIH BEL (2011)
	toluene in Blood	Sampling time: Prior to last shift of work week.	0.02 mg/l	ACGIH BEL (2011)
	toluene in Urine	Sampling time: End of shift.	0.03 mg/l	ACGIH BEL (2011)

Ethylbenzene	Sum of mandelic acid and phenylglyoxylic acid in Creatinine in urine	Sampling time: End of shift at end of work week.	0.7 g/g	ACGIH BEL (2011)
	Ethyl benzene in End-exhaled air	Sampling time: Not critical.		ACGIH BEL (2011)
Xylene	Methylhippuric acids in Creatinine in urine	Sampling time: End of shift.	1.5 g/g	ACGIH BEL (2011)
Naphthalene	1-Naphthol, with hydrolysis + 2-Naphthol, with hydrolysis	Sampling time: End of shift.		ACGIH BEL (02 2013)

Appropriate Engineering Controls : The level of protection and types of controls necessary will vary depending upon potential exposure conditions. Select controls based on a risk assessment of local circumstances. Appropriate measures include: Use sealed systems as far as possible. Adequate explosion-proof ventilation to control airborne concentrations below the exposure guidelines/limits. Local exhaust ventilation is recommended. Eye washes and showers for emergency use. Always observe good personal hygiene measures, such as washing hands after handling the material and before eating, drinking, and/or smoking. Routinely wash work clothing and protective equipment to remove contaminants. Discard contaminated clothing and footwear that cannot be cleaned. Practice good housekeeping. Define procedures for safe handling and maintenance of controls. Educate and train workers in the hazards and control measures relevant to normal activities associated with this product. Ensure appropriate selection, testing and maintenance of equipment used to control exposure, e.g. personal protective equipment, local exhaust ventilation. Firewater monitors and deluge systems are recommended. Drain down system prior to equipment break-in or maintenance. Retain drain downs in sealed storage pending disposal or for subsequent recycle.

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Individual Protection Measures	:	Personal protective equipment (PPE) should meet recommended national standards. Check with PPE suppliers.
Respiratory Protection	:	If engineering controls do not maintain airborne concentrations to a level which is adequate to protect worker health, select respiratory protection equipment suitable for the specific conditions of use and meeting relevant legislation. Check with respiratory protective equipment suppliers. Where air-filtering respirators are suitable, select an appropriate combination of mask and filter. Where air-filtering respirators are unsuitable (e.g. airborne concentrations are high, risk of oxygen deficiency, confined space) use appropriate positive pressure breathing apparatus. All respiratory protection equipment and use must be in accordance with local regulations. Select a filter suitable for combined particulate/organic gases and vapours [boiling point >65°C(149 °F)].
Hand Protection	:	Personal hygiene is a key element of effective hand care. Gloves must only be worn on clean hands. After using gloves, hands should be washed and dried thoroughly. Application of a non-perfumed moisturizer is recommended. Suitability and durability of a glove is dependent on usage, e.g. frequency and duration of contact, chemical resistance of glove material, dexterity. Always seek advice from glove suppliers. Contaminated gloves should be replaced. For continuous contact we recommend gloves with breakthrough time of more than 240 minutes with preference for > 480 minutes where suitable gloves can be identified. For short-term/splash protection we recommend the same, but recognise that suitable gloves offering this level of protection may not be available and in this case a lower breakthrough time may be acceptable so long as appropriate maintenance and replacement regimes are followed. Glove thickness is not a good predictor of glove resistance to a chemical as it is dependent on the exact composition of the glove material. Select gloves tested to a relevant standard (e.g. Europe EN374, US F739). When prolonged or frequent repeated contact occurs, Nitrile gloves may be suitable. (Breakthrough time of > 240 minutes.) For incidental contact/splash protection Neoprene, PVC gloves may be suitable.
Eye Protection	:	Chemical splash goggles (chemical monogoggles). If a local risk assessment deems it so, then chemical splash goggles may not be required and safety glasses may provide adequate eye protection.
Protective Clothing	:	Chemical resistant gloves/gauntlets, boots, and apron (where risk of splashing).
Thermal Hazards	:	Not applicable.

Monitoring Methods	:	Monitoring of the concentration of substances in the breathing zone of workers or in the general workplace may be required to confirm compliance with an OEL and adequacy of exposure controls. For some substances biological monitoring may also be appropriate. Validated exposure measurement methods should be applied by a competent person and samples analysed by an accredited laboratory. Examples of sources of recommended exposure measurement methods are given below or contact the supplier. Further national methods may be available. National Institute of Occupational Safety and Health (NIOSH), USA: Manual of Analytical Methods http://www.cdc.gov/niosh/ Occupational Safety and Health Administration (OSHA), USA: Sampling and Analytical Methods http://www.osha.gov/
Environmental Exposure Controls	:	Local guidelines on emission limits for volatile substances must be observed for the discharge of exhaust air containing vapour. Take appropriate measures to fulfil the requirements of relevant environmental protection legislation. Avoid contamination of the environment by following advice given in Chapter 6. If necessary, prevent undissolved material from being discharged to waste water. Waste water should be treated in a municipal or industrial waste water treatment plant before discharge to surface water.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	:	Yellow. Clear, bright liquid.
Odour	:	Hydrocarbon
Odour threshold	:	Data not available
pH	:	Data not available
Initial Boiling Point and Boiling Range	:	25 - 220 °C / 77 - 428 °F
Freezing Point	:	Data not available
Flash point	:	-40 °C / -40 °F (Tagliabue Closed Cup)
Upper / lower Flammability or Explosion limits	:	1 - 8 %(V)
Auto-ignition temperature	:	> 250 °C / 482 °F
Vapour pressure	:	Typical 570 hPa at 37.8 °C / 100.0 °F
Relative Density	:	Data not available
Density	:	Typical 0.740 g/cm3 at 15 °C / 59 °F
Water solubility	:	Negligible.
Solubility in other solvents	:	Data not available
n-octanol/water partition	:	2 - 7

coefficient (log Pow)		
Dynamic viscosity	:	Data not available
Kinematic viscosity	:	0.5 - 0.75 mm2/s at 40 °C / 104 °F
Vapour density (air=1)	:	Data not available
Electrical conductivity	:	Low conductivity: < 100 pS/m, The conductivity of this material makes it a static accumulator., A liquid is typically considered nonconductive if its conductivity is below 100 pS/m and is considered semi-conductive if its conductivity is below 10 000 pS/m., Whether a liquid is nonconductive or semi-conductive, the precautions are the same., A number of factors, for example liquid temperature, presence of contaminants, and anti-static additives can greatly influence the conductivity of a liquid.
Evaporation rate (nBuAc=1)	:	Data not available
Decomposition Temperature	:	Data not available
Flammability	:	Extremely flammable.

10. STABILITY AND REACTIVITY

Chemical stability	:	Stable under normal conditions of use.
Possibility of Hazardous Reactions	:	No hazardous reaction is expected when handled and stored according to provisions.
Conditions to Avoid	:	Avoid heat, sparks, open flames and other ignition sources.
Incompatible Materials	:	Strong oxidising agents.
Hazardous Decomposition Products	:	Hazardous decomposition products are not expected to form during normal storage. Thermal decomposition is highly dependent on conditions. A complex mixture of airborne solids, liquids and gases, including carbon monoxide, carbon dioxide and other organic compounds will be evolved when this material undergoes combustion or thermal or oxidative degradation.
Hazardous Polymerisation	:	No
Sensitivity to Mechanical Impact	:	No
Sensitivity to Static Discharge	:	Yes, in certain circumstances product can ignite due to static electricity.

11. TOXICOLOGICAL INFORMATION

Information on Toxicological effects

Basis for Assessment	:	Information given is based on product data, a knowledge of the components and the toxicology of similar products. Unless indicated otherwise, the data presented is representative of the

product as a whole, rather than for individual component(s).

Likely Routes of Exposure	:	Exposure may occur via inhalation, ingestion, skin absorption, skin or eye contact, and accidental ingestion.
Acute Oral Toxicity	:	Low toxicity: LD50 > 5000 mg/kg
Acute Dermal Toxicity	:	Low toxicity: LD50 >2000 mg/kg , Rabbit
Acute Inhalation Toxicity	:	Low toxicity: LC50 >5 mg/l , 4 h, Rat
Skin corrosion/irritation	:	Irritating to skin.
Serious eye damage/irritation	:	Expected to be slightly irritating.
Respiratory Irritation	:	Based on human experience, breathing of vapours or mists may cause a temporary burning sensation to nose, throat and lungs.
Respiratory or skin sensitisation	:	Not expected to be a sensitiser.
Aspiration Hazard	:	Aspiration into the lungs when swallowed or vomited may cause chemical pneumonitis which can be fatal.
Germ cell mutagenicity	:	May cause heritable genetic damage. (Benzene) Mutagenicity studies on gasoline and gasoline blending streams have shown predominantly negative results.
Carcinogenicity	:	Known human carcinogen. (Benzene) May cause leukaemia (AML - acute myelogenous leukemia). (Benzene) Inhalation exposure to mice causes liver tumours, which are not considered relevant to humans.

Material	:	**Carcinogenicity Classification**
Gasoline, low boiling point naphtha	:	ACGIH Group A3: Confirmed animal carcinogen with unknown relevance to humans.
Gasoline, low boiling point naphtha	:	IARC 2B: Possibly carcinogenic to humans.
Gasoline, low boiling point naphtha	:	GHS / CLP: Carcinogenicity Category 1B
Trimethylbenzene, all isomers	:	GHS / CLP: No carcinogenicity classification
Ethylbenzene	:	IARC 2B: Possibly carcinogenic to humans.
Ethylbenzene	:	GHS / CLP: No carcinogenicity classification
n-hexane	:	GHS / CLP: No carcinogenicity classification

Benzene	:	ACGIH Group A1: Confirmed human carcinogen.
Benzene	:	NTP: Known To Be Human Carcinogen.
Benzene	:	IARC 1: Carcinogenic to humans.
Benzene	:	GHS / CLP: Carcinogenicity Category 1A
Toluene	:	ACGIH Group A4: Not classifiable as a human carcinogen.
Toluene	:	IARC 3: Not classifiable as to carcinogenicity to humans.
Toluene	:	GHS / CLP: No carcinogenicity classification
Xylene	:	ACGIH Group A4: Not classifiable as a human carcinogen.
Xylene	:	IARC 3: Not classifiable as to carcinogenicity to humans.
Xylene	:	GHS / CLP: No carcinogenicity classification
Cyclohexane	:	GHS / CLP: No carcinogenicity classification
Naphthalene	:	ACGIH Group A4: Not classifiable as a human carcinogen.
Naphthalene	:	NTP: Reasonably Anticipated to be a Human Carcinogen.
Naphthalene	:	IARC 2B: Possibly carcinogenic to humans.
Naphthalene	:	GHS / CLP: Carcinogenicity Category 2
Ethyl tertiary butyl ether	:	ACGIH Group A4: Not classifiable as a human carcinogen.
Ethyl tertiary butyl ether	:	GHS / CLP: No carcinogenicity classification
Methyl tertiary butyl ether	:	IARC 3: Not classifiable as to carcinogenicity to humans.
Methyl tertiary butyl ether	:	GHS / CLP: No carcinogenicity classification
Tertiary amyl methyl ether	:	GHS / CLP: No carcinogenicity classification
Cumene	:	IARC 2B: Possibly carcinogenic to humans.
Cumene	:	GHS / CLP: No carcinogenicity classification

Reproductive and Developmental Toxicity : Causes foetotoxicity at doses which are maternally toxic. (Toluene)
May impair fertility at doses which produce other toxic effects. (n-hexane)
Many case studies involving abuse during pregnancy indicate that toluene can cause birth defects, growth retardation and learning difficulties. (Toluene)
Inhalation of high concentrations of gasoline vapour containing Methyl tertiary butyl ether produced a very low incidence of rare birth defects (ventral midline closure failure) in mice.

Specific target organ toxicity - single exposure : High concentrations may cause central nervous system depression resulting in headaches, dizziness and nausea; continued inhalation may result in unconsciousness and/or death.

Specific target organ toxicity - repeated exposure : Kidney: caused kidney effects in male rats which are not considered relevant to humans

Blood-forming organs: repeated exposure affects the bone

marrow.

Additional Information : Prolonged and repeated exposures to high concentrations have resulted in hearing loss in rats. Solvent abuse and noise interaction in the work environment may cause hearing loss. (Toluene)

Abuse of vapours has been associated with organ damage and death. (Toluene)

Exposure to very high concentrations of similar materials has been associated with irregular heart rhythms and cardiac arrest.

May cause MDS (Myelodysplastic Syndrome). (Benzene)

Classifications by other authorities under varying regulatory frameworks may exist.

12. ECOLOGICAL INFORMATION

Basis for Assessment : Fuels are typically made from blending several refinery streams. Ecotoxicological studies have been carried out on a variety of hydrocarbon blends and streams but not those containing additives. Information given is based on a knowledge of the components and the ecotoxicology of similar products. Unless indicated otherwise, the data presented is representative of the product as a whole, rather than for individual component(s).

Acute Toxicity : Expected to be toxic: LL/EL/IL50 > 1 <= 10 mg/l (to aquatic organisms) LL/EL50 expressed as the nominal amount of product required to prepare aqueous test extract.

Fish : Expected to be toxic: LL/EL/IL50 > 1 <= 10 mg/l

Aquatic crustacea : Expected to be toxic: LL/EL/IL50 > 1 <= 10 mg/l

Algae/aquatic plants : Expected to be toxic: LL/EL/IL50 > 1 <= 10 mg/l

Microorganisms : Expected to be harmful: LL/EL/IL50 >10 <= 100 mg/l

Chronic Toxicity

Fish : NOEC/NOEL expected to be > 1.0 - <= 10 mg/l

Aquatic crustacea : NOEC/NOEL expected to be > 1.0 - <= 10 mg/l

Mobility : Evaporates within a day from water or soil surfaces. Large volumes may penetrate soil and could contaminate groundwater. Toxic to aquatic organisms; may cause long-term adverse effects in the aquatic environment. Ether oxygenates are significantly more water soluble and less biodegradable

		than benzene, toluene, ethyl benzene and xylenes (BTEX). Consequently ether oxygenates have the potential to migrate relatively longer distances than BTEX in groundwater. Contains volatile components. Floats on water. Methyl tertiary butyl ether degradation may result in the formation of tert-butyl alcohol (TBA).
Persistence/degradability	:	Major constituents are expected to be inherently biodegradable, but the product contains components that may persist in the environment. The volatile constituents will oxidize rapidly by photochemical reactions in air. While biodegradation of Methyl tertiary butyl ether has been documented, it is generally less biodegradable than many petroleum hydrocarbons and has a potential to migrate relatively longer distances in groundwater.
Bioaccumulative Potential	:	Contains constituents with the potential to bioaccumulate. Log Kow > =4
Other Adverse Effects	:	Films formed on water may affect oxygen transfer and damage organisms.

13. DISPOSAL CONSIDERATIONS

Material Disposal	:	Recover or recycle if possible. It is the responsibility of the waste generator to determine the toxicity and physical properties of the material generated to determine the proper waste classification and disposal methods in compliance with applicable regulations. Waste arising from a spillage or tank cleaning should be disposed of in accordance with prevailing regulations, preferably to a recognised collector or contractor. The competence of the collector or contractor should be established beforehand. Do not dispose into the environment, in drains or in water courses. Do not dispose of tank water bottoms by allowing them to drain into the ground. This will result in soil and groundwater contamination.
Container Disposal	:	Drain container thoroughly. After draining, vent in a safe place away from sparks and fire. Residues may cause an explosion hazard. Do not puncture, cut, or weld uncleaned drums. Send to drum recoverer or metal reclaimer. Do not pollute the soil, water or environment with the waste container.
Local Legislation	:	Disposal should be in accordance with applicable regional, national, and local laws and regulations. Local regulations may be more stringent than regional or national requirements and must be in compliance.

14. TRANSPORT INFORMATION

Land (as per ADR classification): Regulated

Class	:	3
Packing group	:	II
Hazard indentification no.	:	33
UN number	:	1203
Danger label (primary risk)	:	3
Proper shipping name	:	GASOLINE (UNLEADED)
Environmentally Hazardous	:	Yes

IMDG

Identification number	UN 1203
Proper shipping name	GASOLINE
Technical name	(UNLEADED)
Class / Division	3
Packing group	II
Environmental hazards:	Yes

IATA (Country variations may apply)

UN number	:	1203
Proper shipping name	:	Gasoline
Technical name	:	(UNLEADED)
Class / Division	:	3
Packing group	:	II

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code

Pollution Category	:	Not applicable.
Ship Type	:	Not applicable.
Product Name	:	Not applicable.
Special Precaution	:	Not applicable.
Additional Information	:	MARPOL Annex 1 rules apply for bulk shipments by sea.

15. REGULATORY INFORMATION

The regulatory information is not intended to be comprehensive. Other regulations may apply to this material.

Local Regulations

Workplace Safety and Health Act & Workplace	:	This product is subject to the requirement in the Act/ Regulations.

Safety and Health (General Provision) Regulations		
Environmental Protection and Management Act and Environmental Protection and Management (Hazardous Substances) Regulations	:	This product is subject to the requirement in the Act/ Regulations.
Maritime and Port Authority of Singapore (Dangerous Goods, Petroleum and Explosives) Regulations	:	This product is subject to the requirement in the Act/ Regulations.
Fire Safety Act and Fire Safety (Petroleum & Flammable Materials) Regulations	:	This product is subject to the requirement in the Act/ Regulations.
Classification triggering components	:	Contains gasoline, low boiling point naphtha, unspecified.

16. OTHER INFORMATION

Hazard Statement

H224	Extremely flammable liquid and vapour.
H225	Highly flammable liquid and vapour.
H302	Harmful if swallowed.
H303	May be harmful if swallowed.
H304	May be fatal if swallowed and enters airways.
H305	May be harmful if swallowed and enters airways.
H315	Causes skin irritation.
H316	Causes mild skin irritation.
H336	May cause drowsiness or dizziness.
H340	May cause genetic defects.
H350	May cause cancer.
H361	Suspected of damaging fertility or the unborn child.
H401	Toxic to aquatic life.
H402	Harmful to aquatic life.
H411	Toxic to aquatic life with long lasting effects.

Additional Information	:	This document contains important information to ensure the safe storage, handling and use of this product. The information in this document should be brought to the attention of the person in your organisation responsible for advising on safety matters.
SDS Version Number	:	1.0
SDS Effective Date	:	10.03.2014

Safety Data Sheet

SDS Revisions : A vertical bar (|) in the left margin indicates an amendment from the previous version.

Uses and Restrictions : This product must not be used in applications other than those recommended in Section 1, without first seeking the advice of the supplier.
This product is not to be used as a solvent or cleaning agent; for lighting or brightening fires; as a skin cleanser.
This product is designed only to suit automotive applications and no provision is made for the requirements of aviation applications.

SDS Distribution : The information in this document should be made available to all who may handle the product.

Key/Legend to Abbrevations used in this SDS : The standard abbreviations and acronyms used in this document can be looked up in reference literature (e.g. scientific dictionaries) and/or websites.

Flam. Liq.	Flammable liquids
Asp. Tox.	Aspiration hazard
Muta.	Germ cell mutagenicity
Carc.	Carcinogenicity
Skin Corr.	Skin corrosion/irritation
STOT SE	Specific target organ toxicity - single exposure
	Toxic for Reproduction

Key Literature References : The quoted data are from, but not limited to, one or more sources of information (e.g. toxicological data from Shell Health Services, material suppliers' data, CONCAWE, EU IUCLID date base, EC 1272 regulation, etc).

Disclaimer : This information is based on our current knowledge and is intended to describe the product for the purposes of health, safety and environmental requirements only. It should not therefore be construed as guaranteeing any specific property of the product.

Safety Data Sheet

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

Chevron Ultra-Duty Grease EP NLGI 0, 1, 2

Product Use: Grease
Product Number(s): 238011, 238012, 238013
Company Identification
Chevron Products Company
a division of Chevron U.S.A. Inc.
6001 Bollinger Canyon Rd.
San Ramon, CA 94583
United States of America
www.chevronlubricants.com

Transportation Emergency Response
CHEMTREC: (800) 424-9300 or (703) 527-3887
Health Emergency
Chevron Emergency Information Center: Located in the USA. International collect calls accepted. (800) 231-0623 or (510) 231-0623
Product Information
email : lubemsds@chevron.com
Product Information: 1 (800) 582-3835, LUBETEK@chevron.com

SECTION 2 HAZARDS IDENTIFICATION

CLASSIFICATION: Acute aquatic toxicant: Category 3. Chronic aquatic toxicant: Category 3.

Environmental Hazards: Harmful to aquatic life with long lasting effects.

PRECAUTIONARY STATEMENTS:
Prevention: Avoid release to the environment.
Disposal: Dispose of contents/container in accordance with applicable local/regional/national/international regulations.

HAZARDS NOT OTHERWISE CLASSIFIED: Not Applicable

SECTION 3 COMPOSITION/ INFORMATION ON INGREDIENTS

COMPONENTS	CAS NUMBER	AMOUNT
Highly refined mineral oil (C15 - C50)	Mixture	70 - 99 %weight
Distillates, hydrotreated middle	64742-46-7	0 - 40 %weight
Zinc dialkyldithiophosphate	68649-42-3	1 - < 5 %weight
Phosphoric acid ester, amine salt	Mixture	0 - < 1 %weight

SECTION 4 FIRST AID MEASURES

Description of first aid measures
Eye: No specific first aid measures are required. As a precaution, remove contact lenses, if worn, and flush eyes with water.
Skin: No specific first aid measures are required. As a precaution, remove clothing and shoes if contaminated. To remove the material from skin, apply a waterless hand cleaner, mineral oil, or petroleum jelly. Then wash with soap and water. Discard contaminated clothing and shoes or thoroughly clean before reuse.
Ingestion: No specific first aid measures are required. Do not induce vomiting. As a precaution, get medical advice.
Inhalation: No specific first aid measures are required. If exposed to excessive levels of material in the air, move the exposed person to fresh air. Get medical attention if coughing or respiratory discomfort occurs.

Most important symptoms and effects, both acute and delayed
IMMEDIATE HEALTH EFFECTS
Eye: Not expected to cause prolonged or significant eye irritation.
Skin: High-Pressure Equipment Information: Accidental high-velocity injection under the skin of materials of this type may result in serious injury. Seek medical attention at once should an accident like this occur. The initial wound at the injection site may not appear to be serious at first; but, if left untreated, could result in disfigurement or amputation of the affected part.
Contact with the skin is not expected to cause prolonged or significant irritation. Contact with the skin is not expected to cause an allergic skin response. Not expected to be harmful to internal organs if absorbed through the skin.
Ingestion: Not expected to be harmful if swallowed.
Inhalation: Not expected to be harmful if inhaled. Contains a petroleum-based mineral oil. May cause respiratory irritation or other pulmonary effects following prolonged or repeated inhalation of oil mist at airborne levels above the recommended mineral oil mist exposure limit. Symptoms of respiratory irritation may include coughing and difficulty breathing.

DELAYED OR OTHER HEALTH EFFECTS: Not classified

Indication of any immediate medical attention and special treatment needed
Note to Physicians: In an accident involving high-pressure equipment, this product may be injected under the skin. Such an accident may result in a small, sometimes bloodless, puncture wound. However, because of its driving force, material injected into a fingertip can be deposited into the palm of the hand. Within 24 hours, there is usually a great deal of swelling, discoloration, and intense throbbing pain. Immediate treatment at a surgical emergency center is recommended.

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

PROTECTION OF FIRE FIGHTERS:
Fire Fighting Instructions: This material will burn although it is not easily ignited. See Section 7 for proper

handling and storage. For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus.
Combustion Products: Highly dependent on combustion conditions. A complex mixture of airborne solids, liquids, and gases including carbon monoxide, carbon dioxide, and unidentified organic compounds will be evolved when this material undergoes combustion. Combustion may form oxides of: Nitrogen, Phosphorus, Sulfur, Zinc.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Protective Measures: Eliminate all sources of ignition in vicinity of spilled material.
Spill Management: Clean up spills immediately, observing precautions in Exposure Controls/Personal Protection section. Stop the source of the release if you can do it without risk. Contain release to prevent further contamination of soil, surface water or groundwater. Clean up spill as soon as possible, observing precautions in Exposure Controls/Personal Protection. Use appropriate techniques such as applying non-combustible absorbent materials or pumping. Where feasible and appropriate, remove contaminated soil. Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations.
Reporting: Report spills to local authorities and/or the U.S. Coast Guard's National Response Center at (800) 424-8802 as appropriate or required.

SECTION 7 HANDLING AND STORAGE

General Handling Information: Avoid contaminating soil or releasing this material into sewage and drainage systems and bodies of water.
Precautionary Measures: Keep out of the reach of children.
Static Hazard: Electrostatic charge may accumulate and create a hazardous condition when handling this material. To minimize this hazard, bonding and grounding may be necessary but may not, by themselves, be sufficient. Review all operations which have the potential of generating and accumulating an electrostatic charge and/or a flammable atmosphere (including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation, and vacuum truck operations) and use appropriate mitigating procedures.
Container Warnings: Container is not designed to contain pressure. Do not use pressure to empty container or it may rupture with explosive force. Empty containers retain product residue (solid, liquid, and/or vapor) and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, static electricity, or other sources of ignition. They may explode and cause injury or death. Empty containers should be completely drained, properly closed, and promptly returned to a drum reconditioner or disposed of properly.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

GENERAL CONSIDERATIONS:
Consider the potential hazards of this material (see Section 2), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

ENGINEERING CONTROLS:
Use in a well-ventilated area.

PERSONAL PROTECTIVE EQUIPMENT
Eye/Face Protection: No special eye protection is normally required. Where splashing is possible, wear safety glasses with side shields as a good safety practice.
Skin Protection: No special protective clothing is normally required. Where splashing is possible, select protective clothing depending on operations conducted, physical requirements and other substances in the

workplace. Suggested materials for protective gloves include: Neoprene, Nitrile Rubber, Silver Shield, Viton.
Respiratory Protection: No respiratory protection is normally required.
If user operations generate an oil mist, determine if airborne concentrations are below the occupational exposure limit for mineral oil mist. If not, wear an approved respirator that provides adequate protection from the measured concentrations of this material. For air-purifying respirators use a particulate cartridge.
Use a positive pressure air-supplying respirator in circumstances where air-purifying respirators may not provide adequate protection.

Occupational Exposure Limits:

Component	Agency	TWA	STEL	Ceiling	Notation
Highly refined mineral oil (C15 - C50)	ACGIH	5 mg/m3	10 mg/m3	--	--
Highly refined mineral oil (C15 - C50)	OSHA Z-1	5 mg/m3	--	--	--
Distillates, hydrotreated middle	Not Applicable	--	--	--	--
Zinc dialkyldithiophosphate	Not Applicable	--	--	--	--
Phosphoric acid ester, amine salt	Not Applicable	--	--	--	--

Consult local authorities for appropriate values.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Attention: the data below are typical values and do not constitute a specification.

Color: Red
Physical State: Semi-solid
Odor: Petroleum odor
Odor Threshold: No data available
pH: Not Applicable
Vapor Pressure: <0.01 mmHg (Estimated) @ 100 °C (212 °F)
Vapor Density (Air = 1): >1 (Estimated)
Initial Boiling Point: 260°C (500°F) (Minimum)
Solubility: Soluble in hydrocarbons; insoluble in water
Freezing Point: No data available
Melting Point: 165°C (329°F) (Min)
Density: No data available
Viscosity: 22 mm2/s (Minimum)
Evaporation Rate: No data available
Decomposition temperature: No data available
Octanol/Water Partition Coefficient: No data available

FLAMMABLE PROPERTIES:
Flammability (solid, gas): No Data Available

Flashpoint: (Cleveland Open Cup) 204 °C (399 °F) (Minimum)
Autoignition: No data available
Flammability (Explosive) Limits (% by volume in air): Lower: Not Applicable Upper: Not Applicable

SECTION 10 STABILITY AND REACTIVITY

Reactivity: May react with strong acids or strong oxidizing agents, such as chlorates, nitrates, peroxides, etc.
Chemical Stability: This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.
Incompatibility With Other Materials: Not applicable
Hazardous Decomposition Products: Alkyl Mercaptans (Elevated temperatures), Hydrogen Sulfide (Elevated

temperatures)
Hazardous Polymerization: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects
Serious Eye Damage/Irritation: The eye irritation hazard is based on evaluation of data for product components.

Skin Corrosion/Irritation: The skin irritation hazard is based on evaluation of data for product components.

Skin Sensitization: The skin sensitization hazard is based on evaluation of data for product components.

Acute Dermal Toxicity: The acute dermal toxicity hazard is based on evaluation of data for product components.

Acute Oral Toxicity: The acute oral toxicity hazard is based on evaluation of data for product components.

Acute Inhalation Toxicity: The acute inhalation toxicity hazard is based on evaluation of data for product components.
Acute Toxicity Estimate: Not Determined

Germ Cell Mutagenicity: The hazard evaluation is based on data for components or a similar material.

Carcinogenicity: The hazard evaluation is based on data for components or a similar material.

Reproductive Toxicity: The hazard evaluation is based on data for components or a similar material.

Specific Target Organ Toxicity - Single Exposure: The hazard evaluation is based on data for components or a similar material.

Specific Target Organ Toxicity - Repeated Exposure: The hazard evaluation is based on data for components or a similar material.

ADDITIONAL TOXICOLOGY INFORMATION:
This product contains petroleum base oils which may be refined by various processes including severe solvent extraction, severe hydrocracking, or severe hydrotreating. None of the oils requires a cancer warning under the OSHA Hazard Communication Standard (29 CFR 1910.1200). These oils have not been listed in the National Toxicology Program (NTP) Annual Report nor have they been classified by the International Agency for Research on Cancer (IARC) as; carcinogenic to humans (Group 1), probably carcinogenic to humans (Group 2A), or possibly carcinogenic to humans (Group 2B).
These oils have not been classified by the American Conference of Governmental Industrial Hygienists (ACGIH) as: confirmed human carcinogen (A1), suspected human carcinogen (A2), or confirmed animal carcinogen with unknown relevance to humans (A3).

SECTION 12 ECOLOGICAL INFORMATION

ECOTOXICITY
This material is expected to be harmful to aquatic organisms and may cause long-term adverse effects in the aquatic environment.
The product has not been tested. The statement has been derived from the properties of the individual components.

MOBILITY
No data available.

PERSISTENCE AND DEGRADABILITY

This material is not expected to be readily biodegradable. The biodegradability of this material is based on an evaluation of data for the components or a similar material.
The product has not been tested. The statement has been derived from the properties of the individual components.

POTENTIAL TO BIOACCUMULATE
Bioconcentration Factor: No data available.
Octanol/Water Partition Coefficient: No data available

SECTION 13 DISPOSAL CONSIDERATIONS

Use material for its intended purpose or recycle if possible. Oil collection services are available for used oil recycling or disposal. Place contaminated materials in containers and dispose of in a manner consistent with applicable regulations. Contact your sales representative or local environmental or health authorities for approved disposal or recycling methods.

SECTION 14 TRANSPORT INFORMATION

The description shown may not apply to all shipping situations. Consult 49CFR, or appropriate Dangerous Goods Regulations, for additional description requirements (e.g., technical name) and mode-specific or quantity-specific shipping requirements.

DOT Shipping Description: NOT REGULATED AS HAZARDOUS MATERIAL UNDER 49 CFR

IMO/IMDG Shipping Description: NOT REGULATED AS DANGEROUS GOODS FOR TRANSPORT UNDER THE IMDG CODE

ICAO/IATA Shipping Description: NOT REGULATED AS DANGEROUS GOODS FOR TRANSPORT UNDER ICAO

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC code:
Not applicable

SECTION 15 REGULATORY INFORMATION

EPCRA 311/312 CATEGORIES: Not applicable

REGULATORY LISTS SEARCHED:

01-1=IARC Group 1	03=EPCRA 313
01-2A=IARC Group 2A	04=CA Proposition 65
01-2B=IARC Group 2B	05=MA RTK
02=NTP Carcinogen	06=NJ RTK
	07=PA RTK

The following components of this material are found on the regulatory lists indicated.

Zinc dialkyldithiophosphate	06, 07

CHEMICAL INVENTORIES:
All components comply with the following chemical inventory requirements: AICS (Australia), DSL (Canada),

IECSC (China), KECI (Korea), NZIoC (New Zealand), PICCS (Philippines), TSCA (United States).

One or more components does not comply with the following chemical inventory requirements: ENCS (Japan).

NEW JERSEY RTK CLASSIFICATION:
Under the New Jersey Right-to-Know Act L. 1983 Chapter 315 N.J.S.A. 34:5A-1 et. seq., the product is to be identified as follows: PETROLEUM OIL (Grease)

SECTION 16 OTHER INFORMATION

NFPA RATINGS: Health: 0 Flammability: 1 Reactivity: 0

HMIS RATINGS: Health: 0 Flammability: 1 Reactivity: 0
(0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme, PPE:- Personal Protection Equipment Index recommendation, *- Chronic Effect Indicator). These values are obtained using the guidelines or published evaluations prepared by the National Fire Protection Association (NFPA) or the National Paint and Coating Association (for HMIS ratings).

REVISION STATEMENT: SECTION 03 - Composition information was modified.
SECTION 04 - Immediate Health Effects - Skin information was modified.
SECTION 05 - Fire Fighters Protection Measures information was modified.
SECTION 05 - Special hazards arising from the substance or mixture information was added.
SECTION 08 - Occupational Exposure Limit Table information was modified.
SECTION 09 - Physical/Chemical Properties information was added.
SECTION 09 - Physical/Chemical Properties information was deleted.
SECTION 09 - Physical/Chemical Properties information was modified.
SECTION 10 - Hazardous Decomposition Products information was modified.
SECTION 14 - DOT Classification information was added.
SECTION 14 - DOT Classification information was deleted.
SECTION 14 - ICAO Classification information was added.
SECTION 14 - ICAO Classification information was deleted.
SECTION 14 - IMO Classification information was added.
SECTION 14 - IMO Classification information was deleted.
SECTION 15 - Chemical Inventories information was modified.
SECTION 15 - Regulatory Information information was modified.
SECTION 15 - SARA 311 EPCRA Score information was added.
SECTION 15 - SARA 311 Score information was deleted.

Revision Date: January 31, 2019

ABBREVIATIONS THAT MAY HAVE BEEN USED IN THIS DOCUMENT:

TLV - Threshold Limit Value	TWA - Time Weighted Average
STEL - Short-term Exposure Limit	PEL - Permissible Exposure Limit
GHS - Globally Harmonized System	CAS - Chemical Abstract Service Number
ACGIH - American Conference of Governmental Industrial Hygienists	IMO/IMDG - International Maritime Dangerous Goods Code
API - American Petroleum Institute	SDS - Safety Data Sheet
HMIS - Hazardous Materials Information System	NFPA - National Fire Protection Association (USA)
DOT - Department of Transportation (USA)	NTP - National Toxicology Program (USA)
IARC - International Agency for Research on Cancer	OSHA - Occupational Safety and Health Administration
NCEL - New Chemical Exposure Limit	EPA - Environmental Protection Agency
SCBA - Self-Contained Breathing Apparatus	

Prepared according to the 29 CFR 1910.1200 (2012) by Chevron Energy Technology Company, 6001 Bollinger Canyon Road, San Ramon, CA 94583.

The above information is based on the data of which we are aware and is believed to be correct as of the date hereof. Since this information may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modifications of the information, we do not assume any responsibility for the results of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.

SAFETY DATA SHEET

ADVANCED GEL HAND SANITIZER

SECTION 1. PRODUCT AND COMPANY IDENTIFICATION

Product name	:	ADVANCED GEL HAND SANITIZER
Other means of identification	:	not applicable
Recommended use	:	Hand Sanitizer
Restrictions on use	:	Reserved for industrial and professional use.
Product dilution information	:	Product is sold ready to use.
Company	:	Ecolab Inc. 370 N. Wabasha Street St. Paul, Minnesota USA 55102 1-800-352-5326
Emergency telephone	:	1-800-328-0026 (US/Canada), 1-651-222-5352 (outside US)
Issuing date	:	03/28/2014

SECTION 2. HAZARDS IDENTIFICATION

GHS Classification

Flammable liquids	:	Category 3
Eye irritation	:	Category 2A

GHS Label element

Hazard pictograms :



Signal Word : Warning

Hazard Statements : Flammable liquid and vapor.
Causes serious eye irritation.

Precautionary Statements : **Prevention:**
Keep away from heat/sparks/open flames/hot surfaces. - No smoking.
Keep container tightly closed.
Response:
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/ attention. In case of fire: Use dry sand, dry chemical or alcohol-resistant foam for extinction.
Storage:
Store in a well-ventilated place. Keep cool.
Disposal:
Dispose of contents/ container to an approved waste disposal plant.

Other hazards : None known.

SECTION 3. COMPOSITION/INFORMATION ON INGREDIENTS

Pure substance/mixture : Mixture

Chemical Name	CAS-No.	Concentration (%)
ethanol	64-17-5	60 - 100

SECTION 4. FIRST AID MEASURES

In case of eye contact	:	Rinse with water.
In case of skin contact	:	Rinse with water.
If swallowed	:	Rinse mouth. Get medical attention if symptoms occur.
If inhaled	:	Get medical attention if symptoms occur.
Protection of first-aiders	:	No special precautions are necessary for first aid responders.
Notes to physician	:	Treat symptomatically.

See toxicological information (Section 11)

SECTION 5. FIRE-FIGHTING MEASURES

Suitable extinguishing media	:	Use extinguishing measures that are appropriate to local circumstances and the surrounding environment.
Unsuitable extinguishing media	:	High volume water jet
Specific hazards during fire fighting	:	Fire Hazard Keep away from heat and sources of ignition. Flash back possible over considerable distance. Beware of vapors accumulating to form explosive concentrations. Vapors can accumulate in low areas.
Hazardous combustion products	:	Carbon oxides
Special protective equipment for fire-fighters	:	Use personal protective equipment.
Specific extinguishing methods	:	Use water spray to cool unopened containers. Fire residues and contaminated fire extinguishing water must be disposed of in accordance with local regulations. In the event of fire and/or explosion do not breathe fumes.

SECTION 6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures	:	Remove all sources of ignition. Ensure clean-up is conducted by trained personnel only. Refer to protective measures listed in sections 7 and 8.
Environmental precautions	:	Do not allow contact with soil, surface or ground water.
Methods and materials for containment and cleaning up	:	Eliminate all ignition sources if safe to do so. Stop leak if safe to do so. Contain spillage, and then collect with non-combustible absorbent material, (e.g. sand, earth, diatomaceous earth, vermiculite) and place in container for disposal according to local / national regulations (see section 13). Flush away traces with water. For large spills, dike spilled material or otherwise contain material to ensure runoff does not reach a waterway.

SECTION 7. HANDLING AND STORAGE

Advice on safe handling : Take necessary action to avoid static electricity discharge (which might cause ignition of organic vapors). Keep away from fire, sparks and heated surfaces.

Conditions for safe storage : Keep away from heat and sources of ignition. Keep in a cool, well-ventilated place. Keep away from oxidizing agents. Keep out of reach of children. Keep container tightly closed. Store in suitable labeled containers.

Storage temperature : 0 °C to 35 °C

SECTION 8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Ingredients with workplace control parameters

Ingredients	CAS-No.	Form of exposure	Permissible concentration	Basis
ethanol	64-17-5	TWA	1,000 ppm	ACGIH
		TWA	1,000 ppm 1,900 mg/m3	NIOSH REL
		TWA	1,000 ppm 1,900 mg/m3	OSHA Z1

Engineering measures : Good general ventilation should be sufficient to control worker exposure to airborne contaminants.

Personal protective equipment

Eye protection : No special protective equipment required.

Hand protection : No special protective equipment required.

Skin protection : No special protective equipment required.

Respiratory protection : No personal respiratory protective equipment normally required.

Hygiene measures : No specific measures identified.

SECTION 9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance : gel

Color : opaque, white

Odor : alcoholic

pH : 6.3 - 8.5, 100 %

Flash point : 23 °C closed cup

Odor Threshold : no data available

Melting point/freezing point : no data available

Initial boiling point and boiling range : no data available

Evaporation rate	:	no data available
Flammability (solid, gas)	:	no data available
Upper explosion limit	:	no data available
Lower explosion limit	:	no data available
Vapor pressure	:	no data available
Relative vapor density	:	no data available
Relative density	:	0.869 - 0.873
Water solubility	:	no data available
Solubility in other solvents	:	no data available
Partition coefficient: n-octanol/water	:	no data available
Autoignition temperature	:	no data available
Thermal decomposition	:	no data available
Viscosity, kinematic	:	no data available
Explosive properties	:	no data available
Oxidizing properties	:	no data available
Molecular weight	:	no data available
VOC	:	no data available

SECTION 10. STABILITY AND REACTIVITY

Chemical stability	:	Stable under normal conditions.
Possibility of hazardous reactions	:	No dangerous reaction known under conditions of normal use.
Conditions to avoid	:	Heat, flames and sparks.
Incompatible materials	:	None known.
Hazardous decomposition products	:	Carbon oxides

SECTION 11. TOXICOLOGICAL INFORMATION

Information on likely routes of exposure	:	Inhalation, Eye contact, Skin contact

Potential Health Effects

Eyes	:	Causes serious eye irritation.
Skin	:	Health injuries are not known or expected under normal use.
Ingestion	:	Health injuries are not known or expected under normal use.
Inhalation	:	Health injuries are not known or expected under normal use.
Chronic Exposure	:	Health injuries are not known or expected under normal use.

Experience with human exposure

Eye contact	:	Redness, Pain, Irritation
Skin contact	:	No symptoms known or expected.
Ingestion	:	No symptoms known or expected.
Inhalation	:	No symptoms known or expected.

Toxicity

Acute oral toxicity	:	Acute toxicity estimate : > 5,000 mg/kg
Acute inhalation toxicity	:	no data available
Acute dermal toxicity	:	no data available
Skin corrosion/irritation	:	no data available
Serious eye damage/eye irritation	:	no data available
Respiratory or skin sensitization	:	no data available
Carcinogenicity		
IARC		No component of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.
OSHA		No ingredient of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.
NTP		No ingredient of this product present at levels greater than or equal to 0.1% is identified as a known or anticipated carcinogen by NTP.
Reproductive effects	:	no data available
Germ cell mutagenicity	:	no data available
Teratogenicity	:	no data available
STOT-single exposure	:	The substance or mixture is not classified as specific target organ toxicant, single exposure.
STOT-repeated exposure	:	no data available
Aspiration toxicity	:	no data available

Ingredients

Acute inhalation toxicity	:	ethanol 4 h LC50 rat: 117 mg/l

Ingredients

Acute dermal toxicity	:	ethanol LD50 rabbit: 15,800 mg/kg

SECTION 12. ECOLOGICAL INFORMATION

Ecotoxicity

Environmental Effects	:	Harmful to aquatic life.

Product

Toxicity to fish	:	no data available
Toxicity to daphnia and other aquatic invertebrates	:	no data available
Toxicity to algae	:	no data available

Ingredients

Toxicity to fish	:	ethanol 96 h LC50 Fish: 11,000 mg/l

Persistence and degradability

no data available

Bioaccumulative potential

no data available

Mobility in soil

no data available

Other adverse effects

no data available

SECTION 13. DISPOSAL CONSIDERATIONS

Disposal methods	:	The product should not be allowed to enter drains, water courses or the soil. Where possible recycling is preferred to disposal or incineration. If recycling is not practicable, dispose of in compliance with local regulations. Dispose of wastes in an approved waste disposal facility.
Disposal considerations	:	Dispose of as unused product. Empty containers should be taken to an approved waste handling site for recycling or disposal. Do not re-use empty containers.
RCRA - Resource Conservation and Recovery Authorization Act Hazardous waste	:	D001 (Ignitable)

SECTION 14. TRANSPORT INFORMATION

The shipper/consignor/sender is responsible to ensure that the packaging, labeling, and markings are in compliance with the selected mode of transport.

Land transport (DOT)

UN number	:	1170
Description of the goods	:	Ethanol solutions
Class	:	3
Packing group	:	III
Environmentally hazardous	:	no

Sea transport (IMDG/IMO)

UN number	:	1170
Description of the goods	:	ETHANOL SOLUTION

Class	:	3
Packing group	:	III
Marine pollutant	:	no

SECTION 15. REGULATORY INFORMATION

EPCRA - Emergency Planning and Community Right-to-Know

CERCLA Reportable Quantity

This material does not contain any components with a CERCLA RQ.

SARA 304 Extremely Hazardous Substances Reportable Quantity

This material does not contain any components with a section 304 EHS RQ.

SARA 311/312 Hazards	:	Fire Hazard Acute Health Hazard
SARA 302	:	SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.
SARA 313	:	SARA 313: This material does not contain any chemical components with known CAS numbers that exceed the threshold (De Minimis) reporting levels established by SARA Title III, Section 313.

California Prop 65

This product does not contain any chemicals known to the State of California to cause cancer, birth, or any other reproductive defects.

The ingredients of this product are reported in the following inventories:

1907/2006 (EU) :
not determined

Switzerland. New notified substances and declared preparations :
not determined

United States TSCA Inventory :
On TSCA Inventory

Canadian Domestic Substances List (DSL) :
This product contains one or several components that are not on the Canadian DSL nor NDSL.

Australia Inventory of Chemical Substances (AICS) :
not determined

New Zealand. Inventory of Chemical Substances :
not determined

Japan. ENCS - Existing and New Chemical Substances Inventory :
not determined

Japan. ISHL - Inventory of Chemical Substances (METI) :
not determined

Korea. Korean Existing Chemicals Inventory (KECI) :
not determined

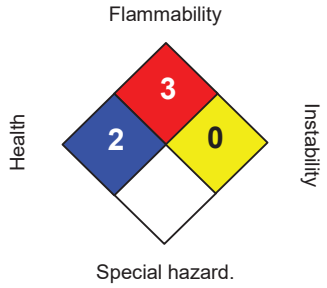
Philippines Inventory of Chemicals and Chemical Substances (PICCS) :

not determined

China. Inventory of Existing Chemical Substances in China (IECSC) :
not determined

SECTION 16. OTHER INFORMATION

NFPA:



HMIS III:

HEALTH	2
FLAMMABILITY	3
PHYSICAL HAZARD	0

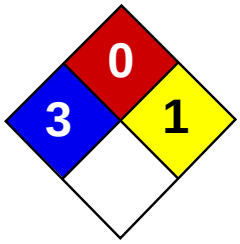
0 = not significant, 1 =Slight,
2 = Moderate, 3 = High
4 = Extreme, * = Chronic

Issuing date	:	03/28/2014
Version	:	1.0
Prepared by	:	Regulatory Affairs

REVISED INFORMATION: Significant changes to regulatory or health information for this revision is indicated by a bar in the left-hand margin of the SDS.

The information provided in this Material Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.







Material Safety Data Sheet
Hydrochloric acid MSDS

Section 1: Chemical Product and Company Identification

Product Name: Hydrochloric acid

Catalog Codes: SLH1462, SLH3154

CAS#: Mixture.

RTECS: MW4025000

TSCA: TSCA 8(b) inventory: Hydrochloric acid

CI#: Not applicable.

Synonym: Hydrochloric Acid; Muriatic Acid

Chemical Name: Not applicable.

Chemical Formula: Not applicable.

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
Hydrogen chloride	7647-01-0	20-38
Water	7732-18-5	62-80

Toxicological Data on Ingredients: Hydrogen chloride: GAS (LC50): Acute: 4701 ppm 0.5 hours [Rat].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of eye contact (irritant, corrosive), of ingestion, . Slightly hazardous in case of inhalation (lung sensitizer). Non-corrosive for lungs. Liquid or spray mist may produce tissue damage particularly on mucous membranes of eyes, mouth and respiratory tract. Skin contact may produce burns. Inhalation of the spray mist may produce severe irritation of respiratory tract, characterized by coughing, choking, or shortness of breath. Severe over-exposure can result in death. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
Slightly hazardous in case of skin contact (sensitizer). CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance may be toxic to kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth. Repeated or prolonged exposure to the substance can produce target

organs damage. Repeated or prolonged contact with spray mist may produce chronic eye irritation and severe skin irritation. Repeated or prolonged exposure to spray mist may produce respiratory tract irritation leading to frequent attacks of bronchial infection. Repeated exposure to a highly toxic material may produce general deterioration of health by an accumulation in one or many human organs.

Section 4: First Aid Measures

Eye Contact:
Check for and remove any contact lenses. In case of contact, immediately flush eyes with plenty of water for at least 15 minutes. Cold water may be used. Get medical attention immediately.

Skin Contact:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Cover the irritated skin with an emollient. Cold water may be used.Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek immediate medical attention.

Inhalation:
If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention immediately.

Serious Inhalation:
Evacuate the victim to a safe area as soon as possible. Loosen tight clothing such as a collar, tie, belt or waistband. If breathing is difficult, administer oxygen. If the victim is not breathing, perform mouth-to-mouth resuscitation. WARNING: It may be hazardous to the person providing aid to give mouth-to-mouth resuscitation when the inhaled material is toxic, infectious or corrosive. Seek immediate medical attention.

Ingestion:
If swallowed, do not induce vomiting unless directed to do so by medical personnel. Never give anything by mouth to an unconscious person. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Non-flammable.

Auto-Ignition Temperature: Not applicable.

Flash Points: Not applicable.

Flammable Limits: Not applicable.

Products of Combustion: Not available.

Fire Hazards in Presence of Various Substances: of metals

Explosion Hazards in Presence of Various Substances: Non-explosive in presence of open flames and sparks, of shocks.

Fire Fighting Media and Instructions: Not applicable.

Special Remarks on Fire Hazards:
Non combustible. Calcium carbide reacts with hydrogen chloride gas with incandescence. Uranium phosphide reacts with hydrochloric acid to release spontaneously flammable phosphine. Rubidium acetylene carbides burns with slightly warm hydrochloric acid. Lithium silicide in contact with hydrogen chloride becomes incandescent. When dilute hydrochloric acid is used, gas spontaneously flammable in air is evolved. Magnesium boride treated with concentrated hydrochloric acid produces spontaneously flammble gas. Cesium acetylene carbide burns hydrogen chloride gas. Cesium carbide ignites in contact with hydrochloric acid unless acid is dilute. Reacts with most metals to produce flammable Hydrodgen gas.

Special Remarks on Explosion Hazards:

Hydrogen chloride in contact with the following can cause an explosion, ignition on contact, or other violent/vigorous reaction: Acetic anhydride AgClO + CCl4 Alcohols + hydrogen cyanide, Aluminum Aluminum-titanium alloys (with HCl vapor), 2-Amino ethanol, Ammonium hydroxide, Calcium carbide Ca3P2 Chlorine + dinitroanilines (evolves gas), Chlorosulfonic acid Cesium carbide Cesium acetylene carbide, 1,1-Difluoroethylene Ethylene diamine Ethylene imine, Fluorine, HClO4 Hexalithium disilicide H2SO4 Metal acetylides or carbides, Magnesium boride, Mercuric sulfate, Oleum, Potassium permanganate, beta-Propiolactone Propylene oxide Rubidium carbide, Rubidium, acetylene carbide Sodium (with aqueous HCl), Sodium hydroxide Sodium tetraselenium, Sulfonic acid, Tetraselenium tetranitride, U3P4 , Vinyl acetate. Silver perchlorate with carbon tetrachloride in the presence of hydrochloric acid produces trichloromethyl perchlorate which detonates at 40 deg. C.

Section 6: Accidental Release Measures

Small Spill:
Dilute with water and mop up, or absorb with an inert dry material and place in an appropriate waste disposal container. If necessary: Neutralize the residue with a dilute solution of sodium carbonate.

Large Spill:
Corrosive liquid. Poisonous liquid. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Use water spray curtain to divert vapor drift. Use water spray to reduce vapors. Prevent entry into sewers, basements or confined areas; dike if needed. Call for assistance on disposal. Neutralize the residue with a dilute solution of sodium carbonate. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep locked up.. Keep container dry. Do not ingest. Do not breathe gas/fumes/ vapor/spray. Never add water to this product. In case of insufficient ventilation, wear suitable respiratory equipment. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes. Keep away from incompatibles such as oxidizing agents, organic materials, metals, alkalis, moisture. May corrode metallic surfaces. Store in a metallic or coated fiberboard drum using a strong polyethylene inner package.

Storage: Keep container tightly closed. Keep container in a cool, well-ventilated area.

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection:
Face shield. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Gloves. Boots.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Vapor respirator. Boots. Gloves. A self contained breathing apparatus should be used to avoid inhalation of the product. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
CEIL: 5 (ppm) from OSHA (PEL) [United States] CEIL: 7 (mg/m3) from OSHA (PEL) [United States] CEIL: 5 from NIOSH CEIL: 7 (mg/m3) from NIOSH TWA: 1 STEL: 5 (ppm) [United Kingdom (UK)] TWA: 2 STEL: 8 (mg/m3) [United Kingdom (UK)]Consult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid.

Odor: Pungent. Irritating (Strong.)

Taste: Not available.

Molecular Weight: Not applicable.

Color: Colorless to light yellow.

pH (1% soln/water): Acidic.

Boiling Point:
108.58 C @ 760 mm Hg (for 20.22% HCl in water) 83 C @ 760 mm Hg (for 31% HCl in water) 50.5 C (for 37% HCl in water)

Melting Point:
-62.25°C (-80°F) (20.69% HCl in water) -46.2 C (31.24% HCl in water) -25.4 C (39.17% HCl in water)

Critical Temperature: Not available.

Specific Gravity:
1.1- 1.19 (Water = 1) 1.10 (20%and 22% HCl solutions) 1.12 (24% HCl solution) 1.15 (29.57% HCl solution) 1.16 (32% HCl solution) 1.19 (37% and 38%HCl solutions)

Vapor Pressure: 16 kPa (@ 20°C) average

Vapor Density: 1.267 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.25 to 10 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, diethyl ether.

Solubility: Soluble in cold water, hot water, diethyl ether.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Incompatible materials, water

Incompatibility with various substances:
Highly reactive with metals. Reactive with oxidizing agents, organic materials, alkalis, water.

Corrosivity:
Extremely corrosive in presence of aluminum, of copper, of stainless steel(304), of stainless steel(316). Non-corrosive in presence of glass.

Special Remarks on Reactivity:
Reacts with water especially when water is added to the product. Absorption of gaseous hydrogen chloride on mercuric sulfate becomes violent @ 125 deg. C. Sodium reacts very violently with gaseous hydrogen chloride. Calcium phosphide and hydrochloric acid undergo very energetic reaction. It reacts with oxidizers releasing chlorine gas. Incompatible with, alkali metals, carbides, borides, metal oxides, vinyl acetate, acetylides, sulphides, phosphides, cyanides, carbonates. Reacts with most metals to produce flammable Hydrogen gas. Reacts violently (moderate reaction with heat of evolution) with water especially when water is added to the product. Isolate hydrogen chloride from heat, direct sunlight, alkalies (reacts vigorously), organic materials, and oxidizers (especially nitric acid and chlorates), amines, metals, copper and alloys (e.g. brass), hydroxides, zinc (galvanized materials), lithium silicide (incandescence), sulfuric acid(increase in temperature and pressure) Hydrogen chloride gas is emitted when this product is in contact with sulfuric acid. Adsorption of Hydrochloric Acid onto silicon dioxide results in exothmeric reaction. Hydrogen chloride causes aldehydes and epoxides to violently polymerize. Hydrogen chloride or Hydrochloric Acid in contact with the folloiwng can cause explosion or ignition on contact or

Special Remarks on Corrosivity:

Highly corrosive. Incompatible with copper and copper alloys. It attacks nearly all metals (mercury, gold, platinium, tantalum, silver, and certain alloys are exceptions). It is one of the most corrosive of the nonoxidizing acids in contact with copper alloys. No corrosivity data on zinc, steel. Severe Corrosive effect on brass and bronze

Polymerization: Will not occur.

Section 11: Toxicological Information

Routes of Entry: Absorbed through skin. Dermal contact. Eye contact. Inhalation.

Toxicity to Animals:
Acute oral toxicity (LD50): 900 mg/kg [Rabbit]. Acute toxicity of the vapor (LC50): 1108 ppm, 1 hours [Mouse]. Acute toxicity of the vapor (LC50): 3124 ppm, 1 hours [Rat].

Chronic Effects on Humans:
CARCINOGENIC EFFECTS: Classified 3 (Not classifiable for human.) by IARC [Hydrochloric acid]. May cause damage to the following organs: kidneys, liver, mucous membranes, upper respiratory tract, skin, eyes, Circulatory System, teeth.

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (corrosive, irritant, permeator), of ingestion, . Hazardous in case of eye contact (corrosive), of inhalation (lung corrosive).

Special Remarks on Toxicity to Animals:
Lowest Published Lethal Doses (LDL/LCL) LDL [Man] -Route: Oral; 2857 ug/kg LCL [Human] - Route: Inhalation; Dose: 1300 ppm/30M LCL [Rabbit] - Route: Inhalation; Dose: 4413 ppm/30M

Special Remarks on Chronic Effects on Humans:
May cause adverse reproductive effects (fetoxicity). May affect genetic material.

Special Remarks on other Toxic Effects on Humans:
Acute Potential Health Effects: Skin: Corrosive. Causes severe skin irritation and burns. Eyes: Corrosive. Causes severe eye irritation/conjuntivitis, burns, corneal necrosis. Inhalation: May be fatal if inhaled. Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract. Inhalation of hydrochloric acid fumes produces nose, throat, and larryngeal burning, and irritation, pain and inflammation, coughing, sneezing, choking sensation, hoarseness, laryngeal spasms, upper respiratory tract edema, chest pains, as well has headache, and palpitations. Inhalation of high concentrations can result in corrosive burns, necrosis of bronchial epithelium, constriction of the larynx and bronchi, nasospetal perforation, glottal closure, occur, particularly if exposure is prolonged. May affect the liver. Ingestion: May be fatal if swallowed. Causes irritation and burning, ulceration, or perforation of the gastrointestinal tract and resultant peritonitis, gastric hemorrhage and infection. Can also cause nausea, vomitting (with "coffee ground" emesis), diarrhea, thirst, difficulty swallowing, salivation, chills, fever, uneasiness, shock, strictures and stenosis (esophogeal, gastric, pyloric). May affect behavior (excitement), the cardiovascular system (weak rapid pulse, tachycardia), respiration (shallow respiration), and urinary system (kidneys- renal failure, nephritis). Acute exposure via inhalation or ingestion can also cause erosion of tooth enamel. Chronic Potential Health Effects: dyspnea, bronchitis. Chemical pneumonitis and pulmonary edema can also

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are less toxic than the product itself.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Waste must be disposed of in accordance with federal, state and local environmental control regulations.

Section 14: Transport Information

DOT Classification: Class 8: Corrosive material

Identification: : Hydrochloric acid, solution UNNA: 1789 PG: II

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Connecticut hazardous material survey.: Hydrochloric acid Illinois toxic substances disclosure to employee act: Hydrochloric acid Illinois chemical safety act: Hydrochloric acid New York release reporting list: Hydrochloric acid Rhode Island RTK hazardous substances: Hydrochloric acid Pennsylvania RTK: Hydrochloric acid Minnesota: Hydrochloric acid Massachusetts RTK: Hydrochloric acid Massachusetts spill list: Hydrochloric acid New Jersey: Hydrochloric acid New Jersey spill list: Hydrochloric acid Louisiana RTK reporting list: Hydrochloric acid Louisiana spill reporting: Hydrochloric acid California Director's List of Hazardous Substances: Hydrochloric acid TSCA 8(b) inventory: Hydrochloric acid TSCA 4(a) proposed test rules: Hydrochloric acid SARA 302/304/311/312 extremely hazardous substances: Hydrochloric acid SARA 313 toxic chemical notification and release reporting: Hydrochloric acid CERCLA: Hazardous substances.: Hydrochloric acid: 5000 lbs. (2268 kg)

Other Regulations:
OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200). EINECS: This product is on the European Inventory of Existing Commercial Chemical Substances.

Other Classifications:

WHMIS (Canada):
CLASS D-2A: Material causing other toxic effects (VERY TOXIC). CLASS E: Corrosive liquid.

DSCL (EEC):
R34- Causes burns. R37- Irritating to respiratory system. S26- In case of contact with eyes, rinse immediately with plenty of water and seek medical advice. S45- In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible).

HMIS (U.S.A.):

Health Hazard: 3

Fire Hazard: 0

Reactivity: 1

Personal Protection:

National Fire Protection Association (U.S.A.):

Health: 3

Flammability: 0

Reactivity: 1

Specific hazard:

Protective Equipment:
Gloves. Full suit. Vapor respirator. Be sure to use an approved/certified respirator or equivalent. Wear appropriate respirator when ventilation is inadequate. Face shield.

Section 16: Other Information

References:
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Guide de la loi et du règlement sur le transport des marchandises dangeureuses au canada. Centre de conformité internatinal Ltée. 1986.

Other Special Considerations: Not available.

Created: 10/09/2005 05:45 PM

Last Updated: 05/21/2013 12:00 PM

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Safety Data Sheet

Material Name: ISOBUTYLENE **SDS ID: 00233334**

* * * Section 1 - PRODUCT AND COMPANY IDENTIFICATION * * *

Material Name: ISOBUTYLENE

Manufacturer Information

ADVANCED GAS TECHNOLOGIES
1401 Stauffer Road
Palm, PA 18070-0035
Mfg Contact: Outside the US: 703-572-3887 (Collect Calls Accepted)

Phone: 1-800-416-2505

Emergency # 1-800-424-9300 (CHEMTREC

Chemical Family

hydrocarbons, aliphatic

Synonyms

Mtg msds 56; 2-Methylpropene; Isobutylene; Liquified petroleum gas; 2-Methyl-1-propene; L.p.g.; gamma-Butylene; Asym-dimethyl ethylene; UN 1055; RTECS: UD0890000

* * * Section 2 - HAZARDS IDENTIFICATION * * *

EMERGENCY OVERVIEW

Color: colorless
Physical Form: liquefied gas
Odor: petroleum odor
Health Hazards: central nervous system depression, difficulty breathing
Physical Hazards: Flammable gas. May cause flash fire.

POTENTIAL HEALTH EFFECTS

Inhalation

Short Term: irritation, nausea, vomiting, headache, symptoms of drunkenness, disorientation, tingling sensation, suffocation, convulsions, coma
Long Term: no information on significant adverse effects

Skin

Short Term: burns, frostbite
Long Term: no information is available

Eye

Short Term: irritation, frostbite, blurred vision
Long Term: no information on significant adverse effects

Ingestion

Short Term: frostbite
Long Term: no information is available

* * * Section 3 - COMPOSITION / INFORMATION ON INGREDIENTS * * *

CAS	Component	Percent
115-11-7	Isobutylene	100.0

Component Related Regulatory Information

This product may be regulated, have exposure limits or other information identified as the following: Butylene (25167-67-3).

* * * Section 4 - FIRST AID MEASURES * * *

Inhalation

If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

Skin

If frostbite or freezing occur, immediately flush with plenty of lukewarm water (105-115 F; 41-46 C). DO NOT USE HOT WATER. If warm water is not available, gently wrap affected parts in blankets. Get immediate medical attention.

Eyes

Contact with liquid: Immediately flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

Ingestion

If a large amount is swallowed, get medical attention.

Note to Physicians

For inhalation, consider oxygen.

* * * Section 5 - FIRE FIGHTING MEASURES * * *

See Section 9 for Flammability Properties

NFPA Ratings: Health: 1 **Fire:** 4 **Reactivity:** 0

Hazard Scale: 0 = Minimal 1 = Slight 2 = Moderate 3 = Serious 4 = Severe

Flammable Properties

Severe fire hazard. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back. Vapor/air mixtures are explosive above flash point.

Extinguishing Media

carbon dioxide regular dry chemical

Large fires: Flood with fine water spray.

Fire Fighting Measures

Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck: Stop leak if possible without personal risk. Let burn unless leak can be stopped immediately. For smaller tanks or cylinders, extinguish and isolate from other flammables. Evacuation radius: 800 meters (1/2 mile). Do not attempt to extinguish fire unless flow of material can be stopped first. Flood with fine water spray. Cool containers with water spray until well after the fire is out. Apply water from a protected location or from a safe distance. Avoid inhalation of material or combustion by-products. Stay upwind and keep out of low areas. Evacuate if fire gets out of control or containers are directly exposed to fire. Evacuation radius: 500 meters (1/3 mile). Consider downwind evacuation if material is leaking. Stop flow of gas.

* * * Section 6 - ACCIDENTAL RELEASE MEASURES * * *

Occupational spill/release

Avoid heat, flames, sparks and other sources of ignition. Do not touch spilled material. Stop leak if possible without personal risk. Reduce vapors with water spray. Keep unnecessary people away, isolate hazard area and deny entry. Remove sources of ignition. Ventilate closed spaces before entering.

* * * Section 7 - HANDLING AND STORAGE * * *

Storage Procedures

Store and handle in accordance with all current regulations and standards. Grounding and bonding required. Subject to storage regulations: U.S. OSHA 29 CFR 1910.110. U.S. OSHA 29 CFR 1910.101. Keep separated from incompatible substances.

* * * Section 8 - EXPOSURE CONTROLS / PERSONAL PROTECTION * * *

Component Analysis

Isobutylene (115-11-7)

ACGIH: 250 ppm TWA

Ventilation

Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Provide local exhaust ventilation system. Ensure compliance with applicable exposure limits.

PERSONAL PROTECTIVE EQUIPMENT

Eyes/Face

For the gas: Eye protection not required, but recommended. For the liquid: Wear splash resistant safety goggles. Contact lenses should not be worn. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

Protective Clothing

For the gas: Protective clothing is not required. For the liquid: Wear appropriate protective, cold insulating clothing.

Glove Recommendations

Wear insulated gloves.

Respiratory Protection

Under conditions of frequent use or heavy exposure, respiratory protection may be needed.

Respiratory protection is ranked in order from minimum to maximum.

Consider warning properties before use.

Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode.

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

For Unknown Concentrations or Immediately Dangerous to Life or Health -

Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.

Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.

* * * Section 9 - PHYSICAL AND CHEMICAL PROPERTIES * * *

Physical State:	Gas	**Appearance:**	Not available
Color:	colorless	**Physical Form:**	liquefied gas
Odor:	petroleum odor	**Odor Threshold:**	Not available
Melting Point:	-140 °C	**Boiling Point:**	-7 °C
Flash Point:	-76 °C	**Vapor Pressure:**	3278 mmHg @ 37.7 °C
Vapor Density (air = 1):	1.9	**Specific Gravity (water = 1):**	0.5879 @ 25 °C
Water Solubility:	almost insoluble	**Auto Ignition:**	465 °C
Molecular Weight:	56.12	**Molecular Formula:**	C4-H8

Solvent Solubility

Soluble: organic solvents, alcohol, ether, sulfuric acid

* * * Section 10 - STABILITY AND REACTIVITY * * *

Chemical Stability

Stable at normal temperatures and pressure.

Conditions to Avoid

Avoid heat, flames, sparks and other sources of ignition. Minimize contact with material. Containers may rupture or explode if exposed to heat.

Materials to Avoid

oxidizing materials.

Decomposition Products

oxides of carbon

Possibility of Hazardous Reactions

Will not polymerize.

* * * Section 11 - TOXICOLOGICAL INFORMATION * * *

Component Analysis - LD50/LC50

The components of this material have been reviewed in various sources and the following selected endpoints are published:

Isobutylene (115-11-7)

Inhalation LC50 Rat: 620 mg/L/4H

Acute Toxicity Level

Isobutylene (115-11-7)

Non Toxic: inhalation.

Component Carcinogenicity

Isobutylene (115-11-7)

ACGIH: A4 - Not Classifiable as a Human Carcinogen

Target Organs

Isobutylene (115-11-7)

central nervous system.

* * * Section 12 - ECOLOGICAL INFORMATION * * *

Component Analysis - Aquatic Toxicity

No LOLI ecotoxicity data are available for this product's components.

* * * Section 13 - DISPOSAL CONSIDERATIONS * * *

Disposal Methods

Dispose in accordance with all applicable regulations. Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): D001.

Component Waste Numbers

The U.S. EPA has not published waste numbers for this product's components.

* * * Section 14 - TRANSPORT INFORMATION * * *

US DOT Information

Shipping Name: Isobutylene
UN/NA #: UN1055 **Hazard Class:** 2.1
Required Label(s): 2.1

TDG Information

Shipping Name: Isobutylene
UN #: UN1055 **Hazard Class:** 2.1
Required Label(s): 2.1

* * * Section 15 - REGULATORY INFORMATION * * *

U.S. Federal Regulations

None of this products components are listed under SARA Sections 302/304 (40 CFR 355 Appendix A), SARA Section 311/312 (40 CFR 370.21), SARA Section 313 (40 CFR 372.65), CERCLA (40 CFR 302.4), TSCA 12(b), or require an OSHA process safety plan.

SARA 311/312

Acute Health: Yes **Chronic Health:** No **Fire:** Yes **Pressure:** Yes **Reactive:** No

U.S. State Regulations

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA	RI
Isobutylene (¹related to: Butylene)	115-11-7	No	Yes	No	Yes	Yes	Yes¹

Not regulated under California Proposition 65

Component Analysis - Inventory

Component	CAS	US	CA	EU	AU	PH	JP	KR	CN	NZ
Isobutylene	115-11-7	Yes	DSL	EIN	Yes	Yes	Yes	Yes	Yes	Yes

* * * Section 16 - OTHER INFORMATION * * *

Key / Legend

ACGIH - American Conference of Governmental Industrial Hygienists; ADR - European Road Transport; AU - Australia; BOD - Biochemical Oxygen Demand; C - Celsius; CA - Canada; CAS - Chemical Abstracts Service; CERCLA - Comprehensive Environmental Response, Compensation, and Liability Act; CN - China; CPR - Controlled Products Regulations; DFG - Deutsche Forschungsgemeinschaft; DOT - Department of Transportation; DSL - Domestic Substances List; EEC - European Economic Communicty; EINECS - European Inventory of Existing Commercial Chemical Substances; EPA - Environmental Protection Agency; EU - European Union; F - Farenheit; IARC - International Agency for Research on Cancer; IATA - International Air Transport Association; ICAO - International Civil Aviation Organization; IDL - Ingredient Disclosure List; IMDG - International Maritime Dangerous Goods; JP - Japan; Kow - Octanol/water partition coefficient; KR - Korea; LEL - Lower Explosive Limit; LOLI - List Of LIsts™ - ChemADVISOR's Regulatory Database; MAK - Maximum Concentration Value in the Workplace; MEL - Maximum Exposure Limits; NFPA - National Fire Protection Agency; NIOSH - National Institute for Occupational Safety and Health; NJTSR - New Jersey Trade Secret Registry; NTP - National Toxicology Program; NZ - New Zealand; OSHA - Occupational Safety and Health Administration; PH - Philippines; RCRA - Resource Conservation and Recovery Act; RID - European Rail Transport; RTECS - Registry of Toxic Effects of Chemical Substances®; SARA - Superfund Amendments and Reauthorization Act; STEL - Short-term Exposure Limit; TDG - Transportation of Dangerous Goods; TSCA - Toxic Substances Control Act; TWA - Time Weighted Average; UEL - Upper Explosive Limit; US - United States

End of Sheet 00233334

Panasonic®

BATTERY SALES GROUP

MATERIAL SAFETY DATA SHEET

LC SEALED LEAD ACID BATTERY SERIES

Section I: Chemical Product and Company Identification

Product Identity: Sealed Lead Acid Battery

Trade Name: Panasonic LC Valve Regulated Lead Acid Battery Series

Distributor:
Panasonic Industrial Company - Battery Sales Group
Two Panasonic Way/7A-1, Secaucus, New Jersey 07094

Manufacturer:
Matsushita Battery Industrial
Osaka, 570, Japan

For Chemical Emergency
Spill, Leak, Fire, Exposure or Accident
Call CHEMTREC - Day or Night - 24 hours
1-800-424-9300
Outside the USA: 1-703-527-3887 (collect)

Telephone Number for General Information
Toll Free 1-800-793-3772
Internet: www.panasonic.com/batteries

Section II: Hazardous Ingredients / Identity Information

Component	Common Name	Chemical Name	Approximate % by wt. or vol.	OSHA PEL	ACGIH TLV	CAS#
Lead	(Negative Electrode and Grid)	Pb	48~53 wt%	0.05 mg/m^3	0.15 mg/m^3	7439-92-1
Lead Oxide	(Positive Electrode)	PbO_2	23~26%	0.05 mg/m^3	0.15 mg/m^3	1309-60-0
Lead Sulfate	(Positive and Negative Electrode)	$PbSO_4$	< 1. wt%	0.05 mg/m^3	0.15 mg/m^3	7446-14-2
Sulfuric Acid	(Electrolyte)	H_2SO_4	7~10 wt%	1.0 mg/m^3	1.0 mg/m^3	7664-93-9

Percentages of components are dependant both on the model of the battery and state of charge/discharge of the battery. Sulfuric Acid is reportable under Sections 302, 311, 312 and 313 of the Emergency Planning and Community Right-to-Know Act of 1986 (EPCRA). Reportable Quantity: 500 lbs for sulfuric acid and 10,000 lbs for lead. See Section XII, Page 3 for more information.

Overall Chemical Reaction: $PbO2 + Pb + 2H_2SO_4 \rightleftharpoons 2PbSO_4 + 2H_2O$

Note: Panasonic Sealed Lead Acid batteries are a sealed, non-spillable design. Under normal use and handling the customer has no contact with the internal components of the battery or the chemical hazards. Under normal use and handling these batteries do not emit regulated or hazardous substances. Warning: Battery terminals/posts and related accessories contain lead and lead compounds, chemicals known to the State of California to cause cancer and reproductive harm. Wash hands thoroughly after working with batteries and before eating, drinking or smoking.

Section III: Physical / Chemical Characteristics

Boiling Point:	Electrolyte 110°C - 112°C
Vapor Pressure:	Electrolyte 11.7 mm Hg. at 20°C
Vapor Density (AIR = 1):	Electrolyte 3.4
Solubility in Water:	Lead, Lead Oxide and Lead Sulfate are insoluble in water. Sulfuric Acid is 100% soluble in water.
Appearance and Odor:	The entire battery is a solid article consisting of an opaque plastic case with two protruding lead terminals. The battery is odorless. Sulfuric Acid is a liquid.
Specific Gravity (H2O = 1)	Electrolyte 1.300

Health Hazard Information (Acute and Chronic) - Sulfuric Acid only.

The International Agency for Research on Cancer (IARC) has classified "strong inorganic acid mist containing sulfuric acid" as a Category I carcinogen, a substance that is carcinogenic to humans. This classification does not apply to liquid forms of sulfuric acid or sulfuric acid solutions contained within the battery. Inorganic acid mist (sulfuric acid mist) is not generated under normal use of this product. Misuse of the product, such as overcharging, may however result in the generation of sulfuric acid mist.

Routes of Entry:	By inhalation (mist), skin and eyes, ingestion.
Acute:	Tissue destruction on contact. May cause 2nd and 3rd degree burns or blindness. Ingestion will cause corrosive burns on contact. May be fatal if swallowed.
Chronic:	Inhalation of mists may cause upper respiratory irritation.
Signs and Symptoms:	Irritation and burning of exposed tissues.
Medical Conditions:	Respiratory disorders may be aggravated by prolonged inhalation of mists.

Section IV: Emergency and First Aid Procedures

Battery Electrolyte

Inhalation:	Remove to fresh air. Give oxygen or artificial respiration if needed. **Get immediate medical attention.**
Eye Contact:	Flush with plenty of water for at least 15 minutes. **Get immediate medical attention.**
Skin Contact:	Remove contaminated clothing and flush affected areas with plenty of water for at least 15 minutes.
Ingestion:	Do not induce vomiting. Dilute by giving large quantities of water. If available give several glasses of milk. Do not give anything by mouth to an unconscious person. **Give CPR if breathing has stopped. Get immediate medical attention.**

Section V: Fire and Explosion Hazard Data

Flash Point:	Not Applicable
Flammable Limits:	Lower 4.10% (Hydrogen gas) Upper 74.20%
Extinguishing Media:	Dry chemical, foam, halon or CO_2.

Special Fire Fighting Procedures:
If batteries are on charge, turn off power. Use positive pressure, self-contained breathing apparatus in fighting fire. Water applied to electrolyte generates heat and causes it to splatter. Wear acid resistant clothing. Ventilate area well.
Unusual Fire and Explosion Hazards:
Hydrogen and oxygen gases are generated in cells during normal battery operation or when on charge. (Hydrogen is flammable and oxygen supports combustion). These gases enter the air through the vent caps during battery overcharging. To avoid risk of fire or explosion, keep sparks and other sources of ignition away from the battery. Do not allow metal objects to simultaneously contact both positive and negative terminal of batteries. Ventilate area well.

Section VI: Reactivity Data

Stability:	Stable under normal conditions.
Conditions to Avoid:	Sparks and other sources of ignition. Prolonged overcharge. Fire or explosion hazard due to possible hydrogen gas generation.

Incompatibility:
Combination of sulfuric acid with combustibles and organic materials may cause fire and explosion. Avoid strong reducing agents, most metals, carbides, chlorates, nitrates, picrate.
Hazardous Decomposition Products: Hydrogen gas may be generated in an overcharged condition, in fire or at very high temperatures. CO, CO_2 and sulfur oxides may emit in fire.
Hazardous polymerization will not occur.

Section VII: Precautions for Safe Handling and Use

Steps to be Taken in Case of Broken Battery Case or Electrolyte Leakage:
Neutralize any electrolyte or exposed internal battery parts with soda ash (sodium bicarbonate) until fizzing stops. Keep untrained personnel away from electrolyte and broken battery. Place broken battery and clean-up materials in a plastic bag or non-metallic container. Dispose of clean-up materials as a hazardous waste. Ventilate area as hydrogen gas may be given off during neutralization.
Waste Disposal Method:
Federal and State laws prohibit the improper disposal of all lead acid batteries. The battery end users (owners) are responsible for their batteries from the date of purchase through their ultimate disposal. The only legally acceptable method of disposal of lead acid batteries is to recycle them at a Resource Conservation and Recovery Act (RCRA) approved secondary lead smelter. The Panasonic SAV-LEAD Recycling Program allows for the recycling of lead-acid batteries in an environmentally sound manner. For more information on the SAV-LEAD Recycling Program call toll-free, 1-800-SAV-LEAD (1800-728-5323). These batteries are chemically identical to common automotive starter batteries and can be recycled with automotive lead-acid batteries.
HAZARDOUS WASTE CODES: D002, D008.
Precautions to be Taken in Handling, Storing and Transportation:
Store in cool, dry area away from combustible materials. Do not store in sealed, unventilated areas. Avoid overheating and overcharging.
Other Precautions:
Do not charge in unventilated areas. Do not use organic solvents or other than recommended chemical cleaners on battery.

Section VIII: Control Measures / Personal Protection

General:

Normal room ventilation is sufficient during normal use and handling. Recommend 2 to 3 room air changes per hour to prevent buildup of hydrogen gas.

Personal Protective Equipment (In the Event of Battery Case Breakage):

Always wear safety glasses with side shields or full face shield.
Use rubber or neoprene gloves.
Wear acid resistant boots, apron or clothing.

Work/Hygienic Practices:

Remove jewelry, rings, watches and any other metallic objects while working on batteries. All tools should be adequately insulated to avoid the possibility of shorting connections. DO NOT lay tools on top of battery. Be sure to discharge static electricity from tools and individual person by touching a grounded surface in the vicinity of the batteries, but away from cells. Batteries are heavy. Serious injury can result from improper lifting or installation. DO NOT lift, carry, install or remove cells by lifting or pulling the terminal posts for safety reasons and because terminal posts and post seals may be damaged. DO NOT wear nylon clothes or overalls as they can create static electricity. DO KEEP a fire extinguisher and emergency communications device in the work area.

IMPORTANT:

Wash hands thoroughly after working with batteries and before eating, drinking or smoking.

Section IX: Regulatory Information

NFPA Hazard Rating for Sulfuric Acid:

Flammability (Red) = 0 Health (Blue) = 3 Reactivity (Yellow) = 2

Section X: Transportation Information

Identification and Proper Shipping Name:

Batteries – Wet, Non-Spillable, Electric Storage, UN 2800.

DOT - Unregulated, meets the requirements of 49 CFR 173, 159 (d).

IATA/ICAO - Unregulated, meets the requirements of Special Provision A67.

IMO - Unregulated.

***For all modes of transportation, each battery and outer package must be labeled: "Non-Spillable" or "Non-Spillable Battery." This label must be visible during transportation. * Batteries must be securely packed to prevent short-circuiting.**

Section XI: California Proposition 65 Information

The State of California has determined that certain battery terminals contain lead and lead compounds, *and handling this product may also expose you to sulfuric acid mist*, chemicals known to the State of California to cause cancer and reproductive harm. IMPORTANT: WASH HANDS THOROUGHLY AFTER WORKING WITH BATTERIES AND BEFORE EATING, DRINKING OR SMOKING.

Section XII: Other Information - Notice to Readers

General Product Description – LC VRLA Batteries

Panasonic LC Batteries are **sealed** (valve regulated) non-spillable lead-acid batteries with pasted lead-calcium plates. The electrolyte is held captive in an Absorbed Glass Mat (AGM) separator between plates that immobilize the electrolyte in the cell. AGM separator material is a highly porous, absorbent micro fiberglass mat mixed with polymer fibers. There is no "free" electrolyte to leak out if the cell is tipped over (cell case and cover are sealed together) or if the cell is punctured. The AGM separator material immobilizes the electrolyte and creates a situation where the spill of electrolyte is highly unlikely. Typical accidents where a battery case is punctured results in a slight drip or a slow ooze of material out of the cell that cannot be characterized as a spill.

Panasonic LC VRLA batteries are also different from conventional **unsealed** (wet/flooded) cells because they contain only a minimum amount of electrolyte. VRLA battery electrolyte is a dilute mixture of sulfuric acid in water, which typically has a specific gravity between 1.270 and 1.3. Specific Gravity is a measure of the density of a liquid as compared to that of water, which has a specific gravity of 1.000. Pure sulfuric acid has a specific gravity of 1.835.

NOTE: Panasonic LC batteries do not contain a gel electrolyte.

General Product Description - LC VRLA Batteries (continued)

During normal battery installation, operation and maintenance, the user has NO contact with the internal components of the battery or its internal hazardous chemicals.

Panasonic LC batteries are UL recognized under the file number: Matsushita Electric Industrial Co. Ltd., Matsushita Electric Corp. of America, File #MH13723, 1 Panasonic Way, Secaucus, NJ 07094.

NOTICE TO READERS: DISCLAIMER

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Preparer: Charles P. Monahan Director, Regulatory Compliance 201-392-6464
Printed in the U.S.A.

Supplemental Information on Panasonic Valve-Regulated Lead Acid Batteries

Transportation

All Panasonic valve-regulated lead acid batteries are considered "non-spillable" for purposes of transportation by the U.S. Department of Transportation (DOT), International Civil Aviation Administration (ICAO), the International Air Transport Association (IATA) and the International Maritime Dangerous Goods regulations (IMDG). They are considered "non-spillable" by DOT by passing the Vibration Test and Pressure Differential Test as required in 49 CFR 173.159(d). They are also considered to be "non-spillable" by both ICAO and IATA by exceeding the requirements of Special Provisions "A67" as defined in their 1998 Handbooks.

Our batteries are authorized for transportation on deck or under deck storage on either a passenger or cargo vessel by passing the Vibration and Pressure Differential Tests as described in the International Maritime Dangerous Goods Regulations (IMDG).

To transport these batteries as "non-spillable" they must be shipped in a condition that would protect them from short-circuits and be securely packaged so as to withstand conditions normal to transportation. For transportation by a consumer, in or out of a device, they are unregulated thus requiring no additional special handling or packaging.

All of our lead acid batteries and their outside packaging, manufactured after September 30, 1995 are labeled "NON-SPILLABLE" per 49 CFR 173.159(d). If you repackage our batteries either as batteries or as a component of another product you must label the outer package "NON-SPILLABLE" per 49 CFR 173.159(d).

Assure Proper Recycling!

Valve-Regulated Lead Acid batteries destined for recycling can be managed under the federal *Universal Waste Rule* codified at 40 CFR Part 273.

In the event of disposal, dispose only in accordance with federal, state and local regulation. Batteries generated as a waste are subject to the Resource Conservation and Recovery Act (RCRA) as a D008 (lead) hazardous waste.

Panasonic VRLA Recycling Program

The Panasonic 1-800-SAV-LEAD Recycling Program for the collection and recycling of valve-regulated lead acid batteries (VRLA) covers all Panasonic Valve-Regulated Lead Acid Batteries. The proper disposal of spent VRLA batteries is becoming more of a critical issue, both from the viewpoint of environmental stewardship and from compliance with federal and state environmental regulations. Panasonic recognizes the burdens and responsibilities that have been placed on our customers to properly dispose of spent VRLA batteries and is proud to offer this voluntary nationwide battery recycling program.

Federal and State Requirements for Proper Disposal

Federal and State laws prohibit the improper disposal of all lead acid batteries. The battery end users (owners) are responsible for their batteries from the date of purchase through their ultimate disposal. The only legally acceptable method of disposal of lead acid batteries is to recycle them at Resource Conservation and Recovery Act (RCRA) approved secondary lead smelter. This Panasonic 1-800-SAV-LEAD Recycling Program will allow for you to arrange for the recycling of your VRLA batteries from anywhere in the United States. The Program will accept Panasonic and other VRLA batteries regardless of manufacturer. Panasonic will handle all VRLA batteries returned in an environmentally sound manner designed to comply with all applicable Federal and State laws and regulations. Panasonic will send batteries only to fully-permitted secondary lead smelters that we believe meet the highest environmental standards. Once the VRLA batteries are received by Panasonic, the cost to transport the batteries to the secondary lead smelter and the actual recycling costs will be borne by Panasonic.

See the next page for How the 1-800-SAV-LEAD Recycling Program Works

Supplemental Information on Panasonic Valve-Regulated Lead Acid Batteries (Cont.)

How the 1-800-SAV-LEAD Recycling Program Works

1) We encourage all of our customers to serve as VRLA collection centers for your customers, thereby establishing a reverse distribution network between the end user and the secondary lead recycling facility.
2) All shipments to our national consolidation facility must be prepaid. No freight collect shipments will be accepted. All freight collect and non-VRLA batteries will be returned to the shipper.
3) Panasonic will maintain on file all necessary documentation for EPA reference. A copy will be provided upon request.
4) All batteries must be shipped, prepaid to Ebco Battery Company that serves as our national consolidation facility. (See *exception* below).

SHIPPING ADDRESS:
Ebco Battery Company
4017 Warm Springs Road
Columbus, Georgia 31909

5) Only VRLA batteries that meet the U.S. Department of Transportation (DOT) "NON-SPILLABLE" (49 CFR 173.159d) requirements will be accepted by this program.
6) Panasonic reserves the right to alter or discontinue this program at any time.

Packaging Requirements

1) All VRLA batteries must be fully discharged and packaged in a manner as to insure safe handling and conform to all applicable DOT regulations. (49 CFR 173.159d). A dab of silicon caulking or non-conductive tape on each terminal will ensure that no direct shorts occur during shipment.
2) VRLA battery shipments should be made in pallet quantities whenever possible.
3) Palletized shipments should be secured with metal bands or poly-wrapped with stack height limited to four (4) feet.
4) VRLA batteries shipped on pallets should be of uniform size or be stacked with the larger batteries on the bottom.
5) VRLA batteries should be stacked upright in a head-to-base arrangement. Each layer should be separated by cardboard to prevent accidental shorting.
6) Smaller quantities of VRLA batteries may be shipped via standard UPS. Be sure that each box does not exceed the UPS weight limit of 70 lbs. A dab of silicon caulking or non-conductive tape on each terminal will ensure that no shorts occur during shipment.
7) The outside of every pallet and individual box must be labeled "NON-SPILLABLE" as required by DOT regulations. This label must be visible during transportation.

Exception:

Full-Truck-Loads – All full-truck-load shipments of VRLA batteries must be scheduled 48 hours in advance. To schedule shipments to our consolidation site, please be sure to fax a scheduling request (including contact name and phone number) to Ebco Battery Company at fax: (706) 569-6774.

Consumer Users of Panasonic VRLA Batteries

All Panasonic VRLA batteries are chemically identical to common automotive starter batteries and can be returned to any site that accepts automotive lead acid batteries for recycling. Examples include retailers of automotive batteries, automotive service centers, scrap metal dealers, etc...

For additional information on this program or information on how to recycle other Panasonic batteries please call your local Panasonic Battery Sales Group sales office.

Panasonic Batteries
Panasonic Industrial Company
A Division of Panasonic Corporation of North America
Two Panasonic Way
Secaucus, NJ 07094
Toll Free: 877-726-2228
Fax: 847-468-5750
e-mail: oembatteries@us.panasonic.com
Internet: www.panasonic.com/batteries

SAFETY DATA SHEET

Creation Date 16-Nov-2010 **Revision Date** 24-Jul-2014 **Revision Number** 1

1. Identification

Product Name **Lead(II,IV) oxide**

Cat No. : **AC221110000; AC221110050; AC221110051; AC221111000; AC221115000**

Synonyms Red lead oxide

Recommended Use Laboratory chemicals.

Uses advised against No Information available

Details of the supplier of the safety data sheet

Company
Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Entity / Business Name
Acros Organics
One Reagent Lane
Fair Lawn, NJ 07410

Emergency Telephone Number
For information **US** call: 001-800-ACROS-01 / **Europe** call: +32 14 57 52 11
Emergency Number **US:**001-201-796-7100 / **Europe:** +32 14 57 52 99
CHEMTREC Tel. No.**US:**001-800-424-9300 / **Europe:**001-703-527-3887

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute oral toxicity	Category 4
Acute Inhalation Toxicity - Dusts and Mists	Category 4
Carcinogenicity	Category 1B
Reproductive Toxicity	Category 1A
Specific target organ toxicity - (repeated exposure)	Category 1

Label Elements

Signal Word
Danger

Hazard Statements
Harmful if swallowed
Harmful if inhaled
May cause cancer
May damage the unborn child. Suspected of damaging fertility
Causes damage to organs through prolonged or repeated exposure



Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Use personal protective equipment as required
Wash face, hands and any exposed skin thoroughly after handling
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area
Do not breathe dust/fume/gas/mist/vapors/spray
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Ingestion
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Rinse mouth
Storage
Store locked up
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
Very toxic to aquatic life with long lasting effects

3. Composition / information on ingredients

Component	CAS-No	Weight %
Lead tetraoxide	1314-41-6	>95

4. First-aid measures

General Advice Show this safety data sheet to the doctor in attendance. Immediate medical attention is required.

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. In the case of contact with eyes, rinse immediately with plenty of water and seek medical advice.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation Move to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth resuscitation if victim ingested or inhaled the substance; induce artificial respiration with a respiratory medical device. Immediate medical attention is required.

Ingestion Do not induce vomiting. Call a physician or Poison Control Center immediately.

Most important symptoms/effects No information available.
Notes to Physician Treat symptomatically

5. Fire-fighting measures

Unsuitable Extinguishing Media No information available

Flash Point No information available
Method - No information available

Autoignition Temperature Not applicable

Explosion Limits

Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical
Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
lead oxides lead
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear. Thermal decomposition can lead to release of irritating gases and vapors.

NFPA

Health	Flammability	Instability	Physical hazards
3	0	0	N/A

6. Accidental release measures

Personal Precautions Ensure adequate ventilation. Use personal protective equipment. Keep people away from and upwind of spill/leak. Evacuate personnel to safe areas. Avoid dust formation.

Environmental Precautions Do not flush into surface water or sanitary sewer system. Do not allow material to contaminate ground water system. Prevent product from entering drains. Local authorities should be advised if significant spillages cannot be contained. Should not be released into the environment. See Section 12 for additional ecological information. Avoid release to the environment. Collect spillage.

Methods for Containment and Clean Up Avoid dust formation. Sweep up or vacuum up spillage and collect in suitable container for disposal.

7. Handling and storage

Handling Do not get in eyes, on skin, or on clothing. Do not ingest. Use only under a chemical fume hood. Wear personal protective equipment. Do not breathe vapors/dust. Avoid dust formation.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH
Lead tetraoxide	TWA: 0.05 mg/m³		IDLH: 100 mg/m³ TWA: 0.050 mg/m³

Component	Quebec	Mexico OEL (TWA)	Ontario TWAEV
Lead tetraoxide	TWA: 0.05 mg/m³	TWA: 0.15 mg/m³	TWA: 0.05 mg/m³

Legend

ACGIH - American Conference of Governmental Industrial Hygienists
OSHA - Occupational Safety and Health Administration
NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures Ensure adequate ventilation, especially in confined areas.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection	Long sleeved clothing.
Respiratory Protection	Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.
Hygiene Measures	Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Powder Solid
Appearance	Orange
Odor	Odorless
Odor Threshold	No information available
pH	No information available
Melting Point/Range	500 - 530 °C / 932 - 986 °F
Boiling Point/Range	No information available
Flash Point	No information available
Evaporation Rate	Not applicable
Flammability (solid,gas)	No information available
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	1 mmHg @ 943 °C
Vapor Density	Not applicable
Relative Density	8.32 - 9.16
Solubility	Insoluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	Not applicable
Decomposition temperature	> 500°C
Viscosity	Not applicable
Molecular Formula	O4 Pb3
Molecular Weight	685.57

10. Stability and reactivity

Reactive Hazard	None known, based on information available
Stability	Stable under normal conditions.
Conditions to Avoid	Incompatible products. Excess heat.
Incompatible Materials	Strong oxidizing agents, Strong reducing agents, Powdered metals
Hazardous Decomposition Products	lead oxides, lead
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions	None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation	No information available
Sensitization	No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Lead tetraoxide	1314-41-6	Group 2A	Not listed	A3	X	Not listed

IARC: (International Agency for Research on Cancer)

ACGIH: (American Conference of Governmental Industrial Hygienists)

IARC: (International Agency for Research on Cancer)
Group 1 - Carcinogenic to Humans
Group 2A - Probably Carcinogenic to Humans
Group 2B - Possibly Carcinogenic to Humans
A1 - Known Human Carcinogen
A2 - Suspected Human Carcinogen
A3 - Animal Carcinogen
ACGIH: (American Conference of Governmental Industrial Hygienists)

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity Teratogenic effects have occurred in experimental animals.

STOT - single exposure None known
STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed No information available

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated. See actual entry in RTECS for complete information.

12. Ecological information

Ecotoxicity

Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. The product contains following substances which are hazardous for the environment. Do not allow material to contaminate ground water system.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Lead tetraoxide	Not listed	56000 mg/L LC50 96 h	Not listed	Not listed

Persistence and Degradability Insoluble in water May persist

Bioaccumulation/ Accumulation No information available.

Mobility Is not likely mobile in the environment due its low water solubility.

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT

UN-No UN3288
Proper Shipping Name TOXIC SOLID, INORGANIC, N.O.S.
Hazard Class 6.1
Packing Group III

TDG

UN-No UN3288
Proper Shipping Name TOXIC SOLID, INORGANIC, N.O.S.
Hazard Class 6.1
Packing Group III

IATA

UN-No UN3288
Proper Shipping Name TOXIC SOLID, INORGANIC, N.O.S.
Hazard Class 6.1
Packing Group III

IMDG/IMO

UN-No UN3288
Proper Shipping Name TOXIC SOLID, INORGANIC, N.O.S.
Hazard Class 6.1
Packing Group III

15. Regulatory information

All of the components in the product are on the following Inventory lists: X = listed

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Lead tetraoxide	X	X	-	215-235-6	-		X	X	X	X	X

Legend:
X - Listed
E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.
F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.
N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.
P - Indicates a commenced PMN substance
R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.
S - Indicates a substance that is identified in a proposed or final Significant New Use Rule
T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.
XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B).
Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.
Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Lead tetraoxide	1314-41-6	>95	0.1

SARA 311/312 Hazardous Categorization

Acute Health Hazard Yes
Chronic Health Hazard Yes
Fire Hazard No
Sudden Release of Pressure Hazard No
Reactive Hazard No

Clean Water Act Not applicable

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Lead tetraoxide	-	-	X	-

Clean Air Act Not applicable

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Lead tetraoxide	X		-

OSHA Occupational Safety and Health Administration
OSHA - United States Occupational Safety and Health Administration

Component	Specifically Regulated Chemicals	Highly Hazardous Chemicals
Lead tetraoxide	30 µg/m³ Action Level 50 µg/m³ TWA	-

CERCLA
Not applicable

California Proposition 65 This product contains the following Proposition 65 chemicals:

Component	CAS-No	California Prop. 65	Prop 65 NSRL	Category
Lead tetraoxide	1314-41-6	Carcinogen Developmental	-	Developmental Carcinogen

State Right-to-Know

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Lead tetraoxide	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): N
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security
This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

Canada
This product has been classified in accordance with the hazard criteria of the Controlled Products Regulations (CPR) and the MSDS contains all the information required by the CPR

WHMIS Hazard Class D1B Toxic materials
D2A Very toxic materials



16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 16-Nov-2010
Revision Date 24-Jul-2014
Print Date 24-Jul-2014
Revision Summary This document has been updated to comply with the US OSHA HazCom 2012 Standard replacing the current legislation under 29 CFR 1910.1200 to align with the Globally Harmonized System of Classification and Labeling of Chemicals (GHS)

Disclaimer

The information provided on this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guide for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered as a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other material or in any process, unless specified in the text.

End of SDS

Methanol, Lab Grade, 4L

SECTION 1 : Identification of the substance/mixture and of the supplier

Product name : **Methanol, Lab Grade, 4L**

Manufacturer/Supplier Trade name:

Manufacturer/Supplier Article number: **S25426A**

Recommended uses of the product and uses restrictions on use:

Manufacturer Details:

AquaPhoenix Scientific
9 Barnhart Drive, Hanover, PA 17331

Supplier Details:

Fisher Science Education
15 Jet View Drive, Rochester, NY 14624

Emergency telephone number:

Fisher Science Education Emergency Telephone No.: 800-535-5053

SECTION 2 : Hazards identification

Classification of the substance or mixture:



Flammable
Flammable liquids, category 2



Toxic
Acute toxicity (oral, dermal, inhalation), category 3



Health hazard
Specific target organ toxicity following single exposure, category 1

AcTox Dermal. 3
Flammable liq. 2
AcTox Oral. 3
AcTox Inhaln. 3
Stot SE. 1

Signal word :Danger

Hazard statements:
Highly flammable liquid and vapour
Toxic if swallowed
Toxic in contact with skin
Toxic if inhaled
Causes damage to organs

Precautionary statements:
If medical advice is needed, have product container or label at hand
Keep out of reach of children
Read label before use

Wear protective gloves/protective clothing/eye protection/face protection
Wash skin thoroughly after handling
Do not eat, drink or smoke when using this product
Avoid breathing dust/fume/gas/mist/vapours/spray
Keep away from heat/sparks/open flames/hot surfaces. No smoking
Do not breathe dust/fume/gas/mist/vapours/spray
Specific treatment (see supplemental first aid instructions on this label)
IF ON SKIN: Wash with soap and water
Call a POISON CENTER or doctor/physician if you feel unwell
Specific measures (see supplemental first aid instructions on this label)
Take off contaminated clothing and wash before reuse
Wash contaminated clothing before reuse
IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician
IF exposed: Call a POISON CENTER or doctor/physician
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Store locked up
Store in a well ventilated place. Keep cool
Dispose of contents and container as instructed in Section 13

Other Non-GHS Classification:

WHMIS

B2 

D1B 

D2B 

NFPA/HMIS



NFPA SCALE (0-4)



HMIS RATINGS (0-4)

SECTION 3 : Composition/information on ingredients

Ingredients:		
CAS 67-56-1	Methanol	>90 %

Percentages are by weight

SECTION 4 : First aid measures

Description of first aid measures

After inhalation: Move exposed individual to fresh air. Loosen clothing as necessary and position individual in a comfortable position.Get medical assistance.If breathing is difficult, give oxygen

After skin contact: Wash affected area with soap and water. Rinse/flush exposed skin gently using water for 15-20 minutes. Seek medical attention if irritation persists or if concerned.

After eye contact: Protect unexposed eye. Rinse or flush eye gently with water for at least 15-20 minutes, lifting upper and lower lids.Seek medical attention if irritation persists or if concerned

After swallowing: Rinse mouth thoroughly. Do not induce vomiting. Have exposed individual drink sips of water. Dilute mouth with water or milk after rinsing.Get medical assistance.

Most important symptoms and effects, both acute and delayed:

Poison. Toxic by ingestion, absorption through skin and inhalation, potentially causing irreversible effects. Irritating to eyes, skin, and respiratory tract. Irritation- all routes of exposure.Shortness of breath.Nausea.Headache.May be fatal or cause blindness if swallowed. Cannot be made non-poisonous. May cause gastrointestinal irritation, vomiting, and diarrhea. Central nervous system disorders. Skin disorders, preexisting eye disorders, gastrointestinal tract;Toxic: danger of very serious irreversible effects by inhalation, ingestion or absorption through skin. Experiments have shown reproductive toxicity effects on laboratory animals. May cause adverse kidney and liver effects

Indication of any immediate medical attention and special treatment needed:

If seeking medical attention, provide SDS document to physician.Physician should treat symptomatically.

SECTION 5 : Firefighting measures

Extinguishing media

Suitable extinguishing agents: Dry chemical, foam, dry sand, or Carbon Dioxide.Water spray can keep containers cool.

For safety reasons unsuitable extinguishing agents: Water may be ineffective.

Special hazards arising from the substance or mixture:

Risk of ignition. Vapors may form explosive mixtures with air. Vapors may travel to source of ignition and flash back. Containers may explode when heated

Advice for firefighters:

Protective equipment: Wear protective eyeware, gloves, and clothing. Refer to Section 8.

Additional information (precautions): Remove all sources of ignition. Avoid contact with skin, eyes, and clothing.Ensure adequate ventilation.Take precautions against static discharge.

SECTION 6 : Accidental release measures

Personal precautions, protective equipment and emergency procedures:

Use spark-proof tools and explosion-proof equipment.Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and mists below the applicable workplace exposure limits (Occupational Exposure Limits-OELs) indicated above.Ensure adequate ventilation.

Environmental precautions:

Prevent from reaching drains, sewer or waterway. Should not be released into environment.

Methods and material for containment and cleaning up:

If necessary use trained response staff or contractor. Remove all sources of ignition. Contain spillage and then

collect. Do not flush to sewer.Absorb with a noncombustible absorbent material such as sand or earth and containerize for disposal. Ventilate area of leak or spill.Use spark-proof tools and explosion-proof equipment.Follow proper disposal methods. Refer to Section 13.

Reference to other sections:

SECTION 7 : Handling and storage

Precautions for safe handling:

Use in a chemical fume hood. Wash hands before breaks and immediately after handling the product.Avoid contact with skin, eyes, and clothing.Take precautions against static discharge.

Conditions for safe storage, including any incompatibilities:

Store in a cool location. Provide ventilation for containers. Avoid storage near extreme heat, ignition sources or open flame. Keep container tightly sealed.Store with like hazards. Protect from freezing and physical damage.

SECTION 8 : Exposure controls/personal protection





Control Parameters:	67-56-1, Methanol, ACGIH: 250 ppm STEL; 200 ppm TWA 67-56-1, Methanol, NIOSH: 250 ppm STEL; 325 mg/m3 STEL 67-56-1, Methanol, NIOSH: 200 ppm TWA; 260 mg/m3 TWA
Appropriate Engineering controls:	Emergency eye wash fountains and safety showers should be available in the immediate vicinity of use or handling. Ensure that dust-handling systems (exhaust ducts, dust collectors, vessels, and processing equipment) are designed to prevent the escape of dust into the work area.
Respiratory protection:	Use in a chemical fume hood. If exposure limit is exceeded, a full-face respirator with organic cartridge may be worn.
Protection of skin:	Select glove material impermeable and resistant to the substance.Select glove material based on rates of diffusion and degradation.
Eye protection:	Safety glasses with side shields or goggles.
General hygienic measures:	Wash hands before breaks and at the end of work. Avoid contact with the eyes and skin.Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices.Perform routine housekeeping.

SECTION 9 : Physical and chemical properties

Appearance (physical state,color):	Clear colorless liquid	**Explosion limit lower**: **Explosion limit upper**:	6 31
Odor:	Alcohol	**Vapor pressure**:	128 hPa @ 20°C
Odor threshold:	Not Available	**Vapor density**:	1.11
pH-value:	Not Available	**Relative density**:	0.79
Melting/Freezing point:	-98°C	**Solubilities**:	Miscible at 20 °C

Boiling point/Boiling range:	64.7°C @ 760mmHg	**Partition coefficient (n-octanol/water)**:	Not Available
Flash point (closed cup):	12°C	**Auto/Self-ignition temperature**:	455°C
Evaporation rate:	5.2	**Decomposition temperature**:	Not Available
Flammability (solid,gaseous):	Flammable	**Viscosity**:	a. Kinematic:Not Available b. Dynamic: Not Available
Density: Not Available			

SECTION 10 : Stability and reactivity

Reactivity: Vapours may form explosive mixture with air.
Chemical stability: Stable under normal conditions.
Possible hazardous reactions: None under normal processing.
Conditions to avoid: Excess heat, Incompatible Materials, flames, or sparks.
Incompatible materials: Oxidizing agents, reducing agents, alkali metals, acids, sodium, potassium, metals as powders, acid chlorides, acid anhydrides, powdered magnesium, and aluminum.
Hazardous decomposition products:carbon monoxide, formaldehyde.

SECTION 11 : Toxicological information

Acute Toxicity:		
Dermal:	(rabbit)	LD-50 15800 mg/kg
Oral:	(rat)	LD-50 5628 mg/kg
Inhalation:	(rat)	LC-50 130,7 mg/l
Chronic Toxicity: No additional information.		
Corrosion Irritation:		
Ocular:		Irritating to eyes
Dermal:		Irritating to skin
Sensitization:		No additional information.
Single Target Organ (STOT):		Classified as causing damage to organs:Eyes, skin, optic nerve, gastrointestinal tract, central nervous system, respiratory system, liver, spleen, kidney, blood
Numerical Measures:		No additional information.
Carcinogenicity:		Teratogenicity : has occurred in experimental animals.
Mutagenicity:		Mutagenetic effects have occurred in experimental animals.

Reproductive Toxicity:	Developmental Effects (Immediate/Delayed) have occurred in experimental animals

SECTION 12 : Ecological information

Ecotoxicity

Freshwater Fish: 96 Hr LC50 Pimephales promelas: 28200 mg/L

Freshwater Fish: 96 Hr LC50 Oncorhynchus mykiss: 19500 - 20700 mg/L

Freshwater Fish: 96 Hr LC50 Pimephales promelas: >100 mg/L

Freshwater Fish: 96 Hr LC50 Oncorhynchus mykiss: 18 - 20 mL/L

Freshwater Fish: 96 Hr LC50 Lepomis macrochirus: 13500 - 17600 mg/L

Persistence and degradability: Not persistant.
Bioaccumulative potential: Not Bioaccumulative.
Mobility in soil: Aqueous solution has high mobility in soil.
Other adverse effects:

SECTION 13 : Disposal considerations

Waste disposal recommendations:

Methanol RCRA waste code U154. Do not allow product to reach sewage system or open water.It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory entities (US 40CFR262.11). Absorb with a noncombustible absorbent material such as sand or earth and containerize for disposal. Provide ventilation. Have fire extinguishing agent available in case of fire. Eliminate all sources of ignition.Use spark-proof tools and explosion-proof equipment.Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations. Ensure complete and accurate classification.

SECTION 14 : Transport information

UN-Number

UN1230

UN proper shipping name

Methanol

Transport hazard class(es)



Class:
3 Flammable liquids



Class:
6.1 Toxic substances

Packing group:II
Environmental hazard:
Transport in bulk:
Special precautions for user:

SECTION 15 : Regulatory information

United States (USA)

SARA Section 311/312 (Specific toxic chemical listings):

Acute, Chronic, Fire

SARA Section 313 (Specific toxic chemical listings):

67-56-1 Methanol

RCRA (hazardous waste code):

67-56-1 Methanol RCRA waste code U154

TSCA (Toxic Substances Control Act):

All ingredients are listed.

CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act):

67-56-1 Methanol 5000 lbs

Proposition 65 (California):

Chemicals known to cause cancer:

None of the ingredients is listed

Chemicals known to cause reproductive toxicity for females:

None of the ingredients is listed

Chemicals known to cause reproductive toxicity for males:

None of the ingredients is listed

Chemicals known to cause developmental toxicity:

67-56-1 Methanol

Canada

Canadian Domestic Substances List (DSL):

All ingredients are listed.

Canadian NPRI Ingredient Disclosure list (limit 0.1%):

None of the ingredients is listed

Canadian NPRI Ingredient Disclosure list (limit 1%):

67-56-1 Methanol

SECTION 16 : Other information

This product has been classified in accordance with hazard criteria of the Controlled Products Regulations and the SDS contains all the information required by the Controlled Products Regulations.Note:. The responsibility to provide a safe workplace remains with the user.The user should consider the health hazards and safety information contained herein as a guide and should take those precautions required in an individual operation to instruct employees and develop work practice procedures for a safe work environment.The information contained herein is, to the best of our knowledge and belief, accurate.However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by the use of this material.It is the responsibility of the user to comply with all applicable laws and regulations applicable to this material.

GHS Full Text Phrases:

Abbreviations and acronyms:

IMDG: International Maritime Code for Dangerous Goods
PNEC: Predicted No-Effect Concentration (REACH)

CFR: Code of Federal Regulations (USA)
SARA: Superfund Amendments and Reauthorization Act (USA)
RCRA: Resource Conservation and Recovery Act (USA)
TSCA: Toxic Substances Control Act (USA)
NPRI: National Pollutant Release Inventory (Canada)
DOT: US Department of Transportation
IATA: International Air Transport Association
GHS: Globally Harmonized System of Classification and Labelling of Chemicals
ACGIH: American Conference of Governmental Industrial Hygienists
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
WHMIS: Workplace Hazardous Materials Information System (Canada)
DNEL: Derived No-Effect Level (REACH)

Effective date : 01.08.2015
Last updated : 03.27.2015

Safety Data Sheet

SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

Havoline Motor Oil SAE 5W-20 (GF-5)

Product Use: Passenger Car Motor Oil
Product Number(s): 223393
Company Identification
Chevron Products Company
a division of Chevron U.S.A. Inc.
6001 Bollinger Canyon Rd.
San Ramon, CA 94583
United States of America
www.chevronlubricants.com

Transportation Emergency Response
CHEMTREC: (800) 424-9300 or (703) 527-3887
Health Emergency
Chevron Emergency & Information Center: Located in the USA. International collect calls accepted. (800) 231-0623 or (510) 231-0623
Product Information
email : lubemsds@chevron.com
Product Information: 1 (800) 582-3835, LUBETEK@chevron.com

SECTION 2 HAZARDS IDENTIFICATION

CLASSIFICATION: Not classified as hazardous according to 29 CFR 1910.1200 (2012).

HAZARDS NOT OTHERWISE CLASSIFIED: Not Applicable

SECTION 3 COMPOSITION/ INFORMATION ON INGREDIENTS

COMPONENTS	CAS NUMBER	AMOUNT
Highly refined mineral oil (C15 - C50)	Mixture	70 - 99 %weight

SECTION 4 FIRST AID MEASURES

Description of first aid measures
Eye: No specific first aid measures are required. As a precaution, remove contact lenses, if worn, and flush eyes with water.
Skin: No specific first aid measures are required. As a precaution, remove clothing and shoes if contaminated. To remove the material from skin, use soap and water. Discard contaminated clothing and shoes or thoroughly clean before reuse.
Ingestion: No specific first aid measures are required. Do not induce vomiting. As a precaution, get medical advice.
Inhalation: No specific first aid measures are required. If exposed to excessive levels of material in the air, move the exposed person to fresh air. Get medical attention if coughing or respiratory discomfort occurs.

Most important symptoms and effects, both acute and delayed
IMMEDIATE HEALTH EFFECTS
Eye: Not expected to cause prolonged or significant eye irritation.
Skin: Contact with the skin is not expected to cause prolonged or significant irritation. Contact with the skin is not expected to cause an allergic skin response. Not expected to be harmful to internal organs if absorbed through the skin.
Ingestion: Not expected to be harmful if swallowed.
Inhalation: Not expected to be harmful if inhaled. Contains a petroleum-based mineral oil. May cause respiratory irritation or other pulmonary effects following prolonged or repeated inhalation of oil mist at airborne levels above the recommended mineral oil mist exposure limit. Symptoms of respiratory irritation may include coughing and difficulty breathing.

DELAYED OR OTHER HEALTH EFFECTS: Not classified

Indication of any immediate medical attention and special treatment needed Not Applicable

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA: Use water fog, foam, dry chemical or carbon dioxide (CO2) to extinguish flames.

PROTECTION OF FIRE FIGHTERS:
Fire Fighting Instructions: This material will burn although it is not easily ignited. See Section 7 for proper handling and storage. For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus.
Combustion Products: Highly dependent on combustion conditions. A complex mixture of airborne solids, liquids, and gases including carbon monoxide, carbon dioxide, and unidentified organic compounds will be evolved when this material undergoes combustion. Combustion may form oxides of: Nitrogen.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Protective Measures: Eliminate all sources of ignition in vicinity of spilled material.
Spill Management: Stop the source of the release if you can do it without risk. Contain release to prevent further contamination of soil, surface water or groundwater. Clean up spill as soon as possible, observing precautions in Exposure Controls/Personal Protection. Use appropriate techniques such as applying non-combustible absorbent materials or pumping. Where feasible and appropriate, remove contaminated soil. Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations.
Reporting: Report spills to local authorities and/or the U.S. Coast Guard's National Response Center at (800) 424-8802 as appropriate or required.

SECTION 7 HANDLING AND STORAGE

General Handling Information: Avoid contaminating soil or releasing this material into sewage and drainage systems and bodies of water.
Precautionary Measures: Keep out of the reach of children.
Static Hazard: Electrostatic charge may accumulate and create a hazardous condition when handling this material. To minimize this hazard, bonding and grounding may be necessary but may not, by themselves, be sufficient. Review all operations which have the potential of generating and accumulating an electrostatic charge and/or a flammable atmosphere (including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation, and vacuum truck operations) and use appropriate mitigating procedures.
Container Warnings: Container is not designed to contain pressure. Do not use pressure to empty container or it may rupture with explosive force. Empty containers retain product residue (solid, liquid, and/or vapor) and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, static electricity, or other sources of ignition. They may explode and cause injury or death. Empty containers should be completely drained, properly closed, and promptly returned to a drum reconditioner or disposed of properly.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

GENERAL CONSIDERATIONS:
Consider the potential hazards of this material (see Section 2), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

ENGINEERING CONTROLS:
Use in a well-ventilated area.

PERSONAL PROTECTIVE EQUIPMENT
Eye/Face Protection: No special eye protection is normally required. Where splashing is possible, wear safety glasses with side shields as a good safety practice.
Skin Protection: No special protective clothing is normally required. Where splashing is possible, select protective clothing depending on operations conducted, physical requirements and other substances in the workplace. Suggested materials for protective gloves include: 4H (PE/EVAL), Nitrile Rubber, Silver Shield, Viton.
Respiratory Protection: No respiratory protection is normally required.
If user operations generate an oil mist, determine if airborne concentrations are below the occupational exposure limit for mineral oil mist. If not, wear an approved respirator that provides adequate protection from the measured concentrations of this material. For air-purifying respirators use a particulate cartridge.
Use a positive pressure air-supplying respirator in circumstances where air-purifying respirators may not provide adequate protection.

Occupational Exposure Limits:

Component	Agency	Form	TWA	STEL	Ceiling	Notation
Highly refined mineral oil (C15 - C50)	ACGIH	--	5 mg/m3	10 mg/m3	--	--
Highly refined mineral oil (C15 - C50)	OSHA Z-1	--	5 mg/m3	--	--	--

Consult local authorities for appropriate values.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Attention: the data below are typical values and do not constitute a specification.

Color: Light to Brown
Physical State: Liquid
Odor: Petroleum odor
Odor Threshold: No data available
pH: Not Applicable
Vapor Pressure: No data available
Vapor Density (Air = 1): No data available
Initial Boiling Point: No data available
Solubility: Soluble in hydrocarbons; insoluble in water
Freezing Point: Not Applicable
Melting Point: No data available
Density: 0.8607 kg/l - 0.8804 kg/l @ 15°C (59°F) (Typical)
Viscosity: 8 mm2/s - 17.1 mm2/s @ 100°C (212°F) (Minimum)
Evaporation Rate: No data available
Decomposition temperature: No data available
Octanol/Water Partition Coefficient: No data available

FLAMMABLE PROPERTIES:
Flammability (solid, gas): Not Applicable

Flashpoint: (Cleveland Open Cup) 200 °C - 205 °C (392 °F - 401 °F) (Minimum)
Autoignition: No data available
Flammability (Explosive) Limits (% by volume in air): Lower: Not Applicable Upper: Not Applicable

SECTION 10 STABILITY AND REACTIVITY

Reactivity: May react with strong acids or strong oxidizing agents, such as chlorates, nitrates, peroxides, etc.
Chemical Stability: This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.
Incompatibility With Other Materials: Not applicable
Hazardous Decomposition Products: None known (None expected)
Hazardous Polymerization: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects
Serious Eye Damage/Irritation: The eye irritation hazard is based on evaluation of data for product components.

Skin Corrosion/Irritation: The skin irritation hazard is based on evaluation of data for product components.

Skin Sensitization: The skin sensitization hazard is based on evaluation of data for product components.

Acute Dermal Toxicity: The acute dermal toxicity hazard is based on evaluation of data for product components.

Acute Oral Toxicity: The acute oral toxicity hazard is based on evaluation of data for product components.

Acute Inhalation Toxicity: The acute inhalation toxicity hazard is based on evaluation of data for product components.
Acute Toxicity Estimate: Not Determined

Germ Cell Mutagenicity: The hazard evaluation is based on data for components or a similar material.

Carcinogenicity: The hazard evaluation is based on data for components or a similar material.

Reproductive Toxicity: The hazard evaluation is based on data for components or a similar material.

Specific Target Organ Toxicity - Single Exposure: The hazard evaluation is based on data for components or a similar material.

Specific Target Organ Toxicity - Repeated Exposure: The hazard evaluation is based on data for components or a similar material.

ADDITIONAL TOXICOLOGY INFORMATION:

During use in engines, contamination of oil with low levels of cancer-causing combustion products occurs. Used motor oils have been shown to cause skin cancer in mice following repeated application and continuous exposure. Brief or intermittent skin contact with used motor oil is not expected to have serious effects in humans if the oil is thoroughly removed by washing with soap and water.

This product contains petroleum base oils which may be refined by various processes including severe solvent extraction, severe hydrocracking, or severe hydrotreating. None of the oils requires a cancer warning under the OSHA Hazard Communication Standard (29 CFR 1910.1200). These oils have not been listed in the National Toxicology Program (NTP) Annual Report nor have they been classified by the International Agency for Research on Cancer (IARC) as; carcinogenic to humans (Group 1), probably carcinogenic to humans (Group 2A), or possibly carcinogenic to humans (Group 2B).

These oils have not been classified by the American Conference of Governmental Industrial Hygienists (ACGIH) as: confirmed human carcinogen (A1), suspected human carcinogen (A2), or confirmed animal carcinogen with unknown relevance to humans (A3).

SECTION 12 ECOLOGICAL INFORMATION

ECOTOXICITY

This material is not expected to be harmful to aquatic organisms.
The product has not been tested. The statement has been derived from the properties of the individual components.

MOBILITY

No data available.

PERSISTENCE AND DEGRADABILITY

This material is not expected to be readily biodegradable. The biodegradability of this material is based on an evaluation of data for the components or a similar material.
The product has not been tested. The statement has been derived from the properties of the individual components.

POTENTIAL TO BIOACCUMULATE

Bioconcentration Factor: No data available.
Octanol/Water Partition Coefficient: No data available

SECTION 13 DISPOSAL CONSIDERATIONS

Use material for its intended purpose or recycle if possible. Oil collection services are available for used oil recycling or disposal. Place contaminated materials in containers and dispose of in a manner consistent with applicable regulations. Contact your sales representative or local environmental or health authorities for approved disposal or recycling methods.

SECTION 14 TRANSPORT INFORMATION

The description shown may not apply to all shipping situations. Consult 49CFR, or appropriate Dangerous Goods Regulations, for additional description requirements (e.g., technical name) and mode-specific or quantity-specific shipping requirements.

DOT Shipping Description: NOT REGULATED AS HAZARDOUS MATERIAL UNDER 49 CFR

IMO/IMDG Shipping Description: NOT REGULATED AS DANGEROUS GOODS FOR TRANSPORT UNDER THE IMDG CODE

ICAO/IATA Shipping Description: NOT REGULATED AS DANGEROUS GOODS FOR TRANSPORT UNDER ICAO

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC code:
Not applicable

SECTION 15 REGULATORY INFORMATION

EPCRA 311/312 CATEGORIES: Not applicable

REGULATORY LISTS SEARCHED:

01-1=IARC Group 1	03=EPCRA 313
01-2A=IARC Group 2A	04=CA Proposition 65
01-2B=IARC Group 2B	05=MA RTK
02=NTP Carcinogen	06=NJ RTK
	07=PA RTK

No components of this material were found on the regulatory lists above.

CHEMICAL INVENTORIES:
All components comply with the following chemical inventory requirements: AICS (Australia), DSL (Canada), ENCS (Japan), KECI (Korea), NZIoC (New Zealand), PICCS (Philippines), TCSI (Taiwan), TSCA (United States).

One or more components is listed on ELINCS (European Union). All other components are listed or exempted from listing on EINECS.

NEW JERSEY RTK CLASSIFICATION:
Under the New Jersey Right-to-Know Act L. 1983 Chapter 315 N.J.S.A. 34:5A-1 et. seq., the product is to be identified as follows: PETROLEUM OIL (Motor oil)

SECTION 16 OTHER INFORMATION

NFPA RATINGS: Health: 0 Flammability: 1 Reactivity: 0

HMIS RATINGS: Health: 0 Flammability: 1 Reactivity: 0
(0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme, PPE:- Personal Protection Equipment Index recommendation, *-Chronic Effect Indicator). These values are obtained using the guidelines or published evaluations prepared by the National Fire Protection Association (NFPA) or the National Paint and Coating Association (for HMIS ratings).

REVISION STATEMENT: SECTION 01 - Product Code(s) information was modified.
SECTION 01 - Product Identifier information was modified.
SECTION 01 - Product Use information was modified.
SECTION 05 - Fire Fighters Protection Measures information was modified.
SECTION 08 - Occupational Exposure Limit Table information was modified.
SECTION 09 - Physical/Chemical Properties information was deleted.

SECTION 09 - Physical/Chemical Properties information was modified.
SECTION 15 - Chemical Inventories information was modified.
SECTION 15 - SARA 311 EPCRA Score information was added.
SECTION 15 - SARA 311 Score information was deleted.

Revision Date: November 06, 2019

ABBREVIATIONS THAT MAY HAVE BEEN USED IN THIS DOCUMENT:

TLV - Threshold Limit Value	TWA - Time Weighted Average
STEL - Short-term Exposure Limit	PEL - Permissible Exposure Limit
GHS - Globally Harmonized System	CAS - Chemical Abstract Service Number
ACGIH - American Conference of Governmental Industrial Hygienists	IMO/IMDG - International Maritime Dangerous Goods Code
API - American Petroleum Institute	SDS - Safety Data Sheet
HMIS - Hazardous Materials Information System	NFPA - National Fire Protection Association (USA)
DOT - Department of Transportation (USA)	NTP - National Toxicology Program (USA)
IARC - International Agency for Research on Cancer	OSHA - Occupational Safety and Health Administration
NCEL - New Chemical Exposure Limit	EPA - Environmental Protection Agency
SCBA - Self-Contained Breathing Apparatus	

Prepared according to the 29 CFR 1910.1200 (2012) by Chevron Energy Technology Company, 6001 Bollinger Canyon Road, San Ramon, CA 94583.

The above information is based on the data of which we are aware and is believed to be correct as of the date hereof. Since this information may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modifications of the information, we do not assume any responsibility for the results of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.

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Naphthalene

SECTION 1 : Identification of the substance/mixture and of the supplier

Product name : **Naphthalene**

Manufacturer/Supplier Trade name:

Manufacturer/Supplier Article number: **S25441**

Recommended uses of the product and uses restrictions on use:

Manufacturer Details:

AquaPhoenix Scientific
9 Barnhart Drive, Hanover, PA 17331

Supplier Details:

Fisher Science Education
15 Jet View Drive, Rochester, NY 14624

Emergency telephone number:

Fisher Science Education Emergency Telephone No.: 800-535-5053

SECTION 2 : Hazards identification

Classification of the substance or mixture:



Explosive
Organic peroxides, type B



Flammable
Organic peroxides, type B



Irritant
Eye irritation, category 2A
Skin sensitization, category 1

Organic peroxides Type B
Eye Irrit. 2A
Skin Sens. 1

Signal word :Danger

Hazard statements:
Heating may cause a fire or explosion
May cause an allergic skin reaction
Causes serious eye irritation

Precautionary statements:
If medical advice is needed, have product container or label at hand
Keep out of reach of children
Read label before use
Keep away from heat/sparks/open flames/hot surfaces. No smoking
Keep/Store away from clothing/combustible materials
Keep only in original container
Avoid breathing dust/fume/gas/mist/vapours/spray

Wash skin thoroughly after handling
Contaminated work clothing should not be allowed out of the workplace
Wear protective gloves/protective clothing/eye protection/face protection
IF ON SKIN: Wash with soap and water
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses if present and easy to do.
Continue rinsing
Specific treatment (see supplemental first aid instructions on this label)
If skin irritation or a rash occurs: Get medical advice/attention
If eye irritation persists get medical advice/attention
Wash contaminated clothing before reuse
Protect from sunlight
Store at temperatures not exceeding ... °C/... °F. Keep cool
Store away from other materials
Dispose of contents and container to an approved waste disposal plant

Other Non-GHS Classification:

WHMIS

C 

F 

D2B 

NFPA/HMIS



NFPA SCALE (0-4)



HMIS RATINGS (0-4)

SECTION 3 : Composition/information on ingredients

Ingredients:		
CAS 94-36-0	Benzoyl Peroxide	100 %
		Percentages are by weight

SECTION 4 : First aid measures

Description of first aid measures

After inhalation: Move exposed to fresh air. Give artificial respiration if necessary. If breathing is difficult give oxygen.Loosen clothing and place exposed in a comfortable position.Seek medical assistance if cough or other symptoms appear.

After skin contact: Wash hands and exposed skin with soap and plenty of water. Seek medical attention if irritation persists or if concerned.

After eye contact: Protect unexposed eye.Flush exposed eye gently using water for 15-20 minutes. Remove contact lenses while rinsing.Seek medical attention if irritation persists or concerned.

After swallowing: Rinse mouth with water.Do not induce vomiting. Never give anything by mouth to an unconscious person.Seek medical attention if irritation, discomfort, or vomiting persists.

Most important symptoms and effects, both acute and delayed:

Irritation.Shortness of breath.Headache.Nausea.Dizziness.;

Indication of any immediate medical attention and special treatment needed:

If seeking medical attention provide SDS document to physician. Physician should treat symptomatically.Move out of dangerous area

SECTION 5 : Firefighting measures

Extinguishing media

Suitable extinguishing agents: Use water spray, dry chemical, carbon dioxide, or chemical foam.

For safety reasons unsuitable extinguishing agents: Do NOT use halogenated agents or foam

Special hazards arising from the substance or mixture:

Thermal decomposition can lead to release of irritating gases and vapors.Oxidizer. Contact with combustible materials may cause a fire. Dry residue is explosive. Will burn if involved in a fire. This material poses an explosion hazard when exposed to heat, friction or when agitated.Explosion hazard if exposed to mechanical shock.

Advice for firefighters:

Protective equipment: Wear protective eyeware, gloves, and clothing. Refer to Section 8.

Additional information (precautions): Avoid inhaling gases, fumes, dust, mist, vapor, and aerosols. Avoid contact with skin, eyes, and clothing.Explosion hazard if exposed to mechanical shock.

SECTION 6 : Accidental release measures

Personal precautions, protective equipment and emergency procedures:

Ensure adequate ventilation.Ensure that air-handling systems are operational.Avoid contact with skin, eyes and clothing.

Environmental precautions:

Should not be released into environment.Prevent from reaching drains, sewer, or waterway.

Methods and material for containment and cleaning up:

Wear protective eyeware, gloves, and clothing. Refer to Section 8.Avoid dust generation.Remove all sources of ignition.Always obey local regulations.If necessary use trained response staff or contractor. Evacuate personnel to safe areas. Containerize for disposal. Refer to Section 13.Keep in suitable closed containers for disposal.Keep combustibles away from spill area.Sweep up spillage and collect in suitable container for disposal.Use spark-proof tools and explosion-proof equipment.

Reference to other sections:

SECTION 7 : Handling and storage

Precautions for safe handling:

Avoid contact with skin, eyes, and clothing.Follow good hygiene procedures when handling chemical materials. Refer to Section 8.Follow proper disposal methods. Refer to Section 13.Do not eat, drink, smoke, or use personal products when handling chemical substances.Use under a chemical fume hood.

Conditions for safe storage, including any incompatibilities:

Store in a cool location.Keep away from food and beverages.Protect from freezing and physical damage.Provide ventilation for containers. Keep container tightly sealed. Store away from incompatible materials. Keep in temperatures below 40C. Store away from combustibles. Material can explode if dry.

SECTION 8 : Exposure controls/personal protection





Control Parameters: 94-36-0, Benzoyl Peroxide, ACGIH TLV TWA 5 mg/m3
94-36-0, Benzoyl Peroxide, OSHA PEL TWA 5 mg/m3

Appropriate Engineering controls: Emergency eye wash fountains and safety showers should be available in the immediate vicinity of use or handling. Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapor and mists below the applicable workplace exposure limits (Occupational Exposure Limits-OELs) indicated above.

Respiratory protection: Where risk assessment shows air-purifying respirators are appropriate use a full-face particle respirator type N100 (US) or type P3 (EN 143) respirator cartridges as a backup to engineering controls.When necessary use NIOSH approved breathing equipment. Use under a chemical fume hood.

Protection of skin: Select glove material impermeable and resistant to the substance.Select glove material based on rates of diffusion and degradation. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices.Use proper glove removal technique without touching outer surface. Avoid skin contact with used gloves.Wear protective clothing.

Eye protection: Wear equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU).Safety glasses or goggles are appropriate eye protection.

General hygienic measures: Perform routine housekeeping.Wash hands before breaks and immediately after handling the product.Avoid contact with skin, eyes, and clothing.Before rewearing wash contaminated clothing.

SECTION 9 : Physical and chemical properties

Appearance (physical state,color):	White powder	**Explosion limit lower**: **Explosion limit upper**:	Not Determined Not Determined
Odor:	Weak odor	**Vapor pressure**:	Not Determined
Odor threshold:	Not Determined	**Vapor density**:	Not Determined
pH-value:	Not Determined	**Relative density**:	Not Determined
Melting/Freezing point:	104-106C	**Solubilities**:	Slightly in water

Naphthalene

Boiling point/Boiling range:	Not Determined	**Partition coefficient (n-octanol/water)**:	Not Determined
Flash point (closed cup):	Not Determined	**Auto/Self-ignition temperature**:	Not Determined
Evaporation rate:	Not Determined	**Decomposition temperature**:	Not Determined
Flammability (solid,gaseous):	Not Determined	**Viscosity**:	a. Kinematic:Not Determined b. Dynamic: Not Determined
Density: Not Determined			

SECTION 10 : Stability and reactivity

Reactivity: Nonreactive under normal conditions.
Chemical stability: Organic peroxides may undergo hazardous decomposition
Possible hazardous reactions: None under normal processing.
Conditions to avoid: Incompatible materials.Mechanical shock, ignition sources, excess heat, combustible materials, organic matter, excess temperatures
Incompatible materials: Strong oxidizing agents.Alcohols. metals
Hazardous decomposition products: Carbon oxides.

SECTION 11 : Toxicological information

Acute Toxicity:		
Oral:		LD50 Rat: 7,710 mg/kg
Chronic Toxicity: No additional information.		
Corrosion Irritation:		
Ocular:		Rabbit: Mild Eye Irritation - 24 - h
Sensitization:		No additional information.
Single Target Organ (STOT):		No additional information.
Numerical Measures:		No additional information.
Carcinogenicity:		No additional information.
Mutagenicity:		Not mutagenic in AMES Test
Reproductive Toxicity:		No additional information.

SECTION 12 : Ecological information

Ecotoxicity Persistence and degradability: Expected to be biodegradable
Bioaccumulative potential: Not Determined
Mobility in soil: Not Determined
Other adverse effects: None identified.

SECTION 13 : Disposal considerations

Waste disposal recommendations:

Contact a licensed professional waste disposal service to dispose of this material.Dispose of empty containers as unused product.Product or containers must not be disposed together with household garbage. It is the responsibility of the waste generator to properly characterize all waste materials according to applicable regulatory entities (US 40CFR262.11). Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations. Ensure complete and accurate classification.

SECTION 14 : Transport information

UN-Number

3104

UN proper shipping name

Organic peroxide type B, solid (Benzoyl peroxide)

Transport hazard class(es)



Class:
5.2 Organic peroxides

Packing group:II
Environmental hazard:
Transport in bulk:
Special precautions for user:

SECTION 15 : Regulatory information

United States (USA)

SARA Section 311/312 (Specific toxic chemical listings):

Reactive, Acute

SARA Section 313 (Specific toxic chemical listings):

94-36-0 Benzoyl peroxide

RCRA (hazardous waste code):

None of the ingredients is listed

TSCA (Toxic Substances Control Act):

All ingredients are listed.

CERCLA (Comprehensive Environmental Response, Compensation, and Liability Act):

None of the ingredients is listed

Proposition 65 (California):

Chemicals known to cause cancer:

None of the ingredients is listed

Chemicals known to cause reproductive toxicity for females:

None of the ingredients is listed

Chemicals known to cause reproductive toxicity for males:

None of the ingredients is listed

Chemicals known to cause developmental toxicity:

None of the ingredients is listed

Naphthalene

Canada

Canadian Domestic Substances List (DSL):

All ingredients are listed.

Canadian NPRI Ingredient Disclosure list (limit 0.1%):

None of the ingredients is listed

Canadian NPRI Ingredient Disclosure list (limit 1%):

94-36-0 Benzoyl peroxide

SECTION 16 : Other information

This product has been classified in accordance with hazard criteria of the Controlled Products Regulations and the SDS contains all the information required by the Controlled Products Regulations. Note: . The responsibility to provide a safe workplace remains with the user. The user should consider the health hazards and safety information contained herein as a guide and should take those precautions required in an individual operation to instruct employees and develop work practice procedures for a safe work environment.The information contained herein is, to the best of our knowledge and belief, accurate. However, since the conditions of handling and use are beyond our control, we make no guarantee of results, and assume no liability for damages incurred by the use of this material. It is the responsibility of the user to comply with all applicable laws and regulations applicable to this material.

GHS Full Text Phrases:

Abbreviations and acronyms:

Effective date : 01.31.2015
Last updated : 03.19.2015

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HI 7021
ORP Solution for Platinum and Gold Electrodes

Safety Data Sheet

According to Regulation (EC) No. 1907/2006
OSHA Regulation 29 CFR 1910.1200
Canadian Regulation SOR/88-66

Revision Date: 2013-06-14
Reason for Revision: Regulation (EC) No. 1272/2008 Compliance

SECTION 1: IDENTIFICATION OF THE PRODUCT AND COMPANY

Product Name: HI 7021 ORP Solution

Additional Product Codes: HI 7021L, HI 7021M, HI 7021/G

Application: ORP Solution for Platinum and Gold Electrodes. 240 mV @ 25°C/77°F

Company Information (USA):
Hanna Instruments, Inc.
584 Park East Dr, Woonsocket, Rhode Island, USA 02895

Technical Service Contact Information:
1-800-426-6287 (8:30AM - 5:00PM ET)
+1-401-766-4260 (8:30AM - 5:00PM ET)

USA Emergency Contact Information: 1-800-424-9300 (Chemtrec 24Hr. Emergency)

International Emergency Contact Information: +1-703-527-3887 (Chemtrec 24Hr. Emergency)

E-mail Address: tech@hannainst.com

SECTION 2: HAZARD IDENTIFICATION

Non-hazardous product as specified in Directives 67/548/EEC and 1999/45/EC.
Non-hazardous product as specified in OSHA Regulation 29 CFR 1910.1200.
Non-hazardous product as specified in Canadian Regulation SOR/88-66.
Non-hazardous product as specified in Regulation (EC) 1272/2008.

SECTION 3: COMPOSITION AND COMPONENT INFORMATION

Aqueous Solution

SECTION 4: FIRST AID MEASURES

After Inhalation: Remove to fresh air.

After Skin Contact: Wash affected area with plenty of water.

After Eye Contact: Rinse out with water.

After Swallowing: Wash out mouth thoroughly with water and give plenty of water to drink. In severe cases obtain medical attention.

General Information: Remove contaminated, soaked clothing immediately and dispose of safely.

SECTION 5: FIRE-FIGHTING MEASURES

Suitable Extinguishing Media:
Water spray, Carbon Dioxide, Dry Chemical Powder, Appropriate Foam.

Special Risks:
Non-combustible.

Special Protective Equipment:
Do not stay in dangerous zone without suitable chemical protection clothing and self-contained breathing apparatus.

Additional Information:
NA

SECTION 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions:

Avoid formation of dusts. Do not inhale dusts. Avoid substance contact.

Environmental Precautions:

Do not discharge into the drains/surface waters/groundwater.

Additional Notes:

Take up with liquid-absorbent material. Clean up affected area and dispose according to local regulation. Avoid generation of dusts.

SECTION 7: HANDLING AND STORAGE

Handling:

Cannot be stored indefinitely.

Storage:

Tightly closed. Store at room temperature (+15 to +25 °C recommended). Protect from light.

SECTION 8: EXPOSURE CONTROL/PERSONAL PROTECTION

Engineering:

Maintain general industrial hygiene practice.

Personal Protective Equipment:

Protective clothing should be selected specifically for the working place, depending on concentration and quantity of the hazardous substances handled.

Respiratory Protection:	***Protective Gloves:***	***Eye Protection:***
Required when vapors/aerosols are generated. Work under hood.	Rubber or plastic	Goggles or face mask

Industrial Hygiene:

Change contaminated clothing. Wash hands after working with substance.

SECTION 9: PHYSICAL/CHEMICAL PROPERTIES

Appearance:	Yellow liquid	***Odor:***	Odorless	***Density at 20°C:***	~ 1 g/cm³
Melting Point:	NA	***Boiling Point:***	ND	***Solubility:***	Soluble
pH at 20°C:	~ 7	***Explosion Limit:***	NA	***Flash Point:***	NA
Thermal Decomp.:	NA				

SECTION 10: STABILITY AND REACTIVITY

Conditions to be Avoided:

Strong Heating

Hazardous Decomposition Products:

None

Hazardous Polymerization:

Will not occur.

Substances to be Avoided:

The generally known reaction partners of water

Further Information:

Not available

SECTION 11: TOXICOLOGICAL INFORMATION

Product Toxicity

No toxic effects are to be expected when the product is handled appropriately.

Component Toxicity

Acute Toxicity:
Not Available

Chronic Toxicity:
Not Available

Additional Data:
Not Available

SECTION 12: ECOLOGICAL INFORMATION

No environmental hazard.

Further Data: Can be safely disposed off as ordinary refuse.

SECTION 13: DISPOSAL CONSIDERATIONS

Waste Disposal:

SECTION 14: TRANSPORTATION INFORMATION

Land:	***Sea:***	***Air:***
Not subject to transport regulations	Not subject to transport regulations	Not subject to transport regulations

SECTION 15: REGULATORY INFORMATION

Complies with European Regulations (EC) No. 1907/2006 and No. 1272/2008.
Complies with European Council Directives 67/548/EEC and 1999/45/EC.
Complies with OSHA Regulation 29 CFR 1910.1200.
Complies with Canadian Regulation SOR/88-66

SECTION 16: OTHER INFORMATION

Text of phrases under Section 3

NA

Revision Information

Revision Date:	2013-06-14
Supersedes edition of:	2012-06-01
Reason for revision:	Regulation (EC) No. 1272/2008 Compliance
Legend	NA: Not Applicable ND: Not Determined

THE INFORMATION CONTAINED HEREIN IS BASED ON THE PRESENT STATE OF OUR KNOWLEDGE. IT CHARACTERIZES THE PRODUCT WITH REGARD TO THE APPROPRIATE SAFETY PRECAUTIONS. IT DOES NOT REPRESENT A GUARANTEE OF THE PROPERTIES OF THE PRODUCT.

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SAFETY DATA SHEET
Klozur® SP

SDS # : 7775-27-1-12
Revision date: 2018-07-13
Format: NA
Version 1.04

1. PRODUCT AND COMPANY IDENTIFICATION

Product Identifier

Product Name Klozur® SP

CAS-No 7775-27-1

Synonyms Sodium Persulfate; Sodium Peroxydisulfate; Disodium Peroxydisulfate; Peroxydisulfuric acid, disodium salt; Peroxydisulfuric acid, sodium salt.

Alternate Commercial Name Klozur® Persulfate

Recommended use of the chemical and restrictions on use

Recommended Use: In situ and ex situ chemical oxidation of contaminants and compounds of concern for environmental remediation applications

Restrictions on Use No uses to be advised against were identified.

Manufacturer/Supplier

PeroxyChem LLC
2005 Market Street
Suite 3200
Philadelphia, PA 19103
Phone: +1 267/ 422-2400 (General Information)
E-Mail: sdsinfo@peroxychem.com

Emergency telephone numbers

For leak, fire, spill or accident emergencies, call:
1 800 / 424 9300 (CHEMTREC - U.S.A.)
1 703 / 527 3887 (CHEMTREC - Collect - All Other Countries)
1 303/ 389-1409 (Medical - U.S. - Call Collect)

2. HAZARDS IDENTIFICATION

Classification

OSHA Regulatory Status
This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute toxicity - Oral	Category 4
Skin corrosion/irritation	Category 2
Serious eye damage/eye irritation	Category 2B
Respiratory sensitization	Category 1
Skin sensitization	Category 1
Specific target organ toxicity (single exposure)	Category 3
Oxidizing Solids	Category 3

GHS Label elements, including precautionary statements

EMERGENCY OVERVIEW

Danger

Hazard Statements
H334 - May cause allergy or asthma symptoms or breathing difficulties if inhaled
H335 - May cause respiratory irritation
H319 - Causes serious eye irritation
H315 - Causes skin irritation
H317 - May cause an allergic skin reaction
H302 - Harmful if swallowed
H272 - May intensify fire; oxidizer



Precautionary Statements - Prevention
P261 - Avoid breathing dust/ fume/ gas/ mist/ vapors/ spray
P285 - In case of inadequate ventilation wear respiratory protection
P271 - Use only outdoors or in a well-ventilated area
P280 - Wear protective gloves/ protective clothing
P264 - Wash face, hands and any exposed skin thoroughly after handling
P210 - Keep away from heat/sparks/open flames/hot surfaces. - No smoking
P220 - Keep/Store away from clothing/combustible materials
P221 - Take any precaution to avoid mixing with combustibles

Precautionary Statements - Response
P305 + P351 + P338 - IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P337 + P313 - If eye irritation persists: Get medical advice/ attention
P302 + P352 - IF ON SKIN: Wash with plenty of water.
P333 + P313 - If skin irritation or rash occurs: Get medical advice/ attention
P362 - Take off contaminated clothing and wash before reuse
P304 + P340 - IF INHALED: Remove person to fresh air and keep comfortable for breathing
P342 + P311 - If experiencing respiratory symptoms: Call a POISON CENTER or doctor
P301 + P312 - IF SWALLOWED: Call a POISON CENTER or doctor if you feel unwell
P330 - Rinse mouth
P370 + P378 - In case of fire: Use water for extinction

Precautionary Statements - Storage
P403 + P233 - Store in a well-ventilated place. Keep container tightly closed

Hazards not otherwise classified (HNOC)
No hazards not otherwise classified were identified.

Other Information
Risk of decomposition by heat or by contact with incompatible materials

Unknown acute toxicity
0% of the mixture consists of ingredient(s) of unknown toxicity

3. COMPOSITION/INFORMATION ON INGREDIENTS

Formula Na2O8S2

Chemical name	CAS-No	Weight %
Sodium Persulfate	7775-27-1	> 99
Sodium sulfate	7757-82-6	< 2

4. FIRST AID MEASURES

General Advice May produce an allergic reaction.

Eye Contact Rinse thoroughly with plenty of water for at least 15 minutes, lifting lower and upper eyelids intermittently. Consult a physician. If symptoms persist, call a physician.

Skin Contact Wash off immediately with soap and plenty of water while removing all contaminated clothes and shoes. Get medical attention if irritation develops and persists.

Inhalation Remove from exposure, lie down. If breathing is irregular or stopped, administer artificial respiration. Call a physician immediately.

Ingestion Do NOT induce vomiting. Call a physician or poison control center immediately. Rinse mouth. Drink 1 or 2 glasses of water.

Most important symptoms and effects, both acute and delayed Itching; Redness; Coughing and/ or wheezing.

Indication of immediate medical attention and special treatment needed, if necessary Treat symptomatically

5. FIRE-FIGHTING MEASURES

Suitable Extinguishing Media Water. Cool containers with flooding quantities of water until well after fire is out.

Unsuitable extinguishing media Do not use carbon dioxide or other gas filled fire extinguishers; they will have little effect on decomposing persulfate.

Specific Hazards Arising from the Chemical Decomposes under fire conditions to release oxygen that intensifies the fire.

Flammable properties Contact with combustible material may cause fire

Explosion data
Sensitivity to Mechanical Impact Not sensitive.
Sensitivity to Static Discharge Not sensitive.

Protective equipment and precautions for firefighters As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

6. ACCIDENTAL RELEASE MEASURES

Personal Precautions Keep off any unprotected persons. Avoid contact with the skin and the eyes. Avoid breathing dust. Wear personal protective equipment.

Other Never add other substances or combustible waste to product residues.

Environmental Precautions Prevent material from entering into soil, ditches, sewers, waterways, and/or groundwater. See Section 12, Ecological Information for more detailed information.

Methods for Containment Vacuum, shovel or pump waste into a drum and label contents for disposal. Avoid dust formation. Store in closed container.

Methods for cleaning up Clean up spill area and treat as special waste. Dispose of waste as indicated in Section 13.

7. HANDLING AND STORAGE

Handling Wear personal protective equipment. Use only in area provided with appropriate exhaust ventilation. Avoid dust formation. Handle product only in closed system or provide appropriate exhaust ventilation at machinery. Avoid contact with skin and eyes. Avoid breathing dust. Remove and wash contaminated clothing before re-use. Reference to other sections.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Keep away from heat. Do not store near combustible materials. Avoid contamination of opened product. Keep away from food, drink and animal feedingstuffs. Avoid formation and deposition of dust.

Incompatible products Acids, Alkalis, Halides, Combustible materials, Organic material, Reducing agents. Acids, alkalis, halides (fluorides, chlorides, bromides), combustible materials, reducing agents and organic compounds.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

Control parameters

Exposure Guidelines .

Chemical name	ACGIH TLV	OSHA PEL	NIOSH	Mexico
Sodium Persulfate 7775-27-1	TWA: 0.1 mg/m³	-	-	-
Chemical name	**British Columbia**	**Quebec**	**Ontario TWAEV**	**Alberta**
Sodium Persulfate 7775-27-1	TWA: 0.1 mg/m³	-	TWA: 0.1 mg/m³	TWA: 0.1 mg/m³

Appropriate engineering controls

Engineering measures Provide local exhaust or general ventilation adequate to maintain exposures below permissable exposure limits.

Individual protection measures, such as personal protective equipment

Eye/Face Protection Eye protection recommended. Chemical goggles consistent with EN 166 or equivalent.

Skin and Body Protection Wear long-sleeved shirt, long pants, socks, and shoes.

Hand Protection Protective gloves: Neoprene gloves, Polyvinylchloride, Natural Rubber.

Respiratory Protection If exposure limits are exceeded or irritation is experienced, NIOSH/MSHA approved respiratory protection should be worn: particulate filtering facepiece respirators.

Hygiene measures Keep away from food, drink and animal feeding stuffs. Do not eat, drink or smoke when using this product. Wash hands before breaks and after shifts. Keep work clothes separate, remove contaminated clothing - launder after open handling of product.

General information Protective engineering solutions should be implemented and in use before personal protective equipment is considered.

9. PHYSICAL AND CHEMICAL PROPERTIES

Information on basic physical and chemical properties

Appearance	Crystalline solid
Physical State	Solid
Color	White
Odor	odorless
Odor threshold	Not applicable
pH	6.0 (1% solution)
Melting point/freezing point	180 °C (Decomposes)
Boiling Point/Range	Decomposes upon heating
Flash point	Not flammable
Evaporation Rate	No information available
Flammability (solid, gas)	Not flammable
Flammability Limit in Air	Not applicable
Upper flammability limit:	No information available
Lower flammability limit:	No information available
Vapor pressure	6.07E-30 mm Hg at 25ºC
Vapor density	No information available
Density	2.59 g/cm³ (crystal density)
Specific gravity	No information available
Water solubility	42 % @ 25 °C
Solubility in other solvents	No information available
Partition coefficient	No information available (inorganic)
Autoignition temperature	No evidence of combustion up to 600°C No evidence of combustion up to 600 °C
Decomposition temperature	> 100 °C (assume)
Viscosity, kinematic	No information available (Solid)
Viscosity, dynamic	No information available
Explosive properties	Not explosive
Oxidizing properties	oxidizer
Molecular weight	238.1
VOC content (%)	Not applicable
Bulk density	1.12 g/cm³ (loose)

10. STABILITY AND REACTIVITY

Reactivity None under normal use condtions. Oxidizer. Contact with other material may cause fire.

Chemical Stability Stable.

Possibility of Hazardous Reactions None under normal processing.

Hazardous polymerization Hazardous polymerization does not occur.

Conditions to avoid Heat. Moisture.

Incompatible materials Acids, alkalis, halides (fluorides, chlorides, bromides), combustible materials, reducing agents and organic compounds. . Acids, Alkalis, Halides, Combustible materials, Organic material, Reducing agents.

Hazardous Decomposition Products Oxygen which supports combustion.

11. TOXICOLOGICAL INFORMATION

Product Information

Unknown acute toxicity 0% of the mixture consists of ingredient(s) of unknown toxicity

LD50 Oral	Sodium Persulfate: 895 mg/kg (rat)
LD50 Dermal	Sodium Persulfate: > 10 g/kg
LC50 Inhalation	Sodium Persulfate: >5.10 mg/L (4h) (rat)

Serious eye damage/eye irritation Irritating to eyes.
Skin corrosion/irritation Minimally irritating.

Sensitization Sodium Persulfate:. May cause sensitization by inhalation and skin contact.

Component Information

Chemical name	LD50 Oral	LD50 Dermal	LC50 Inhalation	NOAEL Oral Value
Sodium Persulfate (7775-27-1)	895 mg/kg (Rat)	> 10000 mg/kg (Rabbit)	> 21.6 mg/L (Rat) 4 h	
Sodium sulfate (7757-82-6)	> 10000 mg/kg (Rat)			

Information on toxicological effects

Symptoms Symptoms of allergic reaction may include rash, itching, swelling and trouble breathing.

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes, respiratory system and skin.
corrosivity None.

Carcinogenicity Contains no ingredient listed as a carcinogen.

Mutagenicity Did not show mutagenic effects in animal experiments

Neurological effects Not neurotoxic

Reproductive toxicity This product is not recognized as reprotox by Research Agencies.
Developmental toxicity None known.
Teratogenicity Not teratogenic in animal studies.

STOT - single exposure May cause respiratory irritation.
STOT - repeated exposure Not classified.

Target organ effects Eyes, Lungs.

Aspiration hazard No information available.

12. ECOLOGICAL INFORMATION

Ecotoxicity

Ecotoxicity effects

Sodium Persulfate (7775-27-1)				
Active Ingredient(s)	Duration	Species	Value	Units
Sodium Persulfate	96 h LC50	Rainbow trout	163	mg/L
Sodium Persulfate	48 h LC50	Daphnia magna	133	mg/L
Sodium Persulfate	96 h LC50	Grass shrimp	519	mg/L
Sodium Persulfate	72 h EC50	Algae Selenastrum capricornutum	116	mg/L

Persistence and degradability Biodegradability does not pertain to inorganic substances.

Bioaccumulation Does not bioaccumulate.

Mobility Dissociates into ions.

Other Adverse Effects None known.

13. DISPOSAL CONSIDERATIONS

Waste disposal methods This material, as supplied, is a hazardous waste according to federal regulations (40 CFR 261). It must undergo special treatment, e.g. at suitable disposal site, to comply with local regulations.

Contaminated Packaging Empty remaining contents. Dispose of in accordance with local regulations.

14. TRANSPORT INFORMATION

DOT

UN/ID no UN 1505
Proper Shipping Name SODIUM PERSULFATE
Hazard class 5.1
Packing Group III

TDG

UN/ID no UN 1505
Proper Shipping Name SODIUM PERSULFATE
Hazard class 5.1
Packing Group III

MEX

UN/ID no UN 1505
Proper Shipping Name SODIUM PERSULFATE
Hazard class 5.1
Packing Group III

ICAO

UN/ID no UN 1505
Proper Shipping Name SODIUM PERSULFATE
Hazard class 5.1
Packing Group III

ICAO/IATA

UN/ID no UN 1505
Proper Shipping Name SODIUM PERSULFATE
Hazard class 5.1

Packing Group	III

IMDG/IMO

UN/ID no	UN 1505
Proper Shipping Name	SODIUM PERSULFATE
Hazard class	5.1
Packing Group	III

ADR/RID

UN/ID no	UN 1505
Proper Shipping Name	SODIUM PERSULFATE
Hazard class	5.1
Packing Group	III

ADN

Proper Shipping Name	SODIUM PERSULFATE
Hazard class	5.1
Packing Group	III

15. REGULATORY INFORMATION

U.S. Federal Regulations

SARA 313
Section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 (SARA). This product does not contain any chemicals which are subject to the reporting requirements of the Act and Title 40 of the Code of Federal Regulations, Part 372

SARA 311/312 Hazard Categories
This product is not subject to reporting under the Emergency Planning and Community Right-to-Know rule.

Clean Water Act
This product does not contain any substances regulated as pollutants pursuant to the Clean Water Act (40 CFR 122.21 and 40 CFR 122.42)

CERCLA/EPCRA
This material, as supplied, does not contain any substances regulated as hazardous substances under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302) or the Superfund Amendments and Reauthorization Act (SARA) (40 CFR 355). There may be specific reporting requirements at the local, regional, or state level pertaining to releases of this material

US State Regulations

U.S. State Right-to-Know Regulations
This product contains the following substances regulated under state Right-to-Know laws:

Chemical name	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Sodium Persulfate		X			
Sodium sulfate	X		X		

California Proposition 65
This product does not contain any Proposition 65 chemicals

CANADA

Environmental Emergencies
This product contains no substances listed under Canada's Environmental Emergency regulations.

Canadian National Pollutant Release Inventory

This product contains no substances reportable under Canada's National Pollutant Release Inventory regulations.

International Inventories

Component	TSCA (United States)	DSL (Canada)	EINECS/ELINCS (Europe)	ENCS (Japan)	China (IECSC)	KECL (Korea)	PICCS (Philippines)	AICS (Australia)	NZIoC (New Zealand)
Sodium Persulfate 7775-27-1 (> 99)	X	X	X	X	X	X	X	X	X
Sodium sulfate 7757-82-6 (< 2)	X	X	X	X	X	X	X	X	X

Mexico

Mexico - Grade Slight risk, Grade 1

16. OTHER INFORMATION

NFPA	**Health Hazards** 1	**Flammability** 0	**Stability** 1	**Special Hazards** OX
HMIS	**Health Hazards** 1	**Flammability** 0	**Physical hazard** 1	**Special precautions** J

NFPA/HMIS Ratings Legend Special Hazards: OX = Oxidizer
Protection=J (Safety goggles, gloves, apron, combination dust and vapor respirator)

Revision date: 2018-07-13
Revision note SDS sections updated: 3.
Issuing Date: 2017-03-17

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Prepared By:

PeroxyChem

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End of Safety Data Sheet

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Nonafluorobutanesulfonic acid

Safety Data Sheet 6164309

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Date of issue: 01/16/2017 Version: 1.0

SECTION 1: Identification

1.1. Identification

Product form	:	Substance
Substance name	:	Nonafluorobutanesulfonic acid
CAS No	:	375-73-5
Product code	:	6164-3-09
Formula	:	C4HF9O3S
Synonyms	:	Perfluorobutanesulfonic acid
Other means of identification	:	MFCD01320794

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture	:	Laboratory chemicals Manufacture of substances Scientific research and development

1.3. Details of the supplier of the safety data sheet

SynQuest Laboratories, Inc.
P.O. Box 309
Alachua, FL 32615 - United States of America
T (386) 462-0788 - F (386) 462-7097
info@synquestlabs.com - www.synquestlabs.com

1.4. Emergency telephone number

Emergency number	:	(844) 523-4086 (3E Company - Account 10069)

SECTION 2: Hazard(s) identification

2.1. Classification of the substance or mixture

Classification (GHS-US)

Acute Tox. 4 (Oral)	H302 - Harmful if swallowed
Skin Corr. 1B	H314 - Causes severe skin burns and eye damage
Eye Dam. 1	H318 - Causes serious eye damage
STOT SE 3	H335 - May cause respiratory irritation

Full text of H-phrases: see section 16

2.2. Label elements

GHS-US labeling

Hazard pictograms (GHS-US) :



GHS05 GHS07

Signal word (GHS-US) : Danger

Hazard statements (GHS-US) :
H302 - Harmful if swallowed
H314 - Causes severe skin burns and eye damage
H335 - May cause respiratory irritation

Precautionary statements (GHS-US) :
P260 - Do not breathe fumes, mist, spray, vapors
P264 - Wash skin thoroughly after handling
P270 - Do not eat, drink or smoke when using this product
P271 - Use only outdoors or in a well-ventilated area
P280 - Wear protective gloves/protective clothing/eye protection/face protection
P301+P312 - If swallowed: Call a POISON CENTER or doctor/ physician if you feel unwell
P301+P330+P331 - If swallowed: rinse mouth. Do NOT induce vomiting
P303+P361+P353 - If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
P304+P340 - If inhaled: Remove person to fresh air and keep comfortable for breathing
P305+P351+P338 - If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
P310 - Immediately call a POISON CENTER or doctor/ physician
P321 - Specific treatment (see supplemental first aid instructions on this label)
P330 - Rinse mouth

P363 - Wash contaminated clothing before reuse
P403+P233 - Store in a well-ventilated place. Keep container tightly closed
P405 - Store locked up
P501 - Dispose of contents/container to an approved waste disposal plant

2.3. Other hazards

Other hazards not contributing to the classification : Reacts violently with water.

2.4. Unknown acute toxicity (GHS US)

Not applicable

SECTION 3: Composition/information on ingredients

3.1. Substance

Substance type : Mono-constituent

Name	Product identifier	%	Classification (GHS-US)
Nonafluorobutanesulfonic acid (Main constituent)	(CAS No) 375-73-5	<= 100	Acute Tox. 4 (Oral), H302 Skin Corr. 1B, H314 Eye Dam. 1, H318 STOT SE 3, H335

Full text of H-phrases: see section 16

3.2. Mixture

Not applicable

SECTION 4: First aid measures

4.1. Description of first aid measures

First-aid measures general : In case of accident or if you feel unwell, seek medical advice immediately (show the label where possible). Move the affected personnel away from the contaminated area.

First-aid measures after inhalation : Remove person to fresh air and keep comfortable for breathing. If not breathing, give artificial respiration. Get immediate medical advice/attention.

First-aid measures after skin contact : Wash with plenty of soap and water. Remove contaminated clothing and shoes. Get immediate medical advice/attention.

First-aid measures after eye contact : Immediately flush eyes thoroughly with water for at least 15 minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Get immediate medical advice/attention.

First-aid measures after ingestion : Do NOT induce vomiting. Never give anything by mouth to an unconscious person. Rinse mouth out with water. Get immediate medical advice/attention.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries : The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11.

Symptoms/injuries after inhalation : Material is destructive to tissue of the mucuous membranes and upper respiratory tract. Cough, shortness of breath, headache, nausea.

4.3. Indication of any immediate medical attention and special treatment needed

Treat symptomatically.

SECTION 5: Firefighting measures

5.1. Extinguishing media

Suitable extinguishing media : Alcohol resistant foam. Carbon dioxide. Dry powder. Water spray. Use extinguishing media appropriate for surrounding fire.

5.2. Special hazards arising from the substance or mixture

Fire hazard : Thermal decomposition generates: Carbon oxides. Hydrogen fluoride. Sulfur oxides.

Explosion hazard : Risk of explosion if heated under confinement. Use water spray or fog for cooling exposed containers.

5.3. Advice for firefighters

Firefighting instructions : In case of fire: Evacuate area. Fight fire remotely due to the risk of explosion.

Protection during firefighting : Wear gas tight chemically protective clothing in combination with self contained breathing apparatus. For further information refer to section 8: "Exposure controls/personal protection".

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

General measures : Evacuate unnecessary personnel. Ensure adequate air ventilation. Do not breathe gas, fumes, vapor or spray.

6.1.1. For non-emergency personnel

Emergency procedures : Only qualified personnel equipped with suitable protective equipment may intervene.

6.1.2. For emergency responders

Protective equipment : Do not attempt to take action without suitable protective equipment. For further information refer to section 8: "Exposure controls/personal protection".

Emergency procedures : Gas/vapor heavier than air. May accumulate in confined spaces, particularly at or below ground level.

6.2. Environmental precautions

Avoid release to the environment. Notify authorities if product enters sewers or public waters.

6.3. Methods and material for containment and cleaning up

For containment : Stop leak if safe to do so. Dike for recovery or absorb with appropriate material.

Methods for cleaning up : Take up large spills with pump or vacuum and finish with dry chemical absorbent. Use explosion-proof equipment. Take up small spills with dry chemical absorbent. Sweep or shovel spills into appropriate container for disposal. Ventilate area.

Other information : For disposal of solid materials or residues refer to section 13 : "Disposal considerations".

6.4. Reference to other sections

No additional information available

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling : Do not handle until all safety precautions have been read and understood. Ensure good ventilation of the work station. Do not breathe fumes, mist, spray, vapors. Wear personal protective equipment. Avoid contact with skin and eyes.

Hygiene measures : Handle in accordance with good industrial hygiene and safety procedures. Do not eat, drink or smoke when using this product. Always wash hands after handling the product.

7.2. Conditions for safe storage, including any incompatibilities

Technical measures : Comply with applicable regulations.

Storage conditions : Keep container closed when not in use. Keep contents under inert gas.

Incompatible materials : Refer to Section 10 on Incompatible Materials.

Storage temperature : 2 - 8 °C Use explosion proof refrigerator

Prohibitions on mixed storage : Do not store with: Water.

Storage area : Store in dry, well-ventilated area.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

No additional information available

8.2. Exposure controls

Appropriate engineering controls : Ensure good ventilation of the work station. Emergency eye wash fountains and safety showers should be available in the immediate vicinity of any potential exposure.

Hand protection : Protective gloves. 29 CFR 1910.138: Hand Protection.

Eye protection : Chemical goggles or safety glasses. Face shield. 29 CFR 1910.133: Eye and Face Protection.

Skin and body protection : Wear suitable protective clothing.

Respiratory protection : In case of inadequate ventilation wear respiratory protection. 29 CFR 1910.134: Respiratory Protection.

Other information : Safety shoes. 29 CFR 1910.136: Foot Protection.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state : Liquid

Color : No data available

Odor : No data available

Odor threshold : No data available

pH : No data available

Melting point : No data available

Freezing point	:	No data available
Boiling point	:	76 - 84 °C (@ 0.1 mm Hg)
Flash point	:	No data available
Relative evaporation rate (butyl acetate=1)	:	No data available
Flammability (solid, gas)	:	No data available
Explosion limits	:	No data available
Explosive properties	:	No data available
Oxidizing properties	:	No data available
Vapor pressure	:	No data available
Relative density	:	No data available
Relative vapor density at 20 °C	:	No data available
Specific gravity / density	:	1.811 g/ml (@ 25 °C)
Molecular mass	:	300.1 g/mol
Solubility	:	No data available
Log Pow	:	No data available
Auto-ignition temperature	:	No data available
Decomposition temperature	:	No data available
Viscosity	:	No data available
Viscosity, kinematic	:	No data available
Viscosity, dynamic	:	No data available

9.2. Other information

Refractive index : 1.323 (@ 20 °C)

SECTION 10: Stability and reactivity

10.1. Reactivity

No additional information available

10.2. Chemical stability

The product is stable at normal handling and storage conditions.

10.3. Possibility of hazardous reactions

Reacts violently with water.

10.4. Conditions to avoid

Keep away from heat, sparks and flame. Moisture.

10.5. Incompatible materials

Bases. Strong oxidizing agents. Water.

10.6. Hazardous decomposition products

Under normal conditions of storage and use, hazardous decomposition products should not be produced. Hazardous decomposition products in case of fire, see Section 5.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Oral: Harmful if swallowed.

Nonafluorobutanesulfonic acid (375-73-5)	
LD50 oral rat	430 mg/kg
ATE US (oral)	430.000 mg/kg body weight

Skin corrosion/irritation	:	Causes severe skin burns and eye damage.
Serious eye damage/irritation	:	Causes serious eye damage.
Respiratory or skin sensitization	:	Not classified
Germ cell mutagenicity	:	Not classified
Carcinogenicity	:	Not classified
Reproductive toxicity	:	Not classified
Specific target organ toxicity (single exposure)	:	May cause respiratory irritation.

Specific target organ toxicity (repeated exposure)	:	Not classified
Aspiration hazard	:	Not classified
Symptoms/injuries after inhalation	:	Material is destructive to tissue of the mucuous membranes and upper respiratory tract. Cough, shortness of breath, headache, nausea.

SECTION 12: Ecological information

12.1. Toxicity

No additional information available

12.2. Persistence and degradability

No additional information available

12.3. Bioaccumulative potential

No additional information available

12.4. Mobility in soil

No additional information available

12.5. Other adverse effects

No additional information available

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste treatment methods	:	Remove to an authorized incinerator equipped with an afterburner and a flue gas scrubber.
Waste disposal recommendations	:	Dispose of contents/container in accordance with licensed collector's sorting instructions.
Additional information	:	Recycle the material as far as possible.

SECTION 14: Transport information

Department of Transportation (DOT)

In accordance with DOT

Transport document description	:	UN3265 Corrosive liquid, acidic, organic, n.o.s., 8, II
UN-No.(DOT)	:	UN3265
Proper Shipping Name (DOT)	:	Corrosive liquid, acidic, organic, n.o.s.
Transport hazard class(es) (DOT)	:	8 - Class 8 - Corrosive material 49 CFR 173.136
Hazard labels (DOT)	:	8 - Corrosive



Packing group (DOT)	:	II - Medium Danger
DOT Packaging Non Bulk (49 CFR 173.xxx)	:	202
DOT Packaging Bulk (49 CFR 173.xxx)	:	242
DOT Symbols	:	G - Identifies PSN requiring a technical name

DOT Special Provisions (49 CFR 172.102)	:	B2 - MC 300, MC 301, MC 302, MC 303, MC 305, and MC 306 and DOT 406 cargo tanks are not authorized. IB2 - Authorized IBCs: Metal (31A, 31B and 31N); Rigid plastics (31H1 and 31H2); Composite (31HZ1). Additional Requirement: Only liquids with a vapor pressure less than or equal to 110 kPa at 50 C (1.1 bar at 122 F), or 130 kPa at 55 C (1.3 bar at 131 F) are authorized. T11 - 6 178.274(d)(2) Normal..... 178.275(d)(3) TP2 - a. The maximum degree of filling must not exceed the degree of filling determined by the following: (image) Where: tr is the maximum mean bulk temperature during transport, tf is the temperature in degrees celsius of the liquid during filling, and a is the mean coefficient of cubical expansion of the liquid between the mean temperature of the liquid during filling (tf) and the maximum mean bulk temperature during transportation (tr) both in degrees celsius. b. For liquids transported under ambient conditions may be calculated using the formula: (image) Where: d15 and d50 are the densities (in units of mass per unit volume) of the liquid at 15 C (59 F) and 50 C (122 F), respectively. TP27 - A portable tank having a minimum test pressure of 4 bar (400 kPa) may be used provided the calculated test pressure is 4 bar or less based on the MAWP of the hazardous material, as defined in 178.275 of this subchapter, where the test pressure is 1.5 times the MAWP.
DOT Packaging Exceptions (49 CFR 173.xxx)	:	154
DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27)	:	1 L
DOT Quantity Limitations Cargo aircraft only (49 CFR 175.75)	:	30 L
DOT Vessel Stowage Location	:	B - (i) The material may be stowed ‘‘on deck’’ or ‘‘under deck’’ on a cargo vessel and on a passenger vessel carrying a number of passengers limited to not more than the larger of 25 passengers, or one passenger per each 3 m of overall vessel length; and (ii) ‘‘On deck only’’ on passenger vessels in which the number of passengers specified in paragraph (k)(2)(i) of this section is exceeded.
DOT Vessel Stowage Other	:	40 - Stow ‘‘clear of living quarters’’
Other information	:	No supplementary information available.

TDG

No additional information available

Transport by sea

UN-No. (IMDG)	:	3265
Proper Shipping Name (IMDG)	:	CORROSIVE LIQUID, ACIDIC, ORGANIC, N.O.S.
Class (IMDG)	:	8 - Corrosive substances
Packing group (IMDG)	:	II - substances presenting medium danger

Air transport

UN-No. (IATA)	:	3265
Proper Shipping Name (IATA)	:	Corrosive liquid, acidic, organic, n.o.s.
Class (IATA)	:	8 - Corrosives
Packing group (IATA)	:	II - Medium Danger

SECTION 15: Regulatory information

15.1. US Federal regulations

Nonafluorobutanesulfonic acid (375-73-5)
Listed on the United States TSCA (Toxic Substances Control Act) inventory

All components of this product are listed, or excluded from listing, on the United States Environmental Protection Agency Toxic Substances Control Act (TSCA) inventory

This product or mixture does not contain a toxic chemical or chemicals in excess of the applicable de minimis concentration as specified in 40 CFR §372.38(a) subject to the reporting requirements of section 313 of Title III of the Superfund Amendments and Reauthorization Act of 1986 and 40 CFR Part 372.

15.2. International regulations

CANADA

Nonafluorobutanesulfonic acid (375-73-5)
Listed on the Canadian NDSL (Non-Domestic Substances List)

EU-Regulations
No additional information available

National regulations

Nonafluorobutanesulfonic acid (375-73-5)
Listed on the AICS (Australian Inventory of Chemical Substances)
Listed on the Japanese ISHL (Industrial Safety and Health Law)
Listed on PICCS (Philippines Inventory of Chemicals and Chemical Substances)

15.3. US State regulations
California Proposition 65 - This product does not contain any substances known to the state of California to cause cancer and/or reproductive harm

SECTION 16: Other information

Full text of H-phrases:

Acute Tox. 4 (Oral)	Acute toxicity (oral) Category 4
Eye Dam. 1	Serious eye damage/eye irritation Category 1
Skin Corr. 1B	Skin corrosion/irritation Category 1B
STOT SE 3	Specific target organ toxicity (single exposure) Category 3
H302	Harmful if swallowed
H314	Causes severe skin burns and eye damage
H318	Causes serious eye damage
H335	May cause respiratory irritation

NFPA health hazard : 3 - Short exposure could cause serious temporary or residual injury even though prompt medical attention was given.

NFPA fire hazard : 0 - Materials that will not burn.

NFPA reactivity : 0 - Normally stable, even under fire exposure conditions, and are not reactive with water.



HMIS III Rating

Health : 3 Serious Hazard - Major injury likely unless prompt action is taken and medical treatment is given

Flammability : 0 Minimal Hazard - Materials that will not burn

Physical : 0 Minimal Hazard - Materials that are normally stable, even under fire conditions, and will NOT react with water, polymerize, decompose, condense, or self-react. Non-Explosives.

SDS US (GHS HazCom 2012)

The above information is believed to be correct but does not purport to be all inclusive and shall be used only as a guide. The information in this document is based on the present state of our knowledge and is offered solely for your consideration, investigation, and verification. It does not represent any guarantee of the properties of the product nor that the hazard precautions or procedures described are the only ones which exist. SynQuest shall not be held liable or any damage resulting from handling or from contact with the above product.

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Safety Data Sheet
acc. to OSHA HCS

Printing date 03/23/2019 Version Number 2 Reviewed on 03/23/2019

*
1 Identification

· **Product identifier**

· **Trade name: Perfluorooctanoic Acid (PFOA)**

· **Part number:** N-1588
· **CAS Number:**
335-67-1
· **EC number:**
206-397-9
· **Index number:**
607-704-00-2
· **Application of the substance / the mixture** Reagents and Standards for Analytical Chemical Laboratory Use

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
Agilent Technologies, Inc.
5301 Stevens Creek Blvd.
Santa Clara, CA 95051 USA

· **Information department:**
Telephone: 800-227-9770
e-mail: pdl-msds_author@agilent.com
· **Emergency telephone number:** CHEMTREC®: 1-800-424-9300

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2 Hazard(s) identification

· **Classification of the substance or mixture**


GHS08 Health hazard

Carc. 2 H351 Suspected of causing cancer.
Repr. 1B H360 May damage fertility or the unborn child.
STOT RE 1 H372 Causes damage to the liver through prolonged or repeated exposure.


GHS05 Corrosion

Eye Dam. 1 H318 Causes serious eye damage.


GHS07

Acute Tox. 4 H302 Harmful if swallowed.
Acute Tox. 4 H332 Harmful if inhaled.

· **Label elements**
· **GHS label elements** The substance is classified and labeled according to the Globally Harmonized System (GHS).

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Trade name: Perfluorooctanoic Acid (PFOA)

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· **Hazard pictograms**



GHS05 GHS07 GHS08

· **Signal word** Danger

· **Hazard-determining components of labeling:**
perfluorooctanoic acid (PFOA)
· **Hazard statements**
Harmful if swallowed or if inhaled.
Causes serious eye damage.
Suspected of causing cancer.
May damage fertility or the unborn child.
Causes damage to the liver through prolonged or repeated exposure.
· **Precautionary statements**
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Do not breathe dust/fume/gas/mist/vapors/spray.
Wash thoroughly after handling.
Do not eat, drink or smoke when using this product.
Use only outdoors or in a well-ventilated area.
Wear protective gloves/protective clothing/eye protection/face protection.
If swallowed: Call a poison center/doctor if you feel unwell.
Rinse mouth.
IF INHALED: Remove person to fresh air and keep comfortable for breathing.
If in eyes: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do.
Continue rinsing.
Immediately call a poison center/doctor.
IF exposed or concerned: Get medical advice/attention.
Get medical advice/attention if you feel unwell.
Store locked up.
Dispose of contents/container in accordance with local/regional/national/international regulations.
· **Classification system:**
· **NFPA ratings (scale 0 - 4)**



Health = 3
Fire = 0
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**



Health = *3
Fire = 0
Reactivity = 0

· **Other hazards**
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.

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· **vPvB:** Not applicable.

3 Composition/information on ingredients

· **Chemical characterization: Substances**
· **CAS No. Description**
335-67-1 perfluorooctanoic acid (PFOA)
· **Identification number(s)**
· **EC number:** 206-397-9
· **Index number:** 607-704-00-2

4 First-aid measures

· **Description of first aid measures**
· **General information:**
Symptoms of poisoning may even occur after several hours; therefore medical observation for at least 48 hours after the accident.
· **After inhalation:**
Supply fresh air. If required, provide artificial respiration. Keep patient warm. Consult doctor if symptoms persist.
In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:** Generally the product does not irritate the skin.
· **After eye contact:** Rinse opened eye for several minutes under running water. Then consult a doctor.
· **After swallowing:** Immediately call a doctor.
· **Information for doctor:**
· **Most important symptoms and effects, both acute and delayed** No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed**
No further relevant information available.

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:** Use fire fighting measures that suit the environment.
· **Special hazards arising from the substance or mixture**
During heating or in case of fire poisonous gases are produced.
· **Advice for firefighters**
· **Protective equipment:** Mouth respiratory protective device.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures**
Mount respiratory protective device.
Wear protective equipment. Keep unprotected persons away.
· **Environmental precautions:** Do not allow to enter sewers/ surface or ground water.
· **Methods and material for containment and cleaning up:**
Use neutralizing agent.
Dispose contaminated material as waste according to item 13.
Ensure adequate ventilation.

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· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.
· **Protective Action Criteria for Chemicals**

· **PAC-1:**
1.1 mg/m³
· **PAC-2:**
12 mg/m³
· **PAC-3:**
75 mg/m³

7 Handling and storage

· **Handling:**
· **Precautions for safe handling**
Thorough dedusting.
Ensure good ventilation/exhaustion at the workplace.
Open and handle receptacle with care.
· **Information about protection against explosions and fires:** Keep respiratory protective device available.

· **Conditions for safe storage, including any incompatibilities**
· **Storage:**
· **Requirements to be met by storerooms and receptacles:** No special requirements.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:** Keep receptacle tightly sealed.
· **Specific end use(s)** No further relevant information available.

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8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see item 7.

· **Control parameters**
· **Components with limit values that require monitoring at the workplace:** Not required.
· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Store protective clothing separately.
Avoid contact with the eyes.
Avoid contact with the eyes and skin.
· **Breathing equipment:**
When used as intended with Agilent instruments, the use of the product under normal laboratory conditions and with standard practices does not result in significant airborne exposures and therefore respiratory protection is not needed.
Under an emergency condition where a respirator is deemed necessary, use a NIOSH or equivalent approved device/equipment with appropriate organic or acid gas cartridge.

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· **Protection of hands:**
Although not recommended for constant contact with the chemicals or for clean-up, nitrile gloves 11-13 mil thickness are recommended for normal use. The breakthrough time is 1 hr. For cleaning a spill where there is direct contact of the chemical, butyl rubber gloves are recommended 12-15 mil thickness with breakthrough times exceeding 4 hrs. Supplier recommendations should be followed.
· **Material of gloves**
For normal use: nitrile rubber, 11-13 mil thickness
For direct contact with the chemical: butyl rubber, 12-15 mil thickness
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer.
· **Penetration time of glove material**
For normal use: nitrile rubber: 1 hour
For direct contact with the chemical: butyl rubber: >4 hours
· **Eye protection:**



Tightly sealed goggles

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Solid
Color:	Not determined.
· **Odor:**	Characteristic
· **Odor threshold:**	Not determined.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	55-56 °C (131-132.8 °F)
Boiling point/Boiling range:	190 °C (374 °F)
· **Flash point:**	Not applicable.
· **Flammability (solid, gaseous):**	Product is not flammable.
· **Decomposition temperature:**	Not determined.
· **Auto igniting:**	Not determined.
· **Danger of explosion:**	Product does not present an explosion hazard.
· **Explosion limits:**	
Lower:	Not determined.
Upper:	Not determined.
· **Vapor pressure at 20 °C (68 °F):**	0.69 hPa (0.5 mm Hg)
· **Density at 20 °C (68 °F):**	0.9 g/cm³ (7.5105 lbs/gal)
· **Relative density**	Not determined.
· **Vapor density**	Not applicable.

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· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with Water at 20 °C (68 °F):**	3.4 g/l
· **Partition coefficient (n-octanol/water):**	Not determined.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
VOC content:	0.00 % 0.0 g/l / 0.00 lb/gal
Solids content:	100.0 %
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.
· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:** No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.
· **Incompatible materials:** No further relevant information available.
· **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

· **Information on toxicological effects**
· **Acute toxicity:**

· **LD/LC50 values that are relevant for classification:**

ATE (Acute Toxicity Estimate)

Oral	LD50	500 mg/kg
Inhalative	LC50/4 h	1.5 mg/L

· **Primary irritant effect:**
· **on the skin:** No irritant effect.
· **on the eye:** Strong irritant with the danger of severe eye injury.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**

· **Carcinogenic categories**

· **IARC (International Agency for Research on Cancer)**

2B

· **NTP (National Toxicology Program)**

Substance is not listed.

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· **OSHA-Ca (Occupational Safety & Health Administration)**

Substance is not listed.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability** No further relevant information available.
· **Behavior in environmental systems:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 2 (Assessment by list): hazardous for water
Do not allow product to reach ground water, water course or sewage system.
Must not reach bodies of water or drainage ditch undiluted or unneutralized.
Danger to drinking water if even small quantities leak into the ground.
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **Other adverse effects** No further relevant information available.

13 Disposal considerations

· **Waste treatment methods**
· **Recommendation:**
Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

· **Uncleaned packagings:**
· **Recommendation:** Disposal must be made according to official regulations.

14 Transport information

· **UN-Number**	
· **DOT, IMDG, IATA**	UN3261
· **UN proper shipping name**	
· **DOT**	Corrosive solid, acidic, organic, n.o.s. (perfluorooctanoic acid (PFOA))
· **IMDG, IATA**	CORROSIVE SOLID, ACIDIC, ORGANIC, N.O.S. (perfluorooctanoic acid (PFOA))

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Trade name: Perfluorooctanoic Acid (PFOA)

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· **Transport hazard class(es)**

· **IATA**



· **Class**	8 Corrosive substances
· **Label**	8
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Warning: Corrosive substances
· **Danger code (Kemler):**	80
· **EMS Number:**	F-A,S-B
· **Segregation groups**	Acids
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **Transport/Additional information:**	
· **DOT**	
· **Quantity limitations**	On passenger aircraft/rail: 25 kg On cargo aircraft only: 100 kg
· **IMDG**	
· **Limited quantities (LQ)**	5 kg
· **Excepted quantities (EQ)**	Code: E1 Maximum net quantity per inner packaging: 30 g Maximum net quantity per outer packaging: 1000 g
· **UN "Model Regulation":**	UN 3261 CORROSIVE SOLID, ACIDIC, ORGANIC, N.O.S. (PERFLUOROOCTANOIC ACID (PFOA)), 8, III

15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**

· **Sara**

· **Section 355 (extremely hazardous substances):**

Substance is not listed.

· **Section 313 (Specific toxic chemical listings):**

Substance is not listed.

· **TSCA (Toxic Substances Control Act):**

Substance is listed.

· **Proposition 65**

· **Chemicals known to cause cancer:**

Substance is not listed.

· **Chemicals known to cause reproductive toxicity for females:**

Substance is not listed.

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· **Chemicals known to cause reproductive toxicity for males:**
Substance is not listed.

· **Chemicals known to cause developmental toxicity:**
Substance is listed.

· **Carcinogenic categories**

· **EPA (Environmental Protection Agency)**
Substance is not listed.

· **TLV (Threshold Limit Value established by ACGIH)**
Substance is not listed.

· **NIOSH-Ca (National Institute for Occupational Safety and Health)**
Substance is not listed.

· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

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16 Other information

The information contained in this document is based on Agilent's state of knowledge at the time of preparation. No warranty as to its accurateness, completeness or suitability for a particular purpose is expressed or implied.

· **Date of preparation / last revision** 03/23/2019 / 1

· **Abbreviations and acronyms:**
ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
ACGIH: American Conference of Governmental Industrial Hygienists
EINECS: European Inventory of Existing Commercial Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
VOC: Volatile Organic Compounds (USA, EU)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
Acute Tox. 4: Acute toxicity – Category 4
Eye Dam. 1: Serious eye damage/eye irritation – Category 1
Carc. 2: Carcinogenicity – Category 2
Repr. 1B: Reproductive toxicity – Category 1B
STOT RE 1: Specific target organ toxicity (repeated exposure) – Category 1

· *** Data compared to the previous version altered.**

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Printing date 12/13/2016 Reviewed on 12/13/2016

1 Identification

· **Product identifier**

· **Product Name: Perfluoro-n-octane Sulfonate (PFOS)**

· **Part Number:** LCS-4951
· **Application of the substance / the mixture** Certified Reference Material

· **Details of the supplier of the safety data sheet**
· **Manufacturer/Supplier:**
SPEX CertiPrep, LLC.
203 Norcross Ave, Metuchen,
NJ 08840 USA

· **Information department:** product safety department
· **Emergency telephone number:**
Emergency Phone Number (24 hours)
CHEMTREC (800-424-9300)
Outside US: 703-527-3887

2 Hazard(s) identification

· **Classification of the substance or mixture**



GHS02 Flame

Flam. Liq. 2 H225 Highly flammable liquid and vapor.



GHS06 Skull and crossbones

Acute Tox. 3 H331 Toxic if inhaled.



GHS08 Health hazard

Carc. 2 H351 Suspected of causing cancer.
Repr. 1 H360-H362 May damage fertility or the unborn child. May cause harm to breast-fed children.
STOT SE 1 H370 Causes damage to organs.

· **Label elements**
· **GHS label elements** The product is classified and labeled according to the Globally Harmonized System (GHS).
· **Hazard pictograms**



GHS02 GHS06 GHS08

· **Signal word** Danger

· **Hazard-determining components of labeling:**
methanol
perfluorooctane sulfonic acid
· **Hazard statements**
H225 Highly flammable liquid and vapor.
H331 Toxic if inhaled.
H351 Suspected of causing cancer.
H360-H362 May damage fertility or the unborn child. May cause harm to breast-fed children.
H370 Causes damage to organs.
· **Precautionary statements**
Avoid contact during pregnancy/while nursing.
Keep away from heat/sparks/open flames/hot surfaces. No smoking.
Use explosion-proof electrical/ventilating/lighting/equipment.
If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
Store locked up.
Dispose of contents/container in accordance with local/regional/national/international regulations.

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Product Name: Perfluoro-n-octane Sulfonate (PFOS)

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· **Classification system:**
· **NFPA ratings (scale 0 - 4)**



Health = 3
Fire = 3
Reactivity = 0

· **HMIS-ratings (scale 0 - 4)**



Health = *3
Fire = 3
Reactivity = 0

· **Other hazards**
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.

3 Composition/information on ingredients

· **Chemical characterization: Mixtures**
· **Description:** Mixture of the substances listed below with nonhazardous additions.

· **Dangerous components:**		
67-56-1	methanol	99.9%
1763-23-1	perfluorooctane sulfonic acid	0.1%

4 First-aid measures

· **Description of first aid measures**
· **General information:**
Immediately remove any clothing soiled by the product.
Remove breathing apparatus only after contaminated clothing have been completely removed.
In case of irregular breathing or respiratory arrest provide artificial respiration.
· **After inhalation:**
Supply fresh air or oxygen; call for doctor.
In case of unconsciousness place patient stably in side position for transportation.
· **After skin contact:** Immediately wash with water and soap and rinse thoroughly.
· **After eye contact:** Rinse opened eye for several minutes under running water. Then consult a doctor.
· **After swallowing:** Do not induce vomiting; immediately call for medical help.
· **Information for Doctor:**
· **Most important symptoms and effects, both acute and delayed** No further relevant information available.
· **Indication of any immediate medical attention and special treatment needed** No further relevant information available.

5 Fire-fighting measures

· **Extinguishing media**
· **Suitable extinguishing agents:** CO2, sand, extinguishing powder. Do not use water.
· **For safety reasons unsuitable extinguishing agents:** Water with full jet
· **Special hazards arising from the substance or mixture** No further relevant information available.
· **Advice for firefighters**
· **Protective equipment:** Mouth respiratory protective device.

6 Accidental release measures

· **Personal precautions, protective equipment and emergency procedures** Wear protective equipment. Keep unprotected persons away.
· **Environmental precautions:**
Do not allow product to reach sewage system or any water course.
Inform respective authorities in case of seepage into water course or sewage system.
Do not allow to enter sewers/ surface or ground water.
· **Methods and material for containment and cleaning up:**
Absorb with liquid-binding material (sand, diatomite, acid binders, universal binders, sawdust).
Dispose contaminated material as waste according to item 13.
Ensure adequate ventilation.
Do not flush with water or aqueous cleansing agents

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· **Reference to other sections**
See Section 7 for information on safe handling.
See Section 8 for information on personal protection equipment.
See Section 13 for disposal information.

7 Handling and storage

· **Handling:**
· **Precautions for safe handling**
Ensure good ventilation/exhaustion at the workplace.
Open and handle receptacle with care.
Prevent formation of aerosols.
· **Information about protection against explosions and fires:**
Keep ignition sources away - Do not smoke.
Protect against electrostatic charges.
Keep respiratory protective device available.

· **Conditions for safe storage, including any incompatibilities**
· **Storage:**
· **Requirements to be met by storerooms and receptacles:** Store in a cool location.
· **Information about storage in one common storage facility:** Not required.
· **Further information about storage conditions:**
Keep receptacle tightly sealed.
Store in cool, dry conditions in well sealed receptacles.
· **Specific end use(s)** No further relevant information available.

8 Exposure controls/personal protection

· **Additional information about design of technical systems:** No further data; see item 7.

· **Control parameters**
· **Components with limit values that require monitoring at the workplace:**
The following constituent is the only constituent of the product which has a PEL, TLV or other recommended exposure limit.
At this time, the remaining constituent has no known exposure limits.

67-56-1 methanol	
PEL	Long-term value: 260 mg/m³, 200 ppm
REL	Short-term value: 325 mg/m³, 250 ppm Long-term value: 260 mg/m³, 200 ppm Skin
TLV	Short-term value: 328 mg/m³, 250 ppm Long-term value: 262 mg/m³, 200 ppm Skin; BEI

· **Ingredients with biological limit values:**	
67-56-1 methanol	
BEI	15 mg/L Medium: urine Time: end of shift Parameter: Methanol (background, nonspecific)

· **Additional information:** The lists that were valid during the creation were used as basis.

· **Exposure controls**
· **Personal protective equipment:**
· **General protective and hygienic measures:**
Keep away from foodstuffs, beverages and feed.
Immediately remove all soiled and contaminated clothing.
Wash hands before breaks and at the end of work.
Store protective clothing separately.
Avoid contact with the eyes and skin.
· **Breathing equipment:**
In case of brief exposure or low pollution use respiratory filter device. In case of intensive or longer exposure use respiratory protective device that is independent of circulating air.
· **Protection of hands:**



Protective gloves

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The glove material has to be impermeable and resistant to the product/ the substance/ the preparation.
Due to missing tests no recommendation to the glove material can be given for the product/ the preparation/ the chemical mixture.
Selection of the glove material on consideration of the penetration times, rates of diffusion and the degradation

· **Material of gloves**
The selection of the suitable gloves does not only depend on the material, but also on further marks of quality and varies from manufacturer to manufacturer. As the product is a preparation of several substances, the resistance of the glove material can not be calculated in advance and has therefore to be checked prior to the application.

· **Penetration time of glove material**
The exact break through time has to be found out by the manufacturer of the protective gloves and has to be observed.

· **Eye protection:**



Tightly sealed goggles

9 Physical and chemical properties

· **Information on basic physical and chemical properties**	
· **General Information**	
· **Appearance:**	
Form:	Liquid
Color:	According to product specification
· **Odor:**	Characteristic
· **Odour Threshold:**	Not applicable.
· **pH-value:**	Not applicable.
· **Change in condition**	
Melting point/Melting range:	Undetermined.
Boiling point/Boiling range:	64 °C (147 °F)
· **Flash point:**	11 °C (52 °F)
· **Flammability (solid, gaseous):**	Not applicable.
· **Ignition temperature:**	455 °C (851 °F)
· **Decomposition temperature:**	Not applicable.
· **Auto igniting:**	Product is not selfigniting.
· **Danger of explosion:**	Product is not explosive. However, formation of explosive air/vapor mixtures are possible.
· **Explosion limits:**	
Lower:	5.5 Vol %
Upper:	44.0 Vol %
· **Vapor pressure at 20 °C (68 °F):**	128 hPa (96 mm Hg)
· **Density at 20 °C (68 °F)**	0.79 g/cm³ (6.593 lbs/gal)
· **Relative density**	Not applicable.
· **Vapor density**	Not applicable.
· **Evaporation rate**	Not applicable.
· **Solubility in / Miscibility with**	
Water:	Not miscible or difficult to mix.
· **Partition coefficient (n-octanol/water):**	Not applicable.
· **Viscosity:**	
Dynamic:	Not applicable.
Kinematic:	Not applicable.
· **Solvent content:**	
Organic solvents:	99.9 %
VOC content:	99.9 %
Solids content:	0.1 %
· **Other information**	No further relevant information available.

10 Stability and reactivity

· **Reactivity** No further relevant information available.

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Product Name: Perfluoro-n-octane Sulfonate (PFOS)

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· **Chemical stability**
· **Thermal decomposition / conditions to be avoided:** No decomposition if used according to specifications.
· **Possibility of hazardous reactions** No dangerous reactions known.
· **Conditions to avoid** No further relevant information available.
· **Incompatible materials:** No further relevant information available.
· **Hazardous decomposition products:** No dangerous decomposition products known.

11 Toxicological information

· **Information on toxicological effects**
· **Acute toxicity:**

· **LD/LC50 values that are relevant for classification:**		
67-56-1 methanol		
Oral	LD50	5628 mg/kg (rat)
Dermal	LD50	15800 mg/kg (rabbit)

· **Primary irritant effect:**
· **on the skin:** No irritant effect.
· **on the eye:** No irritating effect.
· **Sensitization:** No sensitizing effects known.
· **Additional toxicological information:**
The product shows the following dangers according to internally approved calculation methods for preparations:
Toxic

· **Carcinogenic categories**

· **IARC (International Agency for Research on Cancer)**
None of the ingredients is listed.

· **NTP (National Toxicology Program)**
None of the ingredients is listed.

· **OSHA-Ca (Occupational Safety & Health Administration)**
None of the ingredients is listed.

12 Ecological information

· **Toxicity**
· **Aquatic toxicity:** No further relevant information available.
· **Persistence and degradability** No further relevant information available.
· **Behavior in environmental systems:**
· **Bioaccumulative potential** No further relevant information available.
· **Mobility in soil** No further relevant information available.
· **Additional ecological information:**
· **General notes:**
Water hazard class 1 (Self-assessment): slightly hazardous for water
Do not allow undiluted product or large quantities of it to reach ground water, water course or sewage system.
· **Results of PBT and vPvB assessment**
· **PBT:** Not applicable.
· **vPvB:** Not applicable.
· **Other adverse effects** No further relevant information available.

13 Disposal considerations

· **Waste treatment methods**
· **Recommendation:** Must not be disposed of together with household garbage. Do not allow product to reach sewage system.

· **Uncleaned packagings:**
· **Recommendation:** Disposal must be made according to official regulations.

14 Transport information

· **UN-Number**	
· **DOT, ADR, IMDG, IATA**	UN1230
· **UN proper shipping name**	
· **DOT**	Methanol

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Safety Data Sheet
acc. to OSHA HCS

Printing date 12/13/2016 Reviewed on 12/13/2016

Product Name: Perfluoro-n-octane Sulfonate (PFOS)

(Contd. of page 5)

· **ADR**	1230 Methanol
· **IMDG, IATA**	METHANOL
· **Transport hazard class(es)**	
· **DOT**	
	
· **Class**	3 Flammable liquids
· **Label**	3, 6.1
· **ADR**	
	
· **Class**	3 Flammable liquids
· **Label**	3+6.1
· **IMDG**	
	
· **Class**	3 Flammable liquids
· **Label**	3/6.1
· **IATA**	
	
· **Class**	3 Flammable liquids
· **Label**	3 (6.1)
· **Packing group**	
· **DOT, ADR, IMDG, IATA**	II
· **Environmental hazards:**	Not applicable.
· **Special precautions for user**	Warning: Flammable liquids
· **Danger code (Kemler):**	336
· **EMS Number:**	F-E,S-D
· **Stowage Category**	B
· **Stowage Code**	SW2 Clear of living quarters.
· **Transport in bulk according to Annex II of MARPOL73/78 and the IBC Code**	Not applicable.
· **Transport/Additional information:**	
· **ADR**	
· **Excepted quantities (EQ)**	Code: E2 Maximum net quantity per inner packaging: 30 ml Maximum net quantity per outer packaging: 500 ml
· **IMDG**	
· **Limited quantities (LQ)**	1L
· **Excepted quantities (EQ)**	Code: E2 Maximum net quantity per inner packaging: 30 ml Maximum net quantity per outer packaging: 500 ml
· **UN "Model Regulation":**	UN 1230 METHANOL, 3 (6.1), II

US

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Safety Data Sheet
acc. to OSHA HCS

Product Name: Perfluoro-n-octane Sulfonate (PFOS)

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15 Regulatory information

· **Safety, health and environmental regulations/legislation specific for the substance or mixture**
· **Sara**

· **Section 355 (extremely hazardous substances):**
None of the ingredients is listed.

· **Section 313 (Specific toxic chemical listings):**

67-56-1	methanol

· **TSCA (Toxic Substances Control Act):**
All ingredients are listed.

· **Proposition 65**

· **Chemicals known to cause cancer:**
None of the ingredients is listed.

· **Chemicals known to cause reproductive toxicity for females:**
None of the ingredients is listed.

· **Chemicals known to cause reproductive toxicity for males:**
None of the ingredients is listed.

· **Chemicals known to cause developmental toxicity:**

67-56-1	methanol

· **Carcinogenic categories**

· **EPA (Environmental Protection Agency)**
None of the ingredients is listed.

· **TLV (Threshold Limit Value established by ACGIH)**
None of the ingredients is listed.

· **NIOSH-Ca (National Institute for Occupational Safety and Health)**
None of the ingredients is listed.

· **Protective Action Criteria for Chemicals**

· **PAC-1:**

67-56-1	methanol	530 ppm

· **PAC-2:**

67-56-1	methanol	2,100 ppm

· **PAC-3:**

67-56-1	methanol	7200* ppm

· **GHS label elements** The product is classified and labeled according to the Globally Harmonized System (GHS).
· **Hazard pictograms**



GHS02 GHS06 GHS08

· **Signal word** Danger

· **Hazard-determining components of labeling:**
methanol
perfluorooctane sulfonic acid
· **Hazard statements**
H225 Highly flammable liquid and vapor.
H331 Toxic if inhaled.
H351 Suspected of causing cancer.
H360-H362 May damage fertility or the unborn child. May cause harm to breast-fed children.
H370 Causes damage to organs.
· **Precautionary statements**
Avoid contact during pregnancy/while nursing.
Keep away from heat/sparks/open flames/hot surfaces. No smoking.
Use explosion-proof electrical/ventilating/lighting/equipment.
If on skin (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower.
Store locked up.
Dispose of contents/container in accordance with local/regional/national/international regulations.

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Safety Data Sheet
acc. to OSHA HCS

Product Name: Perfluoro-n-octane Sulfonate (PFOS)

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· **Chemical safety assessment:** A Chemical Safety Assessment has not been carried out.

16 Other information

This information is based on our present knowledge. However, this shall not constitute a guarantee for any specific product features and shall not establish a legally valid contractual relationship.

· **Department issuing SDS:** product safety department
· **Contact:**
SPEX CertiPrep, LLC.
1-732-549-7144
· **Date of preparation / last revision** 12/13/2016 / -
· **Abbreviations and acronyms:**
ADR: Accord européen sur le transport des marchandises dangereuses par Route (European Agreement concerning the International Carriage of Dangerous Goods by Road)
IMDG: International Maritime Code for Dangerous Goods
DOT: US Department of Transportation
IATA: International Air Transport Association
ACGIH: American Conference of Governmental Industrial Hygienists
EINECS: European Inventory of Existing Commercial Chemical Substances
ELINCS: European List of Notified Chemical Substances
CAS: Chemical Abstracts Service (division of the American Chemical Society)
NFPA: National Fire Protection Association (USA)
HMIS: Hazardous Materials Identification System (USA)
VOC: Volatile Organic Compounds (USA, EU)
LC50: Lethal concentration, 50 percent
LD50: Lethal dose, 50 percent
PBT: Persistent, Bioaccumulative and Toxic
vPvB: very Persistent and very Bioaccumulative
NIOSH: National Institute for Occupational Safety
OSHA: Occupational Safety & Health
TLV: Threshold Limit Value
PEL: Permissible Exposure Limit
REL: Recommended Exposure Limit
BEI: Biological Exposure Limit
Flam. Liq. 2: Flammable liquids – Category 2
Acute Tox. 3: Acute toxicity – Category 3
Carc. 2: Carcinogenicity – Category 2
Repr. 1: Reproductive toxicity – Category 1
STOT SE 1: Specific target organ toxicity (single exposure) – Category 1

International SDS Documents

***FOR INFORMATION REFERENCE ONLY**. A product specific SDS is included with each shipment. Use the SDS sent with each sample for information related to the product supplied per program cycle.

"FOR INFORMATION REFERENCE ONLY. A product specific SDS is included with each shipment. Use the SDS sent with each sample for information related to the product supplied per program cycle."

SAFETY DATA SHEET

Revised: November 14, 2016

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Name of the substance	Residual Fuel Oils - All Grades (Refer to Synonyms for Product Name)
Identification number	649-024-00-9
Registration number	01-2119474894-22-0031
Synonyms	Ultra Low Sulfur Diesel
SDS number	2003

1.2. Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Laboratory test sample

Uses advised against: Other uses are not recommended unless an assessment is completed, prior to commencement of that use, which demonstrates that the use will be controlled.

1.3. Details of the supplier of the safety data sheet

Supplier

Clark Laboratories
1801 Route 51 South
Jefferson Hills, PA 15025
412-387-1001

1.4. Emergency telephone number

Transportation Emergency Response

Chemtrec- 24 hour emergency response: (800)424-9300

International Collect: +1 703 741 5970
SDS Assistance Email: sds@clarktesting.com

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

The substance has been assessed and/or tested for its physical, health and environmental hazards and the following classification applies.

Classification according to Directive 67/548/EEC or 1999/45/EC as amended

Classification Carc. Cat. 2;R45, Repr. Cat. 3;R63, Xn;R20-48/21, R66, N;R50/53

The full text for all R-phrases is displayed in section 16.

Classification according to Regulation (EC) No 1272/2008 as amended

Health hazards		
Acute toxicity, inhalation	Category 4	H332 - Harmful if inhaled.
Carcinogenicity	Category 1B	H350 - May cause cancer.
Reproductive toxicity	Category 2	H361d - Suspected of damaging the unborn child.
Specific target organ toxicity - repeated exposure	Category 2 (blood, thymus, liver)	H373 - May cause damage to organs (blood, thymus, liver) through prolonged or repeated exposure.
Aspiration hazard	Category 1	H304 - May be fatal if swallowed and enters airways.
Environmental hazards		
Hazardous to the aquatic environment, long-term aquatic hazard	Category 1	H410 - Very toxic to aquatic life with long lasting effects.

Hazard summary

Physical hazards	Not classified for physical hazards.
Health hazards	May cause cancer. Also harmful by inhalation. Also harmful: danger of serious damage to health by prolonged exposure in contact with skin. Possible risk of harm to the unborn child. Repeated exposure may cause skin dryness or cracking.
Environmental hazards	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Specific hazards	Breathing of high vapour concentrations may cause dizziness, light-headedness, headache, nausea and loss of co-ordination. Continued inhalation may result in unconsciousness. Prolonged or repeated contact with skin may cause redness, itching, irritation, eczema/chapping and oil acne. Components of the product may be absorbed into the body through the skin.
Main symptoms	In high concentrations, vapours are narcotic and may cause headache, fatigue, dizziness and nausea. Defatting of the skin. Dermatitis. Ingestion may cause irritation and malaise.

2.2. Label elements

Label according to Regulation (EC) No. 1272/2008 as amended

Contains:	Fuel oil, residual
Identification number	649-024-00-9
Hazard pictograms	
Signal word	Danger
Hazard statements	H304 - May be fatal if swallowed and enters airways. H332 - Harmful if inhaled. H350 - May cause cancer. H361d - Suspected of damaging the unborn child. H373 - May cause damage to organs (blood, thymus, liver) through prolonged or repeated exposure. H410 - Very toxic to aquatic life with long lasting effects.

Precautionary statements

Prevention	P201 - Obtain special instructions before use. P280 - Wear protective gloves/protective clothing/eye protection/face protection. P260 - Do not breathe dust/fume/gas/mist/vapors/spray.
Response	P301 + P310 - IF SWALLOWED: Immediately call a POISON CENTRE or doctor/physician. P331 - Do NOT induce vomiting.
Storage	P403 + P233 - Store in a well-ventilated place. Keep container tightly closed.
Disposal	P501 - Dispose of contents/container in accordance with local/regional/national/international regulations.

Supplemental label information Repeated exposure may cause skin dryness or cracking.

2.3. Other hazards Not a PBT or vPvB substance or mixture. Hydrogen sulfide (H2S) can accumulate in the headspace of storage tanks and reach potentially hazardous concentrations. Static accumulator - Static accumulating flammable materials can become electrostatically charged even in bonded and grounded equipment. Sparks may ignite material and vapor may cause flash fire (or explosion).

SECTION 3: Composition/information on ingredients

3.1. Substances

General information

Chemical name	%	CAS-No. / EC No.	REACH Registration No.	INDEX No.	Notes
Fuel oil, residual	100	68476-33-5 270-675-6	01-2119474894-22-0031	649-024-00-9	

Classification: **DSD:** Carc. Cat. 2;R45, Repr. Cat. 3;R63, Xn;R20-48/21, R66, N;R50/53

CLP: Acute Tox. 4;H332, Carc. 1B;H350, STOT RE 2;H373, Aquatic Chronic 1;H410

DSD: Directive 67/548/EEC.
CLP: Regulation No. 1272/2008.

Composition comments This product is registered under the REACH Regulation 1907/2006 as a UVCB. The full text for all R- and H-phrases is displayed in section 16. All concentrations are in percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

SECTION 4: First aid measures

General information Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

4.1. Description of first aid measures

Inhalation Move to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Get medical attention.

If there is any suspicion of inhalation of H2S:
Rescuers must wear breathing apparatus, belt and safety rope, and follow rescue procedures.
Remove casualty to fresh air as quickly as possible.
Immediately begin artificial respiration if breathing has ceased.
Provision of oxygen may help.
Obtain medical advice for further treatment.

Skin contact Remove contaminated clothing and shoes. Wash off immediately with soap and plenty of water. Get medical attention if irritation develops or persists. Wash clothing separately before reuse. Destroy or thoroughly clean contaminated shoes. If high pressure injection under the skin occurs, always seek medical attention.

Eye contact Immediately flush with plenty of water for up to 15 minutes. Remove any contact lenses and open eyelids wide apart. Get medical attention if irritation develops or persists.

Ingestion Immediately rinse mouth and drink plenty of water or milk. Keep person under observation. Do not induce vomiting. If vomiting occurs, keep head low. Transport immediately to hospital and take these instructions.

4.2. Most important symptoms and effects, both acute and delayed Defatting of the skin. May cause eye irritation on direct contact. In high concentrations, vapours are narcotic and may cause headache, fatigue, dizziness and nausea. May cause damage to organs () through prolonged or repeated exposure.

4.3. Indication of any immediate medical attention and special treatment needed Treat symptomatically. Symptoms may be delayed.

SECTION 5: Firefighting measures

General fire hazards The product is combustible, and heating may generate vapours which may form explosive vapour/air mixtures. Material will float and can be re-ignited on surface of water.

5.1. Extinguishing media

Suitable extinguishing media Water spray, foam, dry powder or carbon dioxide.

Unsuitable extinguishing media Do not use water jet as an extinguisher, as this will spread the fire.

5.2. Special hazards arising from the substance or mixture Thermal decomposition may produce smoke, oxides of carbon and lower molecular weight organic compounds whose composition have not been characterised. Sulfur Oxides (SOx). Nitrogen Oxides (NOx).

5.3. Advice for firefighters

Special protective equipment for firefighters Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

Special fire fighting procedures Move containers from fire area if you can do it without risk. Use water spray to cool unopened containers. Cool containers with flooding quantities of water until well after fire is out.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

For non-emergency personnel Keep upwind. Keep out of low areas. Ventilate closed spaces before entering. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Local authorities should be advised if significant spillages cannot be contained.

For emergency responders Keep unnecessary personnel away. Wear protective clothing as described in Section 8 of this safety data sheet.

6.2. Environmental precautions Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. If facility or operation has an "oil or hazardous substance contingency plan", activate its procedures. Stay upwind and away from spill. Wear appropriate protective equipment including respiratory protection as conditions warrant. Do not enter or stay in area unless monitoring indicates that it is safe to do so. Isolate hazard area and restrict entry to emergency crew. Extremely flammable. Review Fire and Explosion Hazard Data before proceeding with clean up.

Keep all sources of ignition (flames, smoking, flares, etc.) and hot surfaces away from release. Contain spill in smallest possible area. Recover as much product as possible (e.g., by vacuuming). Stop leak if it can be done without risk. Use water spray to disperse vapors. Spilled material may be absorbed by an appropriate absorbent, and then handled in accordance with environmental regulations. Prevent spilled material from entering sewers, storm drains, other unauthorized treatment or drainage systems and natural waterways. Contact fire authorities and appropriate federal, state and local agencies.

6.3. Methods and material for containment and cleaning up

6.4. Reference to other sections ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Use non-sparking tools and explosion-proof equipment. Stop leak if you can do so without risk. This material is a water pollutant and should be prevented from contaminating soil or from entering sewage and drainage systems and bodies of water. Dike the spilled material, where this is possible. Prevent entry into waterways, sewers, basements or confined areas.

Small Spills: Absorb spill with vermiculite or other inert material, then place in a container for chemical waste. Clean surface thoroughly to remove residual contamination. This material and its container must be disposed of as hazardous waste.

Large Spills: Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal. Prevent product from entering drains. Do not allow material to contaminate ground water system. Should not be released into the environment.

For personal protection, see section 8 of the SDS. For waste disposal, see section 13 of the SDS.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Eliminate sources of ignition. Avoid spark promoters. Ground/bond container and equipment. These alone may be insufficient to remove static electricity.
Before entering storage tanks and commencing any operation in a confined area check the atmosphere for oxygen content and flammability. (Subject to applicability) If sulfur compounds are suspected to be present in the product, check the atmosphere for H2S content. Access to work area should be restricted to people handling the product only. Should be handled in closed systems, if possible. Avoid inhalation of vapors and contact with skin, eyes and clothing. Avoid release to the environment. Wear appropriate personal protective equipment. Immediately change contaminated clothes. Do not eat, drink or smoke when using the product. Be aware of potential for surfaces to become slippery. Observe good industrial hygiene practices.

7.2. Conditions for safe storage, including any incompatibilities

Store in a cool, dry place with adequate ventilation. Keep away from incompatible materials, open flames and high temperatures. Keep away from food, drink and animal feeding stuffs.

7.3. Specific end use(s)

Distribution of a substance. Formulation & (re) packaging of substances and mixtures. Manufacture of substance. Use as a Fuel.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Occupational exposure limits

Bulgaria

Material	Type	Value
Fuel oil, residual (CAS 68476-33-5)	TWA	300 mg/m3

Czech Republic

Material	Type	Value
Fuel oil, residual (CAS 68476-33-5)	Ceiling	1000 mg/m3
	TWA	400 mg/m3

Iceland

Material	Type	Value
Fuel oil, residual (CAS 68476-33-5)	TWA	180 mg/m3
		25 ppm

Italy

Material	Type	Value
Fuel oil, residual (CAS 68476-33-5)		

Romania

Biological limit values No biological exposure limits noted for the ingredient(s).

Recommended monitoring procedures

Derived no-effect level (DNEL)

Material	Type	Route	Value	Form
Fuel oil, residual (CAS 68476-33-5)	Workers	Dermal	0,065 mg/kg/8h	Long term exposure systemic effects
		Inhalation	4700 mg/m³/15min	Aerosol, Acute exposure systemic effects
		Inhalation	0,12 mg/m³/8h	Aerosol, Long term exposure systemic effects

Predicted no effect concentrations (PNECs) Not available.

8.2. Exposure controls

Appropriate engineering controls Provide adequate general and local exhaust ventilation. Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Use explosion-proof equipment.

Individual protection measures, such as personal protective equipment

General information Use personal protective equipment as required. Personal protective equipment should be chosen according to the CEN standards and in discussion with the supplier of the personal protective equipment. Keep working clothes separately. Launder contaminated clothing before reuse.

Eye/face protection Wear safety glasses. If splash potential exists, wear full face shield or chemical goggles.

Skin protection

- Hand protection Chlorinated Polyethylene (or Chlorosulfonated Polyethylene), Viton, Polyurethane, Nitrile rubber. Suitable gloves can be recommended by the glove supplier. Be aware that the liquid may penetrate the gloves. Frequent change is advisable. Wear suitable gloves tested to EN374.

- Other Full body suit and boots are recommended when handling large volumes or in emergency situations. Flame retardant protective clothing is recommended.

Respiratory protection In case of inadequate ventilation or risk of inhalation of oil mist, suitable respiratory equipment with combination filter (type A2/P2) can be used. Use a positive-pressure air-supplied respirator if there is any potential for an uncontrolled release, exposure levels are not known, or any other circumstances where air-purifying respirators may not provide adequate protection.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

Hygiene measures When using, do not eat, drink or smoke. Wash hands after handling. Launder contaminated clothing before reuse. Private clothes and working clothes should be kept separately. Handle in accordance with good industrial hygiene and safety practices. Follow up on any medical surveillance requirements.

Environmental exposure controls Contain spills and prevent releases and observe national regulations on emissions.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance Black liquid.

Physical state Liquid.

Form Liquid.

Colour Black.

Odour Petroleum.

Odour threshold Not available.

pH Not applicable.

Melting point/freezing point Not available.

Initial boiling point and boiling range 160 - 600 °C (320 - 1112 °F)

Flash point 62,0 °C (143,6 °F) Pensky-Martens Closed Cup

Evaporation rate Not available.

Flammability (solid, gas) Non flammable.

Upper/lower flammability or explosive limits

300 ppm

300 mg/m3

Flammability limit - lower (%)

Flammability limit - upper (%)

Not available.

Not available.

Vapour pressure	< 0,04 psi estimated
Vapour density	> 1 estimated
Relative density	Not available.
Solubility(ies)	Insoluble in water.
Partition coefficient (n-octanol/water)	Not applicable.
Auto-ignition temperature	263 °C (505,4 °F)
Decomposition temperature	Not available.
Viscosity	10 - 55 mm²/s (100°C)
Explosive properties	Not explosive.
Oxidizing properties	Not oxidizing.

9.2. Other information

Density	840,00 - 1100,00 kg/m³ (15 °C)

SECTION 10: Stability and reactivity

10.1. Reactivity	The product is stable and non reactive under normal conditions of use, storage and transport.
10.2. Chemical stability	Stable under normal temperature conditions and recommended use.
10.3. Possibility of hazardous reactions	Hazardous polymerisation does not occur.
10.4. Conditions to avoid	Heat, flames and sparks. Ignition sources. Contact with incompatible materials. Do not pressurize, cut, weld, braze, solder, drill, grind or expose empty containers to heat, flame, sparks, static electricity, or other sources of ignition; they may explode and cause injury or death.
10.5. Incompatible materials	Strong acids. Strong oxidizers such as nitrates, chlorates, peroxides.
10.6. Hazardous decomposition products	Thermal decomposition or combustion may liberate carbon oxides and other toxic gases or vapours.

SECTION 11: Toxicological information

General information	Occupational exposure to the substance or mixture may cause adverse effects.

Information on likely routes of exposure

Ingestion	Ingestion may cause irritation and malaise.
Inhalation	Harmful if inhaled. In high concentrations, vapours and spray mists are narcotic and may cause headache, fatigue, dizziness and nausea.
Skin contact	Repeated exposure may cause skin dryness or cracking. May be absorbed through the skin.
Eye contact	Direct contact with eyes may cause temporary irritation.
Symptoms	Skin irritation. Defatting of the skin. Rash. May cause eye irritation on direct contact. In high concentrations, vapours and spray mists are narcotic and may cause headache, fatigue, dizziness and nausea.

11.1. Information on toxicological effects

Acute toxicity	Harmful if inhaled.
Skin corrosion/irritation	Based on available data, the classification criteria are not met.
Serious eye damage/eye irritation	Direct contact with eyes may cause temporary irritation.
Skin sensitisation	Based on available data, the classification criteria are not met.
Germ cell mutagenicity	Based on available data, the classification criteria are not met.
Carcinogenicity	Suspected of causing cancer.

IARC Monographs. Overall Evaluation of Carcinogenicity

Fuel oil, residual (CAS 68476-33-5)	2B Possibly carcinogenic to humans.

Reproductive toxicity	Suspected of damaging fertility or the unborn child.

Specific target organ toxicity - single exposure

Specific target organ toxicity - repeated exposure

Based on available data, the classification criteria are not met.

May cause damage to organs through prolonged or repeated exposure: Blood. Thymus. Liver.

Aspiration hazard May be fatal if swallowed and enters airways.

Mixture versus substance information

Not available.

Other information Symptoms may be delayed.

SECTION 12: Ecological information

12.1. Toxicity Oil spills are generally hazardous to the environment.

Product		Species	Test results
Fuel oil, residual (CAS 68476-33-5)			
Aquatic			
Algae	EL50	Pseudokirchneriella subcapitata	0,75 mg/l, 72 Hours
Crustacea	EL50	Daphnia magna	2 mg/l, 48 Hours
Fish	LL50	Oncorhynchus mykiss	79 mg/l, 96 Hours

12.2. Persistence and degradability The degradability of the product has not been stated.

12.3. Bioaccumulative potential No data available on bioaccumulation.

Partition coefficient n-octanol/water (log Kow) Not available.

Bioconcentration factor (BCF) Not available.

12.4. Mobility in soil Not available.

Mobility in general The product is insoluble in water. It will spread on the water surface while some of the components will eventually sediment in water systems. The volatile components of the product will spread in the atmosphere.

12.5. Results of PBT and vPvB assessment Not a PBT or vPvB substance or mixture.

12.6. Other adverse effects Very toxic to aquatic life with long lasting effects. Oil spills are generally hazardous to the environment.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Residual waste Dispose of in accordance with local regulations.

Contaminated packaging Since emptied containers may retain product residue, follow label warnings even after container is emptied.

EU waste code 13 07 03*
The Waste code should be assigned in discussion between the user, the producer and the waste disposal company.

Disposal methods/information Dispose in accordance with all applicable regulations. This material and its container must be disposed of as hazardous waste. Do not discharge into drains, water courses or onto the ground.

SECTION 14: Transport information

Environmentally hazardous substances may be shipped as non restricted when meeting the descriptions of UN3082 as they are not subject to the IMO-IMDG or IATA/ICAO Codes when transported in packaging that does not exceed 5L or 5kg net and the packaging used meets defined standards (Special Provision A197)

ADR

14.1. UN number UN3082

14.2. UN proper shipping name Environmentally hazardous substance, liquid, n.o.s. (Fuel oil, residual)

14.3. Transport hazard class(es) 9

Subsidiary class(es) -

14.4. Packing group III

14.5. Environmental hazards Yes

Tunnel restriction code	E
Labels required	9
14.6. Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

RID

14.1. UN number	UN3082
14.2. UN proper shipping name	Environmentally hazardous substance, liquid, n.o.s. (Fuel oil, residual)
14.3. Transport hazard class(es)	9
Subsidiary class(es)	-
14.4. Packing group	III

15

15.1. Environmental hazards Yes	Read safety instructions, SDS and emergency procedures before handling.
Labels required	9
	UN3082
15.2. Special precautions for user	Environmentally Hazardous Liquid, N.o.s. (Fuel oil, residual)
	9

ADN

14.1. UN number	-
14.2. UN proper shipping name	III
14.3. Transport hazard class(es)	
Subsidiary class(es)	
14.4. Packing group	
14.5. Environmental hazards	Yes
Labels required	9
14.6. Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

IATA

14.1. UN number	UN3082
14.2. UN proper shipping name	Environmentally hazardous substance, liquid, n.o.s. (Fuel oil, residual)
14.3. Transport hazard class(es)	9
Subsidiary class(es)	-
14.4. Packing group	III
14.5. Environmental hazards	Yes
Labels required	9
ERG code	9L
14.6. Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

IMDG

14.1. UN number	UN3082
14.2. UN proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (Residues (petroleum), atmospheric)
14.3. Transport hazard class(es)	9
Subsidiary class(es)	-
14.4. Packing group	III
14.5. Environmental hazards	
Marine pollutant	Yes
Labels required	9
EmS	F-A, S-F
14.6. Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not applicable. However, this product is a liquid and if transported in bulk covered under MARPOL 73/78, Annex I.

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

EU regulations

Regulation (EC) No. 1005/2009 on substances that deplete the ozone layer, Annex I

Not listed.

Regulation (EC) No. 1005/2009 on substances that deplete the ozone layer, Annex II

Not listed.

Regulation (EC) No. 850/2004 On persistent organic pollutants, Annex I as amended

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 1 as amended

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 2 as amended

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 3 as amended

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex V as amended

Not listed.

Regulation (EC) No. 166/2006 Annex II Pollutant Release and Transfer Registry

Not listed.

Regulation (EC) No. 1907/2006, REACH Article 59(1) Candidate List as currently published by ECHA

Not listed.

Authorisations

Regulation (EC) No. 1907/2006, REACH Annex XIV Substances subject to authorisation, as amended

Not listed.

Restrictions on use

Regulation (EC) No. 1907/2006, REACH Annex XVII Substances subject to restriction on marketing and use as amended

Fuel oil, residual (CAS 68476-33-5)

Directive 2004/37/EC: on the protection of workers from the risks related to exposure to carcinogens and mutagens at work

Not regulated.

Directive 92/85/EEC: on the safety and health of pregnant workers and workers who have recently given birth or are breastfeeding

Fuel oil, residual (CAS 68476-33-5)

Other EU regulations

Directive 96/82/EC (Seveso II) on the control of major-accident hazards involving dangerous substances

Not regulated.

Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents at work

Fuel oil, residual (CAS 68476-33-5)

Directive 94/33/EC on the protection of young people at work

Fuel oil, residual (CAS 68476-33-5)

Other regulations	The product is classified and labelled in accordance with Regulation (EC) 1272/2008 (CLP Regulation) as amended and respective national laws implementing EC directives. This Safety Data Sheet complies with the requirements of Regulation (EC) No 1907/2006. 96/82/EC (Seveso II) Directive; Part 2 (Classified Substances) - Extremely Flammable
National regulations	Young people under 18 years old are not allow to work with this product according to the EU Directive 94/33/EC on the protection of young people at work. Pregnant women should not work with the product, if there is the least risk of exposure.
15.1. Chemical safety assessment	For this substance a chemical safety assessment has been carried out.

SECTION 16: Other information

List of abbreviations	DSD: Directive 67/548/EEC. CLP: Regulation No. 1272/2008. DNEL: Derived No-Effect Level. PNEC: Predicted No-Effect Concentration. PBT: Persistent, bioaccumulative and toxic. vPvB: Very Persistent and very Bioaccumulative.
References	Chemical safety report. CLP files – http://concawe.org/
Information on evaluation method leading to the classification of mixture	The mixture is classified based on test data for physical hazards. The classification for health and environmental hazards is derived by a combination of calculation methods and test data, if available. For details, refer to Sections 9, 11 and 12.
Full text of any statements or R-phrases and H-statements under Sections 2 to 15	R20 Harmful by inhalation. R45 May cause cancer. R48/21 Harmful: danger of serious damage to health by prolonged exposure in contact with skin. R50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. R63 Possible risk of harm to the unborn child. R66 Repeated exposure may cause skin dryness or cracking. H332 Harmful if inhaled. H350 May cause cancer. H373 May cause damage to organs through prolonged or repeated exposure. H410 Very toxic to aquatic life with long lasting effects.
This SDS contains revisions in the following section(s):	This safety data sheet contains revisions in the following section(s): 2, 3, 5, 7, 11, 12.

Training information	Follow training instructions when handling this material.

NOTICE: The information presented herein is based on data considered to be accurate as of the date of preparation of this Safety Data Sheet Adequate training and instruction should be given by you to your employees and affected personnel. Appropriate warnings and safe handling procedures should be provided by you to handlers and users. Additionally, the user should review this information, satisfy itself as to its suitability and completeness, and pass on the information to its employees or customers in accordance with the applicable federal, state, provincial or local hazard communication requirements. This SDS may not be used as a commercial specification sheet of manufacturer or seller, and no warranty or representation, expressed or implied, is made as to the fitness for use of the material, or the accuracy or comprehensiveness of the foregoing data and safety information, nor is any authorization given or implied to practice any patented invention without a license. In addition, vendor neither assumes nor retains any responsibility for any damage or injury resulting from abnormal use, from any failure to adhere to appropriate practices, or from any hazards inherent in the nature of the material. Moreover, unless an employee or a customer accesses or receives a SDS directly from the company, there is no assurance that a document obtained from alternate sources is the most currently available SDS. The above information is based on the data of which we are aware and is believed to be correct as of the date hereof. Since this information may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modifications of the information, we do not assume any responsibility for the results of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.

Completed by Clark PTP Staff

NO ANNEX

Domestic SDS Documents

***FOR INFORMATION REFERENCE ONLY**. A product specific SDS is included with each shipment. Use the SDS sent with each sample for information related to the product supplied per program cycle.

"FOR INFORMATION REFERENCE ONLY. A product specific SDS is included with each shipment. Use the SDS sent with each sample for information related to the product supplied per program cycle."

SAFETY DATA SHEET

Revised: November 14, 2016

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Name of the substance	Residual Fuel Oils - All Grades (Refer to Synonyms for Product Name)
Identification number	649-024-00-9
Registration number	01-2119474894-22-0031
Synonyms	Ultra Low Sulfur Diesel
SDS number	2003

1.2. Relevant identified uses of the substance or mixture and uses advised against

Identified uses: Laboratory test sample

Uses advised against: Other uses are not recommended unless an assessment is completed, prior to commencement of that use, which demonstrates that the use will be controlled.

1.3. Details of the supplier of the safety data sheet

Supplier

Clark Laboratories
1801 Route 51 South
Jefferson Hills, PA 15025
412-387-1001

1.4. Emergency telephone number

Transportation Emergency Response

Chemtrec- 24 hour emergency response: (800)424-9300

International Collect: +1 703 741 5970
SDS Assistance Email: sds@clarktesting.com

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

The substance has been assessed and/or tested for its physical, health and environmental hazards and the following classification applies.

Classification according to Directive 67/548/EEC or 1999/45/EC as amended

Classification Carc. Cat. 2;R45, Repr. Cat. 3;R63, Xn;R20-48/21, R66, N;R50/53

The full text for all R-phrases is displayed in section 16.

Classification according to Regulation (EC) No 1272/2008 as amended

Health hazards		
Acute toxicity, inhalation	Category 4	H332 - Harmful if inhaled.
Carcinogenicity	Category 1B	H350 - May cause cancer.
Reproductive toxicity	Category 2	H361d - Suspected of damaging the unborn child.
Specific target organ toxicity - repeated exposure	Category 2 (blood, thymus, liver)	H373 - May cause damage to organs (blood, thymus, liver) through prolonged or repeated exposure.
Aspiration hazard	Category 1	H304 - May be fatal if swallowed and enters airways.
Environmental hazards		
Hazardous to the aquatic environment, long-term aquatic hazard	Category 1	H410 - Very toxic to aquatic life with long lasting effects.

Hazard summary

Physical hazards	Not classified for physical hazards.
Health hazards	May cause cancer. Also harmful by inhalation. Also harmful: danger of serious damage to health by prolonged exposure in contact with skin. Possible risk of harm to the unborn child. Repeated exposure may cause skin dryness or cracking.
Environmental hazards	Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment.
Specific hazards	Breathing of high vapour concentrations may cause dizziness, light-headedness, headache, nausea and loss of co-ordination. Continued inhalation may result in unconsciousness. Prolonged or repeated contact with skin may cause redness, itching, irritation, eczema/chapping and oil acne. Components of the product may be absorbed into the body through the skin.
Main symptoms	In high concentrations, vapours are narcotic and may cause headache, fatigue, dizziness and nausea. Defatting of the skin. Dermatitis. Ingestion may cause irritation and malaise.

2.2. Label elements

Label according to Regulation (EC) No. 1272/2008 as amended

Contains:	Fuel oil, residual
Identification number	649-024-00-9
Hazard pictograms	
Signal word	Danger
Hazard statements	H304 - May be fatal if swallowed and enters airways. H332 - Harmful if inhaled. H350 - May cause cancer. H361d - Suspected of damaging the unborn child. H373 - May cause damage to organs (blood, thymus, liver) through prolonged or repeated exposure. H410 - Very toxic to aquatic life with long lasting effects.

Precautionary statements

Prevention	P201 - Obtain special instructions before use. P280 - Wear protective gloves/protective clothing/eye protection/face protection. P260 - Do not breathe dust/fume/gas/mist/vapors/spray.
Response	P301 + P310 - IF SWALLOWED: Immediately call a POISON CENTRE or doctor/physician. P331 - Do NOT induce vomiting.
Storage	P403 + P233 - Store in a well-ventilated place. Keep container tightly closed.
Disposal	P501 - Dispose of contents/container in accordance with local/regional/national/international regulations.

Supplemental label information Repeated exposure may cause skin dryness or cracking.

2.3. Other hazards Not a PBT or vPvB substance or mixture. Hydrogen sulfide (H2S) can accumulate in the headspace of storage tanks and reach potentially hazardous concentrations. Static accumulator - Static accumulating flammable materials can become electrostatically charged even in bonded and grounded equipment. Sparks may ignite material and vapor may cause flash fire (or explosion).

SECTION 3: Composition/information on ingredients

3.1. Substances

General information

Chemical name	%	CAS-No. / EC No.	REACH Registration No.	INDEX No.	Notes
Fuel oil, residual	100	68476-33-5 270-675-6	01-2119474894-22-0031	649-024-00-9	

Classification: **DSD:** Carc. Cat. 2;R45, Repr. Cat. 3;R63, Xn;R20-48/21, R66, N;R50/53

CLP: Acute Tox. 4;H332, Carc. 1B;H350, STOT RE 2;H373, Aquatic Chronic 1;H410

DSD: Directive 67/548/EEC.
CLP: Regulation No. 1272/2008.

Composition comments This product is registered under the REACH Regulation 1907/2006 as a UVCB. The full text for all R- and H-phrases is displayed in section 16. All concentrations are in percent by weight unless ingredient is a gas. Gas concentrations are in percent by volume.

SECTION 4: First aid measures

General information Ensure that medical personnel are aware of the material(s) involved, and take precautions to protect themselves.

4.1. Description of first aid measures

Inhalation Move to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Get medical attention.

If there is any suspicion of inhalation of H2S:
Rescuers must wear breathing apparatus, belt and safety rope, and follow rescue procedures.
Remove casualty to fresh air as quickly as possible.
Immediately begin artificial respiration if breathing has ceased.
Provision of oxygen may help.
Obtain medical advice for further treatment.

Skin contact Remove contaminated clothing and shoes. Wash off immediately with soap and plenty of water. Get medical attention if irritation develops or persists. Wash clothing separately before reuse. Destroy or thoroughly clean contaminated shoes. If high pressure injection under the skin occurs, always seek medical attention.

Eye contact Immediately flush with plenty of water for up to 15 minutes. Remove any contact lenses and open eyelids wide apart. Get medical attention if irritation develops or persists.

Ingestion Immediately rinse mouth and drink plenty of water or milk. Keep person under observation. Do not induce vomiting. If vomiting occurs, keep head low. Transport immediately to hospital and take these instructions.

4.2. Most important symptoms and effects, both acute and delayed Defatting of the skin. May cause eye irritation on direct contact. In high concentrations, vapours are narcotic and may cause headache, fatigue, dizziness and nausea. May cause damage to organs () through prolonged or repeated exposure.

4.3. Indication of any immediate medical attention and special treatment needed Treat symptomatically. Symptoms may be delayed.

SECTION 5: Firefighting measures

General fire hazards The product is combustible, and heating may generate vapours which may form explosive vapour/air mixtures. Material will float and can be re-ignited on surface of water.

5.1. Extinguishing media

Suitable extinguishing media Water spray, foam, dry powder or carbon dioxide.

Unsuitable extinguishing media Do not use water jet as an extinguisher, as this will spread the fire.

5.2. Special hazards arising from the substance or mixture Thermal decomposition may produce smoke, oxides of carbon and lower molecular weight organic compounds whose composition have not been characterised. Sulfur Oxides (SOx). Nitrogen Oxides (NOx).

5.3. Advice for firefighters

Special protective equipment for firefighters Self-contained breathing apparatus and full protective clothing must be worn in case of fire.

Special fire fighting procedures Move containers from fire area if you can do it without risk. Use water spray to cool unopened containers. Cool containers with flooding quantities of water until well after fire is out.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

For non-emergency personnel Keep upwind. Keep out of low areas. Ventilate closed spaces before entering. Do not touch damaged containers or spilled material unless wearing appropriate protective clothing. Local authorities should be advised if significant spillages cannot be contained.

For emergency responders Keep unnecessary personnel away. Wear protective clothing as described in Section 8 of this safety data sheet.

6.2. Environmental precautions Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers. If facility or operation has an "oil or hazardous substance contingency plan", activate its procedures. Stay upwind and away from spill. Wear appropriate protective equipment including respiratory protection as conditions warrant. Do not enter or stay in area unless monitoring indicates that it is safe to do so. Isolate hazard area and restrict entry to emergency crew. Extremely flammable. Review Fire and Explosion Hazard Data before proceeding with clean up.

Keep all sources of ignition (flames, smoking, flares, etc.) and hot surfaces away from release. Contain spill in smallest possible area. Recover as much product as possible (e.g., by vacuuming). Stop leak if it can be done without risk. Use water spray to disperse vapors. Spilled material may be absorbed by an appropriate absorbent, and then handled in accordance with environmental regulations. Prevent spilled material from entering sewers, storm drains, other unauthorized treatment or drainage systems and natural waterways. Contact fire authorities and appropriate federal, state and local agencies.

6.3. Methods and material for containment and cleaning up

6.4. Reference to other sections ELIMINATE all ignition sources (no smoking, flares, sparks or flames in immediate area). Use non-sparking tools and explosion-proof equipment. Stop leak if you can do so without risk. This material is a water pollutant and should be prevented from contaminating soil or from entering sewage and drainage systems and bodies of water. Dike the spilled material, where this is possible. Prevent entry into waterways, sewers, basements or confined areas.

Small Spills: Absorb spill with vermiculite or other inert material, then place in a container for chemical waste. Clean surface thoroughly to remove residual contamination. This material and its container must be disposed of as hazardous waste.

Large Spills: Use a non-combustible material like vermiculite, sand or earth to soak up the product and place into a container for later disposal. Prevent product from entering drains. Do not allow material to contaminate ground water system. Should not be released into the environment.

For personal protection, see section 8 of the SDS. For waste disposal, see section 13 of the SDS.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Eliminate sources of ignition. Avoid spark promoters. Ground/bond container and equipment. These alone may be insufficient to remove static electricity.
Before entering storage tanks and commencing any operation in a confined area check the atmosphere for oxygen content and flammability. (Subject to applicability) If sulfur compounds are suspected to be present in the product, check the atmosphere for H2S content. Access to work area should be restricted to people handling the product only. Should be handled in closed systems, if possible. Avoid inhalation of vapors and contact with skin, eyes and clothing. Avoid release to the environment. Wear appropriate personal protective equipment. Immediately change contaminated clothes. Do not eat, drink or smoke when using the product. Be aware of potential for surfaces to become slippery. Observe good industrial hygiene practices.

7.2. Conditions for safe storage, including any incompatibilities

Store in a cool, dry place with adequate ventilation. Keep away from incompatible materials, open flames and high temperatures. Keep away from food, drink and animal feeding stuffs.

7.3. Specific end use(s)

Distribution of a substance. Formulation & (re) packaging of substances and mixtures. Manufacture of substance. Use as a Fuel.

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Occupational exposure limits

Bulgaria

Material	Type	Value
Fuel oil, residual (CAS 68476-33-5)	TWA	300 mg/m3

Czech Republic

Material	Type	Value
Fuel oil, residual (CAS 68476-33-5)	Ceiling	1000 mg/m3
	TWA	400 mg/m3

Iceland

Material	Type	Value
Fuel oil, residual (CAS 68476-33-5)	TWA	180 mg/m3
		25 ppm

Italy

Material	Type	Value
Fuel oil, residual (CAS 68476-33-5)		

Romania

Biological limit values No biological exposure limits noted for the ingredient(s).

Recommended monitoring procedures

Derived no-effect level (DNEL)

Material	Type	Route	Value	Form
Fuel oil, residual (CAS 68476-33-5)	Workers	Dermal	0,065 mg/kg/8h	Long term exposure systemic effects
		Inhalation	4700 mg/m³/15min	Aerosol, Acute exposure systemic effects
		Inhalation	0,12 mg/m³/8h	Aerosol, Long term exposure systemic effects

Predicted no effect concentrations (PNECs) Not available.

8.2. Exposure controls

Appropriate engineering controls Provide adequate general and local exhaust ventilation. Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below recommended exposure limits. Use explosion-proof equipment.

Individual protection measures, such as personal protective equipment

General information Use personal protective equipment as required. Personal protective equipment should be chosen according to the CEN standards and in discussion with the supplier of the personal protective equipment. Keep working clothes separately. Launder contaminated clothing before reuse.

Eye/face protection Wear safety glasses. If splash potential exists, wear full face shield or chemical goggles.

Skin protection

- Hand protection Chlorinated Polyethylene (or Chlorosulfonated Polyethylene), Viton, Polyurethane, Nitrile rubber. Suitable gloves can be recommended by the glove supplier. Be aware that the liquid may penetrate the gloves. Frequent change is advisable. Wear suitable gloves tested to EN374.

- Other Full body suit and boots are recommended when handling large volumes or in emergency situations. Flame retardant protective clothing is recommended.

Respiratory protection In case of inadequate ventilation or risk of inhalation of oil mist, suitable respiratory equipment with combination filter (type A2/P2) can be used. Use a positive-pressure air-supplied respirator if there is any potential for an uncontrolled release, exposure levels are not known, or any other circumstances where air-purifying respirators may not provide adequate protection.

Thermal hazards Wear appropriate thermal protective clothing, when necessary.

Hygiene measures When using, do not eat, drink or smoke. Wash hands after handling. Launder contaminated clothing before reuse. Private clothes and working clothes should be kept separately. Handle in accordance with good industrial hygiene and safety practices. Follow up on any medical surveillance requirements.

Environmental exposure controls Contain spills and prevent releases and observe national regulations on emissions.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Appearance Black liquid.

Physical state Liquid.

Form Liquid.

Colour Black.

Odour Petroleum.

Odour threshold Not available.

pH Not applicable.

Melting point/freezing point Not available.

Initial boiling point and boiling range 160 - 600 °C (320 - 1112 °F)

Flash point 62,0 °C (143,6 °F) Pensky-Martens Closed Cup

Evaporation rate Not available.

Flammability (solid, gas) Non flammable.

Upper/lower flammability or explosive limits

300 ppm

300 mg/m3

Flammability limit - lower (%)

Flammability limit - upper (%)

Not available.

Not available.

Vapour pressure	< 0,04 psi estimated
Vapour density	> 1 estimated
Relative density	Not available.
Solubility(ies)	Insoluble in water.
Partition coefficient (n-octanol/water)	Not applicable.
Auto-ignition temperature	263 °C (505,4 °F)
Decomposition temperature	Not available.
Viscosity	10 - 55 mm²/s (100°C)
Explosive properties	Not explosive.
Oxidizing properties	Not oxidizing.

9.2. Other information

Density	840,00 - 1100,00 kg/m³ (15 °C)

SECTION 10: Stability and reactivity

10.1. Reactivity	The product is stable and non reactive under normal conditions of use, storage and transport.
10.2. Chemical stability	Stable under normal temperature conditions and recommended use.
10.3. Possibility of hazardous reactions	Hazardous polymerisation does not occur.
10.4. Conditions to avoid	Heat, flames and sparks. Ignition sources. Contact with incompatible materials. Do not pressurize, cut, weld, braze, solder, drill, grind or expose empty containers to heat, flame, sparks, static electricity, or other sources of ignition; they may explode and cause injury or death.
10.5. Incompatible materials	Strong acids. Strong oxidizers such as nitrates, chlorates, peroxides.
10.6. Hazardous decomposition products	Thermal decomposition or combustion may liberate carbon oxides and other toxic gases or vapours.

SECTION 11: Toxicological information

General information	Occupational exposure to the substance or mixture may cause adverse effects.

Information on likely routes of exposure

Ingestion	Ingestion may cause irritation and malaise.
Inhalation	Harmful if inhaled. In high concentrations, vapours and spray mists are narcotic and may cause headache, fatigue, dizziness and nausea.
Skin contact	Repeated exposure may cause skin dryness or cracking. May be absorbed through the skin.
Eye contact	Direct contact with eyes may cause temporary irritation.
Symptoms	Skin irritation. Defatting of the skin. Rash. May cause eye irritation on direct contact. In high concentrations, vapours and spray mists are narcotic and may cause headache, fatigue, dizziness and nausea.

11.1. Information on toxicological effects

Acute toxicity	Harmful if inhaled.
Skin corrosion/irritation	Based on available data, the classification criteria are not met.
Serious eye damage/eye irritation	Direct contact with eyes may cause temporary irritation.
Skin sensitisation	Based on available data, the classification criteria are not met.
Germ cell mutagenicity	Based on available data, the classification criteria are not met.
Carcinogenicity	Suspected of causing cancer.

IARC Monographs. Overall Evaluation of Carcinogenicity

Fuel oil, residual (CAS 68476-33-5)	2B Possibly carcinogenic to humans.

Reproductive toxicity	Suspected of damaging fertility or the unborn child.

Specific target organ toxicity - single exposure

Specific target organ toxicity - repeated exposure

Based on available data, the classification criteria are not met.

May cause damage to organs through prolonged or repeated exposure: Blood. Thymus. Liver.

Aspiration hazard May be fatal if swallowed and enters airways.

Mixture versus substance information

Not available.

Other information Symptoms may be delayed.

SECTION 12: Ecological information

12.1. Toxicity Oil spills are generally hazardous to the environment.

Product		Species	Test results
Fuel oil, residual (CAS 68476-33-5)			
Aquatic			
Algae	EL50	Pseudokirchneriella subcapitata	0,75 mg/l, 72 Hours
Crustacea	EL50	Daphnia magna	2 mg/l, 48 Hours
Fish	LL50	Oncorhynchus mykiss	79 mg/l, 96 Hours

12.2. Persistence and degradability The degradability of the product has not been stated.

12.3. Bioaccumulative potential No data available on bioaccumulation.

Partition coefficient n-octanol/water (log Kow) Not available.

Bioconcentration factor (BCF) Not available.

12.4. Mobility in soil Not available.

Mobility in general The product is insoluble in water. It will spread on the water surface while some of the components will eventually sediment in water systems. The volatile components of the product will spread in the atmosphere.

12.5. Results of PBT and vPvB assessment Not a PBT or vPvB substance or mixture.

12.6. Other adverse effects Very toxic to aquatic life with long lasting effects. Oil spills are generally hazardous to the environment.

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Residual waste Dispose of in accordance with local regulations.

Contaminated packaging Since emptied containers may retain product residue, follow label warnings even after container is emptied.

EU waste code 13 07 03*
The Waste code should be assigned in discussion between the user, the producer and the waste disposal company.

Disposal methods/information Dispose in accordance with all applicable regulations. This material and its container must be disposed of as hazardous waste. Do not discharge into drains, water courses or onto the ground.

SECTION 14: Transport information

Environmentally hazardous substances may be shipped as non restricted when meeting the descriptions of UN3082 as they are not subject to the IMO-IMDG or IATA/ICAO Codes when transported in packaging that does not exceed 5L or 5kg net and the packaging used meets defined standards (Special Provision A197)

ADR

14.1. UN number UN3082

14.2. UN proper shipping name Environmentally hazardous substance, liquid, n.o.s. (Fuel oil, residual)

14.3. Transport hazard class(es) 9

Subsidiary class(es) -

14.4. Packing group III

14.5. Environmental hazards Yes

Tunnel restriction code	E
Labels required	9
14.6. Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

RID

14.1. UN number	UN3082
14.2. UN proper shipping name	Environmentally hazardous substance, liquid, n.o.s. (Fuel oil, residual)
14.3. Transport hazard class(es)	9
Subsidiary class(es)	-
14.4. Packing group	III

15

15.1. Environmental hazards Yes	Read safety instructions, SDS and emergency procedures before handling.
Labels required	9
	UN3082
15.2. Special precautions for user	Environmentally Hazardous Liquid, N.o.s. (Fuel oil, residual)
	9

ADN

14.1. UN number	-
14.2. UN proper shipping name	III
14.3. Transport hazard class(es)	
Subsidiary class(es)	
14.4. Packing group	
14.5. Environmental hazards	Yes
Labels required	9
14.6. Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

IATA

14.1. UN number	UN3082
14.2. UN proper shipping name	Environmentally hazardous substance, liquid, n.o.s. (Fuel oil, residual)
14.3. Transport hazard class(es)	9
Subsidiary class(es)	-
14.4. Packing group	III
14.5. Environmental hazards	Yes
Labels required	9
ERG code	9L
14.6. Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.

IMDG

14.1. UN number	UN3082
14.2. UN proper shipping name	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (Residues (petroleum), atmospheric)
14.3. Transport hazard class(es)	9
Subsidiary class(es)	-
14.4. Packing group	III
14.5. Environmental hazards	
Marine pollutant	Yes
Labels required	9
EmS	F-A, S-F
14.6. Special precautions for user	Read safety instructions, SDS and emergency procedures before handling.
14.7. Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not applicable. However, this product is a liquid and if transported in bulk covered under MARPOL 73/78, Annex I.

SECTION 15: Regulatory information

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

EU regulations

Regulation (EC) No. 1005/2009 on substances that deplete the ozone layer, Annex I

Not listed.

Regulation (EC) No. 1005/2009 on substances that deplete the ozone layer, Annex II

Not listed.

Regulation (EC) No. 850/2004 On persistent organic pollutants, Annex I as amended

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 1 as amended

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 2 as amended

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex I, part 3 as amended

Not listed.

Regulation (EC) No. 689/2008 concerning the export and import of dangerous chemicals, Annex V as amended

Not listed.

Regulation (EC) No. 166/2006 Annex II Pollutant Release and Transfer Registry

Not listed.

Regulation (EC) No. 1907/2006, REACH Article 59(1) Candidate List as currently published by ECHA

Not listed.

Authorisations

Regulation (EC) No. 1907/2006, REACH Annex XIV Substances subject to authorisation, as amended

Not listed.

Restrictions on use

Regulation (EC) No. 1907/2006, REACH Annex XVII Substances subject to restriction on marketing and use as amended

Fuel oil, residual (CAS 68476-33-5)

Directive 2004/37/EC: on the protection of workers from the risks related to exposure to carcinogens and mutagens at work

Not regulated.

Directive 92/85/EEC: on the safety and health of pregnant workers and workers who have recently given birth or are breastfeeding

Fuel oil, residual (CAS 68476-33-5)

Other EU regulations

Directive 96/82/EC (Seveso II) on the control of major-accident hazards involving dangerous substances

Not regulated.

Directive 98/24/EC on the protection of the health and safety of workers from the risks related to chemical agents at work

Fuel oil, residual (CAS 68476-33-5)

Directive 94/33/EC on the protection of young people at work

Fuel oil, residual (CAS 68476-33-5)

Other regulations	The product is classified and labelled in accordance with Regulation (EC) 1272/2008 (CLP Regulation) as amended and respective national laws implementing EC directives. This Safety Data Sheet complies with the requirements of Regulation (EC) No 1907/2006. 96/82/EC (Seveso II) Directive; Part 2 (Classified Substances) - Extremely Flammable
National regulations	Young people under 18 years old are not allow to work with this product according to the EU Directive 94/33/EC on the protection of young people at work. Pregnant women should not work with the product, if there is the least risk of exposure.
15.1. Chemical safety assessment	For this substance a chemical safety assessment has been carried out.

SECTION 16: Other information

List of abbreviations	DSD: Directive 67/548/EEC. CLP: Regulation No. 1272/2008. DNEL: Derived No-Effect Level. PNEC: Predicted No-Effect Concentration. PBT: Persistent, bioaccumulative and toxic. vPvB: Very Persistent and very Bioaccumulative.
References	Chemical safety report. CLP files – http://concawe.org/
Information on evaluation method leading to the classification of mixture	The mixture is classified based on test data for physical hazards. The classification for health and environmental hazards is derived by a combination of calculation methods and test data, if available. For details, refer to Sections 9, 11 and 12.
Full text of any statements or R-phrases and H-statements under Sections 2 to 15	R20 Harmful by inhalation. R45 May cause cancer. R48/21 Harmful: danger of serious damage to health by prolonged exposure in contact with skin. R50/53 Very toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. R63 Possible risk of harm to the unborn child. R66 Repeated exposure may cause skin dryness or cracking. H332 Harmful if inhaled. H350 May cause cancer. H373 May cause damage to organs through prolonged or repeated exposure. H410 Very toxic to aquatic life with long lasting effects.
This SDS contains revisions in the following section(s):	This safety data sheet contains revisions in the following section(s): 2, 3, 5, 7, 11, 12.

Training information	Follow training instructions when handling this material.

NOTICE: The information presented herein is based on data considered to be accurate as of the date of preparation of this Safety Data Sheet Adequate training and instruction should be given by you to your employees and affected personnel. Appropriate warnings and safe handling procedures should be provided by you to handlers and users. Additionally, the user should review this information, satisfy itself as to its suitability and completeness, and pass on the information to its employees or customers in accordance with the applicable federal, state, provincial or local hazard communication requirements. This SDS may not be used as a commercial specification sheet of manufacturer or seller, and no warranty or representation, expressed or implied, is made as to the fitness for use of the material, or the accuracy or comprehensiveness of the foregoing data and safety information, nor is any authorization given or implied to practice any patented invention without a license. In addition, vendor neither assumes nor retains any responsibility for any damage or injury resulting from abnormal use, from any failure to adhere to appropriate practices, or from any hazards inherent in the nature of the material. Moreover, unless an employee or a customer accesses or receives a SDS directly from the company, there is no assurance that a document obtained from alternate sources is the most currently available SDS. The above information is based on the data of which we are aware and is believed to be correct as of the date hereof. Since this information may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modifications of the information, we do not assume any responsibility for the results of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.

Completed by Clark PTP Staff

NO ANNEX

Safety Data Sheet: **Simple Green® Industrial Cleaner & Degreaser** ★

Version No. 13000-15A Issue Date: July 31, 2015 Supersedes Date: September 13, 2014 *OSHA HCS-2012 / GHS*

Section 1: IDENTIFICATION

Product Name: Simple Green® Industrial Cleaner & Degreaser
Additional Names:

Manufacturer's Part Number: **Please refer to Section 16*

Recommended Use: Cleaner & Degreaser for water tolerant surfaces.
Restrictions on Use: Do not use on non-rinsable surfaces.

Company: Sunshine Makers, Inc.
15922 Pacific Coast Highway
Huntington Beach, CA 92649 USA

Telephone: 800-228-0709 ● 562-795-6000 *Mon – Fri, 8am – 5pm PST*
Fax: 562-592-3830
Email: info@simplegreen.com

Emergency Phone: Chem-Tel 24-Hour Emergency Service: 800-255-3924

Section 2: HAZARDS IDENTIFICATION

This product is not classified as hazardous under 2012 OSHA Hazard Communication Standards (29 CFR 1910.1200).

OSHA HCS 2012
Label Elements
Signal Word: None **Hazard Symbol(s)/Pictogram(s):** None required

Hazard Statements: None
Precautionary Statements: None
Hazards Not Otherwise Classified (HNOC): None
Other Information: None Known

Section 3: COMPOSITION/INFORMATION ON INGREDIENTS

Ingredient	CAS Number	Percent Range
Water	7732-18-5	> 84.8%*
Ethoxylated Alcohol	68439-46-3	< 5%*
Sodium Citrate	68-04-2	< 5%*
Tetrasodium *N,N*-bis(carboxymethyl)-L-glutamate	51981-21-6	< 1%*
Sodium Carbonate	497-19-8	< 1%*
Citric Acid	77-92-9	< 1%*
Isothiazolinone mixture	55965-84-9	< 0.2%*
Fragrance	Proprietary Mixture	< 1%*
Colorant	Proprietary Mixture	< 1%*

**specific percentages of composition are being withheld as a trade secret*

Section 4: FIRST-AID MEASURES

Inhalation: Not expected to cause respiratory irritation. If adverse effect occurs, move to fresh air.
Skin Contact: Not expected to cause skin irritation. If adverse effect occurs, rinse skin with water.
Eye Contact: Not expected to cause eye irritation. If adverse effect occurs, flush eyes with water.
Ingestion: May cause upset stomach. Drink plenty of water to dilute. See section 11.

Most Important Symptoms/Effects, Acute and Delayed: None known.

Indication of Immediate Medical Attention and Special Treatment Needed, if necessary: Treat symptomatically

Section 5: FIRE-FIGHTING MEASURES

Suitable & Unsuitable Extinguishing Media: Use Dry chemical, CO2, water spray or "alcohol" foam. Avoid high volume jet water.
Specific Hazards Arising from Chemical: In event of fire, fire created carbon oxides may be formed.
Special Protective Actions for Fire-Fighters: Wear positive pressure self-contained breathing apparatus; Wear full protective clothing.

This product is non-flammable. See Section 9 for Physical Properties.

Section 6: ACCIDENTAL RELEASE MEASURES

Personal Precautions, Protective Equipment and Emergency Procedures: *For non-emergency and emergency personnel:* See section 8 – personal protection. Avoid eye contact. Safety goggles suggested.

Environmental Precautions: Do not allow into open waterways and ground water systems.

Methods and Materials for Containment and Clean Up: Dike or soak up with inert absorbent material. See section 13 for disposal considerations.

Section 7: HANDLING AND STORAGE

Precautions for Safe Handling: Ensure adequate ventilation. Keep out of reach of children. Keep away from heat, sparks, open flame and direct sunlight. Do not pierce any part of the container. Do not mix or contaminate with any other chemical. Do not eat, drink or smoke while using this product.

Conditions for Safe Storage including Incompatibilities: Keep container tightly closed. Keep in cool dry area. Avoid prolonged exposure to sunlight. Do not store at temperatures above 109°F (42.7°C). If separation occurs, mix the product for reconstitution.

Section 8: EXPOSURE CONTROLS / PERSONAL PROTECTION

Exposure Limit Values: No components listed with TWA or STEL values under OSHA or ACGIH.

Appropriate Engineering Controls: Showers, eyewash stations, ventilation systems

Individual Protection Measures / Personal Protective Equipment (PPE)
Eye Contact: Use protective glasses or safety goggles if splashing or spray-back is likely.
Respiratory: Use in well ventilated areas or local exhaust ventilations when cleaning small spaces.
Skin Contact: Use protective gloves (any material) when used for prolonged periods or dermally sensitive.
General Hygiene Considerations: Wash thoroughly after handling and before eating or drinking.

Section 9: PHYSICAL AND CHEMICAL PROPERTIES

Appearance: Green Liquid
Odor: Added sassafras odor
Odor Threshold: Not determined
pH ASTM D-1293**:** 8.5 – 9.5
Freezing Point ASTM D-1177**:** 0-3.33°C (32-38°F)
Boiling Point & Range ASTM D-1120**:** 101°C (213.8°F)
Flash Point ASTM D-93**:** > 212°F
Evaporation Rate ASTM D-1901**:** ½ Butyl Acetate @ 25°C
Flammability (solid, gas): Not applicable
Upper/Lower Flammability or Explosive Limits: Not applicable
Vapor Pressure ASTM D-323**:** 0.60 PSI @77°F, 2.05 PSI @100°F
Vapor Density: Not determined

Partition Coefficient: n-octanol/water: Not determined
Autoignition Temperature: Non-flammable
Decomposition Temperature: 109°F
Viscosity: Like water
Specific Gravity ASTM D-891**:** 1.01 – 1.03
VOCs: ***Water & fragrance exemption in calculation*

SCAQMD 304-91 / EPA 24:	0 g/L	0 lb/gal	0%
CARB Method 310**:	2.5 g/L	0.021 lb/gal	0.25%
SCAQMD Method 313:	Not tested		

VOC Composite Partial Pressure: Not determined
Relative Density ASTM D-4017**:** 8.34 – 8.42 lb/gal
Solubility: 100% in water

Section 10: STABILITY AND REACTIVITY

Reactivity: Non-reactive.
Chemical Stability: Stable under normal conditions 70°F (21°C) and 14.7 psig (760 mmHg).
Possibility of Hazardous Reactions: None known.
Conditions to Avoid: Excessive heat or cold.
Incompatible Materials: Do not mix with oxidizers, acids, bathroom cleaners, or disinfecting agents.
Hazardous Decomposition Products: Normal products of combustion - CO, CO2.

Section 11: TOXICOLOGICAL INFORMATION

Likely Routes of Exposure:
Inhalation - Overexposure may cause headache.
Skin Contact - Not expected to cause irritation, repeated contact may cause dry skin.
Eye Contact - Not expected to cause irritation.
Ingestion - May cause upset stomach.

Symptoms related to the physical, chemical and toxicological characteristics: no symptoms expected under typical use conditions.
Delayed and immediate effects and or chronic effects from short term exposure: no symptoms expected under typical use conditions.
Delayed and immediate effects and or chronic effects from long term exposure: headache, dry skin, or skin irritation may occur.
Interactive effects: Not known.

Numerical Measures of Toxicity

Acute Toxicity:
Oral LD_{50} (rat) > 5 g/kg body weight
Dermal LD_{50} (rabbit) > 5 g/kg body weight
Calculated via OSHA HCS 2012 / Globally Harmonized System of Classification and Labelling of Chemicals

Skin Corrosion/Irritation: Non-irritant per Dermal Irritection® assay modeling. No animal testing performed.
Eye Damage/Irritation: Minimal irritant per Ocular Irritection® assay modeling. No animal testing performed.
Germ Cell Mutagenicity: Mixture does not classify under this category.
Carcinogenicity: No ingredients trigger or classify under this category under NTP, IARC or OSHA.
Reproductive Toxicity: Mixture does not classify under this category.
STOT-Single Exposure: Mixture does not classify under this category.
STOT-Repeated Exposure: Mixture does not classify under this category.
Aspiration Hazard: Mixture does not classify under this category.

Section 12: ECOLOGICAL INFORMATION

Ecotoxicity: Volume of ingredients used does not trigger toxicity classifications under the Globally Harmonized System of Classification and Labelling of Chemicals.
Aquatic: Aquatic Toxicity - Low, based on OECD 201, 202, 203 + Microtox: EC_{50} & IC_{50} ≥100 mg/L. Volume of ingredients used does not trigger toxicity classifications under the Globally Harmonized System of Classification and Labelling of Chemicals.
Terrestrial: Not tested on finished formulation.

Persistence and Degradability: Readily Biodegradable per OCED 301D, Closed Bottle Test
Bioaccumulative Potential: No data available.
Mobility in Soil: No data available.
Other Adverse Effects: No data available.

Section 13: DISPOSAL CONSIDERATIONS

Unused or Used Liquid: May be considered hazardous in your area depending on usage and tonnage of disposal – check with local, regional, and or national regulations for appropriate methods of disposal.

Empty Containers: May be offered for recycling.

Never dispose of used degreasing rinsates into lakes, streams, and open bodies of water or storm drains.

Section 14: TRANSPORT INFORMATION

U.N. Number: Not applicable
U.N. Proper Shipping Name: Cleaning Compound, Liquid NOI
Transport Hazard Class(es): Not applicable
NMFC Number: 48580-3
Packing Group: Not applicable
Class: 55
Environmental Hazards: Marine Pollutant - NO
Transport in Bulk (according to Annex II of MARPOL 73/78 and IBC Code): Unknown.
Special precautions which user needs to be aware of/comply with, in connection with transport or conveyance either within or outside their premises: None known.

U.S. (DOT) / Canadian TDG: Not Regulated for shipping.
ICAO/ IATA: Not classified as Hazardous
IMO / IDMG: Not classified as Hazardous
ADR/RID: Not classified as Hazardous

Section 15: REGULATORY INFORMATION

All components are listed on: TSCA and DSL Inventory.

SARA Title III: Sections 311/312 Hazard Categories – Not applicable.
Sections 313 Superfunds Amendments and Reauthorizations Act of 1986 – Not applicable.
Sections 302 – Not applicable.

Clean Air Act (CAA): Not applicable
Clean Water Act (CWA): Not applicable

State Right To Know Lists: No ingredients listed
California Proposition 65: No ingredients listed
Texas ESL:

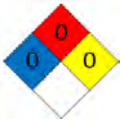
Ethoxylated Alcohol	68439-46-3	60 µg/m^3 long term	600 µg/m^3 short term
Sodium Citrate	68-04-2	5 µg/m^3 long term	50 µg/m^3 short term
Sodium Carbonate	497-19-8	5 µg/m^3 long term	50 µg/m^3 short term
Citric Acid	77-92-9	10 µg/m^3 long term	100 µg/m^3 short term

Section 16: OTHER INFORMATION

Size	UPC	Size	UPC
22 oz. Trigger	043318130229	2.5 Gallon	043318000041
24 oz. Trigger	043318000034	5 Gallon	043318000010
32 oz.	043318130328	55 Gallon	043318000027
1 Gallon	043318000003	15 Gallon	043318000225
1 Gallon w/ Dilution Bottle	043318001253	260 Gallon	043318130663
1 Gallon w/ Dilution Bottle	043318480416	275 Gallon	043318000102
1 Gallon w/ Dilution Bottle	043318000003		

USA items listed only. Not all items listed. USA items may not be valid for international sale.

NFPA:
Health – None
Stability – Stable
Flammability – Non-flammable
Special - None



Acronyms

NTP	National Toxicology Program	IARC	International Agency for Research on Cancer
OSHA	Occupational Safety and Health Administration	CPSC	Consumer Product Safety Commission
TSCA	Toxic Substances Control Act	DSL	Domestic Substances List

Prepared / Revised By: Sunshine Makers, Inc., Regulatory Department.
This SDS has been revised in the following sections: Section 16 – corrected UPC

DISCLAIMER: The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text.

SAFETY DATA SHEET

Creation Date 02-Feb-2010 **Revision Date** 14-Feb-2020 **Revision Number** 2

1. Identification

Product Name **3,3',5,5'-Tetramethylbenzidine**

Cat No. : **A13868**

CAS-No 54827-17-7
Synonyms TMB

Recommended Use Laboratory chemicals.
Uses advised against Food, drug, pesticide or biocidal product use.

Details of the supplier of the safety data sheet

Company
Alfa Aesar
Thermo Fisher Scientific Chemicals, Inc.
30 Bond Street
Ward Hill, MA 01835-8099
Tel: 800-343-0660
Fax: 800-322-4757
Email: tech@alfa.com
www.alfa.com

Emergency Telephone Number
During normal business hours (Monday-Friday, 8am-7pm EST), call (800) 343-0660.
After normal business hours, call Carechem 24 at (866) 928-0789.

2. Hazard(s) identification

Classification
This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Acute oral toxicity	Category 4
Acute Inhalation Toxicity - Dusts and Mists	Category 4
Skin Corrosion/Irritation	Category 2
Serious Eye Damage/Eye Irritation	Category 2
Germ Cell Mutagenicity	Category 2
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system.	

Label Elements

Signal Word
Warning

Hazard Statements
Causes skin irritation
Causes serious eye irritation

Suspected of causing genetic defects
May cause respiratory irritation
Harmful if inhaled



Precautionary Statements
Prevention
Obtain special instructions before use
Do not handle until all safety precautions have been read and understood
Avoid breathing dust/fume/gas/mist/vapors/spray
Wash face, hands and any exposed skin thoroughly after handling
Wash hands and face thoroughly after handling
Do not eat, drink or smoke when using this product
Use only outdoors or in a well-ventilated area
Wear protective gloves/protective clothing/eye protection/face protection
Response
IF exposed or concerned: Get medical attention/advice
Inhalation
IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing
Call a POISON CENTER or doctor/physician if you feel unwell
Skin
IF ON SKIN: Wash with plenty of soap and water
If skin irritation occurs: Get medical advice/attention
Take off contaminated clothing and wash before reuse
Eyes
IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing
If eye irritation persists: Get medical advice/attention
Ingestion
Rinse mouth
IF SWALLOWED: Call a POISON CENTER or doctor/physician if you feel unwell
Storage
Store in a well-ventilated place. Keep container tightly closed
Store locked up
Disposal
Dispose of contents/container to an approved waste disposal plant
Hazards not otherwise classified (HNOC)
None identified

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
[1,1'-Biphenyl]-4,4'-diamine, 3,3',5,5'-tetramethyl-	54827-17-7	>95

4. First-aid measures

Eye Contact Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Get medical attention.

Skin Contact Wash off immediately with plenty of water for at least 15 minutes. Get medical attention.

Inhalation Remove to fresh air. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required. If not breathing, give artificial respiration.

Ingestion Do NOT induce vomiting. Call a physician or poison control center immediately.

Most important symptoms and effects No information available.

Notes to Physician Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media Water spray, carbon dioxide (CO2), dry chemical, alcohol-resistant foam.

Unsuitable Extinguishing Media No information available

Flash Point No information available
Method - No information available

Autoignition Temperature
Explosion Limits
Upper No data available
Lower No data available
Sensitivity to Mechanical Impact No information available
Sensitivity to Static Discharge No information available

Specific Hazards Arising from the Chemical
Thermal decomposition can lead to release of irritating gases and vapors. Keep product and empty container away from heat and sources of ignition.

Hazardous Combustion Products
Carbon monoxide (CO). Carbon dioxide (CO_2). Nitrogen oxides (NOx).
Protective Equipment and Precautions for Firefighters
As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
2	1	1	N/A

6. Accidental release measures

Personal Precautions Use personal protective equipment as required. Ensure adequate ventilation. Avoid dust formation. Avoid contact with skin, eyes or clothing.

Environmental Precautions Avoid release to the environment. See Section 12 for additional Ecological Information.

Methods for Containment and Clean Up Sweep up and shovel into suitable containers for disposal. Avoid dust formation.

7. Handling and storage

Handling Wear personal protective equipment/face protection. Ensure adequate ventilation. Avoid dust formation. Avoid contact with skin, eyes or clothing. Avoid ingestion and inhalation.

Storage Keep containers tightly closed in a dry, cool and well-ventilated place. Store under an inert atmosphere.

8. Exposure controls / personal protection

Exposure Guidelines This product does not contain any hazardous materials with occupational exposure limitsestablished by the region specific regulatory bodies.

Engineering Measures Ensure adequate ventilation, especially in confined areas. Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Solid
Appearance	Light cream
Odor	Odorless
Odor Threshold	No information available
pH	No information available
Melting Point/Range	167 - 170 °C / 332.6 - 338 °F
Boiling Point/Range	No information available
Flash Point	No information available
Evaporation Rate	Not applicable
Flammability (solid,gas)	No information available
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	No information available
Vapor Density	Not applicable
Specific Gravity	No information available
Solubility	Insoluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	
Decomposition Temperature	No information available
Viscosity	Not applicable
Molecular Formula	C16 H20 N2
Molecular Weight	240.35

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability Light sensitive. Moisture sensitive.

Conditions to Avoid Incompatible products. Excess heat. Avoid dust formation. Exposure to light. Exposure to moist air or water.

Incompatible Materials Strong oxidizing agents, Metals, Strong acids

Hazardous Decomposition Products Carbon monoxide (CO), Carbon dioxide (CO_2), Nitrogen oxides (NOx)

Hazardous Polymerization Hazardous polymerization does not occur.

Hazardous Reactions None under normal processing.

11. Toxicological information

Acute Toxicity

Product Information

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
[1,1'-Biphenyl]-4,4'-diamine, 3,3',5,5'-tetramethyl-	> 316 mg/kg (bird)	Not listed	Not listed

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Irritating to eyes, respiratory system and skin

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
[1,1'-Biphenyl]-4,4'-diamine, 3,3',5,5'-tetramethyl-	54827-17-7	Not listed	Not listed	Not listed	Not listed	Not listed

Mutagenic Effects Possible risk of irreversible effects

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Respiratory system

STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects,both acute and delayed No information available

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

Do not empty into drains.

Persistence and Degradability Insoluble in water

Bioaccumulation/ Accumulation No information available.

Mobility Is not likely mobile in the environment due its low water solubility.

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a

hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT Not regulated
TDG Not regulated
IATA Not regulated
IMDG/IMO Not regulated

15. Regulatory information

United States of America Inventory

Component	CAS-No	TSCA	TSCA Inventory notification - Active/Inactive	TSCA - EPA Regulatory Flags
[1,1'-Biphenyl]-4,4'-diamine, 3,3',5,5'-tetramethyl-	54827-17-7	X	ACTIVE	-

Legend:
TSCA - Toxic Substances Control Act, (40 CFR Part 710)
X - Listed
'-' - Not Listed

TSCA 12(b) - Notices of Export Not applicable

International Inventories
Canada (DSL/NDSL), Europe (EINECS/ELINCS/NLP), Philippines (PICCS), Japan (ENCS), Australia (AICS), China (IECSC), Korea (ECL).

Component	CAS-No	DSL	NDSL	EINECS	PICCS	ENCS	AICS	IECSC	KECL
[1,1'-Biphenyl]-4,4'-diamine, 3,3',5,5'-tetramethyl-	54827-17-7	X	-	259-364-6	-	-	X	X	-

U.S. Federal Regulations

SARA 313 Not applicable

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act) Not applicable

Clean Air Act Not applicable

OSHA - Occupational Safety and Health Administration Not applicable

CERCLA Not applicable

California Proposition 65 This product does not contain any Proposition 65 chemicals.

U.S. State Right-to-Know Regulations Not applicable

U.S. Department of Transportation
Reportable Quantity (RQ): N
DOT Marine Pollutant N
DOT Severe Marine Pollutant N

U.S. Department of Homeland Security This product does not contain any DHS chemicals.

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By
Health, Safety and Environmental Department
Email: tech@alfa.com
www.alfa.com

Creation Date 02-Feb-2010
Revision Date 14-Feb-2020
Print Date 14-Feb-2020
Revision Summary SDS authoring systems update, replaces ChemGes SDS No. 54827-17-7/1.

Disclaimer
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SECTION 10: STABILITY AND REACTIVITY

10.1. Reactivity

The product is stable and non-reactive under normal conditions of use, storage and transport.

10.2. Chemical stability

Material is stable under normal conditions.

10.3. Possibility of hazardous reactions

No dangerous reactions known under normal conditions of use.

10.4. Conditions to avoid

None reasonably foreseeable.

10.5. Incompatible materials

No materials to be especially mentioned.

10.6. Hazardous decomposition products

No hazardous decomposition products if stored and handled as prescribed/indicated.

SECTION 11: TOXICOLOGICAL INFORMATION

11.1. Information on toxicological effects

Acute toxicity : Not classified

Skin corrosion/irritation : Not classified

Serious eye damage/irritation : Not classified

Respiratory or skin sensitization : Not classified

Germ cell mutagenicity : Not classified

Carcinogenicity : Not classified

Reproductive toxicity : Not classified

STOT-single exposure : Not classified

STOT-repeated exposure : Not classified

Aspiration hazard : Not classified

Symptoms/injuries after inhalation : May cause drowsiness or dizziness.

Symptoms/injuries after skin contact : Repeated exposure may cause skin dryness or cracking.

Symptoms/injuries after eye contact : Vapours may cause irritation to eyes.

Symptoms/injuries after ingestion : Aspiration hazard if swallowed. May cause lung damage if swallowed.

Chronic symptoms : Repeated exposure may cause skin dryness or cracking.

SECTION 12: ECOLOGICAL INFORMATION

12.1. Toxicity

Ecology - general : The product is not considered harmful to aquatic organisms or to cause long-term adverse effects in the environment.

12.2. Persistence and degradability

No additional information available

12.3. Bioaccumulative potential

No additional information available

12.4. Mobility in soil

No additional information available

12.5. Other adverse effects

No additional information available

SECTION 13: DISPOSAL CONSIDERATIONS

13.1. Waste treatment methods

Waste disposal recommendations : Dispose in a safe manner in accordance with local/national regulations.

Additional information : Handle empty containers with care because residual vapours are flammable.

Ecology - waste materials : Avoid release to the environment.

SECTION 14: TRANSPORT INFORMATION

In accordance with ADR / RID / IMDG / IATA / ADN

14.1. UN number

UN-No. : 1294

14.2. UN proper shipping name

Proper Shipping Name : TOLUENE

14.3. Transport hazard class(es)

ADR : 3

14.4. Packing group

Packing Group : II

14.5. Environmental hazards

Dangerous for the environment : No

14.6. Special precautions for user

Special transport precautions : None known

SECTION 15: REGULATORY INFORMATION

15.1. Safety, health and environmental regulations/legislation specific for the substance or mixture

Regulation (EC) No 1907/2006 (REACH)

Annex XVII - Restrictions on the manufacture, placing on the market and use of certain dangerous substances, mixtures and articles : Not applicable

Annex XIV - List of substances subject to authorisation : Not applicable

Substances of very high concern (SVHC) : Not applicable

Regulation (EC) No 1005/2009 on substances that deplete the ozone layer : Not applicable

Regulation (EC) No 850/2004 on persistent organic pollutants : Not applicable

Regulation (EC) No 689/2008 concerning the export and import of dangerous chemicals : Not applicable

Regulation (EC) No 2019/1021 on persistent organic pollutants : Not applicable

Regulation (EC) No 649/2012 concerning the export and import of hazardous chemicals : Not applicable

Directive 2004/37/EC on the protection against carcinogens or mutagens at work : Not applicable

Directive 2000/60/EC establishing a framework for Community action in the field of water policy : Not applicable

Directive 2012/18/EU on the control of major-accident hazards involving dangerous substances : Not applicable

Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control) : Not applicable

Directive 2003/105/EC on the control of major-accident hazards involving dangerous substances : Not applicable

Directive 2004/42/EC on the limitation of emissions of volatile organic compounds due to the use of organic solvents in certain paints and varnishes and vehicle refinishing products : Not applicable

**Directive 2010/75/EU on industrial emissions (integrated pollution prevention and control)

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!:6556; /:/.9Ā<7*:/+OĀ867>	B C)Ā7[737/!# 9
Z*= 0)Ā61+Ā,((0)Ā0I(:*7/K 0Ā <2:655 6;:0>Ā:/5/.7	B <] #1`ĀE9Ej ;00#1`ĀI9Ej
\ 6(*)Ā()077,)0	B J9EĀĀ7ĀU@J9EKĀHEAĀ(ĀY:VĀe1 (Ā)#(0#17)"1#f
\ 6(*)Ā+017/. 9	B J9EĀĀU631ĀhĀEV
À(0-/2/-Ā*:,50Ā< 2.ĀU:;>	B E9ELBL
'67Ā%017/.9Ā<:;JĀ>	B F9HIĀĀĀU@Fg=Ā5ĀKHĀ) Āg
L0:6./K0Ā+017/.9	B F9HI
À*:;; /:/.9	B C)Ā7[737/!# 9
À*:;; /:/.9Ā/1Ā6.0)	B F9AIJĀ:5!
E6)././*1Ā-* 022/-/01.ĒĀ1T *-.61* :J=6.0)	B @9IJ
, .* T/81/./*1 Ā.05(0)6.,)0	B LHFg=ĀUHBKgMV
%0-*5(* 7/./*1 Ā.05(0)6.,)0	B C)Ā7[737/!# 9
À %#	B C)Ā7[737/!# 9
\ /7-*7/.9	B Q+$7(34ĀU(1 Ā)#(0#17)"1#V`ĀF9AKĀ7(8ĀUF9AKĀ4GV

À0-./*1Ā?]@ĀÀ;/:/ .9Ā61+)Ā06- ./K/.9

L06-./K /.9	B C Ā80#43Ā4Ā)#8)Ā>7)7Ā1#!7)#>Ā) Ā1)#Ā7[37/!#Ā? Ā)*38Ā1 >"4)Ā 1Ā3)8Ā3$:1#>3#$)89
C405/-6:Ā7.6;/:/. 9	B À*#Ā01 >"4)Ā38Ā8)7/!#9
E*77/;/:/.9Ā*2Ā46K8)+*,7Ā)06-./*17	B ;$>#1Ā$ 1(7!Ā4 $>)3 $8Ā ?Ā8 7:#Ā7$>Ā"8#'Ā*7&1> "8Ā1#74)3 $Ā]3!Ā$)Ā44"19
C*1+ /./*1 7Ā.*Ā6K+	B 6[3>Ā7Ā0 883/!#Ā8 "14#8Ā 2Ā3:$)3 $ĀU807Ā1Ā!7(#V9ĀĀQ ĀĀ01#8Ā3&'Ā4")'Ā]#!>' /178&#'Ā8 !>#1'Ā>1Ā!!3$>Ā 1Ā#\0 8#Ā4 $)73$#18Ā) Ā*#7)Ā 1Ā#8Ā 2Ā:$)3 $9ĀĀQ Ā)Ā 7!!] Ā[70 1Ā) Ā74"("!7)#Ā$Ā!] Ā 1Ā4 3#>Ā7#789
A1-*5(6./;/:/. 9Ā= /.4ĀK6)/*,7Ā 7,;7.61 -07	B N\)1#(#!+Ā1#74)3[#Ā 1Ā3$07)3/!#Ā]3)*Ā)*Ā !!] 3$:Ā(7)#137Ā \3>3$:Ā(7)#137Ā9
&6H6)+*, 7Ā+0-*5(*7/./* 1Ā ()*+, -.7	B ;$>#1Ā$ 1(7!Ā4 $>)3 $8Ā ?Ā8 7:#Ā7$>Ā"8#'Ā*7&1> "8Ā>#4 (0 83)3 $Ā01 >"4)8Ā*8"! >Ā $)Ā/#Ā01 >"4#>9
&6H6)+*, 7Ā(*:950)/H6./*1	B ;$>#1Ā$ 1(7!Ā4 $>)3 $8Ā ?Ā8 7:#Ā7$>Ā"8#'Ā*7&1> "8Ā0 !+(#13&)3 $Ā]3!Ā$)Ā44"19

À0-./*1Ā??@ĀH#*:* 8/-6:Ā/12*)56./*1

A12)56./*1 Ā*1Ā*I/-*:* 8/-6:Ā0220-.7

- ,.0Ā.* I/-/.9

E)*+,-.J/1 8)0+/01. Ā1650	L07,:.	À(0-/07	%*70	" I(*7,)0
) !"# $#	<=AFĀO$*7)3 $Āa70 1 <=AFĀO$*7)3 $Āa70 1	D7) D7)	@HHJFĀ0(LBĀ:5(d	EĀ* "18 LĀ* "18

A))/.6./*1JC*))*7/*1

À0-./*1Ã??@Ã#-*:* 8/-6:Ã/12*)56./*1

E)*+,-.J/1 8)0+/01. Ã1650	L07,:.	À(0-/07	À-*)0	" I(*7,)0	3 ; 70)K6./* 1
) !"# $#	N+#8Ã,Ã.3!>Ã3)7$)	D7//3)	,	F9AÃ(3$")#8Ã EFFÃ (3I3:17(8	,
	N+#8Ã,Ã.3!>Ã3)7$)	D7//3)	,	HIFÃ .341 :17(8	,
	N+#8Ã,Ã2#[#1#Ã3113)7$)	D7//3)	,	@LÃ* "18Ã@Ã (3I3:17(8	,
	2^ 3$Ã,Ã.3Ã3113)7$)	G3:	,	@LÃ* "18Ã@AF,Ã (341 !3)#18	
	2^ 3$Ã,Ã.3Ã3113)7$)	D7//3)	,	LJAÃ (3I3:17(8	,
	2^ 3$Ã,Ã. >#17)#Ã3)7$)	D7//3)	,	@LÃ* "18Ã@FÃ (3I3:17(8	,
	2^ 3$Ã,Ã. >#17)#Ã3)7$)	D7//3)	,	AFFÃ (3I3:17(8	,

À017/./H6J/*1

C)Ã7[737/!# 9

V , .68 01/-/.9

C)Ã7[737/!# 9

C6)-/1*801 /-/.9

C)Ã7[737/!# 9

C:677/2/-6./*1

E)*+,-.J/1 8)0+/01. Ã1650	3À&	A LC	U#E
) !"# $#	,	J	,

L0()*+, -./K0Ã.*l/-/.9

C)Ã7[737/!# 9

#0)6.*801/-/. 9

C)Ã7[737/!# 9

À(0-/2/-Ã.6)80.Ã*)861Ã.*l /-/.9 Ã<7/18:0Ã0l(*7,)0>

C)Ã7[737/!# 9

À(0-/2/-Ã.6)80.Ã*)861Ã.*l /-/.9 Ã<)0(06.0+Ã0l(* 7,)0>

U650	C6.08*)9	L*,. 0Ã*2Ã 0l(*7,)0	#6)80.Ã*)8617
) !"# $#	=7)#: 1+ Ã@	C)Ã>#)#1(3$#>	C)Ã>#)#1(3$#>

7(/)6./*1 Ã46H6)+

C)Ã7[737/!# 9

A12)56./*1 Ã*1Ã40Ã:/P0:Ã)*,.07Ã* 2Ã0l(* 7,)0 B C)Ã7[737/!# 9

E*.01. /6:Ã6-,.0Ã406:.4Ã0220-.7

"9 0Ã-*1.6-. B =7"8#8Ã8#13 "8Ã##Ã3113)7$)

A146:6.1 B C Ã^$] $Ã83:$3?347$)#4#8Ã 1Ã4)34Ã*78?1>89

ÀP/1Ã-*1.6-. B =7"8#8Ã8^3$Ã3)7)3 $9

A1807./*1 B O113)7)3$:Ã)"Ã*(Ã)*1 7)Ã7$>Ã8) (74*9

À0-./*1Ã??@Ã#-*:* 8/-6:Ã/12*)56./*1

À95(. * 57Ã)0:6.0+Ã*.Ã.40Ã(497/-6:OÃ-405/-6:Ã61+Ã/-*:* 8/-6:Ã-46)6-.0)/7./-7

"9 0Ã-*1.6-.	**B** 6>[#18#Ã8(0) (8Ã(7+Ã3$4!">#Ã)*#Ã? !!]3$:` 073$Ã 1Ã3113)7)3 $] 7)#13$: 1#>$#88
A146:6./1	**B** 6>[#18#Ã8(0) (8Ã(7+Ã3$4!">#Ã)*#Ã? !!]3$:` 1#>"4#>Ã#)7!Ã]#3:*) 3$41#78#Ã3$Ã?#)7!Ã>#7)*8 8^#!#)7!Ã(7!? 1(7)3 $8
ÀP/1Ã-*1.6-.	**B** 6>[#18#Ã8(0) (8Ã(7+Ã3$4!">#Ã)*#Ã? !!]3$:` 3113)7$3 1#>$#88 1#>"4#>Ã#)7!Ã]#3:*) 3$41#78#Ã3$Ã?#)7!Ã>#7)*8 8^#!#)7!Ã(7!? 1(7)3 $8
A1807./*1	**B** 6>[#18#Ã8(0) (8Ã(7+Ã3$4!">#Ã)*#Ã? !!]3$:` 1#>"4#>Ã#)7!Ã]#3:*) 3$41#78#Ã3$Ã?#)7!Ã>#7)*8 8^#!#)7!Ã(7!? 1(7)3 $8

%0:69.0+Ã61+Ã/550+/6.0Ã0220-.7Ã61+Ã6:7*Ã-4*1/-Ã0220-.7Ã2)*5Ã74*).Ã61+Ã:*18Ã.0)5Ã0l(*7,)0

À4*).Ã.0)5Ã0l(*7,)0

E*.01. /6:Ã/550+/6.0Ã 0220-.7	**B** C)Ã7[737/!#9
E*.01. /6:Ã+0:69.0+Ã0220-.7	**B** C)Ã7[737/!#9

Z*1 8Ã.0)5Ã0l(* 7,)0

E*.01. /6:Ã/550+/6.0Ã 0220-.7	**B** C)Ã7[737/!#9
E*.01. /6:Ã+0:69.0+Ã0220-.7	**B** C)Ã7[737/!#9

E*.01. /6:Ã-4)*1/-Ã406:.4Ã0220-.7

C)Ã7[737/!#9

'010)6:	**B** .7+ Ã47"8#Ã>7(7:#Ã) Ã 1:7$8Ã)*1 ":*Ã01 ! $:#>Ã 1Ã1#0#7)#>Ã#\0 81#9
C6)-/1*801 /-/.9	**B** C Ã^$] $Ã83:$3?347$3#4#)8Ã 1Ã4:)34Ã*78/1>89
V , .68 01/-/.9	**B** C Ã^$] $Ã83:$3?347$3#4#)8Ã 1Ã4:)34Ã*78/1>89
#0)6.*801/-/. 9	**B** 2"80#4)#>Ã ?Ã>7(7:3$:Ã)*#Ã"$/ 1$Ã4*3!>9
%0K0:*(501. 6:Ã0220-.7	**B** C Ã^$] $Ã83:$3?347$3#4#)8Ã 1Ã4:)34Ã*78/1>89
!0)./:/.9Ã0220-.7	**B** C Ã^$] $Ã83:$3?347$3#4#)8Ã 1Ã4:)34Ã*78/1>89

U,50)/-6:Ã5067,)07Ã*2Ã.* I /-/.9

- ,.0Ã.* I/-/.9 Ã07./56.07

C)Ã7[737/!#9

Toluene

À0-./*1Ã?G@Ã:'*8 /-6:Ã/12*)56./*1

#* l/-/.9

C)Ã7[737/!# 9

E0)7/7.01-0Ã61+Ã08)6+6;/:/.9

C)Ã7[737/!# 9

`/*6--,5, :6./K0Ã(*.01./6:

E)*+,-.J/1 8)0+/01. Ã1650	Z*8 E*=	`C!	E*.01. /6:
) !"# $#	@9IJ	BF	!]

V *:/:/. 9Ã/1Ã7*/:

À*/:J=6.0)Ã(6)././* 1Ã -*022/-/01 .Ã<a c >

B C)Ã7[737/!# 9

3. 40)Ã6+K0)70Ã0220-.7 **B** C Ã^$] $Ã83:$3?347$)#8Ã 1Ã81341*78/1>89

À0-./*1Ã?M@Ã%'76:Ã-*17/ +0)6./*17

%/7(*76:Ã50.4 *+7 **B** À*#Ã:#$#17)3 $Ã ?Ã]78)#Ã8* "!Ã/#Ã7[3>#>Ã 1Ã(3$(3 3#>Ã]* #1#[#1Ã0 883/!#9ÃÃQ380 87!Ã ?Ã)*38Ã01 >"4)'Ã8 !")3 $8Ã7$>ÃÃ7$,01 >"4)8Ã8* "!>Ã7)ÃÃ(3#8Ã4(0!+Ã]3)*Ã)*#Ã 1#Z"31#(#$)8Ã Ã#$[3$(#$)7!Ã0)#4)3 $Ã7$>Ã7)8)#Ã>380 87!Ã!8!7)$Ã7$>Ã$+Ã 1#:3 $7!Ã! 47!Ã"7)* 13)+Ã#Z"31#(#$)89ÃÃQ380 8#Ã"?0!"8Ã7$>$Ã$,1#4+4!7/!#Ã01 >"4)8Ã [37Ã7Ã4$8#>Ã]78)#Ã>380 87!Ã4 $)174 19ÃÃ78)#Ã8* "!>Ã$)Ã/#Ã380 8#>Ã ?Ã$)1#7)#>Ã) Ã)*#Ã8#]#1Ã"$!#88Ã!?+Ã4 (0!7$)Ã]3)*Ã)*#Ã#Z"31#(#$)8Ã Ã7Ã7)* 13)#8Ã]3*Ãb"138>34)3 $9 _ 78)#Ã0747:3$:Ã8* "!>Ã/# Ã1#44!#>9ÃÃO43#3Ã)3Ã!7$>Ã8!"!>Ã $!+Ã#Ã4 $83>#1#>Ã] *#$Ã1#44!3$:Ã8Ã$)Ã#783/!#9ÃÃ8Ã(7)#137Ã7$>Ã8Ã4$)73$#1Ã(" 8)Ã/#Ã>380 8#>Ã ?Ã3$Ã7Ã 87?#Ã]7+9ÃÃ=71#Ã8* "!>Ã/#Ã)7^#$Ã]*#$7>3:Ã# 0)3#>Ã4 $)73$#1Ã(" 8)Ã/#Ã>380 8#>Ã ?Ã3$Ã7Ã 4!#7$#>Ã 1Ã13$8#>Ã ")9ÃÃ4 $)73$#18Ã 1Ã!3$#78Ã(#)73$Ã(8 #Ã01 >"4)Ã1#8"#89 a70 1Ã?1 Ã01 >"4)Ã1#8"#8Ã(7+Ã41#7)#Ã7Ã*3:#Ã7((7/!# Ã 1Ã#0! 83[#Ã7(80*#1#Ã 3$83>#Ã#Ã4 $)73$#19ÃÃQ Ã$)Ã4#)-ÃÃ 1Ã:13$>Ã"8#>Ã4 $)73$Ã1$!#88Ã)*#Ã*7[#Ã##$Ã 4!#7$#>Ã)* 1":*!+ Ã3$)#1$79ÃÃ6[3>Ã80#18!Ã ?Ã03!#>Ã(7)#137Ã7$>Ã1"$ Ã7$>Ã4 $)74)Ã] 3*Ã8 3Ã] 7)#1] 7+8'Ã>173$8Ã7$>Ã8#]#189

X1/.0+ ÃÀ.6.07ÃTÃLCÃ#l/-Ã46H6)+* , 7Ã=67.0ÃbXbÃZ/7.

A18)0+/01.	C ÀÃF	À.6.,7	L020)01-0Ã 1,5 ;0)
À !"#$ #-Ã%#$#8$#'Ã(#)*+!,	EFH,HH,J	<38)#>	; @@F

À0-./*1Ã?S@Ã/6#7(*).Ã/1 2*)56./*1

	%3#	#%'	V 0l/-*	A/ %'	A #
XUÃ1,5;0)	;CE@BL	;CE@BL	;CE@BL	;CE@BL	;CE@BL
XUÃ()*(0)Ã 74/((/18Ã1650	ÄS<;NCN	ÄS<;NCN	ÄS<;NCN	ÄS<;NCN	ÄS<;NCN
#)617(*).Ã 46H6)+Ã-:677<07>	J 	J 	J 	J 	J 
E6-P/18Ã8)*, (	OO	OO	OO	OO	OO

À0-./*1Ã?S@ÃJ6#7(*).Ã/1 2*)56./*1

"1K/)*1501 .	C 9	C 9	C 9	C 9	C 9
++/./*16:Ã /12*)56./*1	L0(*).6 ;:0ÃQ.61./ .9 EFHFÃ!/8Ã5ÃLÃ%:ÃeEJI9 HKÃ:7Ã5ÃA@EÃ0HL G74^7:#Ã83&#8Ã8*3907Ã 3$Ã"Z$)3)3#8Ã8Ã)*7$Ã)*#Ã01>"4)Ã1#01)7/ !#Ã Z"7$)3)Ã71#Ã$)Ã8"/b#4)Ã) Ã)*#ÃDPÃU1#0 1)#Ã Z"7$)3)ÃA)17$801)7)3 $Ã 1#Z"31# #$)89 Z/5/.0+ÃQ.61./ .9 X#89 E6-P68/18Ã/17.),-./*1 E6770180)Ã6/)-)62. P"7$)3)+Ã3(3)7)3 $`ÃAÃ  C6)8*Ã6/)-) 62. P"7$)3)+Ã3(3)7)3 $`ÃKFÃ À(0-/6:Ã()*K /7/*1 7 O%@'ÃÃLÃE	"I(:*7/K 0ÃZ/5/.Ã1+Ã Z/5/.0+Ãg.61./ .9ÃA+0I E E6770180)ÃC6)9/18Ã L*6+Ã*)ÃL6/:ÃA0I A	,	,	E6770180)Ã61+ÃC6)8*Ã /)-)62P"7$)3)+Ã !3(3)7)3 $`ÃAÃ< C6)8*Ã /)-) 62.Ã319 P"7$)3)+Ã3( 3)7)3$`ÃKFÃ< Z/5/.0+Ãg.61./ ./07ÃT E6770180)Ã /)-)6 2. P"7$)3)+Ã3(3)7)3$`ÃEÃ<

dL020)Ã.*ÃC!LÃS^Ã)*Ã6,.4*)/.9Ã46K18Ã,)/7+/-./* 1>ÃÃ+0.0)5/1 0Ã.40Ã/2*)56. /*1Ã)0Q,/)0+Ã2*)Ã74/501.Ã* 2Ã.40Ã ()*+, -.@fÃ

À(0-/6:Ã()0-6,./*17Ã2 *)Ã,70) B #)617(*).Ã = /.4/1 Ã,70)c7Ã()05/707ÃÃ7!]7+8Ã17$80 1)Ã3$Ã4! 8#>Ã4 $)73$#18Ã)*7)Ã71#Ã "013:*)Ã7$>Ã8#4"#9ÃN$8"1#Ã)*7)Ã0#18 $8Ã01 1)3$:Ã)*#Ã01 >4)Ã$] Ã]*7)Ã) Ã> Ã$Ã)*#Ã #[#$)Ã 7$Ã7443>#$)Ã 1Ã8/9!

#)617(*).Ã/1 Ã;,:PÃ6--*)+/1 8Ã B C)Ã7[737/!# 9
.*Ã 110lÃAAÃ%Z LE3ZÃ
[MJ[RÃ61+Ã.40ÃA`CÃC

À0-./*1Ã?W@ÃL0,*)9 Ã/12*56./*1

X@À@Ã!0+0)6:Ã)08,:6.7*1 B #ÀC ÃR<6>ÃC%LÃ"I05(E6)./6:Ã0I05(. /*1 `ÃC)Ã>#)#1$#>
X1/.0+ ÃÀ.6.07Ã/10.*)9Ã<ÀC ÃR;>ÃÀ38Ã(7)#13Ã38Ã#>Ã 1Ã#\#(0)#>9
C:061Ãh6.0)Ã - .Ã<Ch >ÃM]Ã) !"#$#
C:061Ãh6.0)Ã - .Ã<Ch >ÃM?Ã) !"#$#

C:061Ã /)Ã -.ÃÀÀ0-./*1Ã??G B <38)#>
<;>Ã&6H6)+*, 7Ã /)Ã
E*::,. 61.7Ã<&E7>

C:061Ã /)Ã -.ÃÀ0-./*1ÃY]GÃ B C)Ã!8)#>
C:677ÃAÃÀ,;7.61-07

C:061Ã /)Ã -.ÃÀ0-./*1ÃY]GÃ B C)Ã!8)#>
C:677ÃAAÃÀ,;7.61-07

%" ÃZ/7.ÃAÃ0546:7Ã B C)Ã!8)#>
<E)0-,)7*)ÃC405/-6:7>

%" ÃZ/7.ÃAÃ0C46:7Ã B <38)#>
<"7701./6:ÃC405/-6:7>

À L ÃM]GJM]S

C*5(*7/./* 1J/12)56./* 1Ã*1Ã/18)0+/01.7

À0-./*1Ã?W@ÃL08,*)9 Ã/12*56./*1

C Ã01 >"4)8Ã]#1#Ã?$>9

À L ÃM]SÃLg **B** C)Ã700B47/!#9

À L ÃM??JM?G

C:677/2/-6./*1 **B** M31#Ã*7&>
O((#>37)#ÃU74")#VÃ*#7!)*Ã*7&>
Q#!7-#>ÃU4*1 $3ÃW7!)*Ã*7&71>

C*5(*7/./* 1J/12)56./* 1Ã*1Ã/18)0+/01.7

U650	N	!/)0Ã 46H6)+	À,++ 01Ã)0:0670Ã*2Ã ()077,)0	L06-./K 0	A550+/6. 0Ã <6-,.0> 406:.4Ã 46H6)+	%0:690+Ã <-4)*1 /-> 406:.4Ã 46H6)+
) !"# $#	EFF	X#89	C 9	C 9	X#89	X#89

À L ÃM?M

	E)*+,-.Ã1 650	C ÀÃ1,5; 0)	N
!*)5ÃLÃTÃL0(*)./1 8Ã)0Q,/)0501.7	) !"# $#	EFH,HH,J	EFF
À,((:/0)Ã1*./2-6./*1	) !"# $#	EFH,HH,J	EFF

26D6ÃJEJÃ$)3847)3 $8Ã'8)Ã$)Ã/#Ã>#)74*#>Ã(?1Ã)*#Ã2Q2Ã$7>Ã7$-Ã4 0+3$:Ã3$>Ã1#>38)13/$)Ã3 ?Ã)*#Ã2Q2Ã8*7$ÃÃ3>#Ã
4 0+3$:Ã3$>Ã1#>38)13/$)Ã3 ?Ã)*#Ã$)34#Ã7))74*#>Ã) Ã4 03#3ÃÃ2ÃQ2Ã8"/8#Z"#$)!+Ã1#>38)13/")#>9

À.6.0Ã)08,:6./* 17

V 6776-4,70..7 **B** À*38Ã(7)#13ÃÃ38Ã!38)#>9

U0= Ã$*)P **B** À*38Ã(7)#13ÃÃ38Ã!38)#>9

U0= Ãi0)709 **B** À*38Ã(7)#13ÃÃ38Ã!38)#>9

E01179:K61/6 **B** À*38Ã(7)#13ÃÃ38Ã!38)#>9

C6:/2*)1/6ÃE)*(@ÃYW

h LUAU'BÃÀ38Ã01 >"4)Ã4 $)73$8Ã7Ã43#(7!Ã'] $Ã) Ã)*#Ã2)#Ã ?Ã=7!3$37Ã) Ã47"8#Ã/31)*Ã+#3Ã 1Ã)*#1Ã
1#01 >"4)3[#Ã*7(9

A18)0+/01.Ã1650	C61-0)	L0()*+, -./K 0	U*Ã7/81/2/-61.Ã/7PÃ :0K0:	V 6l/5,5Ã 6--0(.6;:0Ã+* 7680Ã :0K0:
) !"# $#	C 9	X#89	C 9	IFFFÃk:5>7+Ã U3$:#8)3 $V

C616+6Ã/1K01.*)9 **B** À*38Ã(7)#13ÃÃ38Ã!38)#>Ã 1Ã#\#(0)#>9

A1.0)16/*16:Ã)08, :6./*1 7

A1.0)16/*16:Ã:/77 **B** , 7.)6:/6Ã/1K01.*)9Ã<ACÀ>ÃÀ38Ã(7)#13ÃÃ38Ã!38)#>Ã 1Ã#\#(0)#>9
C4/16Ã1K01.*)9Ã<A"CÀC>ÀÀ38Ã(7)#13ÃÃ38Ã!38)#>Ã 1Ã#\#(0)#>9
i6(61Ã/1K01.*)9`ÃÀ38Ã(7)#13ÃÃ38Ã!38)#>Ã 1Ã#\#(0)#>9
a*)06Ã/1K01.*)9`ÃÀ38Ã(7)#13ÃÃ38Ã!38)#>Ã 1Ã#\#(0)#>9
V 6:697/6ÃA1K01.*)9Ã<"&ÀÃL08/7.0)ÃC)Ã>#)#1Ã$#>9
U0= Ã_06:61+ÃAK01.*)9Ã*2ÃC06/-6:7Ã<U_AC>ÀÀ38Ã(7)#13ÃÃ38Ã!38)#>Ã 1Ã#\#(0)#>9
E4/:((/107Ã/1K01.*)9Ã<EACCÀ>ÀÀ38Ã(7)#13ÃÃ38Ã!38)#>Ã 1Ã#\#(0)#>9
#6/= 61Ã/1K01.*)9Ã<CÀUU>C)Ã>#)#1Ã$#>9

C405/-6:Ãh 06(*1 7Ã C*1K01./* 1ÃZ/7Ã-40+,:0Ã AÃC405/-6:7 **B** C)Ã!8)#>

À0-./*1Ã?W@ÃL0 8,*)9 Ã/12*)56./*1

C405/-6:Ãh 06(*1 7Ã **B** C)Ã!8)#>
C*1K01./* 1ÃZ/7Ã-40+,:0Ã
AAÃC405/-6:7

C405/-6:Ãh 06(*1 7Ã **B** C)Ã!8)#>
C*1K01./* 1ÃZ/7Ã-40+,:0Ã
AAAÃC405/-6:7

C616+6

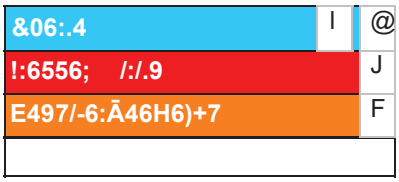
h&V ÃÃ<C616+6> **B** =!788Ã%,@1ÃM(7/!#ÃBZ"3
=!788ÃQ@6`Ã.7)#13Ã47"83$:Ã)#1Ã) \34Ã#4)8ÃUa#1Ã) \34V9
=!788ÃQ@%`Ã.7)#71Ã47"83$:Ã)#1Ã) \34Ã#4)8ÃUÀ\34V9

C"E Ã#I/-Ã7,;7. 61-07 `ÃÀ38Ã(7)#137Ã38Ã$)Ã#>9
C616+/61Ã L"# `ÃÀ38Ã(7)#137Ã38Ã$)Ã#>9
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=!788ÃQ@%`Ã.7)#71Ã47"83$:Ã)#1Ã) \34Ã#4)8ÃUÀ\34V9

&6H6)+*, 7ÃV6.0)/6:ÃA12*)56/*1ÃÀ97.05Ã<X@À@>



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)0()0701./18Ã7/8 1/2/-61 .Ã46H6)+7Ã*)Ã)/7P7Ã.4* ,84 Ã&VÀjÃ)6./18 7Ã6)0Ã1*.Ã)0Q,0+Ã*1ÃÀ%ÀÀ7Ã;1)ÃG^ÃC!LÃ?^?]@
?G]]OÃ.40Ã()0(6)0)Ã569Ã-4 **70Ã.*Ã[*K/+0Ã.405@Ã&VÀjÃ)6./187Ã6)0Ã.*Ã;0Ã70+Ã=/.4Ã6Ã,29Ã/5(:0501.0+Ã& V ÀjÃ**
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-405/-6:7@Ã#40Ã,70)Ã/7Ã)020)+Ã.*Ã0).6/1Ã:/5/.0+ Ã1,5 ;0)Ã*2Ã-405/-6:7Ã= /.4Ã)0-*55 01+0+Ã-:677/2/-6./*17Ã/1Ã
U!E ÃS^Ã61+ÃU!EÃMGWOÃ=4Ã=*,:+ Ã;0Ã,70+Ã67Ã6Ã80:/10Ã*1:9@Ã40.4 0)Ã.40Ã-405/-6:7Ã6)0Ã-:677/2/0+Ã;9ÃU!E Ã
***)Ã1*.OÃ619*10Ã,7/1Ã.40Ã[]SÃ7.9057Ã.* Ã-:677/2Ã-405/-6:7Ã+*07 Ã7*Ã6.Ã0/)Ã*=1Ã)/7P@**

&/7.*)9

%6.0Ã*1Ã()/1./18 **B** A5@F5@A9E

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%6.0Ã*Ã()0K*,7Ã/77,0	B	EF5EK5@F9
\ 0)7/*1	B	F9FL
a09Ã.*Ã6;)0K/6./*1 7	B	6ÀNÃhÃ6")#ÃÀ\343)ÃN8)3(7)# %=MÃhÃ%43$4#$)17)3 $ÃM74) 1 WY2ÃhÃW! /7!ÃY71($3&>Ã2-8)#(Ã?Ã=!7883?7)3 $Ã$>Ã<7/#!3:Ã ?Ã=*#(47!8 O6ÀÃhÃO$)#7)3 $7Ã63ÃÀ7$80 1)Ã68 4 37)$ O%=ÃhÃO$)#>37)#%"!^Ã= $)73$#1 O.QWÃhÃO$)#1$7?3Ã$7 13)3#ÃQ7$:#1 "8ÃW >8 < :G] ÃhÃ713)*(Ã ?Ã)*#Ã 4)7$!5]7)#1Ã071)3$Ã4 #?43#$) .6DGS<ÃIJ5IH ÃhÃO$)#1$7?3Ã= $[# $)3 $Ã?1Ã)*#ÃG1#[#$ $Ã?G !!")3 $ÃM1 (Ã2*38' EBIJÃ78Ã(>3?3#>ÃÃ)*#ÃG1) 4 !Ã ?ÃEBIH9ÃUc.7ÃÃhÃ(713$#ÃO1")3$V ;CÃhÃ;$3)#>ÃC7)3 $6=WOYÃmÃ6#1347$Ã= $#1#$4#Ã ?W [#1$(#$)7!ÃO$"8)137!Ã Y+:3#$38)8 6OY6ÃmÃ6#1347$ÃO$>"8)137?3#$#Ã688 437)3$ =62ÃmÃ=*#(47!Ã6/8)174Ã2#1[6#8 =NG6ÃmÃ=7$7>37$ÃN$[1 $(#$)7!ÃG1)#4)3 $Ã64) =ND=<6ÃmÃ= (01#*#$83[#ÃN$[1 $(#$)7!ÃD#80 $8#'Ã= (0#$87)3 $'Ã?$>Ã<73?3)3)Ã64)Ã UNG6V =MDÃmÃ;$3)#>Ã2)8?#= >#Ã ?ÃM#>#17!ÃD#7)3 $8 =GDÃmÃ= $)1#>ÃG1 >")4)8ÃD#:"!7)$8 Q2<ÃmÃQ (#8)34Ã2"/8)7$4#8Ã<38) W_ GÃmÃW! /?!_71(3$:ÃG)#$)3?! O6D=ÃmÃO$)#1$7?)Ã6:#$4+Ã? 1ÃD#8#71?Ã $Ã=7$4#1 O=6SÃmÃO$)#1$7)?Ã$7?Ã6[3?)3 $ÃS17$387)3$ O$*ÃmÃO$)#3?$ <=ÃmÃ<#)*?Ã! $4#$)17)3 $ <QÃmÃ<#)*?Ã!87:# CQ2<ÃmÃC $,Q (#8)34Ã2"/8)7$4#8Ã<38) COS2YÃmÃC7)3 $?7!$8)3")#ÃS4"07)3 $7!Ã27?#)Ã?$>ÃY#7)* ÀQWÃmÃ=7$7>37$?Ã$80 1)7)3 $Ã ?ÃQ7$:#1 "8ÃW+8Ã64)Ã7$>ÃD#:"?)3 $8 Ä<aÃmÃÄ1#8* !>Ã<3 3)Ãa7!# Ä2=6ÃmÃÄ 4Ã2"/8)7$4#8Ã= $)1 !Ã64) _ NN<ÃmÃ1^0!74#ÃN$[1 $(#$)7!ÃN\0 8"1#Ã<#[#! _ Y.O2ÃmÃ=7$?3?7$Ã_ 1^0!74#ÃY7?1> "8Ã.7)#137!ÃO$1(7)3 $Ã28)#(
L020)01-07	B	C)Ã7[737!# 9

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!/16:Ã+0.0)5/16./* 1Ã*2Ã7,/.6; /:/.9Ã*2Ã61Ã56.0)/6:Ã/7Ã.40Ã7*)0Ã(*1 7/;/:/.9Ã*2Ã.0Ã,70)@Ã:Ã56.0)/6:7Ã569Ã()0701.Ã ,1P1 * = 1Ã46H6)+7Ã61+Ã74;*+Ã; 0Ã,70+Ã=.4Ã-6, ./*1 @Ã.4* ,84 Ã-0).6/1Ã46H6)+7Ã6)0Ã+07-)/;0+Ã40)0/10Ã=611*. Ã 8,6)61. 00Ã.46.Ã4070Ã6)0Ã.40Ã*1:9Ã46H6)+7Ã46/7.@

SAFETY DATA SHEET

Trichloroethylene

This SDS is valid for all grades that start with catalog number 348

1. IDENTIFICATION OF SUBSTANCE / MIXTURE AND OF SUPPLIER

Product Identifier: High Purity Chemicals

Synonyms: 1,1,2-Trichloroethylene Trichloroethene Ethylene trichloride Acetylene trichloride, TCE

Other means of identification: CAS No. 79-01-6
EINECS No. 201-167-4

Recommended use of the chemical and restrictions on use:

Supplier Details:
Pharmco Products, Inc.
58 Vale Road, Brookfield,
CT 06804, USA.
Tel: 203.740.3471
Fax: 203.740.3481
CCN17213

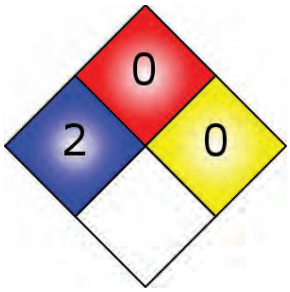
Emergency Contact: **CHEMTREC: 1.800.424.9300 (USA) / +1.703.527.3887 (International)**

2. HAZARDS IDENTIFICATION

OSHA Hazards:
Harmful by ingestion, Irritant

Target Organs:
Central nervous system, Heart, Liver, Lungs

NFPA



GHS label elements, including precautionary statements



Signal Word:
DANGER!

Hazard statement(s)

H315	Causes skin irritation.
H319	Causes serious eye irritation.
H336	May cause drowsiness or dizziness.
H341	Suspected of causing genetic defects.
H350	May cause cancer.
H412	Harmful to aquatic life with long lasting effects.

Precautionary statement(s)

P201	Obtain special instructions before use.
P280	Wear protective gloves and eye and face protection.
P264	Wash hands thoroughly after handling.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P281	Use personal protective equipment as required.
P312	Call a POISON CENTER or doctor/ physician if you feel unwell.
P302 + P352	IF ON SKIN: Wash with plenty of soap and water.
P304 + P340	IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing.
P305 + P351 + P338	IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. Seek medical attention.

P321	Specific treatment (see supplemental first aid instructions on this label).
P332 + P313	If skin irritation occurs: Get medical advice/ attention.
P362	Take off contaminated clothing and wash before reuse.
P202	Do not handle until all safety precautions have been read and understood.
P261	Avoid breathing dust/fumes/gas/mist/vapors.
P501	Dispose of contents and container to an approved waste disposal plant.
P271	Use only outdoors or in a well-ventilated area.
P273	Avoid release to the environment.
P403 + P233	Store in a well-ventilated place. Keep container tightly closed.
P405	Store locked up.

GHS Classification(s)
Skin irritation (Category 2)
Carcinogenicity (Category 1B)
Specific target organ toxicity - single exposure (Category 3)
Chronic aquatic toxicity (Category 3)
Eye irritation (Category 2)
Germ cell mutagenicity (Category 2)

Other hazards which do not result in classification:

Potential Health Effects:

Organ	Description
Eyes	Causes eye irritation.
Ingestion	Harmful if swallowed.
Inhalation	May be harmful if inhaled. Causes respiratory tract irritation.
Skin	Harmful if absorbed through skin. Causes skin irritation.

3. COMPOSITION AND INFORMATION ON INGREDIENTS

Chemical identity:	Trichloroethylene
Common name / Synonym:	TCE; 1,1,2-Trichloroethylene Trichloroethene Ethylene trichloride Acetylene trichloride
CAS number:	79-01-6
EINECS number:	201-167-4
ICSC number:	0081
RTECS #:	KX4550000
UN #:	1710
EC #:	602-027-00-9

% Weight	Material	CAS
100	Trichloroethylene	79-01-6

4. FIRST AID MEASURES

Skin

Wash skin with soap and copious amounts of water.

Inhalation

Remove person to fresh air. If signs/symptoms continue, get medical attention. Give oxygen or artificial respiration as needed.

Eyes

Thoroughly flush the eyes with large amounts of clean low-pressure water for at least 15 minutes, occasionally lifting the upper and lower eyelids. If irritation persists, seek medical attention.

Ingestion

DO NOT induce vomiting. If vomiting does occur, have victim lean forward to prevent aspiration. Rinse mouth with water. Seek medical attention. Never give anything by mouth to an unconscious individual.

5. FIRE FIGHTING MEASURES

Suitable (and unsuitable) extinguishing media:

Use water spray, alcohol-resistant foam, dry chemical or carbon dioxide.

Specific hazards arising from the chemical (e.g., nature of any hazardous combustion products):

Carbon oxides, hydrogen chloride gas are expected to be the primary hazardous combustion products.

Special protective equipment and precautions for firefighters:

Wear self-contained breathing apparatus and protective clothing to prevent contact with skin and eyes. Keep unopened containers cool by spraying with water.

Classification

Not flammable or combustible.

6. ACCIDENTAL RELEASE MEASURES

Personal precautions, protective equipment and emergency procedures:

Use personal protective equipment. Avoid dust formation. Do not inhale vapors, mist or gas. Ensure adequate ventilation. Evacuate personnel to safe areas. Avoid breathing dust.

Environmental precautions:

Stop leak. Contain spill if possible and safe to do so. Prevent product from entering drains.

Methods and materials for containment and cleaning up:

Absorb with an inert dry material and place in an appropriate waste disposal container. Keep disposal containers closed when finished.

7. HANDLING AND STORAGE

Precautions for safe handling:

Do not get on skin or in eyes. Avoid formation of dust and aerosols. Provide proper exhaust ventilation system in areas where dust forms.

Conditions for safe storage, including any incompatibilites:

Keep container closed in a dry, well ventilated location. Handle under inert gas. Light sensitive.

8. EXPOSURE CONTROLS / PERSONAL PROTECTION

Control parameters, e.g., occupational exposure limit values or biological limit values:

Occupational Exposure Limits

Component	Source	Type	Value	Note
Trichloroethylene	US (ACGIH)	TWA	10 ppm	ACGIH Hreshold Exposure Limit Values
Trichloroethylene	US (OSHA)	TWA	100 ppm	OSHA Occupational Exposure Limits (Table Z2)
Trichloroethylene	US (OSHA)	TWA	50 ppm / 270 mg/m3	29 CFR 1910.1000 Table Z-1 Limits for Air Contaminants.

Individual protection measures, such as personal protective equipment:

Respiratory protection:

Where protection from nuisance levels of dusts are desired, use type N95 (US) or type P1 (EN 143) dust masks. For higher level protection use type OV/AG/P99 (US) or type ABEK-P2 (EU EN 143) respirator cartridges. Use respirators and components tested and approved under appropriate government standards such as NIOSH (US) or CEN (EU).

Hand protection:

Handle with gloves. Gloves must be inspected prior to use. Use proper glove removal technique (without touching glove's outer surface) to avoid skin contact with this product. Dispose of contaminated gloves after use in accordance with applicable laws and good laboratory practices. Wash and dry hands.

Eye protection:

Use chemical safety goggles and/or a full face shield where splashing is possible. Use equipment approved by appropriate government standards, such as NIOSH (US) or EN166 (EU) Maintain eye wash fountain and quick-drench facilities in work area.

Skin and body protection:

Choose body protection according to the amount and concentration of the dangerous substance at the work place.

Hygiene measures:

Handle in accordance with good industrial hygiene and safety practice. Wash hands before breaks and at the end of workday.

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance *(physical state, color, etc.)*	Clear colorless liquid
Freezing point	-84.8 °C (-120.6 °F)
Initial boiling point and boiling range	86.7 °C (188.1 °F)
Upper / Lower flammability or explosive limits	8 %(V) / 10.5 %(V)
Vapor pressure	81.3 hPa (61.0 mmHg) at 20.0 °C (68.0 °F)
Relative Density	1.463 g/mL at 25 °C (77 °F)
Solubility(ies)	Slightly soluble in water.
Partition coefficient n-octanol/water(ies)	log Pow: 2.29
Auto-ignition temperature	410 °C (770 °F)
Formula (Trichloroethylene)	C2HCL3
Molecular Weight (Trichloroethylene)	131.39 g/mol

10. STABILITY AND REACTIVITY

Chemical Stability	Stable under recommended storage conditions.
Possibility of hazardous reactions	No data available
Conditions to avoid (e.g., static discharge, shock or vibration)	OPEN FLAME,IGNITION SOURCES,HOT SURFACES.
Incompatible materials	Oxidizing agents, Strong bases, Magnesium
Hazardous decomposition products	Hazardous decomposition products formed under fire conditions. - Carbon oxides, hydrogen chloride gas

11. TOXICOLOGICAL INFORMATION

- Trichloroethylene 79-01-6

Product Summary:
No data available for the teratogenic, mutagenic, or reproductive toxicity effects of this product.

Acute Toxicity:

LC50 (Inhalation)	Mouse	8450 ppm	4 hours
LD50 (Dermal)	Rabbit	> 20,000 mg/kg	
LD50 (Oral)	Rat	4920 mg/kg	

Irritation:

Eyes
Rabbit - eye irritation - 24 hours

Skin
Rabbit - Severe skin irritation - 24 hours

Carcinogenicity
IARC: Group 2A: Probably carcinogenic to humans
ACGIH: No data is available.
NTP: Reasonably anticipated to be a human carcinogen
OSHA: No component of this product present at levels greater than or equal to 0.1% is identified as a carcinogen or potential carcinogen by OSHA.

Other Hazards

Organ	Description
Eyes	Causes eye irritation.
Ingestion	Harmful if swallowed.
Inhalation	May be harmful if inhaled. Causes respiratory tract irritation.
Skin	Harmful if absorbed through skin. Causes skin irritation.

12. ECOLOGICAL INFORMATION

- Trichloroethylene 79-01-6

Ecotoxicity (aquatic and terrestrial, where available):
Acut algae toxicity (Trichloroethylene)
IC50 / 96h / green algae - 175.00 mg/l

Acute daphnia toxicity (Trichloroethylene)
EC50 / 48h / Water flea - 18.00 mg/l

Acute Fish Toxicity (Trichloroethylene)
LC50 / 96h / Fathead minnow - 41mg/l

Bioaccumulative potential:
Does not bioaccumulate.

13. DISPOSAL CONSIDERATIONS

Description of waste residues and information on their safe handling and methods of disposal, including the

disposal of any contaminated packaging:

Offer surplus and non-recyclable solutions to a licensed disposal company.

14. TRANSPORT INFORMATION

Description of waste residues and information on their safe handling and methods of disposal:

UN number	1710
UN proper shipping name	Trichloroethylene
Transport hazard class(es)	6.1
Packing group *(if applicable)*	III

Reportable Quantity

100

IMDG

UN-Number: 1710 Class: 6.1 Packing Group: III

EMS-No: F-A, S-A

Proper shipping name: TRICHLOROETHYLENE

Marine pollutant: No

IATA

UN-Number: 1710 Class: 6.1 Packing Group: III

Proper shipping name: Trichloroethylene

15. REGULATORY INFORMATION

Safety, health and environmental regulations specific for the product in question:

OSHA Hazards

Harmful by ingestion, Irritant

All ingredients are on the following inventories or are exempted from listing

Country	Notification
Australia	AICS
Canada	DSL
China	IECS
European Union	EINECS
Japan	ENCS/ISHL
Korea	ECL
New Zealand	NZIoC
Philippines	PICCS
United States of America	TSCA

SARA 302 Components

SARA 302: No chemicals in this material are subject to the reporting requirements of SARA Title III, Section 302.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:
Trichloroethylene CAS-No. 79-01-6 Revision Date 2007-07-01

SARA 311/312 Hazards
Acute Health Hazard
Chronic Health Hazard

CERCLA
Ammonium chloride CAS-No. 506-87-6, RQ: 5,000 lbs.

Massachusetts Right To Know Components
Trichloroethylene CAS-No. 79-01-6 Revision Date 2007-07-01

Pennsylvania Right To Know Components
Trichloroethylene CAS-No. 79-01-6 Revision Date 2007-07-01

New Jersey Right To Know Components
Trichloroethylene CAS-No. 79-01-6 Revision Date 2007-07-01

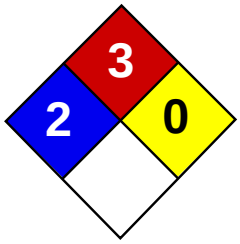
California Prop 65 Components
WARNING! This product contains a chemical known to the State of California to cause cancer. Trichloroethylene CAS-No. 79-01-6 Revision Date 2008-10-10

16. OTHER INFORMATION: INCLUDING INFORMATION ON PREPARATION AND REVISION OF THE SDS

Disclaimer
PHARMCO-AAPER believes that the information on this SDS was obtained from reliable sources. However, the information is provided without any warranty, expressed or implied, regarding its correctness. Some information presented and conclusions drawn herein are from sources other than direct test data on the substance itself. The conditions or methods of handling, storage, use and disposal of the product are beyond our control and may be beyond our knowledge. For this and other reasons, PHARMCO-AAPER does not assume responsibility and expressly disclaims liability for loss, damage, or expense arising out of or in any way connected with handling, storage, use, or disposal of this product. If the product is used as a component in another product, this SDS information may not be applicable. Information is correct to the best of our knowledge at the date of the SDS publication.

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Material Safety Data Sheet
m-Xylene MSDS

Section 1: Chemical Product and Company Identification

Product Name: m-Xylene

Catalog Codes: SLX1066

CAS#: 108-38-3

RTECS: ZE2275000

TSCA: TSCA 8(b) inventory: m-Xylene

CI#: Not applicable.

Synonym: m-Methyltoluene

Chemical Name: 1,3-Dimethylbenzene

Chemical Formula: C6H4(CH3)2

Contact Information:

Sciencelab.com, Inc.
14025 Smith Rd.
Houston, Texas 77396

US Sales: **1-800-901-7247**
International Sales: **1-281-441-4400**

Order Online: ScienceLab.com

CHEMTREC (24HR Emergency Telephone), call:
1-800-424-9300

International CHEMTREC, call: 1-703-527-3887

For non-emergency assistance, call: 1-281-441-4400

Section 2: Composition and Information on Ingredients

Composition:

Name	CAS #	% by Weight
{m-}Xylene	108-38-3	100

Toxicological Data on Ingredients: m-Xylene: ORAL (LD50): Acute: 5000 mg/kg [Rat.]. DERMAL (LD50): Acute: 14100 mg/kg [Rabbit.].

Section 3: Hazards Identification

Potential Acute Health Effects:
Very hazardous in case of skin contact (irritant), of eye contact (irritant). Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation. Inflammation of the eye is characterized by redness, watering, and itching. Skin inflammation is characterized by itching, scaling, reddening, or, occasionally, blistering.

Potential Chronic Health Effects:
Hazardous in case of skin contact (irritant), of eye contact (irritant). Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation. CARCINOGENIC EFFECTS: Not available. MUTAGENIC EFFECTS: Not available. TERATOGENIC EFFECTS: Not available. DEVELOPMENTAL TOXICITY: Not available. The substance is toxic to blood, kidneys, the nervous system, liver. Repeated or prolonged exposure to the substance can produce target organs damage.

Section 4: First Aid Measures

Eye Contact: Check for and remove any contact lenses. Do not use an eye ointment. Seek medical attention.

Skin Contact:
After contact with skin, wash immediately with plenty of water. Gently and thoroughly wash the contaminated skin with running water and non-abrasive soap. Be particularly careful to clean folds, crevices, creases and groin. Cover the irritated skin with an emollient. If irritation persists, seek medical attention. Wash contaminated clothing before reusing.

Serious Skin Contact:
Wash with a disinfectant soap and cover the contaminated skin with an anti-bacterial cream. Seek medical attention.

Inhalation: Allow the victim to rest in a well ventilated area. Seek immediate medical attention.

Serious Inhalation: Not available.

Ingestion:
Do not induce vomiting. Loosen tight clothing such as a collar, tie, belt or waistband. If the victim is not breathing, perform mouth-to-mouth resuscitation. Seek immediate medical attention.

Serious Ingestion: Not available.

Section 5: Fire and Explosion Data

Flammability of the Product: Flammable.

Auto-Ignition Temperature: 527°C (980.6°F)

Flash Points: CLOSED CUP: 25°C (77°F). OPEN CUP: 28.9°C (84°F) (Cleveland).

Flammable Limits: LOWER: 1.1% UPPER: 7%

Products of Combustion: These products are carbon oxides (CO, CO2).

Fire Hazards in Presence of Various Substances: Highly flammable in presence of open flames and sparks, of heat.

Explosion Hazards in Presence of Various Substances:
Risks of explosion of the product in presence of mechanical impact: Not available. Risks of explosion of the product in presence of static discharge: Not available.

Fire Fighting Media and Instructions:
Flammable liquid, insoluble in water. SMALL FIRE: Use DRY chemical powder. LARGE FIRE: Use water spray or fog. Cool containing vessels with water jet in order to prevent pressure build-up, autoignition or explosion.

Special Remarks on Fire Hazards:
Explosive in the form of vapor when exposed to heat or flame. Vapor may travel considerable distance to source of ignition and flash back. When heated to decomposition it emits acrid smoke and irritating fumes.

Special Remarks on Explosion Hazards: Not available.

Section 6: Accidental Release Measures

Small Spill: Absorb with an inert material and put the spilled material in an appropriate waste disposal.

Large Spill:
Flammable liquid, insoluble in water. Keep away from heat. Keep away from sources of ignition. Stop leak if without risk. Absorb with DRY earth, sand or other non-combustible material. Do not get water inside container. Do not touch spilled material. Prevent entry into sewers, basements or confined areas; dike if needed. Eliminate all ignition sources. Call for assistance on disposal. Be careful that the product is not present at a concentration level above TLV. Check TLV on the MSDS and with local authorities.

Section 7: Handling and Storage

Precautions:
Keep away from heat. Keep away from sources of ignition. Ground all equipment containing material. Do not ingest. Do not breathe gas/fumes/ vapour/spray. If ingested, seek medical advice immediately and show the container or the label. Avoid contact with skin and eyes Keep away from incompatibles such as oxidizing agents.

Storage:
Flammable materials should be stored in a separate safety storage cabinet or room. Keep away from heat. Keep away from sources of ignition. Keep container tightly closed. Keep in a cool, well-ventilated place. Ground all equipment containing material. A refrigerated room would be preferable for materials with a flash point lower than 37.8°C (100°F).

Section 8: Exposure Controls/Personal Protection

Engineering Controls:
Provide exhaust ventilation or other engineering controls to keep the airborne concentrations of vapors below their respective threshold limit value. Ensure that eyewash stations and safety showers are proximal to the work-station location.

Personal Protection: Splash goggles. Lab coat. Gloves.

Personal Protection in Case of a Large Spill:
Splash goggles. Full suit. Boots. Gloves. Suggested protective clothing might not be sufficient; consult a specialist BEFORE handling this product.

Exposure Limits:
TWA: 100 STEL: 150 (ppm) from ACGIH (TLV) TWA: 434 STEL: 651 (mg/m3) from ACGIHConsult local authorities for acceptable exposure limits.

Section 9: Physical and Chemical Properties

Physical state and appearance: Liquid. (Liquid.)

Odor: Not available.

Taste: Not available.

Molecular Weight: 106.17 g/mole

Color: Colorless.

pH (1% soln/water): Not applicable.

Boiling Point: 139.3°C (282.7°F)

Melting Point: -47.87°C (-54.2°F)

Critical Temperature: Not available.

Specific Gravity: 0.86 (Water = 1)

Vapor Pressure: 6 mm of Hg (@ 20°C)

Vapor Density: 3.7 (Air = 1)

Volatility: Not available.

Odor Threshold: 0.62 ppm

Water/Oil Dist. Coeff.: Not available.

Ionicity (in Water): Not available.

Dispersion Properties: See solubility in water, methanol, diethyl ether.

Solubility:
Easily soluble in methanol, diethyl ether. Insoluble in cold water, hot water.

Section 10: Stability and Reactivity Data

Stability: The product is stable.

Instability Temperature: Not available.

Conditions of Instability: Not available.

Incompatibility with various substances: Reactive with oxidizing agents.

Corrosivity: Non-corrosive in presence of glass.

Special Remarks on Reactivity: Not available.

Special Remarks on Corrosivity: Not available.

Polymerization: No.

Section 11: Toxicological Information

Routes of Entry: Eye contact.

Toxicity to Animals:
Acute oral toxicity (LD50): 5000 mg/kg [Rat.]. Acute dermal toxicity (LD50): 14100 mg/kg [Rabbit.].

Chronic Effects on Humans: The substance is toxic to blood, kidneys, the nervous system, liver.

Other Toxic Effects on Humans:
Very hazardous in case of skin contact (irritant). Slightly hazardous in case of skin contact (permeator), of ingestion, of inhalation.

Special Remarks on Toxicity to Animals: Not available.

Special Remarks on Chronic Effects on Humans:
0347 Animal: embryotoxic, foetotoxic, passes through the placental barrier. 0900 Detected in maternal milk in human. Narcotic effect; may cause nervous system disturbances.

Special Remarks on other Toxic Effects on Humans: Material is irritating to mucous membranes and upper respiratory tract.

Section 12: Ecological Information

Ecotoxicity: Not available.

BOD5 and COD: Not available.

Products of Biodegradation:
Possibly hazardous short term degradation products are not likely. However, long term degradation products may arise.

Toxicity of the Products of Biodegradation: The products of degradation are more toxic.

Special Remarks on the Products of Biodegradation: Not available.

Section 13: Disposal Considerations

Waste Disposal:

Section 14: Transport Information

DOT Classification: Class 3: Flammable liquid.

Identification: : Xylene : UN1307 PG: III

Special Provisions for Transport: Not available.

Section 15: Other Regulatory Information

Federal and State Regulations:
Pennsylvania RTK: m-Xylene Massachusetts RTK: m-Xylene TSCA 8(b) inventory: m-Xylene SARA 313 toxic chemical notification and release reporting: m-Xylene CERCLA: Hazardous substances.: m-Xylene

Other Regulations: OSHA: Hazardous by definition of Hazard Communication Standard (29 CFR 1910.1200).

Other Classifications:

WHMIS (Canada):
CLASS B-2: Flammable liquid with a flash point lower than 37.8°C (100°F). CLASS D-2B: Material causing other toxic effects (TOXIC).

DSCL (EEC):
R10- Flammable. R38- Irritating to skin. R41- Risk of serious damage to eyes.

HMIS (U.S.A.):

Health Hazard: 2

Fire Hazard: 3

Reactivity: 0

Personal Protection: j

National Fire Protection Association (U.S.A.):

Health: 2

Flammability: 3

Reactivity: 0

Specific hazard:

Protective Equipment:
Gloves. Lab coat. Wear appropriate respirator when ventilation is inadequate. Splash goggles.

Section 16: Other Information

References:
-Hawley, G.G.. The Condensed Chemical Dictionary, 11e ed., New York N.Y., Van Nostrand Reinold, 1987. -Material safety data sheet emitted by: la Commission de la SantÃ© et de la SÃ©curitÃ© du Travail du QuÃ©bec. -SAX, N.I. Dangerous Properties of Indutrial Materials. Toronto, Van Nostrand Reinold, 6e ed. 1984. -The Sigma-Aldrich Library of Chemical Safety Data, Edition II. -Guide de la loi et du rÃ¨glement sur le transport des marchandises dangeureuses au canada. Centre de conformitÃ© internatinal LtÃ©e. 1986.

Other Special Considerations: Not available.

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Tel: 514-956-7503
Fax: 514-956-7504
Internet: www.megs.ca
Email : support@megs.ca

O-XYLENE- MATERIAL SAFETY DATA SHEET

TABLE OF CONTENTS:

1. Chemical Product and Company Identification
2. Composition, Information on Ingredients
3. Hazards Identification
4. First Aid Measures
5. Fire Fighting Measures
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7. Handling and Storage
8. Exposure Controls, Personal Protection
9. Physical and Chemical Properties
10. Stability and Reactivity
11. Toxicological Information
12. Ecological Information
13. Disposal Considerations
14. Transport Information
15. Regulatory Information
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24 Hour EMERGENCY CONTACT

U.S- CHEMTREC 1-800-424-9300

CANADA- CANUTEC 613-996-6666

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

Up to Table of Contents

Matheson Tri-Gas, Inc.

The telephone numbers listed below are emergency numbers, please contact your local branch for routine inquiries.

USA	CANADA
959 Route 46 East	530 Watson Street
Parsippany, New Jersey	Whitby, Ontario
07054-0624 USA	L1N 5R9 Canada
Phone: 973-257-1100	**Phone:** 905-668-3570

SUBSTANCE: O-XYLENE

SYMBOL: C_6H_6

TRADE NAMES/SYNONYMS:
BENZENE, 1,2-DIMETHYL-; O-DIMETHYLBENZENE; 1,2-DIMETHYLBENZENE; O-METHYLTOLUENE; ORTHO-XYLENE; 1,2-XYLENE; O-XYLOL; RCRA U239; STCC 4909349; UN 1307; O-5081; MAT17180; RTECS ZE2450000

CHEMICAL FAMILY: hydrocarbons, aromatic

CREATION DATE: Jan 24 1989
REVISION DATE: Mar 16 1999

2. COMPOSITION, INFORMATION ON INGREDIENTS

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COMPONENT: O-XYLENE

CAS NUMBER: 95-47-6

EC NUMBER (EINECS): 202-422-2

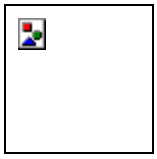
EC INDEX NUMBER: 601-022-00-9

PERCENTAGE: 100.0

3. HAZARDS IDENTIFICATION

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NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=3 REACTIVITY=0

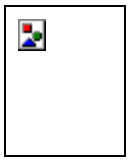


WHMIS CLASSIFICATION: BD2

EC CLASSIFICATION (ASSIGNED):
Flammable
Xn Harmful
Xi Irritant

R 10-20/21-38

EC Classification may be inconsistent with independently-researched data.



EMERGENCY OVERVIEW:

Color: colorless

Physical Form: liquid

Odor: sweet odor

Major Health Hazards: respiratory tract irritation, skin irritation, eye irritation, central nervous system depression

Physical Hazards: Flammable liquid and vapor. Vapor may cause flash fire.

POTENTIAL HEALTH EFFECTS:

INHALATION:
Short Term Exposure: irritation, low body temperature, ringing in the ears, nausea, vomiting, stomach pain, headache, drowsiness, symptoms of drunkenness, visual disturbances, lung congestion, kidney damage, liver damage, coma
Long Term Exposure: same as effects reported in short term exposure, tingling sensation, menstrual disorders, infertility, blood disorders, reproductive effects

SKIN CONTACT:
Short Term Exposure: irritation, blisters
Long Term Exposure: same as effects reported in short term exposure, rash

EYE CONTACT:
Short Term Exposure: irritation (possibly severe), tearing
Long Term Exposure: same as effects reported in short term exposure, blurred vision

INGESTION:
Short Term Exposure: same as effects reported in short term inhalation, digestive disorders, aspiration hazard
Long Term Exposure: reproductive effects

CARCINOGEN STATUS:
OSHA: N
NTP: N
IARC: N

4. FIRST AID MEASURES

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INHALATION:
When safe to enter area, remove from exposure. Use a bag valve mask or similar device to perform artificial respiration (rescue breathing) if needed. Keep warm and at rest. Get medical attention immediately.

SKIN CONTACT:
Remove contaminated clothing, jewelry, and shoes immediately. Wash with soap or mild detergent and large amounts of water until no evidence of chemical remains (at least 15-20 minutes). Get medical attention, if needed.

EYE CONTACT:
Wash eyes immediately with large amounts of water or normal saline, occasionally lifting upper and lower lids, until no evidence of chemical remains. Get medical attention immediately.

INGESTION:

If vomiting occurs, keep head lower than hips to help prevent aspiration. Get medical attention, if needed.

5. FIRE FIGHTING MEASURES

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FIRE AND EXPLOSION HAZARDS:
Severe fire hazard. Vapor/air mixtures are explosive. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back. Electrostatic discharges may be generated by flow or agitation resulting in ignition or explosion.

EXTINGUISHING MEDIA:
regular dry chemical, carbon dioxide, water, regular foam

Large fires: Use regular foam or flood with fine water spray.

FIRE FIGHTING:
Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck: Evacuation radius: 800 meters (1/2 mile). Water may be ineffective.

FLASH POINT:
63 F (17 C)

LOWER FLAMMABLE LIMIT:
0.9%

UPPER FLAMMABLE LIMIT:
6.7%

AUTOIGNITION:
865 F (463 C)

FLAMMABILITY CLASS (OSHA):
IB

6. ACCIDENTAL RELEASE MEASURES

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AIR RELEASE:
Reduce vapors with water spray. Stay upwind and keep out of low areas.

SOIL RELEASE:
Trap spilled material at bottom in deep water pockets, excavated holding areas or within sand bag barriers. Dike for later disposal. Absorb with sand or other non-combustible material. Collect with absorbent into suitable container.

WATER RELEASE:
Cover with absorbent sheets, spill-control pads or pillows. Neutralize. Collect with absorbent into suitable container. Absorb with activated carbon. Remove trapped material with suction hoses. Collect spilled material using mechanical equipment.

OCCUPATIONAL RELEASE:
Avoid heat, flames, sparks and other sources of ignition. Stop leak if possible without personal risk. Reduce vapors with water spray. Small spills: Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Large spills: Dike for later disposal. Remove sources of ignition. Keep unnecessary people away, isolate hazard area and deny entry. Reportable Quantity (RQ): Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

7. HANDLING AND STORAGE

Up to Table of Contents

Store and handle in accordance with all current regulations and standards. Store and handle in accordance with all current regulations and standards. Grounding and bonding required. Protect from physical damage. Store outside or in a detached building. Store with flammable liquids. Keep separated from incompatible substances. Keep separated from incompatible substances. Subject to storage regulations: U.S. OSHA 29 CFR 1910.106. Grounding and bonding required. Keep separated from incompatible substances.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

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EXPOSURE LIMITS:

O-XYLENE:
XYLENE:
100 ppm (434 mg/m3) OSHA TWA
150 ppm (651 mg/m3) OSHA STEL (vacated by 58 FR 35338, June 30, 1993)
100 ppm (434 mg/m3) ACGIH TWA
150 ppm (651 mg/m3) ACGIH STEL
100 ppm (434 mg/m3) NIOSH recommended TWA 10 hour(s)
150 ppm (651 mg/m3) NIOSH recommended STEL

VENTILATION: Provide local exhaust ventilation system. Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Ensure compliance with applicable exposure limits. Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Provide local exhaust ventilation system.

EYE PROTECTION: Wear splash resistant safety goggles. Provide an emergency eye wash fountain and quick drench shower in the immediate work area. Wear splash resistant safety goggles with a faceshield. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: Wear appropriate chemical resistant gloves. Wear appropriate chemical resistant gloves.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.
900 ppm
Any chemical cartridge respirator with organic vapor cartridge(s).

Any powered, air-purifying respirator with organic vapor cartridge(s).
Any supplied-air respirator.
Any self-contained breathing apparatus with a full facepiece.
Escape -
Any air-purifying respirator with a full facepiece and an organic vapor canister.
Any appropriate escape-type, self-contained breathing apparatus.
For Unknown Concentrations or Immediately Dangerous to Life or Health -
Any supplied-air respirator with full facepiece and operated in a pressure-demand or other positive-pressure mode in combination with a separate escape supply.
Any self-contained breathing apparatus with a full facepiece.

9. PHYSICAL AND CHEMICAL PROPERTIES

Up to Table of Contents

PHYSICAL STATE: liquid

APPEARANCE: clear

COLOR: colorless

ODOR: sweet odor

MOLECULAR WEIGHT: 106.17

MOLECULAR FORMULA: C8-H10

BOILING POINT: 291 F (144 C)

FREEZING POINT: -13 F (-25 C)

VAPOR PRESSURE: 5.2 mmHg @ 25 C

VAPOR DENSITY (air=1): 3.7

SPECIFIC GRAVITY (water=1): 0.8802

WATER SOLUBILITY: 0.0175% @ 20 C

PH: Not available

VOLATILITY: 100%

ODOR THRESHOLD: <1 ppm

EVAPORATION RATE: 0.7 (butyl acetate=1)

COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available

SOLVENT SOLUBILITY:
Soluble: alcohol, ether, benzene, acetone, organic solvents

10. STABILITY AND REACTIVITY

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REACTIVITY:
Stable at normal temperatures and pressure.

CONDITIONS TO AVOID:
Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat. Keep out of water supplies and sewers.

INCOMPATIBILITIES:
oxidizing materials

HAZARDOUS DECOMPOSITION:
Thermal decomposition products: oxides of carbon

POLYMERIZATION:
Will not polymerize.

11. TOXICOLOGICAL INFORMATION

Up to Table of Contents

O-XYLENE:

TOXICITY DATA:
3617 mg/kg oral-rat LD50 (Phillips)

LOCAL EFFECTS:
Irritant: inhalation, skin, eye

ACUTE TOXICITY LEVEL:
Moderately Toxic: ingestion

TARGET ORGANS: central nervous system

REPRODUCTIVE EFFECTS DATA: Available.

ADDITIONAL DATA: Alcohol may enhance the toxic effects. Stimulants such as epinephrine may induce ventricular fibrillation.

12. ECOLOGICAL INFORMATION

Up to Table of Contents

ECOTOXICITY DATA:

FISH TOXICITY:
16400 ug/L 96 hour(s) LC50 (Mortality) Fathead minnow (Pimephales promelas)

INVERTEBRATE TOXICITY:
200 mg/L 24 hour(s) EC100 (Abundance) Water flea (Daphnia magna)

ALGAL TOXICITY:
4200 ug/L 8 hour(s) EC50 (Growth) Green algae (Selenastrum capricornutum)

OTHER TOXICITY:
73000 ug/L 48 hour(s) LC50 (Mortality) Clawed toad (Xenopus laevis)

13. DISPOSAL CONSIDERATIONS

Up to Table of Contents

Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): U239.

14. TRANSPORT INFORMATION

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U.S. DOT 49 CFR 172.101. SHIPPING NAME-UN NUMBER; HAZARD CLASS; PACKING GROUP; LABEL:
Xylenes-UN1307; 3; II; Flammable liquid



15. REGULATORY INFORMATION

Up to Table of Contents

U.S. REGULATIONS:
TSCA INVENTORY STATUS: Y

TSCA 12(b) EXPORT NOTIFICATION: Not listed.

CERCLA SECTION 103 (40CFR302.4): Y
Xylene: 100 LBS RQ

SARA SECTION 302 (40CFR355.30): N

SARA SECTION 304 (40CFR355.40): N

SARA SECTION 313 (40CFR372.65): Y
Xylene

SARA HAZARD CATEGORIES, SARA SECTIONS 311/312 (40CFR370.21):
ACUTE: Y
CHRONIC: N
FIRE: Y
REACTIVE: N
SUDDEN RELEASE: N

OSHA PROCESS SAFETY (29CFR1910.119): N

STATE REGULATIONS:
California Proposition 65: N

EUROPEAN REGULATIONS:

EC NUMBER (EINECS): 202-422-2

EC RISK AND SAFETY PHRASES:

R 10	Flammable.
R 20/21	Harmful by inhalation and in contact with skin.
R 38	Irritating to skin.
S 2	Keep out of reach of children.
S 25	Avoid contact with eyes.

CONCENTRATION LIMITS:
C>=20% Xn R 20/21-38
12.5%<=C<20% Xn R 20/21

16. OTHER INFORMATION

Up to Table of Contents

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MATERIAL SAFETY DATA SHEET

1. CHEMICAL PRODUCT AND COMPANY IDENTIFICATION

MATHESON TRI-GAS, INC.
150 Allen Road Suite 302
Basking Ridge, New Jersey 07920
Information: 1-800-416-2505

Emergency Contact:
CHEMTREC 1-800-424-9300
Calls Originating Outside the US:
703-527-3887 (Collect Calls Accepted)

SUBSTANCE: P-XYLENE

TRADE NAMES/SYNONYMS:
MTG MSDS 124; BENZENE, 1,4-DIMETHYL-; P-DIMETHYLBENZENE; 1,4-DIMETHYLBENZENE; P-METHYLTOLUENE; 4-METHYLTOLUENE; 1,4-XYLENE; P-XYLOL; RCRA U239; STCC 4909351; UN 1307; O-5082; MAT17940; RTECS ZE2625000

CHEMICAL FAMILY: hydrocarbons, aromatic

CREATION DATE: Jan 24 1989
REVISION DATE: Dec 11 2008

2. COMPOSITION, INFORMATION ON INGREDIENTS

COMPONENT: P-XYLENE
CAS NUMBER: 106-42-3
PERCENTAGE: 100.0

3. HAZARDS IDENTIFICATION

NFPA RATINGS (SCALE 0-4): HEALTH=2 FIRE=3 REACTIVITY=0



EMERGENCY OVERVIEW:
COLOR: colorless
PHYSICAL FORM: liquid
ODOR: sweet odor
MAJOR HEALTH HAZARDS: respiratory tract irritation, skin irritation, eye irritation, central nervous system depression
PHYSICAL HAZARDS: Flammable liquid and vapor. Vapor may cause flash fire.

POTENTIAL HEALTH EFFECTS:
INHALATION:

SHORT TERM EXPOSURE: irritation, low body temperature, ringing in the ears, nausea, vomiting, stomach pain, headache, drowsiness, symptoms of drunkenness, visual disturbances, lung congestion, kidney damage, liver damage, coma
LONG TERM EXPOSURE: tingling sensation, menstrual disorders, infertility, reproductive effects, convulsions
SKIN CONTACT:
SHORT TERM EXPOSURE: irritation, blisters
LONG TERM EXPOSURE: rash
EYE CONTACT:
SHORT TERM EXPOSURE: irritation (possibly severe), tearing
LONG TERM EXPOSURE: blurred vision
INGESTION:
SHORT TERM EXPOSURE: digestive disorders, symptoms of drunkenness, lung congestion, kidney damage, liver damage
LONG TERM EXPOSURE: reproductive effects

4. FIRST AID MEASURES

INHALATION: If adverse effects occur, remove to uncontaminated area. Give artificial respiration if not breathing. If breathing is difficult, oxygen should be administered by qualified personnel. Get immediate medical attention.

SKIN CONTACT: Wash skin with soap and water for at least 15 minutes while removing contaminated clothing and shoes. Get medical attention, if needed. Thoroughly clean and dry contaminated clothing and shoes before reuse.

EYE CONTACT: Flush eyes with plenty of water for at least 15 minutes. Then get immediate medical attention.

INGESTION: Contact local poison control center or physician immediately. Never make an unconscious person vomit or drink fluids. When vomiting occurs, keep head lower than hips to help prevent aspiration. If person is unconscious, turn head to side. Get medical attention immediately.

NOTE TO PHYSICIAN: For inhalation, consider oxygen. For ingestion, consider gastric lavage.

5. FIRE FIGHTING MEASURES

FIRE AND EXPLOSION HAZARDS: Severe fire hazard. Vapor/air mixtures are explosive above flash point. The vapor is heavier than air. Vapors or gases may ignite at distant ignition sources and flash back. Electrostatic discharges may be generated by flow or agitation resulting in ignition or explosion.

EXTINGUISHING MEDIA: regular dry chemical, carbon dioxide, water, regular foam

Large fires: Use regular foam or flood with fine water spray.

FIRE FIGHTING: Move container from fire area if it can be done without risk. Cool containers with water spray until well after the fire is out. Stay away from the ends of tanks. For fires in cargo or storage area: Cool containers with water from unmanned hose holder or monitor nozzles until well after fire is out. If this is impossible then take the following precautions: Keep unnecessary people away, isolate hazard area and deny entry. Let the fire burn. Withdraw immediately in case of rising sound from venting safety device or any discoloration of tanks due to fire. For tank, rail car or tank truck: Evacuation radius: 800 meters (1/2 mile). Water may be ineffective.

FLASH POINT: 81 F (27 C) (CC)
LOWER FLAMMABLE LIMIT: 1.1%
UPPER FLAMMABLE LIMIT: 7.0%
AUTOIGNITION: 982 F (528 C)
FLAMMABILITY CLASS (OSHA): IC

6. ACCIDENTAL RELEASE MEASURES

AIR RELEASE:
Reduce vapors with water spray. Stay upwind and keep out of low areas.

SOIL RELEASE:
Dig holding area such as lagoon, pond or pit for containment. Dike for later disposal. Absorb with sand or other non-combustible material. Collect with absorbent into suitable container.

WATER RELEASE:
Cover with absorbent sheets, spill-control pads or pillows. Neutralize. Collect with absorbent into suitable container. Absorb with activated carbon. Remove trapped material with suction hoses. Collect spilled material using mechanical equipment.

OCCUPATIONAL RELEASE:
Avoid heat, flames, sparks and other sources of ignition. Stop leak if possible without personal risk. Reduce vapors with water spray. Small spills: Absorb with sand or other non-combustible material. Collect spilled material in appropriate container for disposal. Large spills: Dike for later disposal. Remove sources of ignition. Keep unnecessary people away, isolate hazard area and deny entry. Notify Local Emergency Planning Committee and State Emergency Response Commission for release greater than or equal to RQ (U.S. SARA Section 304). If release occurs in the U.S. and is reportable under CERCLA Section 103, notify the National Response Center at (800)424-8802 (USA) or (202)426-2675 (USA).

7. HANDLING AND STORAGE

STORAGE: Store and handle in accordance with all current regulations and standards. Subject to storage regulations: U.S. OSHA 29 CFR 1910.106. Grounding and bonding required. Protect from physical damage. Store outside or in a detached building. Store with flammable liquids. Keep separated from incompatible substances. Keep separated from incompatible substances.

8. EXPOSURE CONTROLS, PERSONAL PROTECTION

EXPOSURE LIMITS:
P-XYLENE:
XYLENE:
100 ppm (435 mg/m3) OSHA TWA
150 ppm (651 mg/m3) OSHA STEL (vacated by 58 FR 35338, June 30, 1993)
100 ppm ACGIH TWA
150 ppm ACGIH STEL
100 ppm (435 mg/m3) NIOSH recommended TWA 10 hour(s)
150 ppm (655 mg/m3) NIOSH recommended STEL

VENTILATION: Provide local exhaust ventilation system. Ventilation equipment should be explosion-resistant if explosive concentrations of material are present. Ensure compliance with applicable exposure limits.

EYE PROTECTION: Wear splash resistant safety goggles. Provide an emergency eye wash fountain and quick drench shower in the immediate work area.

CLOTHING: Wear appropriate chemical resistant clothing.

GLOVES: Wear appropriate chemical resistant gloves.

RESPIRATOR: The following respirators and maximum use concentrations are drawn from NIOSH and/or OSHA.
900 ppm
Any air-purifying half-mask respirator equipped with organic vapor cartridge(s).
Any powered, air-purifying respirator with organic vapor cartridge(s).
Any supplied-air respirator.
Any self-contained breathing apparatus with a full facepiece.
Emergency or planned entry into unknown concentrations or IDLH conditions -
Any self-contained breathing apparatus that has a full facepiece and is operated in a pressure-demand or other positive-pressure mode.
Any supplied-air respirator with a full facepiece that is operated in a pressure-demand or other positive-pressure mode in combination with an auxiliary self-contained breathing apparatus operated in pressure-demand or other positive-pressure mode.
Escape -
Any air-purifying full-facepiece respirator (gas mask) with a chin-style, front-mounted or back-mounted organic vapor canister.
Any appropriate escape-type, self-contained breathing apparatus.

9. PHYSICAL AND CHEMICAL PROPERTIES

PHYSICAL STATE: liquid
APPEARANCE: clear
COLOR: colorless
ODOR: sweet odor
MOLECULAR WEIGHT: 106.17
MOLECULAR FORMULA: C8-H10
BOILING POINT: 280 F (138 C)
FREEZING POINT: 55 F (13 C)
VAPOR PRESSURE: 8.6 mmHg @ 25 C
VAPOR DENSITY (air=1): 3.7
SPECIFIC GRAVITY (water=1): 0.8611
WATER SOLUBILITY: insoluble
PH: Not available
VOLATILITY: Not available
ODOR THRESHOLD: 0.47 ppm
EVAPORATION RATE: 0.7 (butyl acetate=1)
COEFFICIENT OF WATER/OIL DISTRIBUTION: Not available
SOLVENT SOLUBILITY:
Soluble: alcohol, ether, benzene, acetone, organic solvents

10. STABILITY AND REACTIVITY

REACTIVITY: Stable at normal temperatures and pressure.

CONDITIONS TO AVOID: Avoid heat, flames, sparks and other sources of ignition. Containers may rupture or explode if exposed to heat. Keep out of water supplies and sewers.

INCOMPATIBILITIES: acids, combustible materials, oxidizing materials

HAZARDOUS DECOMPOSITION:
Thermal decomposition products: oxides of carbon

POLYMERIZATION: Will not polymerize.

11. TOXICOLOGICAL INFORMATION

P-XYLENE:
TOXICITY DATA: 4550 ppm/4 hour(s) inhalation-rat LC50; 3910 mg/kg oral-rat LD50
LOCAL EFFECTS:
Irritant: inhalation, skin, eye
ACUTE TOXICITY LEVEL:
Moderately Toxic: inhalation, ingestion
TARGET ORGANS: central nervous system
REPRODUCTIVE EFFECTS DATA: Available.

ADDITIONAL DATA: Alcohol may enhance the toxic effects. Stimulants such as epinephrine may induce ventricular fibrillation.

12. ECOLOGICAL INFORMATION

ECOTOXICITY DATA:
FISH TOXICITY: 8800 ug/L 96 hour(s) LC50 (Mortality) Guppy (Poecilia reticulata)

INVERTEBRATE TOXICITY: 3600 ug/L 24 hour(s) EC50 (Immobilization) Water flea (Daphnia magna)

ALGAL TOXICITY: 4400 ug/L 8 hour(s) EC50 (Growth) Green algae (Selenastrum capricornutum)

13. DISPOSAL CONSIDERATIONS

Subject to disposal regulations: U.S. EPA 40 CFR 262. Hazardous Waste Number(s): U239. Dispose in accordance with all applicable regulations.

14. TRANSPORT INFORMATION



U.S. DOT 49 CFR 172.101:
PROPER SHIPPING NAME: Xylenes
ID NUMBER: UN1307
HAZARD CLASS OR DIVISION: 3
PACKING GROUP: II
LABELING REQUIREMENTS: 3

CANADIAN TRANSPORTATION OF DANGEROUS GOODS:
SHIPPING NAME: Xylenes
UN NUMBER: UN1307
CLASS: 3
PACKING GROUP/CATEGORY: II

15. REGULATORY INFORMATION

U.S. REGULATIONS:
CERCLA SECTIONS 102a/103 HAZARDOUS SUBSTANCES (40 CFR 302.4):
p-Xylene: 100 LBS RQ

SARA TITLE III SECTION 302 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart B): Not regulated.

SARA TITLE III SECTION 304 EXTREMELY HAZARDOUS SUBSTANCES (40 CFR 355 Subpart

C): Not regulated.

SARA TITLE III SARA SECTIONS 311/312 HAZARDOUS CATEGORIES (40 CFR 370 Subparts B and C):
ACUTE: Yes
CHRONIC: No
FIRE: Yes
REACTIVE: No
SUDDEN RELEASE: No

SARA TITLE III SECTION 313 (40 CFR 372.65):
p-Xylene

OSHA PROCESS SAFETY (29 CFR 1910.119): Not regulated.

STATE REGULATIONS:
California Proposition 65: Not regulated.

CANADIAN REGULATIONS:
WHMIS CLASSIFICATION: BD2

NATIONAL INVENTORY STATUS:
U.S. INVENTORY (TSCA): Listed on inventory.

TSCA 12(b) EXPORT NOTIFICATION:
P-XYLENE
CAS NUMBER: 106-42-3
SECTION 4

CANADA INVENTORY (DSL/NDSL): Not determined.

16. OTHER INFORMATION

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APPENDIX D
FIELD STANDARD OPERATING PROCEDURES

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STANDARD OPERATING PROCEDURE

BE-SOP-01

Logbook Documentation and Field Notes

1.0 SCOPE AND PURPOSE

This Standard Operating Procedure (SOP) describes the content and format of field logbooks. It was generated in accordance with the US Environmental Protection Agency (EPA) *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988) requirements. This SOP will be used to direct personnel in field documentation and record keeping requirements to ensure that field activities are properly documented.

Adequate documentation is necessary to describe the work performed. Attention to detail is vital as field logbooks are used in the reporting process as well as in administrative and judicial proceedings. As a result, it is important that documentation be factual, complete, accurate, consistent, and clear.

2.0 PERSONNEL RESPONSIBILITIES

All site personnel who make logbook entries are responsible for maintaining the required documentation. The Field Lead designates who will be responsible for field notebook and form entries, care, and maintenance.

3.0 FIELD NOTEBOOK PROCEDURE

Field logbooks are bound, sequentially paginated, weatherproof notebooks used to record daily field activities. All notes must be entered in permanent ink.

3.1 Front Cover

The front cover of each logbook must include the following information:

- Owner of the book (Example: Brice Engineering, LLC)
- Book number
- Job name and Contract number
- Start date
- End date

3.2 Project Contact Information

Include project contact information on the inside front cover or first page of the logbook. Contact information may include names and phone numbers of subcontractors, project assistants, field team members, and emergency numbers from the Accident Prevention Plan and/or Site-Specific Health and Safety Plan.

3.3 Daily Entries

Logbook entries must abide by the following guidelines:

- Pages can never be removed from the logbook.
- All information is printed legibly and in permanent ink.
- Entries are written in chronological order using objective and factual language.
- Entries are written on subsequent lines such that no blank lines exist on any page.
- If any space remains on the bottom of the last page at the conclusion of the day's field entries, a diagonal line is drawn and signed to obscure any additional entries on that page.
- If corrections are necessary, a single line is drawn through the original entry. The corrected information is then added, initialed, and dated.

The minimum daily standard logbook entries include the following:

- Date and time
- Work start and stop times
- Full names, titles, and roles of personnel on site, including visitors
- Safety meetings/tailgates
- Level of PPE
- Name(s) of person(s) collecting samples or performing work
- Location of work areas (excavations and landfill areas) and sampling points (sketches with north arrows when appropriate)
- Sample identification numbers and descriptions
- Sample shipping information (date, time, destination, location)
- Type of field instrumentation (model and serial numbers)
- All calibrations performed
- Other work performed
- Any deviations from the work plan

Correct erroneous field record or logbook entries with a single line through the error. Do not erase incorrect information. Date and initial revised entries.

3.4 Field Data sheets

All other supportive unbound data documentation that is a part of the field records are maintained as part of the field forms. These entries are recorded in weatherproof ink on weatherproof paper.

3.5 Electronic Data sheets

Electronic data documents include photographs, GPS and survey data, etc. All electronic data that are part of the field records are downloaded to a designated location. Take care when downloading, storing, and managing data. Naming conventions (according to the project-specific work plan) are used to indicate the project, date, and other relevant information.

3.6 Document Control

At the conclusion of a task or project, all field documentation, including logbooks, field forms, photographs, etc., is scanned and placed in a designated location (typically the "Field" folder) and maintained for project use.

4.0 REFERENCES

EPA. 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*. October.

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STANDARD OPERATING PROCEDURE

BE-SOP-02

Sample Chain-of-Custody

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) describes the guidelines for sample handling and custody and has been generated in accordance with the US Environmental Protection Agency (EPA) *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988). This SOP will be used to direct field personnel in sample chain-of-custody (COC) management. The purpose of the COC is to demonstrate accountability and document sample integrity from the time of sample collection until sample analysis by the laboratory.

2.0 COC ELEMENTS

The elements of a COC include the following:

- Sample labels
- Laboratory receipt forms
- Field custody forms (COC form)
- Custody seals
- Inter-laboratory transfer documentation, if applicable

3.0 SAMPLE HANDLING PROCEDURE

The following sections describe sample COC documentation, field custody procedures, sample packaging, custody seals, transfer of custody, and laboratory custody procedures.

3.1 Sample COC Documentation

Sample identification documents are carefully prepared so that sample identification and COC are maintained. Sample identification documents include the field logbook, sample labels, custody seals, and COC records.

A sample is in custody if it meets one of the following conditions:

- In an authorized person's physical possession.
- In an authorized person's view after being in possession.
- In an authorized person's possession and then secured (locked up).
- Kept in a secured area that is restricted to authorized personnel.

3.2 Field Custody Procedures

The following procedures are used by field personnel:

- The sample collector is personally responsible for the care and custody of samples collected until they are properly transferred to another company representative or relinquished to the laboratory.
- The sample collector records sample data (time of collection, sample number, analytical requirements, and matrix) in the field logbook and/or on the appropriate field form.
- Sample labels are completed for each sample, using weatherproof ink.

3.3 Chain-of-Custody Record

The COC record is fully completed prior to sample shipment. When possible, an electronic COC record should be used. Required information on the COC includes the following:

- Client (contractor name)
- Reporting Information (Chemist name and contact information)
- Project Name
- Invoice information
- PO Number
- COC number
- Cooler ID
- Page number
- NPDL number
- Field Sample ID
- Location ID
- Collection date
- Collection time (in 24-hour format)
- Sampler initials
- Quantity (number of containers)
- Container types (VOA, amber, 40 mL, etc.)
- Container volumes
- Preservative
- Sample matrix (soil, water, other)
- Requested laboratory analysis methods required for each jar
- Quality control (trip blanks and MS/MSD)
- Turn-around-time (TAT)
- Notes
- Special instructions

3.4 Sample Packaging

Samples are labeled and packaged according to the *Labeling, Packaging, and Shipping Samples* SOP (BE-SOP-03). The COC record accompanies all sample shipments. Two COC records are prepared for each shipment. One COC record is placed in a re-sealable plastic bag with the bag sealed shut to prevent water intrusion from moisture in the cooler, and the bag is taped inside the cooler lid. The duplicate or electronic copy of the COC record is retained by the sampler and provided to the Project Chemist and other sample

coordinators. Airway bills are retained with the COC record and provided to the Project Chemist, so sample pickup can be coordinated with the laboratory. Airway bills must be scanned and placed in a designated location, typically the "Field" folder, and maintained for project use.

3.5 Custody Seals

Custody seals are preprinted, adhesive-backed seals with security slots designed to break if the seals are disturbed. Seals are signed and dated at the time of use. Sample shipping containers (coolers) are sealed in as many places as necessary to ensure that the container cannot be opened without tearing the custody seals. Typically, one custody seal is placed along the front corner of the cooler, and a second is placed along the opposite back corner of the cooler. Clear tape is placed over the seals to ensure that seals are not accidentally broken during shipment. If the custody seal was broken at some point during transport, the reason for breaking the seal, condition of the container contents, the cooler temperature, and anything added to or removed from the container must be documented on the COC form. The container must then be sealed with a new custody seal.

If a sample handler transports the samples to the laboratory without sample shipment, custody seals are not required but are recommended.

3.6 Transfer of Custody

When transferring the possession of samples from the field sampler to a transporter or to the laboratory, the sampler must sign, date, and note the time as "relinquished by" on the COC record. Name of signatory will also be printed and associated organization the individual represents will be noted. The receiver also signs, dates, and notes the time as "received by" on the COC record; however, when samples are transported by a common commercial carrier, such as Alaska Airlines or Federal Express, the carrier does not sign the COC record; rather, the COC record is signed by the sampler as "relinquished by" prior to closing the sample coolers for shipment and relinquishing them to the commercial carrier.

3.7 Laboratory Custody Procedures

A designated sample custodian accepts custody of the shipped samples and verifies that the sample identification number matches the COC record. The laboratory completes a cooler receipt form when samples are received. The cooler receipt form documents any discrepancies identified between the sample labels and COC, cooler temperature(s), sample preservation, and sample integrity. Cooler receipt information, including a signed COC, custody seals, and a completed cooler receipt form, are provided to the Project Chemist within 24 hours of cooler receipt.

4.0 REFERENCES

EPA. 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA.* October.

STANDARD OPERATING PROCEDURE

BE-SOP-03

Labeling, Packaging, and Shipping Samples

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) will be used to direct field personnel in the techniques and requirements for labeling, packaging, and shipping samples from the field to the laboratory for analysis.

2.0 MATERIALS

The term "environmental sample" refers to any sample that has less than reportable quantities of any hazardous constituents according to U.S. Department of Transportation (DOT) 49 Code of Federal Regulations Section 172. Equipment required for labeling, packaging, and shipping environmental samples includes:

- Weatherproof labels for sample containers
- Coolers
- Gel ice packs
- Sorbent pads
- Contractor-grade plastic bags
- Bubble wrap and/or foam inserts
- Plastic zip-top bags, quart and gallon
- Clear tape
- Strapping tape
- Cooler labels: "Keep Cool/Refrigerate/Do Not Freeze," "This End Up," "Fragile," dangerous goods, excepted quantities, shipping address, etc.

3.0 PROCEDURES

This section describes the procedures for labeling, packaging, and shipping collected samples.

3.1 Labeling

Samples must be labeled using nomenclature defined in the project-specific work plan. All sample labels must be weatherproof and contain the following information:

- Project or project number
- Sampler name or initials
- Sample identification
- Sample date and time (in 24-hour format)
- Laboratory analysis methods required for sample jar
- Preservatives added to sample jar

Adhesive sample labels are placed directly on the sample containers. If the labels do not adequately adhere due to moisture, secure the label by placing clear packaging tape over the label. Sample containers that are weighed by the laboratory prior to use **should not** have any additional labels or tape placed on the container as it affects the weight. For those containers, use the label that is already provided on the jar. Only one label should be placed on each sample container.

3.2 Packaging

When packing sample containers for shipment, the steps below must be followed.

1. Choose a cooler with structural integrity to withstand shipment. Secure and tape the drain plug with duct tape.
2. Be sure that container lids are tight and will not leak. Make sure not to over-tighten and/or break the cap.
3. Ensure that the sample labels are intact, fully completed with the correct information, and that the sample identification exactly matches the chain-of-custody (CoC)record.
4. Place sample containers in bubble wrap, bubble bags, in their original boxes, or in re-sealable bags with sorbent pads, depending on the type of container. Wrap and package containers sufficiently to prevent cross contamination and ensure that containers remain intact during shipment (bubble wrap and plastic zip-top bags).
5. Place a layer of frozen gel ice packs, along the bottom of the cooler. Cover the ice packs with a layer of bubble wrap and then place a sorbent pad over the bubble wrap.
6. Line the cooler with a contractor-grade plastic bag.
7. Place the containers inside the contractor-grade plastic bag with caps up.
8. Ensure that a temperature blank is included in each cooler. The temperature blank should be placed at the same level and next to the samples, preferably in the center of the cooler.
9. If the cooler contains volatile samples, ensure that a trip blank is included.
10. Fill excess space between sample containers with additional bubble wrap or gel ice.
11. Tape the top of the contractor-grade plastic bag shut once all sample containers, trip blanks, and the temp blank are inside.
12. Place another layer of bubble wrap along the top of the cooler, and if possible, place a layer of gel ice packs along the top of the cooler. **Use sufficient ice in packaging to ensure that samples are received by the laboratory at the proper temperature of 0 to 6 degrees Celsius. Note that partially melted or soft gel ice packs should not be used to pack coolers for transport. A minimum of 8 frozen gel ice packs should be used to maintain sample temperature during transit for 24 hours.**
13. Fill remaining headspace with additional packing material.
14. Place the completed CoC record for the laboratory and a Brice Cooler Receipt Form into a plastic zip-top bag, tape the bag to the inner side of the cooler's lid, and then close the cooler.
15. Conduct a "shake test" by gently shaking the cooler to determine if the containers are shifting in the cooler. If so, add additional packing material until there are no sounds of shifting when shaken.

16. Wrap strapping tape around each end of the cooler two times to secure the lid. Place completed custody seals on the front and back of the cooler so that the cooler cannot be opened without breaking the seals. Place clear tape over custody seals.
17. Attach an address label containing the name and address of the shipper to the top of the cooler. Attach other markings such as "Refrigerate" or "Keep Cool," "Do Not Freeze," and "Fragile." For samples with liquid (including preserved soil samples), place "up arrow" stickers on opposite sides of the cooler pointing in the same direction as the containers containing liquids.

3.3 Sample Shipping

Environmental samples are shipped as non-hazardous materials unless the samples meet the established DOT criteria for a "hazardous material" or the International Air Transport Association (IATA)/International Civil Aviation Organization (ICAO) air definition of "Dangerous Goods." If the samples meet criteria for hazardous materials or dangerous goods, then DOT and IATA/ICAO regulations must be followed, which includes having qualified personnel send shipments.

Samples shipped as "Dangerous Goods in Excepted Quantities" must have the appropriate labeling and be declared as dangerous goods to the shipping carrier; however, a dangerous goods "candy-striped" form and Notification to Caption are not required (IATA 2020).

3.3.1 Soil Sample Shipments

Soil samples preserved with methanol, and any excess methanol vials, must be shipped as "Dangerous Goods in Excepted Quantities" per the IATA regulations. The volume for excepted quantities of methanol is 30 milliliters (mL) per container and 500 mL per cooler. The hazard class number is 3, flammable liquid, UN 1230. Sample jars with methanol in excess of 30 mL and coolers with methanol in excess of 500 mL require shipment as "Dangerous Goods" and require the completion of a "candy-striped" form.

3.3.2 Water Sample Shipments

Water samples preserved with hydrochloric acid or other insignificant amounts of preservative are not shipped as dangerous goods once filled; however, pre-preserved sample containers with preservative and no water added must be shipped as "Dangerous Goods in Excepted Quantities" per IATA regulations. The volume for excepted quantities of hydrochloric acid or nitric acid is 30 mL per container and 500 mL per cooler, respectively. The hazard class number is 8, corrosive. Sample jars with hydrochloric acid or nitric acid in excess of 30 mL and coolers with hydrochloric acid or nitric acid in excess of 500 mL require shipment as "Dangerous Goods" and require the completion of a "candy-striped" form.

Upon shipping samples, notify the laboratory contact that samples have been shipped and provide the airway bill number.

4.0 REFERENCES

International Air Transport Association (IATA). 2020. *Dangerous Goods Regulations (DGR) Limited/ Excepted Quantities Labels.* 61st Edition. January.

ATTACHMENTS

Brice Cooler Receipt Form

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COOLER RECEIPT FORM
(ONE PER COOLER)

Please email this form and the completed CoC records to the Brice Project Chemist within 24 hours of sample receipt.

COC Number	
Cooler Number/Name on COC	
Temperature (temp blank, °C)	
Temperature (cooler, °C)	
Thermometer type/ID	
Laboratory/Location	
Laboratory SDG	

				Circle:	
1.	Were custody seals present? **Yes** **No** If no, were samples hand del?			**Yes**	**No**
	If yes, how many and where? Front _____ Back _____ Intact?			**Yes**	**No**
	Signature/date present on custody seals?			**Yes**	**No**
2.	Were custody papers taped to lid inside cooler?			**Yes**	**No**
3.	Were custody papers properly filled out (ink, signed, etc.)?			**Yes**	**No**
4.	Custody forms signed/dated and properly accepted/relinquished?			**Yes**	**No**
5.	Has the shipper/tracking number been documented on the paperwork?			**Yes**	**No**
6.	Was sufficient ice used (if appropriate)?		**N/A**	**Yes**	**No**
	Type used: ☐ Wet ☐ Gel Still frozen? **Yes** **No**				
7.	Were all samples/bottles sealed in separate plastic bags?		**N/A**	**Yes**	**No**
8.	Did all bottles arrive in good condition? (intact, not leaking, etc.)			**Yes**	**No**
9.	Were all bottle labels complete (sample ID, date, analysis, preservative, etc.) ?			**Yes**	**No**
10.	Did all bottle labels agree with the custody papers?			**Yes**	**No**
11.	Were the appropriate containers used for the analyses?			**Yes**	**No**
12.	Are all VOA vials free of headspace > 6mm in diameter?		**N/A**	**Yes**	**No**
	If no, note samples and number of vials affected below.				
	If no, are there vials without headspace to perform the analysis?		**N/A**	**Yes**	**No**
13.	Was sufficient volume sent in each bottle to perform analysis?		**N/A**	**Yes**	**No**
14.	If there are volatiles present, is there a trip blank present in this cooler?		**N/A**	**Yes**	**No**
15.	Is the temperature within 0-6°C?		**N/A**	**Yes**	**No**
16.	Were labels correctly associated with pre-tared containers (not placed directly on jars for methanol-preserved volatiles)?		**N/A**	**Yes**	**No**
17.	Were non-volatile sample checked for appropriate preservation?		**N/A**	**Yes**	**No**
18.	Were methanol-preserved soil containers accompanied by an unpreserved aliquot for percent moisture content?		**N/A**	**Yes**	**No**

(If checked at the bench, include prep logs or narrative with final report.)

Explain any discrepancies/deficiencies (attach additional sheets if required).

_____

_____

_____

_____

_____

If discrepancies/deficiencies are noted, was the Brice chemist contacted*?

Chemist: _____ Date/Time: _____ Contact Method: phone email

Email or phone notes should be included with final report, if applicable,
or at a minimum documented in the case narrative.

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STANDARD OPERATING PROCEDURE

BE-SOP-04

Quality Control Samples

1.0 INTRODUCTION

The purpose of this Standard Operating Procedure (SOP) is to direct field personnel in the requirements necessary for collecting field quality control (QC) samples from certain matrixes. Field QC samples are collected to ensure the reliability and validity of field and laboratory data. This SOP was generated in accordance with the US Environmental Protection Agency (EPA) *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA 1988) requirements.

2.0 SAMPLING PROCEDURE

The following sections describe different QC sample types that may be required in project-specific UFP-QAPP.

2.1 Field duplicate

A field duplicate is collected to evaluate whether sample matrix heterogeneity, contaminant distribution, or sample collection methods affect analytical precision. The field sampler ensures that primary and duplicate samples are effectively identical by collecting the samples from the same location, at the same time, with the same techniques, and from the same matrix. Non-volatile samples should be homogenized in a metal bowl or sealable zip-top bag prior to sample collection. Volatile samples should not be homogenized to minimize loss of volatile constituents; however, an effort should be made to collect samples from the same matrix and part of the sample interval.

At a minimum, one blind field duplicate should be collected per 10 samples for each analytical method and matrix for offsite laboratory analysis. For a sampling effort occurring over multiple days, all field duplicates should not be collected in one day and the goal should be to collect field duplicates over multiple days. If multiple sample coolers are shipped together, an effort should be made during sample packaging to include a duplicate in each cooler.

Field duplicates are submitted as blind samples with a unique sample number and collection time to the approved laboratory for analysis. A duplicate sample collection time of one hour before the primary sample time is recommended to ensure there are no holding time issues.

2.2 Matrix Spike and Matrix Spike Duplicate (MS/MSD)

MS/MSD samples are collected to evaluate the precision and accuracy of laboratory procedures in the project sample matrix. The MS/MSD compound is added at the laboratory. This sample is collected at the same time as the primary sample using the same procedure, equipment, and type of container. The MS/MSD sample should be labeled the same as the primary sample with a matching sample identification and time denoted on the chain-of-custody (CoC) form to ensure that the project MS/MSD pair is used in the laboratory report. The MS/MSD should be noted in the QC column of the CoC. At a minimum, the

frequency of MS/MSD samples collected is one for each analytical batch. Note that the analytical laboratory often batches samples in the same cooler together for shipments containing multiple coolers, so an effort should be made during sample packaging to include an MS/MSD in each cooler. The MS/MSD evaluation process is specified in the UFP-QAPP.

2.3 Temperature Blank

A temperature blank must be included in each sample cooler. A temperature blank is measured by the laboratory to verify and document that the cooler temperature is received between 0 and 6 degrees Celsius (°C). Temperature blanks consist of plastic bottles filled with water, typically prepared by the laboratory. Once shipments are received by the laboratory, the temperature is recorded on the CoC to document that preservation requirements were met.

2.4 Trip Blanks

Trip blanks must accompany volatile samples, including GRO, BTEX, and VOCs. Trip blanks are prepared by the laboratory and are used to establish that the sample has not been contaminated by external sources during sample bottle transport to and from the field. Trip blanks are samples of reagent-grade water, properly preserved in a controlled environment by the laboratory prior to field mobilization. Trip blanks are kept with the sample containers throughout the sampling process and returned to the laboratory with the analytical samples. One trip blank must accompany each cooler containing volatile samples. All trip blanks must be labeled and included on the CoC. Trip blank sample times will be recorded as 0800 on the CoC. The trip blank evaluation process is specified in the UFP-QAPP.

2.5 Equipment Blanks

Equipment blanks may be used to evaluate the effectiveness of a decontamination procedure. The equipment rinsate blank is collected by pouring or pumping deionized water onto or into the sampling equipment after the equipment has been decontaminated, and then collecting the rinsate water for analysis of an analytical suite identical to that performed for the associated sample(s). The required equipment rinsate blank collection frequency and evaluation process are specified in the UFP-QAPP. Decontamination procedures must be performed according to the *Equipment Decontamination* SOP (BE-SOP-14).

3.0 REFERENCES

EPA. 1988. *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*. October.

STANDARD OPERATING PROCEDURE

BE-SOP-05

Soil Logging

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) describes a standard process for classifying and logging soils recovered using a drill rig or other mechanized equipment.

2.0 MATERIALS

Field materials include, but are not limited to the following:

- Clipboard
- Description aids (Munsell color and Unified Soil Classification charts)
- Soil Boring Logs
- Permanent ink pen
- Plastic folding table
- Core cutter with extra blades
- Tape measure
- Duct tape
- White board with erasable markers
- Camera
- Nitrile gloves
- Hand tools (trowels, spoons, rock hammer, etc.)
- Hand broom and dustpan
- 5-gallon bucket

3.0 PROCEDURES

Soil lithology will be determined and documented in general accordance with standards established by the Unified Soil Classification System (USCS), as described in ASTM International (ASTM) Method D2488 (Attachment 1). In general, the process involves visual observation of the soils and documentation on soil boring logs (Attachment 2). All fields on the soil boring log will be used or an "N/A" will be inserted to indicate a field that is not applicable.

3.1 Photograph

Upon opening the Macro-core, dual tube, or split spoon sampler, photograph the sampler. Ensure that the tape measure indicating sample recovery is visible in the photograph. Use a whiteboard with erasable markers to indicate important information about each sample, including:

- LocID
- Depth range

- Top and bottom of sample
- Date

3.2 Soil Boring Log

General information included on each soil boring log must include:

- Project
- Project number
- Client
- Boring No.
- Address, city, and state
- Drilling contracting
- Drill crew
- Logged by
- The start, completion, and backfill date and method
- Drilling method and equipment used, including borehole dimeter
- Groundwater depth
- Elevation
- Total depth of boring

Specific information included on each log must include:

- Sample interval
- Inches driven
- Inches recovered
- Photoionization detector (parts per million)
- Time
- Soil description (soil name, USCS group symbol, color, relative density or consistency, plasticity (silt and clay only), moisture content, secondary grain size, odor, additional facts)
- Sample information (sample ID, time, analytes, number and type of containers, preservatives, quality control – Duplicate or matrix spike/matrix spike duplicate, for volatile containers tare weights and total container weights, methanol lot numbers)
- Blow counts for split spoon sampling (the number of hammer blows to push the split spoon 6, 12, 18, and 24 inches)
- Total boring depth or refusal depth

3.3 Soil Description

Since samples are collected mostly for environmental sampling and contaminant characterization purposes, strict adherence to the USCS may not be required, unless specified in the project-specific Work Plan. The following characteristics should be described in the soil description.

3.3.1 Soil Name and USCS Group Symbol

The first step in soil logging is determining if the soil is primarily coarse-grained or fine-grained. Coarse-grained deposits consist of gravel and sand, while fine-grained deposits consist of silt and clay. For

coarse-grained deposits, the second step is determining the sand to gravel ratio. Sand particle sizes are classified as fine (0.07 millimeters [mm] to 0.43 mm), medium (0.43 mm to 2.0 mm), and coarse (2.0 mm to 5.0 mm). Gravel is defined as fine (0.5 centimeters [cm] to 1.9 cm) and coarse (1.9 cm to 7.6 cm). Once the ratio of sand and gravel is determined, the estimated percentages are used to select a soil name and USCS group symbol using the USCS classification system chart (refer to Attachment 1). For fine-grained deposits, the plasticity must be evaluated before selecting a soil name and USCS group symbol. Silts range from non-plastic to low plasticity, lean clay ranges from low plasticity to medium plasticity, and fat clay is high plasticity.

3.3.2 Color

Color is important in identifying organic soils and materials from similar geologic units. The material's representative color and any layers with different colors should be described on the soil boring log.

3.3.3 Relative Density or Consistency

Density is used to describe coarse-grained deposits (sand and gravel). Soil density is described by the following criteria:

- Very loose
- Loose
- Medium dense
- Dense
- Very dense

Consistency is used to describe fine-grained deposits (silt and clay). Soil consistency is described using the following criteria:

- Very soft – thumb will penetrate more than 1-inch
- Soft – thumb will penetrate soil approximately 1-inch
- Medium – thumb will indent soil approximately 0.5-inch
- Stiff – thumb will indent soil approximately 0.25-inch
- Very stiff – thumb will indent soil approximately 0.125-inch
- Hard – thumb will not indent soil but can be indented by thumbnail

3.3.4 Plasticity

Plasticity is a characteristic of fine-grained soils (silt and clay). Soil that passes through a No. 200 sieve and is non-plastic or low plasticity is silt. Soil that passes through a No. 200 sieve, is plastic over a range of water contents, and has strength when dry is clay. Plasticity should be classified according to the following criteria:

- Non-plastic – A 3 mm or 0.125-inch thread cannot be rolled at any water content
- Low – thread can barely be rolled
- Medium – thread is easy to roll to the plastic limit, but the thread cannot be rerolled
- High – takes a long time rolling to reach plastic limit and the thread can be rerolled multiple times

3.3.5 Moisture Content

The relative soil moisture content is important for determining water table depth and if zones of perched water are present. Soil moisture is described by the following terminology:

- Dry – moisture absent, dusty, dry to the touch
- Moist – damp but no visible water
- Wet – visible water (usually soil below water table)

3.3.6 Secondary and Tertiary Components

The estimated percentages of secondary and tertiary soil components are described using the following terminology:

- Trace less than 5 percent (%)
- Little 6% to 15%
- Few 16% to 30%
- Some 31% to 49%

3.3.7 Odor

Note any odors observed, including organic or unusual odors (petroleum hydrocarbon).

3.3.8 Additional Descriptors

Note any unusual characteristics, such as the presence of roots and debris. Other descriptors that are commonly used follow.

3.3.9 Angularity

Angularity is used to describe coarse-grained soils only (coarse sand, gravel, cobbles, and boulders). The following descriptors are used to describe angularity:

- Angular – sharp edges and plane sides
- Subangular – similar to angular got with rounded edges
- Subrounded – have plane sides with well-rounded corners sand edges
- Rounded – particles have smooth sides and no edges

3.3.10 Lensed

The lensed descriptor indicates that the soil includes small pockets of different soils.

3.3.11 Stratified

The stratified descriptor indicates that there are alternating layers of different materials or colors.

3.4 Examples

- Poorly graded sand with gravel (SP), fine sand, brown, loose, moist, few gravel
- Well graded sand with gravel (SW), fine to coarse sand, gray, medium dense, wet, some gravel
- Poorly graded gravel with sand (GP), subrounded fine gravel, gray, dense, moist, few sand
- Silty sand (SM), fine to medium sand, brown, loose

- Sandy silt (ML), gray, stiff, moist, trace subangular gravel, slight petroleum odor
- Silt (ML), brown, medium, moist, trace fine sand

4.0 REFERENCES

ASTM International (ASTM). 2017. *Standard Practice for Description and Identification of Soils Visual-Manual Procedure.* D2488. West Conshocken, Pennsylvania. July.

ATTACHMENTS

Attachment 1 Standard Terminology for Soil Descriptions
Attachment 2 Soil Boring Log

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Standard Terminology for Soil Descriptions

SOIL DESCRIPTION FORMAT

USCS SOIL NAME: angularity (coarse sand or greater), soil description (order of abundance), cobbles and boulders, *Munsell color (optional)*, color, density, moisture, *odor strength and type (optional*), *structure (optional), other comments (optional*), USCS symbol, *geologic environment (optional).*

EXAMPLES

WELL-GRADED GRAVELLY SAND: angular coarse sand, some gravel, trace silt/clay, 3-5 inch cobbles, 5Y 3/1 gray, very dense, moist, no odor, lensed, with trace fine organics and fine roots, SW, (GLACIAL TILL).

POORLY GRADED GRAVEL: angular fine gravel, some silt/clay, trace sand, 12-18 inch boulders, gray, dense, dry, weak petroleum odor, homogenous, GP.

SILT WITH SAND: silt, with fine to coarse sand, trace gravel, 5Y 3/1, gray, medium dense, wet, ML.

SILT/CLAY: silt, trace sand and gravel, tan, moderate organic odor, hard, wet, laminated, fine organics and roots, ML-CL, (LACUSTRINE).

NOTES:

- Descriptions are in general accordance with ASTM D2488, moisture content and particle abundance descriptors have been modified from the ASTM specification.
- Descriptions may include but are not limited to the information described in this procedure.
- Abundances of gravel, sand, and silt are estimated visually; sieve analysis is not performed typically.
- Blows should be counted when possible (e.g., pounding a split spoon on an auger or mud-rotary drill rig), but direct-push drill rigs typically lack a 140-pound hammer.

PARTICLE ABUNDANCE	
Descriptor	**Criteria**
Some	> 30%
With	15-30%
Little	5-15%
Trace	<5%
Notes: Boulders and cobbles should be listed as present with the range of size in inches.	

GRAIN SIZES	
Component	**Particle Size**
Boulders	>12 inches (30cm)
Cobbles	12 to 3 inches (30 to 7.6 cm)
Gravel	3 inch to #4 sieve (75 to 4.75 mm)
Sand	#4 to #200 sieve (4.75 to 0.075 mm)
Silt/Clay	<#200 sieve(<0.075mm)

MOISTURE CONTENT	
Description	**Criteria**
Dry	Absence of moisture, dusty, dry to the touch
Damp	Slight amount of water
Moist	No visible water, sand will hold together
Wet	Visible free water with effort, glistens
Saturated	Pore space filled (below water table)

SAND AND GRAVEL SIZE		
Description	**Sand Range**	**Gravel Range**
Fine	0.07 to 0.43 mm	0.5 to 1.9 cm
Medium (Sand Only)	0.43 to 2 mm	N/A
Coarse	2 to 5 mm	1.9 to 7.6 cm
Notes: Boulders and cobbles should be listed as present with the range of size in inches.		

RELATIVE DENSITY			
Fine-Grained Soil		**Coarse-Grained Soil**	
Density	**N-Value**	**Density**	**N-Value**
Very Soft	0 to 1	Very Loose	0 to 3
Soft	2 to 4	Loose	4 to 9
Medium Stiff	5 to 8	Medium Dense	10 to 29
Stiff	9 to 15		
Very Stiff	16 to 30	Dense	30 to 49
Hard	>30	Very Dense	>50
Notes: N-Value (Standard Penetration or Blow Count) is considered the number of blows to advance a 2-inch O.D. split-spoon sampler the last 12 inches of the total 18-inch penetration with a 140-pound hammer falling 30 inches (ASTM D1586). Any variation should be noted. If no blow counts are measured, density should be estimated.			

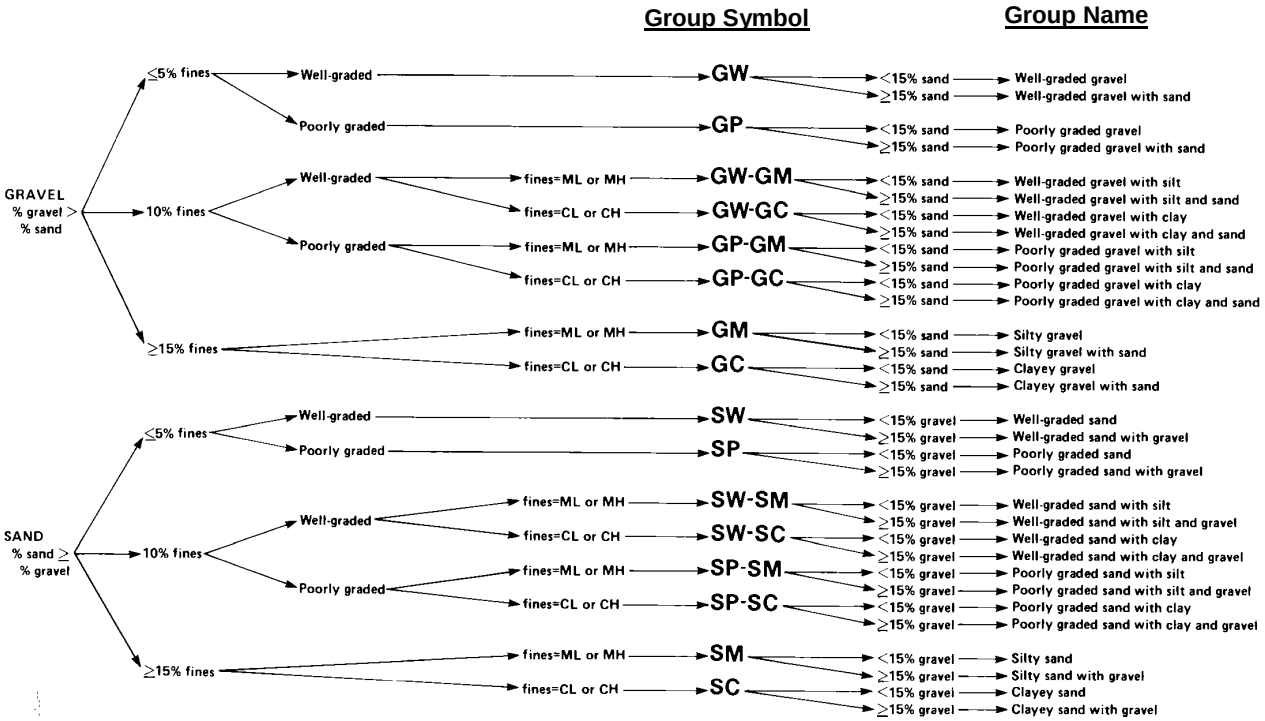
SIMPLIFIED USCS CLASSIFICATION SYSTEMS				
COARSE-GRAINED SOILS <50% passes #200 sieve	GRAVEL <50% coarse fraction passes #4 sieve	GRAVEL <5% pass the #200 sieve	GW	Well-graded gravel, gravel-sand mixture, little or no fines
			GP	Poorly-graded gravel, gravel-sand mixtures, little or no fines
		GRAVEL 5-15%pass the #200 sieve	GW-GM	Well-graded gravel with fines
			GP-GM	Poorly-graded gravel with fines
		GRAVEL >15% pass the #200 sieve	GM	Silty gravel, poorly-graded gravel-sand-silt mixture
			GC	Clayey gravels, poorly-graded gravel-sand-clay mixture
	SANDS >50% coarse fraction passes #4 sieve	SAND <5% pass the #200 sieve	SW	Well-graded sand, gravelly sand, little or no fines
			SP	Poorly-graded sands, gravelly sands, little or no fines
		SAND 5-15% pass the #200 sieve	SW-SM	Well-graded sand with fines
			SP-SM	Poorly-graded sand with fines
		SAND >15% pass the #200 sieve	SM	Silty sand, poorly-graded sand-gravel-silt mixture
			SC	Clayey sand, poorly-graded sand-gravel-clay mixture
FINE-GRAINED SOILS >50% passes #200 sieve	SILT/CLAY Liquid Limit <50%		ML	Inorganic silt & very fine sand, silty or clayey fine sands, clayey silt with slight plasticity
			CL	Inorganic clay of low to medium plasticity, gravelly clay, sandy clay, silty clay, lean clay
			OL	Organic silt & clay of low plasticity
	SILT/CLAY Liquid Limit >50%		MH	Inorganic silt, micaceous or diatomaceous fine sand or silt
			CH	Inorganic clay of high plasticity, fat clay
			OH	Organic silt & clay of medium to high plasticity
HIGHLY ORGANIC SOILS			PT	Peat, humus, swamp soils with high organic content
Notes: If coarse-grained soil contains >10% fines use a dual symbol, e.g. GP-GM. Full USCS chart on page 2.				

Standard Terminology for Soil Descriptions

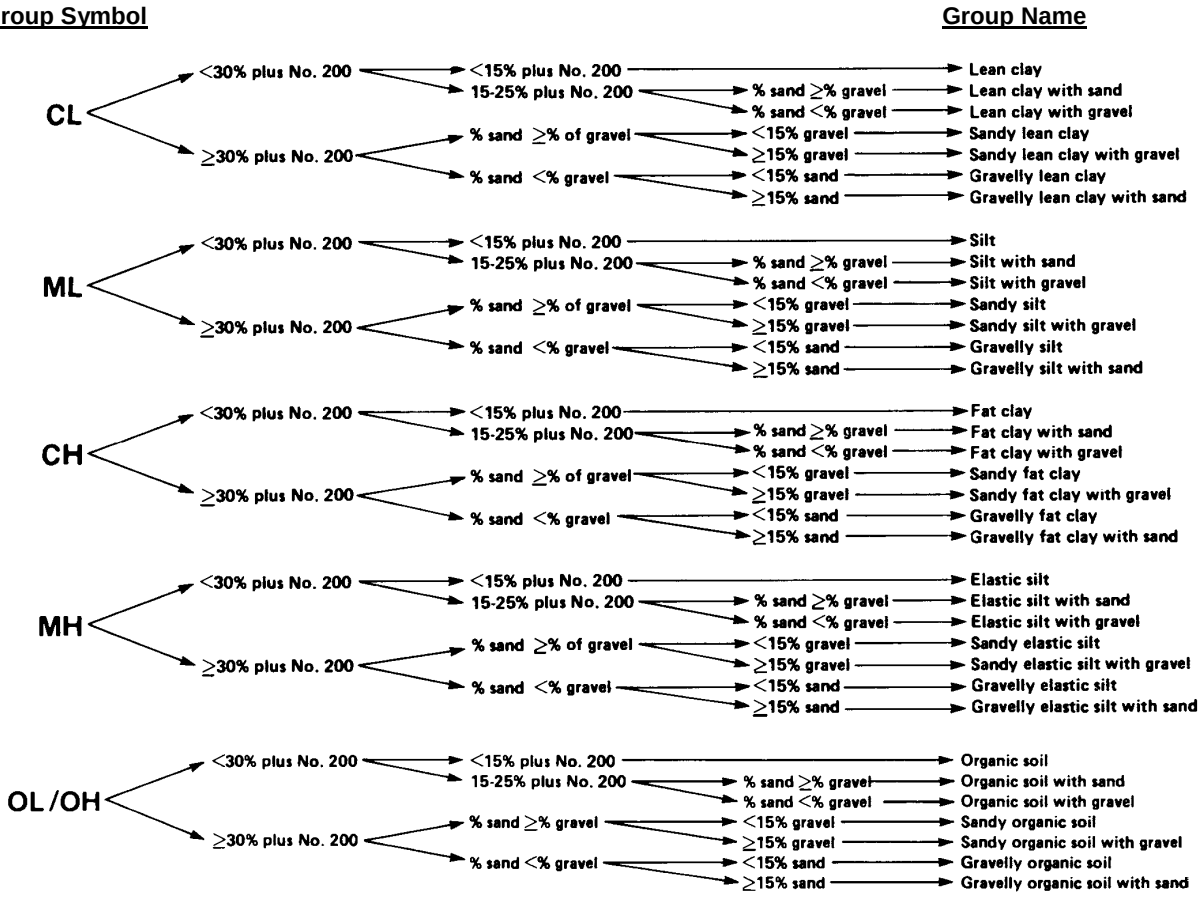
UNIFIED SOIL CLASSIFICATION SYSTEM

(from ASTM D2488)

COARSE-GRAINED SOILS



FINE-GRAINED SOILS



SOIL BORING LOG

Sheet _____ of _____

Project:	Project Number:	Client:	Boring No.
Address, City, State		Drilling Contractor:	
Logged By:	Date: Started:	Drilling Method and Equipment Used:	
	Completed:		
Drill Crew:	Backfilled:		
	Groundwater Depth:	Elevation:	Total Depth of Boring:

Depth (feet)	Sample Interval	Inches Driven	Inches Recovered	PID (ppm)	Time	**Soil Description:** Soil Name, USCS Group Symbol, Color, Relative Density or Consistency, Plasticity, Moisture Content, Secondary Grain Size, Odor, Additional Descriptors	Sample
1							
2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							
16							

SOIL BORING LOG

Sheet _____ of _____

Project:	Project Number:	Client:	Boring No.

Depth (feet)	Sample Interval	Inches Driven	Inches Recovered	PID (ppm)	Time	**Soil Description:** Soil Name, USCS Group Symbol, Color, Relative Density or Consistency, Plasticity, Moisture Content, Secondary Grain Size, Odor, Additional Descriptors	Sample
17							
18							
19							
20							
21							
22							
23							
24							
25							
26							
27							
28							
29							
30							
31							
32							
33							
34							
35							
36							

STANDARD OPERATING PROCEDURE

BE-SOP-06

Soil Sampling

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) will be used for collecting soil samples from both surface and sub-surface soils. The sampling methodology is outlined in the project-specific UFP-QAPP. This SOP focuses on the most commonly used soil sampling tasks and applications anticipated for the project and should be used in conjunction with other applicable project SOPs. **In particular, all field personnel who collect or handle soil samples or materials potentially in contact with samples collected for per- and polyfluorinated alkyl substances (PFAS) will closely review BE-SOP-34 for PFAS sampling protocols and acceptable sampling equipment.**

2.0 GENERAL

Selecting the proper methods and tools for soil sampling is a critical part of field investigations. This SOP describes the methods generally used for surface and subsurface soil sampling, as well as the tools commonly used. Actual sampling locations will be confirmed in the field prior to initiation of the sampling program. Samplers should anticipate adjustments to the sampling program while in the field and be prepared to accommodate necessary changes.

All soil sample collection activities should adhere to the notetaking, decontamination, labeling, packaging, shipping, storage, and chain-of-custody requirements applicable to the soil sampling activities being conducted according to the SOPs discussed in Attachment 1. Refer to technical procedure BE-SOP-03 for details on sample container labeling, handling, shipping, and chain-of-custody requirements.

Project staff are to always wear appropriate personal protective equipment (PPE) as prescribed by the *Health and Safety Plan* (HSP). All personnel who collect or handle the samples should wear, at a minimum, disposable nitrile gloves to prevent cross-contamination and provide personal protection. New gloves should be donned for sample collection at each location, or whenever gloves are torn or otherwise compromised. The HSP provides information on PPE requirements.

3.0 EQUIPMENT AND MATERIALS

The following equipment is typically used for soil sampling, but is not limited to the following:

- Spade or trowel
- Shovel, pickaxe, mattock, or other excavating tools
- Hand auger with extension rods, as necessary
- Survey stakes, flags, or whiskers to mark sample locations
- Tape measure
- Sample gloves-plastic or latex, disposable, powderless
- Personal Protective Equipment (PPE)
- Stainless steel homogenization bucket or bowl

- Stainless steel lab spoons
- Zip-top plastic bags
- Scale
- Laboratory-supplied sample containers, preservatives, labels, custody seals, and temperature blanks
- Ice (wet or gel ice) (see BE-SOP-34 for restrictions for PFAS investigations)
- Decontamination supplies/equipment
- Trash bags
- Field logbook (see BE-SOP-34 for restrictions for PFAS investigations)
- Permanent pens and markers (see BE-SOP-34 for restrictions for PFAS investigations)

Refer to Attachment 1, Soil/Sediment Sampling Checklist for a more detailed equipment list.

4.0 METHOD SUMMARY

Soil samples may be collected using a variety of methods and equipment, depending on the depth of the soil profile, the type of sample required (disturbed vs. undisturbed), contaminants present, and soil classification. In general, surface soil is defined as soil that extends no more than 2 feet below the ground surface (bgs) and subsurface soil is defined as soil that is more than 2 feet bgs.

4.1 Surface Soil Sampling

Surface soil samples will be collected as discrete samples. Each surface soil sample will be collected using a decontaminated stainless-steel scoop/lab spoon. For non-VOC samples, the sampler, wearing clean disposable nitrile gloves, will remove sample debris including pebbles and roots from the mixture as the sample is collected. Each non-VOC sample will be collected by thoroughly homogenizing material from the appropriate depth interval bgs from the respective sampling location. The decontaminated stainless-steel scoop/spoon will be used to collect the soil sample and fill all laboratory-supplied analytical sample containers.

For surface soil sampling, follow these general steps:

1. Ensure that the sampling area is safe for entry.
2. Use decontaminated stainless steel hand tools to access the depth required for sampling.
3. When collecting the sample collect soil from **freshly** uncovered soil.

4.2 Subsurface Soil Sampling

Before subsurface soil sampling, each sample location should be checked and cleared for buried utilities before intrusive activities begin.

Down-the-Hole (DTH) Air Rotary Drilling: DTH air rotary drilling consists of advancing a Macro-Core in front of the outer casing to the desired depth. The drill casing transmits the necessary feed force and rotation to the hammer and the bit, along with air, used to actuate the hammer and flush the cuttings. The drill casings are added to the drill string successively behind the hammer as the hole gets deeper.

Hollow Stem Auger Drilling: The hollow-stem auger allows for continuous soil recovery and monitoring well installation. Comparison studies between direct push and hollow-stem auger drilled wells in a wide range of formations show little difference in performance.

Refusal (in all drilling methods) can be met in certain soil types such as gravel, or where large cobbles or boulders are present. If refusal is encountered, a secondary borehole location may be advanced, depending on site lithology, current conditions, or the recommendation of the on-site Brice Geologist.

Samples for laboratory analysis will be immediately transferred into clean laboratory sample containers using a decontaminated stainless-steel spoon or scoop, as described previously in Section 4.1. The soil core will then be logged for lithology (BE-SOP-05). Drilling and sampling rates must be coordinated so that core sections are not left waiting to be sampled while exposed to air.

Soil cores may also be photographed. Special attention must be paid to labeling and storage of individual core samples when continuous soil samples are collected from a single boring. In many instances, soil cores can be produced faster than they can be opened, logged, screened, and sampled by a technician. In those instances when a backlog of cores is being generated, care must be made to protect the cores from direct sunlight, excessive ambient temperatures, and rain. Always keep the cores labeled so that the up/down orientation is not lost. If necessary, log soils for lithology information after sample collection.

4.3 GENERAL SAMPLE COLLECTION STEPS

1. After retrieval of soil, follow the below general steps for all soil samples.
2. Remove bits of vegetation and large gravel from the sample as these items are not analyzed and reduce the available sample volume for analysis.
3. Take care to prevent cross-contamination and misidentification of samples.
4. Properly label the sample according to the project-specific UFP-QAPP.
5. Record the sample location and depth, the sample date and time, and any other applicable information in the field notebook and on any applicable sampling forms prior to moving on to another sampling location.
6. Decontaminate any non-dedicated, reusable sampling equipment according to the Equipment Decontamination SOP (BE-SOP-14) prior to moving on to the next sampling location.
7. Samples will be collected after soil is homogenized. Collect a non-volatile grab sample using a sample spoon or gloved hand and place the soil into a re-sealable plastic bag or bowl/pan/tray to homogenize the soil. To homogenize the soil, seal the plastic bag and mix and/ or stir the soil with a spoon or spatula. Place the homogenized soil directly into a laboratory-supplied jar.
8. Make notes on the boring log regarding the soil characterization and geologic features, including any staining or olfactory observations (see BE-SOP-05 for soil logging).
9. Wipe down the jar threads to remove any soil, close the jar with the lid, and wipe the outside of the jar using paper towels or other clean, dry wipes.
10. Label the sample container with the appropriate information, typically using a label with waterproof adhesive, or if not, securing the label with clear tape.

5.0 QUALITY ASSURANCE/QUALITY CONTROL PROCEDURES AND SAMPLES

Quality Assurance/Quality Control (QA/QC) samples should be collected during soil sampling according to UFP-QAPP Worksheets 17 and 20 of the UFP-QAPP. QA/QC samples will be assigned unique sample identification and submitted for PFAS analysis, as specified in the UFP-QAPP. QA/QC samples will be handled and submitted to the laboratory in the same manner as field samples.

5.1 Equipment Blanks

Equipment blanks should be collected at a frequency specified in the UFP-QAPP. An equipment blank sample is collected in the field by running ASTM Type II Reagent-Grade water (PFAS-Free and/or deionized water with less than 15 microSiemens conductivity) across the surface of re-usable, decontaminated sampling equipment and into appropriate sample containers.

5.2 Field Duplicate Samples

Field duplicates will be collected at a frequency specified in UFP-QAPP Worksheets 17 and 20. Field duplicate samples will be collected simultaneously or in immediate succession to the normal samples using identical sampling techniques.

5.3 Matrix Spikes and Matrix Spike Duplicates

MS/MSD samples will be collected at a frequency specified in UFP-QAPP Worksheets 17 and 20. MS/MSD samples will be collected simultaneously or in immediate succession to the normal samples using identical sampling techniques.

5.4 Field Blanks

Field blanks will be collected at a frequency specified in UFP-QAPP Worksheets 17 and 20. Field blanks are a sample of reagent water poured into the container in the field and shipped to the laboratory with field samples.

6.0 CROSS CONTAMINATION, INTERFERENCES AND POTENTIAL PROBLEMS

Potential issues associated with soil sampling are cross-contamination and inadequate sample homogenization. To prevent cross-contamination, sampling equipment will be disposable and used only once, or reusable sampling equipment will be decontaminated according to the guidelines in BE-SOP-14 prior to each use. To ensure representative samples and to minimize the variance of duplicates, samples will be homogenized to the extent practicable prior to transferring the soil to the sample jar.

ATTACHMENTS

Attachment 1 Soil/Sediment Sampling Checklist

Soil/Sediment Sampling Checklist

Prior to Sampling	Initial
Safety Tailgate meeting	
Obtain Permits	
Obtain Sample Containers from Lab	

Soil Sampling	Initial
Ekman or Ponar dredge device	
Spade/Trowel	
Shovel, pick ax, pick mattock	
Hand auger with extension rods	
Survey stakes, flags, or whiskers	
Tape measure	
Samplekits	
PFAS-free gel ice or fresh ice	
Sample sheets	
DI & Alconox	
Paper towels	
Shovel	
Full socket set (14mm)	
Tool to open well lids	
zip lock bags	
laboratory supplied containers	
preservatives, labels, custody seals	
temperature blanks	
Plastic Sheeting	
Coolers	
Trash bags	
Decontamination equipment	
Sample kits	
Sample sheets	
DI & Alconox	
Paper towels	
Stainless steel homogenization bucket	
Stainless steel lab spoon or equivalent	
Scale	

PPE/Misc.	Initial
Nitrile gloves	
Shades	
Tailgate form	
Knee pads	
Safety gear (hard hat, gloves, vest, etc.)	
Water	
Laminated site map	
Garbage bags	
PEP/HSE Plan	
Camera	
Whiteboard and marker	

After Sampling	Initial
Address Waste	
Close out permits	
CoC and Samples in cooler	
Download Cameras	
Charge harmony	
QC, chill, and secure samples	
Complete field notes	
Debrief (tailgate form)	

Brice Environmental Services Corporation
Last Updated: 9/23/2015

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STANDARD OPERATING PROCEDURE

BE-SOP-07

Sediment Sample Collection

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) provides guidance for conducting sediment sampling from shallow sediment environments using hand tools. For the purposes of this SOP, sediments are those mineral and organic materials situated beneath an aqueous layer. The aqueous layer may be either static, as in lakes and ponds, or flowing, as in rivers and streams. This SOP also provides general guidance about methods and considerations to be used when collecting sediment samples for field screening or laboratory analysis. The specific methods implemented in the field will be specified in the project-specific Work Plan (WP).

This SOP was developed in accordance with the following guidance documents:

- *Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual* (U.S. Environmental Protection Agency [EPA] 2001)

This SOP focuses on the most common shallow sediment sampling procedures and tasks and should be used in conjunction with other applicable SOPs, including the following:

- BE-SOP-01: Logbook Documentation and Field Notes
- BE-SOP-02: Sample Chain-of-Custody
- BE-SOP-03: Labeling, Packaging, and Shipping Samples
- BE-SOP-04: Quality Control Samples
- BE-SOP-08: Incremental Soil Sampling
- BE-SOP-14: Equipment Decontamination
- BE-SOP-15: Field Screening with a PID
- BE-SOP-25: Underground Utility Locates
- BE-SOP-29: GeoXH GPS Location Survey

In freshwater, estuarine, and marine ecosystems, sediments provide essential habitat for aquatic organisms. Sediments also serve as a reservoir for pollutants and therefore a potential source of pollutants to the water column. In these aquatic ecosystems, anthropogenic chemicals and waste materials, particularly persistent organic and inorganic chemicals, may accumulate in sediments (EPA 2001). Contaminated sediments represent a hazard to many aquatic organisms through direct toxicity, while wildlife and human health may be affected through bioaccumulation in the food chain.

Sediment quality assessment consists of chemical characterization, toxicity tests, and/or bioaccumulation tests using procedures that maintain in situ conditions to represent the sediment most accurately under study. Three common methods for whole sediment sampling devices include:

1. Grab samplers
2. Core samplers
3. Dredge samplers

For the purposes of this SOP, only sediment sampling with grab and core samplers will be discussed. For sediment sampling using dredge samplers, refer to the EPA Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual.

Sediment samples must be collected in the order of volatility:

1. Volatile organic compounds (VOCs) and gasoline range organics (GROs)
2. Sediment toxicity (acute and chronic)
3. Semi-volatile organic compounds (SVOCs); including diesel range organics/residual range organics, polynuclear aromatic hydrocarbons, polychlorinated biphenyls, pesticides, and herbicides
4. Total organic carbon and inorganic compounds (total metals, dissolved metals, nitrate/nitrite, and sulfide)
5. Bioaccumulation testing

2.0 EQUIPMENT AND SUPPLIES

Field materials will include, but are not limited to, the following:

- Flat-bottom scoops with upright, flat sides
- Core sampler with extension rods (AMS Multi-Stage Sediment and Sludge Sampler)
- Plastic core liners
- Core cutter
- Survey stakes, flags, buoys, or anchors to mark sample locations
- Tape measure
- Stainless steel homogenization bowl
- Sheet pan for subsample collection
- Stainless steel spoons
- Plastic sheeting
- Gallon-sized zip-top bags
- Scale
- Sampling containers or syringe samplers (e.g., EnCore sampler), labels, and packing materials
- Decontamination supplies and equipment
- Garbage bags
- Field forms, field logbook, and indelible pens and markers
- 5-gallon buckets
- Personal protective equipment

3.0 PROCEDURES

Equipment selected must meet data quality and collection objectives. No sediment sampling equipment is appropriate for every objective and environmental setting. Selection of an appropriate sediment sampling technique is contingent upon the depth of water at the sampling location, particle size, the portion of the sediment profile required (surface versus subsurface), the type of sample required (disturbed versus undisturbed), and sample volume required.

The sediment sampling techniques described below are designed to minimize effects on the chemical and physical integrity of the sample. If the following procedures are followed, a representative sample of the sediment should be obtained.

3.1 Special Considerations

If samples are to be analyzed for VOCs, GROs, or toxicity testing, they should be collected in a manner that minimizes disturbance of the sample. The sample for VOC analysis should be collected directly from the sample device, if possible, before it is emptied into the pan. The sample shall be placed in the appropriate sample container with no headspace. **Samples for VOC, GRO, and toxicity testing analyses are not homogenized.**

In some cases, the sediment may be soft and not lend itself to collection by plunging EnCore Samplers or syringe samplers into the sample matrix. In these cases, it is appropriate to open the sampling syringe prior to sample collection, and to carefully place the sediment in the device, filling it fully with the required volume of sample (EPA 2020).

3.2 Grab Sampling

The physical location of the sampler when collecting a sample will dictate the equipment to be used. Wading is the preferred method for reaching the sampling location. To minimize biased results by disrupting the bottom surface, samples should be collected facing upstream (if applicable). If the stream is too deep to wade, collect the sample from a platform such as a bridge or boat.

3.2.1 Surface Sediment Sampling Beneath a Shallow Aqueous Layer with a Trowel or Scoop

If the water body is shallow enough to wade, the easiest way to collect a sediment sample is to use a stainless steel scoop or spoon. Wade into the water and while facing upstream (into the current), scoop the sample along the bottom of the water body in the upstream direction. Excess water may be removed from the scoop or spoon. However, this may result in the loss of some fine sediments associated with the bottom of the surface water body (EPA 1999).

This method can be used to collect consolidated sediments but is limited somewhat by the depth of the aqueous layer. In surface water bodies that are too deep to wade, but less than 8 feet deep, a stainless steel scoop or spoon attached to a piece of conduit can be used either from the bankside if the water body is narrow or from a boat (EPA 1999).

After collection, the sediment is placed into an inert pan and homogenized, however refer to Special Considerations in Section 3.1. A stainless steel or plastic scoop or spoon will suffice in most applications. Sediment samples will be collected using the following steps:

- Using a precleaned stainless steel scoop or spoon, remove the desired thickness of sediment from the sampling area.
- Transfer the sample or a specified aliquot of sample into appropriate sample containers or homogenization container, whichever is applicable.
  - See Section 1.0 for sample collection order and Section 3.1 for special considerations.
  - Ensure that homogenization containers are decontaminated prior to re-use.

- Decant surface water from the sample or homogenization container prior to sealing or transfer, while taking care to retain fine sediments during this procedure.
  - Consider waiting a few minutes to let the fine sediment settle out before decanting.

3.3 Core Sampling

Coring devices range from hand-driven push tubes to electronic vibration core tube drivers. Coring devices have the advantage of maintaining the vertical profile thus preserving the depositional history, maintenance of oxygen-free environments in sediments, and creating minimal turbulence through the water thus preserving fine sediments at the sediment-water interface. The disadvantage is the relatively small surface area and sample size obtained, requiring repetitive coring to obtain the required amount of material for analysis (EPA 2001). Most core samplers do not work well in sandy sediments or in extremely soft (high water content) sediments; use of a core catcher is recommended in these sediment types.

Hand-driven core sampling systems consists of a sampler base, coring/auger tips, plastic liners, and a series of extension rods. The sampler base is loaded with a plastic liner, driven into the sediment, and used to extract a core. A core sampler may also consist of only a plastic liner attached to the end of an extendable push rod. The use of additional extensions in conjunction with a sample core device can increase the depth of water from which the sediment can be collected from 24 inches to 10 feet or more. However, sample handling and manipulation increases in difficulty with increasing depth of water.

Waste soil and core liners will be handled and disposed of as described in the waste management section of the project-specific WP.

3.3.1 Surface Sediment Sampling Beneath a Shallow Aqueous Layer with a Core Sampler

Caution should be exercised not to disturb the bottom sediments when the sample is obtained by wading in shallow water. Always work facing upstream and working from downstream up. When extensive core sampling is required, such as a cross-sectional examination of a streambed with the objective of profiling both the physical and chemical contents of the sediment, complete cores are desirable.

Use the following procedure to collect sediment samples with a hand-driven core sampler:

- Attach the core tip and core catcher to the sample liner.
  - Sample liners for surface sediment sampling are typically 12 inches in length.
- Insert the assembled plastic liner into the sampler body base.
  - Sampler bodies come in 12-inch sections.
- Screw on the top cap of the sampler.
  - Ensure rubber check valve is sitting freely on the cap.
- Attach the required length of extensions.
  - Attach “T” handle to the upper extension to assist in rotation of the core sampler, if necessary.
    - Rotation of the core sampler is useful in loose sediment recovery.
- Attach slide hammer to top of extension, if necessary.
- Insert the sampler into the material to be sampled at a 0 to 20 degree (°) angle from vertical.
- Push the core sampler or use the slide hammer to drive the core sampler to the required depth.

  - Slide hammer typically has 17 inches of stroke.
- Slowly withdraw the sampler from the sediment.
  - Back hammer the sampler out using the slide hammer, if necessary.
- Unscrew the top cap from the extensions.
- Unscrew the core tip from the sampler body.
- Push the sample liner out of the sampler body.
- Cap off both ends and label the sample liner.
- Collect samples as described in Section 3.2.1.

3.3.2 Subsurface Sediment Sampling Beneath a Deep Aqueous Layer with a Core Sampler

Similar to surface sediment sampling, the sampler body is attached to extensions allowing it to be pushed or driven into the sediment from a boat or while wading. For deep sediment sampling, the sampler body can be extended to the required depth. Multiple sampler bodies can be attached in 12-inch sections. Continuous samples in 12-inch increments up to 72 inches are possible, if sediment conditions allow. Sample liners are also available in 24-, 36-, or 48-inch increments.

- Attach the required length of sampler body.
- Assemble the remaining parts of the core sampler and collect sediment as above.
- Unscrew the sampler body from the extensions.
- Unscrew the core tip from the sampler body.
- Unscrew the sampler bodies one section at a time.
- Push the sample liner out of the sampler body.
- Cap both ends of the sample liner.
- Label sample liner with the sample depth.
- Collect samples as described in Section 3.2.1.

3.4 Incremental Sediment Sampling

Well thought out decision units (DU) and investigative objectives are required for sediment investigations, similar to soil investigations. Incremental sampling methodology (ISM) sediment sampling activities may provide more reliable data critical for vertical characterization of contaminants in sediment, refer to BE-SOP-08: Incremental Soil Sampling for details.

ISM sediment sampling in shallow water should not involve more effort than that required from the collection of soil surface samples. Grab and core sampling methods may be used for ISM sediment sample collection. Preferably, collected increments should be core-shaped to provide equal coverage across the entire targeted depth of soil. If sediment cover is exceptionally thin (less than 4 inches) a flat-bottom scoop sampler may be more practical. Flat-bottom scoops with upright, flat sides help avoid bias toward the upper layers of sediment (Hawai'i Department of Health [HDH] 2018).

ISM sampling in a stream or canal can be a challenge. For long, narrow DU, consider placing a long, floatable rope with marked spacing within the DU or place a long tape measure with marked increments along the edge of the water.

ISM sediment sampling in deeper and/or larger bodies of water will require a core sampler (Section 3.3). Sediment core samplers have the ability to retain the integrity of sediment horizons with minimal disturbance and allow the collection of unbiased core-shaped increments.

4.0 POTENTIAL INTERFERENCES

The selection of the sampling location can greatly influence the analytical results. Substrate particle size and organic content are directly related to water velocity and flow characteristics of a body of water. Contaminants are more likely to be concentrated in sediments characterized by fine particle size and high organic content typical to depositional zones. In contrast, coarse sediments with low organic content typically do not concentrate pollutants and are typically found in erosional zones (EPA 1999).

5.0 SAMPLE HANDLING, PRESERVATION, AND STORAGE

The following procedure will be followed for sampling handling, preservation, and storage:

1. Transfer the sample into a labeled container.
2. Preserve the sample or use pre-preserved sample bottles (if required by analytical method).
3. Cap the container and place into a cooler to maintain 4 plus or minus 2 degrees Celsius (if required by analytical method).
4. Record all pertinent data in the site logbook and/or on the field data sheet.
5. Complete the chain-of-custody (CoC) form.
6. Attach the custody seals to the cooler prior to shipment.

Refer to the Labeling, Packaging, and Shipping SOP (BE-SOP-03) for procedures on labeling, packaging, and shipping samples.

6.0 DATA AND RECORD MANAGEMENT

Sign the CoC form over to the laboratory or courier. Maintain a copy with the sampling records. Refer to Sample Chain-of-Custody SOP (BE-SOP-02) for procedures on sample CoC.

Sediment sampling locations will be surveyed to the accuracy specified in the project-specific WP, refer to GeoXH GPS Location Survey (BE-SOP-29) for details. Survey information, including swing-tie measurements, will be documented in the field logbook.

7.0 QUALITY CONTROL AND QUALITY ASSURANCE

All field quality control (QC) sample requirements in the project-specific WP must be followed. These may involve trip blanks, equipment blanks, field duplicates, and the collection of additional sample volumes for the laboratory's QC (matrix spike and matrix spike duplicates). The frequency of QC samples will be outlined in the project-specific WP. Refer to the Quality Control SOP (BE-SOP-04) for procedures on QC samples.

8.0 REFERENCES

U.S. Environmental Protection Agency (EPA). 1999. *Sediment Sampling: Field Sampling Guidance.*

EPA. 2001. *Methods for Collection, Storage and Manipulation of Sediments for Chemical and Toxicological Analyses: Technical Manual.* October.

EPA. 2020. *Sediment Sampling: Operating Procedure.* February.

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STANDARD OPERATING PROCEDURE

BE-SOP-09

Groundwater Sample Collection

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) provides methodology for planning groundwater sampling events and collection of groundwater samples.

This SOP was developed in accordance with the following guidance documents:

- *Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers* (U.S. Environmental Protection Agency [EPA] 2002)
- *Low Stress (Low Flow)-Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells* (EPA 2017)
- *Standard Practice for Low-Flow-Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations* (American Society for Testing and Materials [ASTM] 2018)

This SOP focuses on the most commonly used monitoring well sampling tasks and should be used in conjunction with other applicable SOPs, including the following:

- BE-SOP-01: *Logbook Documentation and Field Notes*
- BE-SOP-02: *Sample Chain of Custody*
- BE-SOP-03: *Labeling, Packaging, and Shipping Samples*
- BE-SOP-04: *Quality Control Samples*
- BE-SOP-14: *Equipment Decontamination*
- BE-SOP-20: *Water Quality Measurements*
- BE-SOP-34: *Field Sampling Protocol for PFAS*

All field personnel who collect or handle groundwater samples or materials potentially in contact with samples collected for per- and polyfluorinated alkyl substances (PFAS) must closely review BE-SOP-34 for PFAS sampling protocols and acceptable sampling equipment.

The objective of groundwater sampling is to collect a water sample that is representative conditions within the aquifer for analysis of groundwater contamination and/or naturally occurring analytes. Samplers should refer to the project-specific work plan, Sampling and Analysis Plan, Quality Assurance Project Plan, or similar document to determine sampling locations, methods, and analytes. Four common methods for well sampling include:

1. Low-Flow Method
2. Well-Volume Method
3. Low-Permeability Formation Method

Monitoring well sampling can be initiated as soon as the groundwater has re-equilibrated following well installation, is free of visible sediment, water quality parameters have stabilized, or 24 hours have passed following development. Disturbance of the well, water column, and samples must be minimized, and only discrete grab samples may be collected. If multiple wells are to be sampled, it is recommended that the wells be sampled from the least contaminated well progressing to higher levels of contamination to avoid potential cross-contamination.

Additionally, samples at a given location must be collected in the order of volatility except for PFAS, which should be collected first to avoid potential cross-contamination with sampling materials containing PFAS (e.g., Teflon sample container lids):

1. PFAS
2. Volatile organic compounds (VOCs) and gasoline range organics (GRO)
3. Semi-volatile organic compounds (SVOCs); including diesel range organics/residual range organics (DRO/RRO), polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), pesticides, and herbicides
4. Total organic carbon (TOC)
5. Inorganic compounds (total metals, dissolved metals, nitrate/nitrite, and sulfide)

2.0 EQUIPMENT AND SUPPLIES

Groundwater sampling can be performed using several devices including submersible pumps, bladder pumps, peristaltic pumps, or bailers. Groundwater sampling devices must support the intended data use and site decisions, and selected groundwater purging and sampling equipment must minimize increases in sample temperature, water column agitation, and sample agitation.

Groundwater sampling equipment may include, but is not limited to, the following:

- Appropriate level of personal protective equipment
- Well keys
- Camera
- Logbook, weatherproof pen, sharpie, etc.
- *Groundwater Sampling Form* (Attachment 1)
- Sample labels
- Sampling containers and packing materials
- Oil/water interface probe or water level indicator
- Submersible (e.g., Proactive Monsoon pump with low-flow controller, or equivalent), bladder (e.g., QED Sample Pro), or peristaltic pump (e.g., MasterFlex Easy-Flow)
- Disposable Teflon bailers and twine
- Graduated cylinder or beaker
- YSI water-quality meter or similar multimeter
- Hach turbidimeter
- Potable water and/or deionized water
- Tubing (Teflon, high-density polyethylene [HDPE] and/or silicone)
- Liquinox, Alconox, or equivalent
- RAE Systems MiniRAE photoionization detector (PID) (or similar), if necessary
- Colorimetric gas detector tubes, if necessary

3.0 PROCEDURES

3.1 Recording Field Observations

The *Groundwater Sampling Form* (Attachment 1) is intended to capture all of the information routinely collected during the sampling process for established monitoring wells. The field logbook is intended to record all equipment calibration checks, the wells sampled, sampling start and end times, or any other pertinent information not captured on the *Groundwater Sampling Form*.

3.2 Field Equipment Decontamination

Clean and/or decontaminate all equipment and materials used during groundwater sampling before use, as discussed in *Equipment Decontamination* (BE-SOP-14). Groundwater sampling equipment that typically requires decontamination includes all measurement devices before and between measurements at each well, groundwater sampling pumps between sampling at each well, and water quality meters and probes. Used decontamination solution will be managed as investigation-derived waste.

3.3 Field Instrument Calibration

Field instruments will be calibrated in accordance with the manufacturer's recommended procedures and frequency for each instrument. Refer to *Water Quality Measurements* SOP (BE-SOP-20) for related procedures.

3.4 Air Monitoring

Air monitoring using a PID may be required to screen for the presence of VOCs for certain projects. The project-specific Accident Prevention Plan and/or Site Safety and Health Plan (SSHP) should be consulted to determine monitoring requirements and procedures. PID readings will be monitored until stable and then recorded in the field logbook.

3.5 Free Product and Water Level Measurement

Prior to sampling, the depth to groundwater (DTW), depth to product (DTP) (if present), and total well depth (TD) must be collected to the nearest 0.01-foot with an oil/water interface probe or water level meter, as appropriate. Measurements should be collected relative to an established reference mark from the top of the casing (TOC) at each well. The reference mark should be permanent, such as a small notch cut into the TOC or a permanent ink mark at the TOC. If a reference mark is not present, place a mark on the outside of the top north side of the well casing with indelible ink. TD of a monitoring well should be compared to the well construction log as a check to ensure the correct well is being sampled and to determine the thickness siltation at the bottom of the well. Further measurements procedures are specified in the *Groundwater and LNAPL Measurements SOP* (BE-SOP-21).

If non-aqueous phase liquid (NAPL) is encountered in a well, unless otherwise specified in the project-specific work plan or similar document, do not collect laboratory samples. If samples are to be collected, remove the product with a bailer and make a note on the chain of custody that free product is present.

3.6 Purging

Purging is the process by which stagnant water is removed from the well casing prior to sampling and replaced with groundwater from the adjacent formation. This allows for a representative sample to be collected from the actual aquifer condition and must be completed for both low-flow (Section 3.7.1) and well-volume (Section 3.7.2) sampling methods. Purging for low-flow sampling will be conducted in accordance with EPA low-flow guidelines (EPA 2017).

Different sampling methods may require determining the volume of water in the well being sampled. The formula to calculate one well casing volume is as follows:

*(TD of Casing – DTW) * Gallons per Foot of Casing*

Refer to Attachment 1 for the various gallons per foot of casing based on the diameter of the well.

Sampling using low-flow and well-volume methods involved monitoring water quality parameters while pumping to determine if stability has been achieved. All water quality measurements, except turbidity, must be obtained using a flow-through cell. Water quality parameters are considered stable when consecutive changes between three successive readings at approximately 3 – 5 minute intervals are within:

- ± 3% for temperature
- ± 0.1 for pH
- ± 3% for conductivity
- ± 10 millivolts for oxidation reduction potential
- ± 10% for dissolved oxygen
- ± 10% or ≤ 10 NTU for turbidity

3.7 Groundwater Sampling

3.7.1 Low-Flow Method

The low-flow sampling method uses groundwater quality parameters as indicators to determine when formation water is being discharged. Sampling at low-flow rates provides more accurate and reproducible samples of the formation water by minimizing hydraulic stress compared to high flow/high volume purging, while also reducing purge water volume. Low-flow sampling is not suitable for very low-yield wells or wells known to contain NAPL and may require longer purge times (ASTM 2018).

Low-flow sampling is typically conducted using bladder pumps (positive displacement pumps), submersible pumps or peristaltic pumps. The use of Teflon-lined polyethylene tubing is preferred for the sample collection of organic compounds. For the analysis of per- or polyfluorinated alkyl substances hydrocarbons (PFAS) HDPE tubing is to be used; however, the use of HDPE equipment should be minimized to the extent practical. Sampling of wells in order of increasing chemical concentrations (known or anticipated) is preferred.

Samples will be collected using the following steps:

- Measure and record the initial DTW, DTP, and TD before installing the pump.
- Lower the pump or peristaltic pump tubing to the target depth below the static water level.
  - Record the depth of the pump or bottom of tubing on the Groundwater Field Data Form.

- Consult the project-specific work plan or equivalent document for pump and tubing placement. Typically:
  - § For wells screened across the groundwater interface, a pump intake of 1.0 to 2.0 feet below the static water level is typically used.
  - § For wells with submerged screens, set the pump intake at the middle of the screened interval (ASTM 2018).

· Begin purging water into a graduated cylinder or similar volume measurement device. Measure the volume pumped in one minute to determine flow rate. Adjust the flow rate, as needed, so that drawdown does not exceed 0.33 feet (EPA 2002).
  - Flow rates typically range from 50 to 500 milliliters per minute (mL/min) (0.01 to 0.13 gallons per minute[gal/min]), but higher rates are consistent with low-flow guidelines as long as the drawdown requirement is met.
  - Flow adjustments are best made in the first 15 minutes of pumping in order to minimize purging time.
  - Record flow rate changes on the field sampling sheet.
· After observable turbidity decreases and purge water has shown it is free of product, connect the flow-through cell to begin measuring and recording stabilization parameters and DTW on the field sampling sheet.
· Continue to purge and record measurements until stabilization criteria are met (Section 3.6) or a minimum of three or maximum of six well casing volumes are removed (EPA 2002).
· When collecting samples, disconnect the tubing from the flow-through cell and collect samples directly from the pump's tubing.
· Begin filling laboratory-supplied analytical sample containers in order of volatility as described in Section 1.0.
· Record sample information on the sample bottle labels and Attachment 1.

3.7.2 Well-Volume Method

This method is the default method used during low-flow sampling if groundwater stabilization parameters cannot be achieved. The well-volume method is based on purging three to six well volumes before sampling (EPA, 2002). One well casing volume of water may be calculated using the formula in Section 3.6.

Well-volume method sampling should be conducted as above in the Low-Flow Method, but:

· The purge rate should not be great enough to produce excessive turbulence in the well.
  - Flow rates typically range from 500 mL/min to 3.8 L/min (0.13 to 1 gal/min) in a 2-inch well (EPA 2002).
· Routinely measure and record groundwater parameters and DTW at approximately every 0.5 – 1 well volume interval on Attachment 1 (EPA 2002).
· Once groundwater parameters have stabilized and a minimum of three well casing volumes have been removed, record the final measurements.
· If parameters have not stabilized within six well volumes, stop purging and record the final measurements.

- Reduce the flow rate of the pump to about 0.13 gal/min and collect samples as above (EPA 2002).

3.7.3 Low-Permeability Formation Method

If a well is screened in low hydraulic conductivity aquifers (silt and clay) there may be no way to avoid pumping or bailing a well dry. Low-flow purging and sampling are useful for wells that purge dry or take one hour or longer to recover.

If a low yield well is purged dry, and it is not possible to obtain groundwater stability parameters:

- Purge the well dry and allow the well to recover until at least one of the following is met:
  - If full recovery exceeds one hour, collect samples as soon as the well has recharged to 80 percent of the DTW.
  - A minimum of 2 hours has passed since purging (EPA 2002).
- Collect samples in order of volatility, as described in Section 1.0.
  - Bailers or a peristaltic pump may be used; however, analytical results may be biased low for VOCs if using a peristaltic pump or biased high for metals if using a bailer due to increased turbidity (EPA 2002).

4.0 POTENTIAL INTERFERENCES

Two potential interferences associated with groundwater sampling are cross-contamination and a lack of sample representation due to improper well purging or stabilization. Cross-contamination can be a significant problem when attempting to characterize low concentrations of organic compounds or when soils are highly contaminated (ADEC 2017). To prevent cross-contamination between wells, dedicated tubing can be placed in each well and all non-disposable equipment that may directly or indirectly come in contact with samples will be decontaminated prior to use at a different location. The *Equipment Decontamination* SOP (BE-SOP-14) outlines the decontamination procedure. To ensure that representative conditions within the aquifer are captured during sample collection, the purge rate will be maintained at a rate that produces minimal drawdown until three well casings have been removed or until water quality parameters have stabilized, as described in Section 3.6.

5.0 SAMPLE HANDLING, PRESERVATION, AND STORAGE

The following procedure will be followed for sampling handling, preservation, and storage:

1. Transfer the sample into a labeled container.
2. Preserve the sample or use pre-preserved sample bottles (if required by analytical method).
3. Cap the container and place into a cooler to maintain 4 ± 2°C (if required by analytical method).
4. Record all pertinent data in the site logbook and/or on the field data sheet.
5. Complete the chain of custody form.
6. Attach the custody seals to the cooler prior to shipment.

Refer to the *Labeling, Packaging, and Shipping* SOP (BE-SOP-03) for procedures on labeling, packaging, and shipping samples.

6.0 DATA AND RECORD MANAGEMENT

The chain of custody form is signed over to the laboratory. A copy is kept with the sampling records. Refer to *Sample Chain of Custody* SOP (BE-SOP-02) for procedures on sample chain-of-custody.

7.0 QUALITY CONTROL AND QUALITY ASSURANCE

All field Quality Control (QC) sample requirements in the project-specific work plan must be followed. These may involve trip blanks, equipment blanks, field duplicates, and the collection of additional sample volumes for the laboratory's quality control (matrix spike and matrix spike duplicates). The frequency of QC samples will be outlined in the project-specific work plan. Refer to the *Quality Control* SOP (BE-SOP-04) for procedures on quality control samples.

8.0 REFERENCES

ADEC. 2017 (March). *Underground Storage Tanks Procedures Manual: Guidance for Treatment of Petroleum-Contaminated Soil and Groundwater and Standard Sampling Procedure.*

ASTM. 2018 (September). D6671 - *Standard Practice for Low-Flow-Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations.*

U.S. EPA. 2002 (May). *Ground-Water Sampling Guidelines for Superfund and RCRA Project Managers.* Office of Solid Waste and Emergency Response. EPA 542-S-02-001.

U.S. EPA. 2017 (September). *Low Stress (Low Flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells.* EPA 540-S-95-504.

ATTACHMENTS

Attachment 1 Groundwater Sampling Data Form

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GROUNDWATER SAMPLING DATA FORM

Well ID:_____

Project Name: _____ Date: _____

Project Number: _____ Start Time: _____

Sampling Team: _____ End Time: _____

Sample ID: _____ Time: _____ primary dup other: _____

Sample ID: _____ Time: _____ primary dup other: _____

Sample ID: _____ Time: _____ primary dup other: _____

Depth to Top of Product (BTOC): _____ Total Depth (BTOC): _____

Depth to Oil/Water Interface (BTOC): _____ Depth to Water (BTOC) _____

Casing Diameter:	*1 in.*	*2 in.*	*4 in.*
gal/ft of casing:	*0.041*	*0.163*	*0.653*

Water Column (ft) _____

Casing Volume (gal) _____

Pump Intake Depth: _____ Screen Interval _____

Stable DTW (BTOC): _____ Measured Stick-up _____

Method of Purging (circle one):

Pump: SUB BLDR PERIST OTHER:

Pump Type: Flow Rate (gpm):

Pump Time:

Bailer: TEFLON SS OTHER:

Required Pulls: Bailer Vol. (gal): 0.25 / 0.33

Vol. Purged (gal):

WELL STABILIZATION DATA

Time	Total Volume Purged (gallons)	Water Level (ft BTOC)	Draw Down	Temp. (°F or °C)	pH	Conductivity (µS/cm)	ORP (mV)	D.O. (mg/L)	Turbidity (NTU)
				± 3%	± 0.1	± 3%	± 10mV	± 10%	± 10% or <10 NTU

Notes: Drawdown should be less than 0.3 feet from the original DTW. Minimal drawdown achieved and measured by: 1) pumping at a low rate (approx. 1 liter/3 minutes or 0.26 gallons/3 minutes or 50-500 mL/min) **and** 2) continually measuring water levels in the well.
Sample after 1) removing min. of 3 casing volumes **or** 2) min. of 3 parameters stabilize (4, if using temp.), **or** 3) for low yield wells, entire well casing is evacuated (ADEC, 2013).

Sensory Observations

Color: Clear, Amber, Tan, Brown, Gray, Milky White, Other

Odor: None, Low, Medium, High, Very Strong, H2S, Fuel-Like, Chemical ?, Unknown

Turbidity: None, Low, Medium, High, Very Turbid, Heavy Silts

Comments:

WELL STABILIZATION DATA

Time	Total Volume Purged (gallons)	Water Level (ft BTOC)	Draw Down	Temp. (°F or °C)	pH	Conductivity (µS/cm)	ORP (mV)	D.O. (mg/L)	Turbidity (NTU)
				± 3%	± 0.1	± 3%	± 10mV	± 10%	± 10% or <10 NTU

STANDARD OPERATING PROCEDURE

BE-SOP-10

Surface Water Sampling

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) describes the guidelines and procedures of collecting surface water samples. The SOP for the collection and analysis of sediment samples is found separately in the Sediment Sampling SOP (BE-SOP-07). The methodologies discussed in this procedure are applicable for liquid samples, both aqueous and non-aqueous, from streams, rivers, lakes ponds, lagoons, and surface impoundments. These procedures are applicable for samples collected at the surface.

2.0 MATERIALS AND EQUIPMENT

Collection of surface water includes, but is not limited to:

- Logbook
- Waterproof pen
- Field datasheets (e.g., sample description sheets, etc.)
- Tape measure
- Survey stakes, flags (white), or buoy and anchors
- Dip sampler
- Sampling jars
- Kemmerer bottle
- Preservatives
- Safety equipment
- Decontamination fluids and equipment
- Bottle labels
- Coolers and ice

Refer to Attachment 1, Water Sampling Checklist for a more detailed equipment list.

2.1 Reagents

Reagents are used for the preservation of surface water samples including hydrochloric acid (HCL), nitric acid (HNO_3), sodium hydroxide (NaOH), sodium sulfite, and ascorbic acid. HCL, HNO_3, and NaOH are used to preserve surface water samples collected in the field for volatile organic compound (VOC), metals, and cyanide analyses, respectively. It is not expected that surface water samples will contain free (residual) chlorine unless they are treated effluent samples or are collected near the outfall of a treated water effluent. If chlorine is suspected, the water will be tested for free chlorine using chlorine test strips according to manufacturer directions. If samples are collected for VOC, semi-volatile organic compound (SVOC), or cyanide analyses, samples that test positive for residual chlorine will require treatment with a reducing agent before sample preservation. Ascorbic acid is used as a reducing agent for samples collected for VOC and cyanide analyses, and sodium sulfite is used as a reducing agent for samples collected for

SVOC analysis. Samples collected for oil analysis may sometimes be preserved with HCL or sulfuric acid to prevent degradation by microbial action.

Reagents used for decontamination of sampling equipment are found in the Equipment Decontamination SOP (BE-SOP-14). Non-aqueous samples are typically not preserved due to the uncertain nature of the matrix, which may evolve harmful gases upon addition of acid or base to the sample.

3.0 PROCEDURE

3.1 Sampling Preparation

Prior to conducting sampling activities, a sampling preparation meeting will be held by the team to discuss the proposed sampling strategy for the project-specific Work Plan (WP). Site history, contaminant concerns, sampling methodology, individual responsibilities, sample shipment or delivery, health and safety issues, and lines of communication anticipated during the sampling event will be discussed.

3.2 Surface Water Collection

Surface water samples will be collected using hand tools. Typically, surface samples are collected from just below the water surface.

Samples will be collected at a frequency specified in the project-specific WP. Samples will be collected as follows:

- Don new personal protective equipment (gloves, etc.) before starting sample collection.
- Verify that all needed equipment is readily available and that the sample containers are new and have been properly prepared.
- Label container and sample-specific data sheet, if applicable.
- Using decontaminated or disposable sampling equipment, collect water from the sampling location by slightly submerging the sample container just below the water surface at a slight angle. If preservatives are in the sampling container, use a sampling container with no preservatives to collect the surface water and fill any pre-preserved sampling containers.
- Allow the container to fill with minimal agitation of the water. Be sure to avoid overfilling of the sample container by leaving a slight amount of headspace in the sample jar.
- Place the cap on the sample jar and tighten.
- Wipe the outside surface of the sample jar using a paper towel.
- Place samples upright in a pre-chilled cooler immediately after sample collection.
- Record in the field logbook the sample identification, the sample collection location (sketch), the depth from which the sample was collected, and if a duplicate sample was collected, any discoloration or odor, and other pertinent details.
- Decontaminate any reusable sampling equipment or discard used disposable sampling equipment between samples. The Equipment Decontamination SOP (BE-SOP-14) will be followed for decontamination procedures.

3.3 Handling and Preservation

Samples will be collected using the appropriate unused sample containers (with preservative, if required by the analytical method) provided by the analytical laboratory. Sample containers will be labeled with the sample identification number, date and time of collection, sampler initials, and analysis requested. Samples will be maintained at 4 degrees Celsius (°C) plus or minus 2°C while in storage (if required by the analytical method). Samples will then be packaged and transported to the subcontracted laboratory for analysis.

3.4 Quality Assurance and Quality Control

Quality assurance and quality control samples will be collected in accordance with the Quality Control Samples SOP (BE-SOP-04) and the project-specific WP.

4.0 REFERENCES

U.S. Department of Defense (DoD). 2013. DoD Environmental Field Sampling Handbook Revision 1.0. April.

ATTACHMENTS

Water Sampling Checklist

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Water Sampling Checklist

Prior to Sampling	Initial
Safety tailgate meeting	
Calibrate YSI	
Obtain permits	

Monitoring Well Sampling	Initial
Water level meter	
YSI	
Pump	
Tubing (both soft and hard)	
Tubing cutting tool	
5 gallon buckets for purge water	
Sample kits	
Gel ice	
Sample sheets	
DI and Alconox	
Paper towels	
Shovel	
Full socket set (14mm)	
Tool to open well lids	

Surface Water Sampling	Initial
Water level meter	
YSI	
Pump	
Tubing (both soft and hard)	
Tubing cutting tool	
Sample kits	
Gel ice	
Sample sheets	
DI and Alconox	
Paper towels	
5 gallon buckets for purge water	

PPE/Misc.	Initial
Nitrile gloves	
Shades	
Tailgate form	
Knee pads	
L1RA	
Safety gear (hard hat, gloves, vest, etc.)	
Water	
Laminated site map	
Garbage bags	
PEP/HSE Plan	
Camera	
Whiteboard and marker	

After Sampling	Initial
Drop waste off at waste coordinators	
Closeout permits	
Bump Check YSIs	
Download cameras	
Charge peri pumps	
Charge harmony	
QC, chill, and secure samples	
Complete field notes	
Debrief (tailgate form)	

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STANDARD OPERATING PROCEDURE

BE-SOP-14

Equipment Decontamination

1.0 INTRODUCTION

The purpose of this Standard Operating Procedure (SOP) is to describe the procedures for decontamination of reusable equipment.

2.0 MATERIALS

Materials used for decontamination may include:

- Level D personal protective equipment (PPE) – nitrile or rubber gloves, safety glasses, safety toed boots, hard hat, and safety vest (if decontaminating drilling or heavy equipment)
- Hand tools for bulk contamination removal (shovels, brooms, etc.)
- Liquinox or Alconox
- Spray or rinse bottles, or pump sprayer
- Pressure washer/steam cleaner
- Potable water
- Distilled or deionized water
- Bristle brushes
- Plastic tubs
- Plastic sheeting
- Department of Transportation (DOT)-approved, 5-gallon buckets with screw top lids
- DOT-approved, 55-gallon open-top drums
- Contractor-grade plastic bags
- Paper towels

3.0 PROCEDURE

Reusable sampling equipment must be decontaminated between samples and at the end of each workday. Drilling and excavation equipment should be decontaminated prior to beginning site activities, before collecting each sample when non-dedicated sampling equipment is used, and after completing site activities. Decontamination procedures are detailed in the following subsections.

3.1 Decontamination Area

Identify a localized decontamination area for larger drilling and excavation equipment. Select an area with easy access and level ground to minimize slip, trip, and fall hazards. The decontamination area should be large enough to temporarily store clean equipment and materials. When decontaminating larger drilling

tooling, such as hollow-stem augers, line each area with a heavy-gauge plastic sheeting and include a collection system designed to capture potential decontamination wastes (water and residual soil). Containerize decontamination water and residual soil in approved containers, such as DOT-approved 55-gallon drums, before treating/disposing the water and residual soil as specified in the approved project-specific Work Plan (WP). Decontamination areas should be set up to minimize overspray and risk to the surrounding environment.

Smaller equipment (spoons, trowels, groundwater sampling pumps, etc.) may be decontaminated near the sampling locations. In this case, all required decontamination supplies must be mobilized to the sampling location. A 5-gallon bucket with a screw top lid or a plastic tub should be used to capture decontamination water, which should be transferred to larger containers, as necessary.

3.2 Sampling Equipment Decontamination

Improper decontamination can cause cross-contamination. To prevent cross-contamination, sampling equipment must be either disposed of after one use or decontaminated after each use. Disposable or dedicated sampling equipment should be used whenever possible. When non-dedicated, reusable equipment is used, it should be decontaminated in stages in a way that minimizes contaminant discharge to the environment. The following procedures should be used:

1. Remove as much bulk contamination as possible from equipment at the point of origin.
2. Wash equipment thoroughly with potable water containing a laboratory-grade detergent, such as Liquinox or Alconox. Use a bristle brush to remove any remaining residual contamination.
3. Rinse equipment thoroughly with potable water.
4. Rinse equipment thoroughly with distilled or deionized water. Note that some instruments can be damaged by deionized water, such as YSI 556 and Aqua TROLL 500 probes.
5. Air dry equipment in clean area free of dust or other fugitive contaminants. Alternatively, wet equipment may be dried with a clean, disposable paper towel to assist the drying process. All equipment should be dry before reuse.
6. Store clean and dry sampling equipment within a protective medium (plastic bag, carrying case, etc.).

3.3 Heavy Equipment Decontamination

Equipment decontamination must be performed prior to transporting or walking equipment between contaminated areas. Decontamination will focus on minimizing the spread of contaminated media resulting from equipment movement or transport. This decontamination process will use dry methods (brooms, brushes, shovels, etc.) within the exclusion zone to remove large, easily dislodged deposits of soil and other contaminated media from equipment (tracks, buckets, etc.) prior to exiting the exclusion zone. The Field Lead may alter decontamination procedures based on dry decontamination effectiveness.

Final decontamination should be conducted when equipment is no longer needed onsite. A decontamination area should be established to collect decontamination materials, sludge, and water. Bulk contamination should be removed using shovels and brushes, and the equipment should be further cleaned using a pressure washer with a detergent wash, followed by a potable water rinse, if needed.

3.4 Personnel and PPE Decontamination

During environmental investigations and removal actions, boots and gloves are commonly the most contaminated types of PPE. Contaminated solids such as mud should be scraped and wiped from boots. Personnel decontamination involves removal of bulk contamination first. Any remaining contamination should be removed using soapy water and brushes. Once all debris is removed, rinse the boots with clean water. If boots are not laden with solid materials, a brush can be used to knock off or remove any residual solid materials. If the boots have contacted liquid-phase contaminants, it is important that the contaminants be removed using soapy water and a brush, followed by a clean water rinse. If the contaminants have adsorbed into the boots, the boots must be replaced. Gloves should be removed rolling the glove off from the top down to avoid contact with contaminated soil.

Following removal and cleaning of reusable PPE, field personnel should wash their hands or any exposed body parts which may have been in contact with the associated contaminated substances.

4.0 INVESTIGATION-DERIVED WASTE MANAGEMENT

Typical investigation-derived wastes (IDW) consist of soil cuttings, decontamination water, and solid wastes. Wastes will be managed based on media type following the procedures specified in the Alaska Department of Environmental Conservation-approved project-specific WP and in accordance with the federal, state, and local regulations. Typical methods of managing IDW are described in the Waste Management SOP (BE-SOP-79).

5.0 QUALITY CONTROL

Quality control (QC) samples may be collected to verify that the decontamination process is effective. QC samples include equipment rinsate blanks and equipment wipe samples, which are described in the Quality Control Samples SOP (BE-SOP-04).

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STANDARD OPERATING PROCEDURE

BE-SOP-20

Water Quality Measurements

1.0 INTRODUCTION

The purpose of the Standard Operating Procedure (SOP) is to describe the methods of calibrating, maintaining and operating water quality meters and probes used for groundwater sampling. The YSI 556 Multi-Probe System (MPS) and Aqua TROLL 500 are common multimeters used which will simultaneously measure temperature, conductivity, pH, dissolved oxygen (DO), and oxidation reduction potential (ORP). This SOP also describes the guidelines for calibration and operation of the Hach Portable Turbidity Meter. The manufacturer's operator's manual should be referred to for specific calibration, operation procedures and troubleshooting.

This SOP was developed in accordance with the following guidance document:

- *Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells* (U.S. Environmental Protection Agency [EPA], 2017)
- *Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations* (American Society for Testing and Materials [ASTM], 2018)

This SOP focuses on the mostly commonly used collection methods of field water quality parameters and should be used in conjunction with other applicable SOPs, including the following:

- BE-SOP-01: *Logbook Documentation and Field Notes*
- BE-SOP-09: *Groundwater Sampling*
- BE-SOP-10: *Surface Water Sampling*
- BE-SOP-14: *Equipment Decontamination*
- BE-SOP-21: *Groundwater and LNAPL Measurements*

2.0 EQUIPMENT AND SUPPLIES

Calibration and water quality measurement equipment will include, but is not limited to the following:

- Multimeter, which may include:
  - YSI 556 MPS (or similar)
  - YSI 5563 Probe Module
  - Aqua TROLL 600 Multiparameter Sonde, Wireless TROLL Com communication device, and Aqua TROLL tablet with VuSitu App
- Flow-through cell
- Discharge hoses and fittings to attach sample tubing to the flow-through cell
- Calibration standards (pH 4, 7, and 10, ORP, and conductance)
- Aqua TROLL Quick-Cal Multiple Sensor Solution, if using Aqua TROLL

- Rugged DO (RDO) calibration sponge or 100% saturation bubbler, if using Aqua TROLL
- Deionized water (DI) (PFAS free)
- Spray bottle
- Graduated cylinder or beaker, if needed
- 5-gallon buckets
- Portable turbidity meter (e.g., Hach 2100P or Hach 2100Q) and turbidity standards (<0.1, 20, 100, and 800 NTU)
- Appropriate level of personal protective equipment
- Logbook, weatherproof pen, sharpie, etc.
- Multi-parameter and turbidimeter calibration logs (Attachment 1 and 2)

3.0 PROCEDURES

Calibrate or perform a calibration check on equipment daily. Calibration readings should be documented in the field logbook and/or calibration logs (Attachment 1 and 2). If a field instrument will not calibrate, perform troubleshooting as described in the manufacturer's manual. If the issue cannot be resolved, use a backup instrument. If that is not an option, contact the Project Manager on whether data collection will continue or if any other corrective actions should be taken. Flag any data recorded from a meter with suspected calibration problems on the field forms. If anomalous field readings are given during sample collection, stop and recalibrate the instrument.

3.1 Calibration of YSI 556 MPS

The transport/calibration cup that comes with the probe module serves as the calibration chamber and minimizes the volume of calibration reagents required. The key to successful calibration is to ensure that the sensors are completely submersed when calibration values are entered. For maximum accuracy, use a small amount of calibration solution to pre-rinse the probe module (YSI, 2009). Consult the YSI operation's manual for further information.

3.1.1 pH

Always calibrate pH using the 3-point calibration method. The 3-point calibration method accounts for the full pH range and assures maximum accuracy when the pH of the media to be monitored cannot be anticipated. To calibrate pH:

- Select the 3-point option to calibrate the pH sensor using three calibration solutions.
- When calibrating pH, always calibrate with buffer 7 first.
- Place 30 milliliters (mL) of pH buffer into a clean, dry, or pre-rinsed transport/calibration cup, and securely tighten the cup on the threaded end of the probe module.
- Gently rotate and/or move the probe module up and down to remove any bubbles from the conductivity cell.
- Enter the calibration value of the buffer at the current temperature.
- Press **Enter**. The pH Calibration screen is displayed.

- Allow at least one minute for temperature equilibration before proceeding. The current values of all enabled sensors will appear on the screen and will change with time as they stabilize.
- When the readings show no significant change for approximately 30 seconds, press **Enter**. The screen will indicate that the calibration has been accepted and prompt you to press **Enter** again to continue.
- After returning to the Calibrate screen, rinse the probe module and sensors with tap or purified water and dry.
- Repeat these steps using a second pH buffer, and then repeat again using a third pH buffer.
- After returning to the Calibrate screen, rinse the probe module and sensors with tap or purified water and dry.

3.1.2 Conductivity

For maximum accuracy, the conductivity standard should be within the same conductivity range as the samples you are preparing to measure.

- For fresh water use a 1 mS/cm conductivity standard.
- For brackish water use a 10 mS/cm conductivity standard.
- For seawater use a 50 mS/cm conductivity standard.

Always calibrate conductivity for specific conductance. Calibrating for specific conductance will automatically calibrate for conductivity and salinity. To calibrate specific conductance:

- Place 55 mL of conductivity standard into a clean, dry, or pre-rinsed transport/calibration cup, and securely tighten the cup on the threaded end of the probe module.
- Gently rotate and/or move the probe module up and down to remove any bubbles from the conductivity cell.
- Enter the calibration value of the standard you are using in mS/cm at 25°C and press **Enter**.
- Allow at least one minute for temperature equilibration before proceeding. The current values of all enabled sensors will appear on the screen and will change with time as they stabilize.
- When the readings show no significant change for approximately 30 seconds, press **Enter**. The screen will indicate that the calibration has been accepted and prompt you to press **Enter** again to continue.
- After returning to the Calibrate screen, rinse the probe module and sensors with tap or purified water and dry.

3.1.3 ORP

To calibrate for ORP:

- Place 30 mL of a known ORP solution into a clean, dry, or pre-rinsed transport/calibration cup, and securely tighten the cup on the threaded end of the probe module.
- Gently rotate and/or move the probe module up and down to remove any bubbles from the conductivity cell.
- Enter the correct value of the calibration solution at the current temperature. Refer to the solution values on the calibration standard bottle.
- Press **Enter**. The ORP calibration screen will be displayed.

- Allow at least one minute for temperature equilibration before proceeding. Verify that the temperature reading matches the value you used.
- Observe the reading under ORP. When the reading shows no significant change for approximately 30 seconds, press **Enter**. The screen will indicate that the calibration has been accepted and prompt you to press **Enter** again to continue.
- After returning to the Calibrate screen, rinse the probe module and sensors with tap or purified water and dry.

3.1.4 DO

Always calibrate for % DO. Calibrating for % DO will automatically calibrate for mg/L. The instrument must be on for at least 10 – 15 minutes to polarize the DO sensor before calibrating. To calibrate dissolved oxygen:

- Place 1/8 inch (3 mm) of water in the bottom of the transport/calibration cup.
- Place the probe module into the transport/calibration cup.
  - Make sure the DO and temperature sensors are **not** immersed in the water.
- Engage only 1 or 2 threads of the transport/calibration cup to ensure the DO sensor is vented to the atmosphere.
- Use the keypad to enter the current local barometric pressure in mmHg.
  - If the unit has the optional barometer, no manual entry is required.
- Press **Enter**. The DO % saturation calibration screen will be displayed.
- Allow approximately 10 minutes for the air in the transport/calibration cup to become water saturated and for the temperature to equilibrate before proceeding.
- Observe the reading under DO %. When the reading shows no significant change for approximately 30 seconds, press **Enter**. The screen will indicate that the calibration has been accepted and prompt you to press **Enter** again to continue.
- After returning to the Calibrate screen, rinse the probe module and sensors with tap or purified water and dry.

3.2 Aqua TROLL 500 Multiparameter Sonde

The restrictor attached in storage/calibration mode serves as the calibration chamber and minimizes the volume of calibration reagents required. For best calibration, it is recommended to rinse twice with the calibration solution to ensure all contaminants have been removed (In Situ, 2019). Aqua TROLL may be calibrated using single sensor calibration standards for pH, conductivity, and ORP. However, the Aqua TROLL sonde may also be calibrated using a multi-sensor calibration standard, Quick-Cal Solution, for these three parameters.

3.2.1 Solution-Based Calibration

Refer to the Aqua TROLL operator's manual if using single sensor calibration standards. The following procedures will be used for performing a multi-sensor calibration using Quick-Cal Solution:

- Ready the instrument for calibration
  - Remove the rubber bumper and blue top cap from the restrictor.

- Remove the restrictor and reattach in calibration mode to form the calibration cell.
- Invert the instrument, so the sensors are facing up.
- Rinse the sensors with DI or tap water. Ensure the sensor face and inside of calibration cell are clean and free of debris.

- Ready the tablet for calibration
  - From the main menu, select **Connected Instrument.**
  - Select **Calibrations**.
  - Select **Quick-Cal (multi-sensor)**.
    - All available sensors are selected by default. If one or more sensors are not installed properly, an error message will pop up.
  - Select **Next**.
- Solution Rinse Procedure
  - Pour 10 – 20 mL (½-inch above the sensor face) of the calibration standard onto the sensors to perform the first rinse.
  - Ensure the solution comes in contact with the sensors by moving the solution around in the calibration cell. Reinstall the blue top cap and shake gently, if necessary.
  - Discard the calibration standard.
  - Repeat solution rinse procedure. Aqua TROLL recommends two rinses to ensure the best calibration of the instrument.
- Sensor Calibration Procedure
  - Fill the calibration cell with 40 – 50 mL (to the bottom of the threads inside the restrictor) with fresh calibration solution.
    - Check the sensor for bubbles and gently tap to remove any bubbles.
  - Select **Next**.
  - After the calibration is stable, select **Accept**.
  - The calibration values applied to the sensor will appear on-screen. Select **Done** to return to the calibration menu.

3.2.2 DO 100% Saturation Calibration

The RDO sensor is typically calibrated using a 1-point calibration method. The water saturated air method is most commonly used, while the saturation bubbler method requires an additional calibration chamber. Other calibration methods are available in the owner's manual. The factory calibration of the RDO sensor should produce readings within 3% accuracy (In Situ 2019). If greater accuracy is required, In-Situ recommends performing a 1-point 100% water-saturated air calibration using the following procedure:

- From the main menu, select **Connected Instrument**.
- Select **Calibrations**.
- Select **RDO Saturation**.
- For a 1-point calibration, select **100% Saturation**.
- Set up the instrument for one of the following methods:

Option 1 – Water Saturated Air

- Remove the restrictor and thoroughly dry the RDO sensing foil and temperature sensor.

- Saturate a small sponge with water (does not need to be dripping).
- Place the sponge in the bottom of the restrictor and attach the end cap, turning one full rotation.
  - Do not fully seal the bottom of the restrictor.
- Wait 5 – 10 minutes for 100% water saturation of the air within the calibration chamber before starting the calibration.
- After the calibration chamber has stabilized, select **Next**.
- After calibration is stable, select **Next**.
- The calibration values will be applied to the sensor and appear on-screen. Select **Done** to return to the Calibration Menu.

Option 2 – Bubbler

- Fill at 100% saturation bubbler half full of tap water.
- Turn on the bubbler.
- Wait 5 – 10 minutes for the bubbler to reach 100% saturation.
- Install the restrictor in deployment mode, remove blue end cap and place the sonde in the bubbler.
- After the calibration chamber or bubbler have stabilized, select **Next**.
- After calibration is stable, select **Next**.
- The calibration values will be applied to the sensor and appear on-screen. Select **Done** to return to the Calibration Menu.

3.3 Hach Portable Turbidimeter

The Hach Model 2100P or 2100Q Portable Turbidimeter measures turbidity from 0.01 to 1000 NTU in automatic range mode with automatic decimal point placement. For more information, consult the Hach user manual. Use the following procedure for turbidity measurements:

- Collect a representative sample in a clean container. Fill a sample cell to the line (about 15 mL), taking care to handle the sample cell by the top. Cap the cell.
- Wipe the cell with a soft cloth to remove water spots and fingerprints.
- Apply a thin film of silicone oil. Wipe with a soft cloth to obtain an even film over the entire surface.
- Turn the instrument on and place on a flat sturdy surface.
- Insert the sample cell in the instrument call compartment so the diamond or orientation mark aligns with the raised orientation mark in from of the cell compartment.
- Press **READ** and the result will show in units of NTU.

3.3.1 Calibration of Hach 2100Q Portable Turbidimeter

For best consistency and accuracy, calibrate using the StablCal Calibration Set and always insert the cell so the orientation mark on the cell is correctly aligned with the mark on the front of the cell compartment (Hach, 2017).

- Push the **Calibration** key to enter the Calibration mode.
  - Gently invert each standard before insertion.
- Insert the 20 NTU StablCal Standard and close the lid.
- Push **Read**. The display shows Stabilizing and then shows the result.
- Repeat with the 100 NTU and 800 NTU StablCal Standard.
- Push **Done** to review the calibration details.
- Push **Store** to save the results.

3.4 Collection of Water Quality Measurements

Water quality parameters (DO, ORP, pH, and conductivity) are chemical properties measured to determine when discharged groundwater is considered representative of the formation water and sampling can begin (ASTM, 2018). Water quality parameters are measured using a multi-parameter instrument coupled with an in-line flow- through cell. The typical volume of the flow-through cell is 500 mL.

3.4.1 Groundwater Parameters

Follow this general procedure for collecting water quality parameters using a flow-through cell:

- Secure the instrument to the flow-through cell. Connect a short discharge tube to the effluent connector at the top of the flow-through cell and run the other end of this discharge tube into a 5-gallon purge water bucket.
- Place the tube from the pump directly into the 5-gallon purge water bucket and purge for approximately half a minute or until the purge water begins to visually clear up. The intent is to limit any initially highly turbid water from accumulating in the flow-through cell.
- Once visually clear, secure the tube from the pump to the influent connector at the bottom of the flow-through cell.
- Continue low flow purging at a flow rate of approximately 1 liter (0.26 gallons) every 3-5 minutes, or 50 – 500 mL/min.
- Routinely measure and record required parameters and the depth to groundwater every 3-5 minutes. A minimum of three recordings will be monitored and recorded.
- Continue to monitor until parameters stabilize or until three well casing volumes have been purged. Use the following stabilization parameters:
  - ± 3% for temperature (minimum of ± 0.2 °C)
  - ± 0.1 for pH
  - ± 3% for conductivity
  - ± 10 mv for redox potential
  - ± 10% for DO
  - ± 10% for turbidity
- When parameters have stabilized, record final measurements, and collect samples per the project-specific work plan.

Note: Low-flow purging and sample collection are particularly useful for wells that purge dry or take one hour or longer to recover. If a well is purged dry or recovery exceeds one hour, collect a sample as soon as the well has recharged to approximately 80% of its pre-purge volume, when practical.

3.4.2 Surface Water Parameters

Water quality measurements should be taken when collecting surface water samples, when specified in the project specific UFP-QAPP. Additional parameters (stream discharge rate, salinity, etc.) may be necessary when collecting surface water samples.

4.0 DATA AND RECORD MANAGEMENT

The *Multi-Parameter Calibration Log* (Attachment 1) and the *Turbidimeter Bump Check Log* (Attachment 2) are intended for use in the field during groundwater sampling and monitoring well development activities. Complete these datasheets according to this SOP and the *Logbook Documentation and Field Notes* (BE-SOP-01).

5.0 REFERENCES

ASTM. 2018. *Standard Practice for Low-Flow Purging and Sampling for Wells and Devices Used for Ground-Water Quality Investigations.* D6771. West Conshohocken, Pennsylvania. September.

EPA. 2017. *Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells.* Prepared by Robert Reinhart. EQASOP-GW4. Revision Number 4. September.

Hach Company. 2017. *Hach 2100Q and 2100Qis User Manual.* December.

In-Situ. 2020. *Aqua TROLL 500 Multiparameter Sonde Operator's Manual.* November

YSI Environmental. 2009. *YSI 556 Multi Probe System Operations Manual.* August.

ATTACHMENTS

Multi-Parameter Calibration Log
Turbidimeter Bump Check Log

Multi-Parameter Calibration Log

Project Name/Location: _____

Project Number: _____

Equipment Make and Model(s): _____ & _____

Serial Number(s): _____ & _____

Serial Num.	Date	Temp.	pH (3 pt.)		Cond. (us/cm)		ORP (mV)		DO (100%)		Initials
			Standard	Reading	Standard	Reading	Standard	Reading	Atm. Press. (mmHg)	Reading (%)	

Serial Num.	Date	Temp.	pH (3 pt.)		Cond. (us/cm)		ORP (mV)		DO (100%)		Initials
			Standard	Reading	Standard	Reading	Standard	Reading	Atm. Press. (mmHg)	Reading (%)	

Turbidity Meter Calibration Verification Check

Project Name/Location: _____

Project Number: _____

Equipment Make and Model(s): _____ & _____

Date	Time	Serial #:			Serial #:			Initials
		_____NTU	_____NTU	_____NTU	_____NTU	_____NTU	_____NTU	

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STANDARD OPERATING PROCEDURE

BE-SOP-22

Monitoring Well Installation, Development, and Decommissioning

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) is to be used as reference to describe the process for constructing, installing, and developing groundwater monitoring wells provided by a drilling subcontractor via drill-rig operation. This SOP provides a standard set of procedures applicable under typical site conditions and may vary based on actual site conditions and/or equipment characteristics. Specific monitoring well design and installation procedures depend on project objectives and subsurface conditions and should be discussed in the project-specific UFP-QAPP.

Monitoring wells can be installed as long-term monitoring wells, which can be repeatedly sampled over several years, or as temporary well points, which allow for a one-time groundwater sampling event. Following development, purging, and sampling – a temporary well point is usually removed and backfilled.

2.0 EQUIPMENT AND MATERIALS

The driller will supply all materials and equipment necessary to perform drilling activities and will install monitoring wells in locations based on field observations and the project-specific UFP-QAPP.

Temporary well points are most commonly 1- to 2-inch diameter screened PVC or stainless-steel pipe, which can be pre-packed with filter material, or used without a filter pack. Temporary well points can be installed using a hollow stem auger, direct push, sonic, air rotary, mud rotary, or by hand, if in unconsolidated material with a shallow water table. Equipment and materials needed for monitoring well installation may include, but are not limited to the following:

- Geoprobe® 66 series drill rig or equivalent, as dictated by site lithology
- Well casing and screen
- Filter pack materials
- Bentonite
- Surface seal materials (concrete)
- Surface completion and bollards (if required)
- Potable water and/or deionized water
- Weighted tape measure

Monitoring well development equipment may include, but is not limited to the following:

- Water level meter or Oil/Water interface probe
- Surge block (with foot valve)
- Peristaltic pump
- Submersible pump
- Sprinkler pump (useful for removing large volumes of silt and fine sand laden water)
- Inertial pump and tubing (optional-consider for deep wells greater than 30 feet)
- Disposable polyethylene bailers

- 5-gallon buckets
- Graduated cylinder or beaker
- YSI water-quality meter or Aqua-TROLL
- Hach portable turbidity meter
- Potable water and/or deionized water
- Disposable HDPE tubing

3.0 DOCUMENTATION

Fill out the attached *Well Installation and Well Development Forms* following installation and when developing the monitoring well. All fields on the installation form must be completed for long term monitoring wells as well as temporary well points. All fields on applicable field forms will be used or an "NA" will be inserted to indicate a field that is not applicable. The field form sections are outlined below:

- Well designation
- Date of well installation
- Date of development
- Static water level before and after development
- Quantity of drilling fluid lost during drilling (if applicable)
- Well volume
- Depth from top of well casing to bottom of well
- Screen length
- Depth from top of well casing to top of sediment inside well, before and after development, if present
- Physical characteristics of removed water, including changes during development in clarity, color, particulates, and odor
- Type and size/capacity of pump and/or bailer used
- Height of well casing above/below ground surface
- Typical pumping rate
- Estimate of recharge rate
- Quantity of water removed and time of removal

The *Soil Logging* SOP (BE-SOP-05) will be followed in compliance with the ASTM D2488 Unified Soil Classification standards (ASTM 2009). The *Soil Logging* SOP (BE-SOP-05 Attachment) field form must be completed during installation and before leaving the site to ensure all details are captured and are complete and accurate.

Monitoring wells will be surveyed within a horizontal accuracy of 1.0 feet and a vertical accuracy of 0.01 foot. The top of the well casing will be surveyed as well as ground surface for use as a reference point to determine water-level elevation, sampling depths, and groundwater flow direction. All survey information will be documented in the field logbook.

4.0 WELL INSTALLATION PROCEDURES

This section describes drilling, borehole, casing, well screen, bentonite seal, and monitoring well completion requirements.

Prior to monitoring well installation, a conceptual model of the site geology and hydrology will be developed. This allows for a better understanding of the distribution of aquifers and aquitards at or near the site, hydrologic boundaries, the water surface table, and other hydrogeographic properties. This is a working model to be updated as new data is obtained.

4.1 Drilling Requirements

Several drilling methods are available for creating a borehole for well installation. Primary methods include hollow stem auger, direct push, sonic, air rotary, mud rotary, and cable tool. Which drilling method(s) is used is project-specific and depends on known or expected site lithology and other project considerations such as sampling needs, required borehole diameters, and cost.

All drilling activities will be supervised by a qualified environmental professional. The drill rig will be decontaminated appropriately before it enters and leaves the site in accordance with the *Equipment Decontamination* SOP (BE-SOP-14). All leaks will be repaired prior to coming to the site or as soon as they are discovered at the site. The drill rig will not leak any fluids that may enter the borehole or contaminate equipment placed in the hole. The use of rags or absorbent materials to soak up leaking fluids in lieu of proper repair and maintenance is unacceptable. However, the driller will have spill response equipment on site at all times in case of any unexpected equipment failure.

Drilling mud, synthetic drilling fluids, petroleum or metal-based pipe joint compounds, and other potential contaminants will not be used unless necessary. Only high yield sodium bentonite clay free of organic polymer additives will be used if drilling mud is needed to stabilize the hole. Decontamination water must be potable and obtained from a known water source. Additional decontamination requirements may be applicable, particularly when PFAS sampling is conducted. A monitoring well construction form will be completed for each monitoring well. Each well point will be surveyed.

4.2 Borehole Requirements

The completed monitoring well must be straight and plumb to allow passage of pumps or sampling devices.

4.3 Casing Requirements

The following lists requirements for the casings of monitoring wells:

- All casing will be new, unused, and pre-cleaned (if necessary).
- Glue or solvent will not be used to join casing; casings will be joined only with water-tight flush-joint threads or thermal welds that will not interfere with the planned use of the well.
- Pop rivets or screws should not be used on casings or other monitoring well components.
- All monitoring wells will conform to the American Society for Testing Materials (ASTM) F-480-06b. Polyvinyl chloride (PVC) is a durable monitoring well material with good chemical resistance (EPA 1991). Diameters will be identified in the UFP-QAPP.

- The casing will be straight and plumb within the tolerance stated for the borehole.
- A notch in the top of the casing will be cut or marked to be used as a measuring point for water levels and survey activities.

4.4 Well Screen Requirements

The following are the requirements that must be met for well screens:

- All requirements that apply to casing will also apply to well screen, except for strength requirements.
- Monitoring wells will not be screened across more than one water-bearing unit. Screens will be factory slotted or wrapped.
- Screen slots will be sized to prevent 90 percent of the filter pack from entering the well, and for wells where no filter pack is used, the screen slot size will be selected to retain 60 to 70 percent of the formation materials opposite the screen.
- The bottom of the screen is to be capped, and the cap will be joined to the screen by threads.

In most hydrogeologic settings, screen lengths should not exceed 10 feet. The use of shorter well screens may allow for contaminant detection by reducing excessive dilution.

4.5 Filter Pack Requirements

Filter packs allows groundwater to flow freely into a well from the adjacent aquifer while minimizing or eliminating the entrance of fine-grained materials. Appropriate filter pack material should be selected during project planning to ensure the filter pack is more permeable than the surrounding aquifer. Depending on project requirements, standard or pre-packed filter packs may be used. Standard filter packs may be installed by free pour or tremie pipe. Prior to installation of the filter pack (and seal), the top of the well should be capped with a water-tight plug to prevent material from entering the well. The level of the sand within the annular space should be continuously measured with a tag line during installation to ensure bridging does not occur. Typically, the filter pack should extend above the well screen to a length of 20% of the well screen length, but no less than 2 feet (ASTM D5092 2005). The annual thickness of the filter pack between the edge borehole and the well screen should conform with applicable state regulations and project requirements.

4.6 Seal Requirements

An annular seal is required to restrict vertical movement of water or contaminants by sealing the well casing to the adjacent soil formation. Depending on project requirements and applicable regulations, seals may consist of only bentonite or a bentonite seal and grout. For seal consisting solely of bentonite, bentonite chips, pellets, or granules are installed by free pouring from the top of the filter pack to approximately 2 feet below the ground surface. The level of the bentonite within the annular space should be continuously measured with a tag line during installation to ensure bridging does not occur. Above the water table, the bentonite seal should be hydrated at regular intervals with potable water to ensure seal integrity. Where grout is used, a bentonite seal at least 2 feet thick is installed above the top of the filter pack using the methods outline above. Only 100 % sodium bentonite must be used. Grout is then placed using a tremie pipe or other project-approved means to approximately 2 feet below the ground surface. Grout settles following placement and must be topped off as necessary to reach the proper depth.

The seal will be terminated approximately 2 feet below the ground surface. The remainder of the annulus will be backfilled using silica sand to minimize bentonite intrusion into the well monument and to promote drainage of water from inside the monument. If the monitoring well is advanced in frozen ground, the annular space between the casing and any permafrost should be sealed to minimize effects on the subsurface thermal regime and to prevent water within the well from freezing.

Additional seal requirements may apply for deep wells and wells installed within confined aquifers and will be described in the site-specific UFP-QAPP.

4.7 Soil Boring and Logging

Soil borings will be logged at each site where monitoring wells will be installed. Refer to BE-SOP-05 for core logging procedure.

4.8 Monitoring Well Surface Completion Requirements

Well completions may consist of flush-mount or above ground completions. For flush-mounted completions, cut the casing approximately six inches below the ground surface and ensure the well is capped with a water-tight plug to prevent material from entering the well. A freely draining surface monument with a locking cover should be placed over the casing. The surface monument should be placed in well-sorted sand to allow water drainage. If the well is located on a gravel pad, the top of the monument must be completed at least three inches below pad grade to protect it from snow removal equipment. The top of the casing will be at least one foot above the bottom of the surface monument. The identity of the well should be permanently marked on the monument lid and the casing cap.

For above-ground monitoring well completions, extend the well casing two or three feet above ground surface. Provide a plug for each well, and shield the extended casing with a steel sleeve that is placed over the casing and cap and seated in a 3-foot by 3-foot by 4-inch concrete surface pad. To allow for escape of gas, a small diameter (e.g., 1/4-inch) vent hole must be placed in the well casing, or a ventilated well cap will be used. Install a lockable cap or lid on the guard pipe. The identity of the well should be permanently marked on the casing cap and the protective sleeve.

Install monitoring wells where there is no chance of seasonal inundation by floodwaters, unless the wells have special watertight construction.

5.0 WELL DEVELOPMENT PROCEDURES

Monitoring wells should not be developed for at least 24 hours after installation.

Wells can be developed using a submersible pump, peristaltic pump, and/or bailer. Bailers are more commonly used in wells where there is a small volume of water.

A variety of methods may be used for well development. A critical component of all methods is that they induce a surging action using a surge block, bailer, or pump, which removes fine sediment from the well and filter pack and ensures the filter pack is settled. Monitoring wells can be developed by first purging the well dry, if possible, then allowing the monitoring well to refill with formation water. If the recovery rate by the formation water is too slow, up to one well casing volume of potable water can be added to the well. The well is then surged vigorously for approximately 10 minute. Add more water as necessary. Purge the well dry again to complete the development process.

For a well with sufficient water supply, there is no minimum volume of purge water identified in guidance for well development, but a minimum of three casing volumes is recommended; A clear, steady flow of water is the development target. Some projected may have specific turbidity targets.

Removing twice the volume of water added during drilling and construction is often a UFP-QAPP requirement.

After initial surging and pumping, groundwater parameters will be monitored for stability criteria (described below).

Groundwater parameter stability is reached when three changes between successive readings at approximately 5-minute intervals at a low-flow pumping rate (drawdown recommended to be less than 0.3 feet) are less than the criteria provided in Table 1.

Table 1 Stability Criteria for Low-Flow Purging

PARAMETER[1]	UNITS	RECORDING PRECISION	STABILITY CRITERION
pH	—	0.01	±0.1
Temperature	°C	0.01	±0.2
Conductivity	µS/cm	1	±3%
Turbidity	NTU	0.1	± 10% or ± 1 NTU (whichever is greater)
Oxidation Reduction Potential (ORP)	mV	1	±10
Dissolved Oxygen (DO)	mg/L	0.1	±10% or 0.3 mg/L (whichever is greater)

Notes:
°C – degrees Celsius
µS/cm – microSiemens per centimeter
NTU – nephelometric turbidity units
mV – millivolts
mg/L – milligrams per liter
[1] Only three parameters are required to stabilize, four when using temperature.

Low-yielding wells are exceptions to the above criteria. Such wells should be purged dry, then either be allowed to recover or be filled with potable water to the static water level for surging. Add water as needed to maintain the water level during surging. Satisfactory recovery is defined as 80 percent of the well volume. After the initial recovery period, such wells will be surged and pumped dry again to complete the development process.

The well purge water will be collected into buckets or drums and treated on site or shipped off for disposal as identified in the project-specific UFP-QAPP.

A well is considered fully developed when the following criteria are met:

- The well water is clear to the unaided eye (based on observations of water clarity through a clear glass jar)
- If stability cannot be achieved, the well is considered developed when the total volume of water removed from the well equals five times the standing water volume in the well plus the volume of drilling fluid lost or potable water added (if fluids were added)

6.0 WELL DECOMMISSIONING

The purpose of decommissioning monitoring wells and temporary well points is to protect the aquifer. Monitoring wells and temporary well points should be decommissioned it is determined they are no longer needed and necessary regulatory approval has been obtained. A general abandonment procedure is outlined below; however, specific monitoring well decommissioning procedures (e.g., overdrilling) may depend on project objectives, subsurface conditions, and state requirements as outlined in the project-specific UFP-QAPP.

1. Knock the bottom of the screen out with a steel drill rod/ pipe, which allows the well to be used as a tremie pipe.
2. Remove the well casing and screen until the screened interval is above the groundwater interface. This allows the material surrounding the well to collapse into the borehole. Keep a 1:1 ratio when pulling out the screen (i.e., if you have a 10-foot screen, pull the well out 10 feet).
3. After the casing is withdrawn above the groundwater interface, add bentonite chips to the well. Withdraw the casing further and continue adding bentonite chips. Continue this iterative process (pull the casing, fill the borehole, pull the casing, fill the borehole) to within 2 feet of the ground surface.
4. If the well is shallow, add water to hydrate the bentonite chips. Add additional bentonite chips as necessary to seal the well to within 2 feet of the ground surface.
5. If the well is located in a confined aquifer, bentonite chips should begin to be placed within the confining stratum.
6. Fill the remaining 2 feet of the borehole with sand or gravel and restore the site as necessary.
7. Record decommissioning procedures.

7.0 REFERENCES

ASTM. 2009. *Standard Practice for Description and Identification of Soils (Visual-Manual Procedure.* D2488. West Conshocken, Pennsylvania. July.

U.S. Environmental Protection Agency (EPA). 1991. *Handbook of Suggested Practices for the Design and Installation of Ground-Water Monitoring Wells.* Office of Research and Development.

EPA, Region 1. 2017. *Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells.* EQASOP-GW4. Revision Number: 4. 19 September.

EPA, Region 4. 2018. *Design and Installation of Monitoring Wells, Science and Ecosystem Support Division.* SESDGUID-101-R2. 16 January.

ATTACHMENTS

Record of Well Construction
Well Development Data Sheet

Record of Well Construction

Project	Project Number	Client	Boring No.

Address, City, State		Drilling Contractor	

Logged by	Date	Started	Drilling Method and Equipment Used
Drill Crew		Completed	

Groundwater Depth	Elevation	Total Depth

Depth (feet)	Diagram	Field Installation Information
1		_____ Surface Monument (material _____)
2		_____ Surface Seal
3		_____ Bentonite Seal
4		_____ Casing (material _____)
5		_____ Screen (material _____)
6		_____ Screen Filter (material _____)
7		_____ Surface Elevation
8		_____ Casing Elevation
9		_____ Casing Stickup
10		_____ Depth of Well
11		_____ Depth of Boring
12		_____ Depth to Groundwater from _____ on (date) _____
		Development Method _____
		Development Time and Purge Volume _____

Record of Well Construction

Field Notes from Drilling

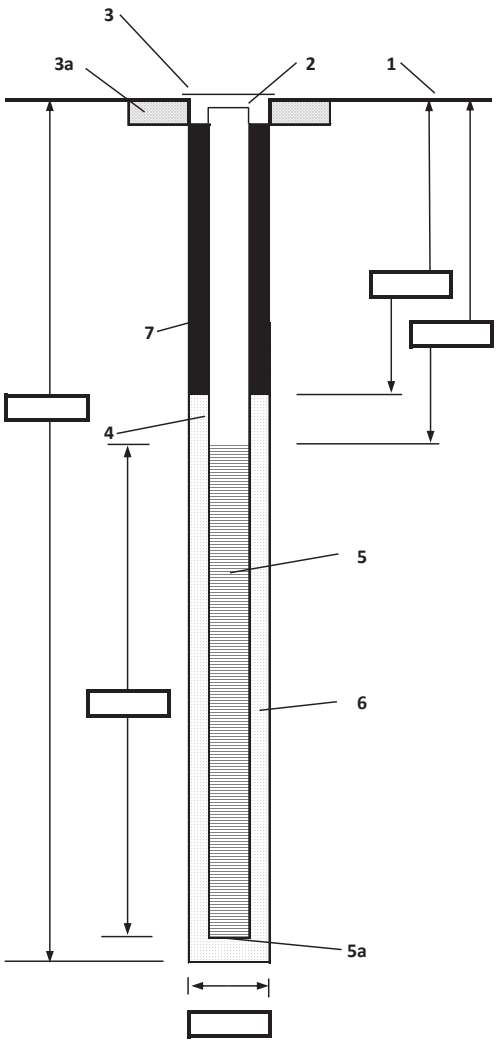
Date	End Time	Start Time
Note-Taker Name		Boring Number
Surface Conditions		

PROJECT NUMBER

WELL ID

FLUSH MOUNT WELL COMPLETION DIAGRAM

PROJECT/CLIENT:	**LOCATION :**
DRILLING CONTRACTOR:	
DRILLING METHOD AND EQUIPMENT USED:	
WATER LEVEL: **START :**	**END :** **LOGGED BY:**



1- Ground elevation at well _____

2- Top of casing elevation _____

3- Wellhead protection cover type _____
a) concrete pad dimensions _____

4- Dia./type of well casing _____

5- Type/slot/size of screen _____
a) End cap _____

6- Type of screen filter _____

7- Type of seal _____

Development method See Development Sheet

Development time See Development Sheet

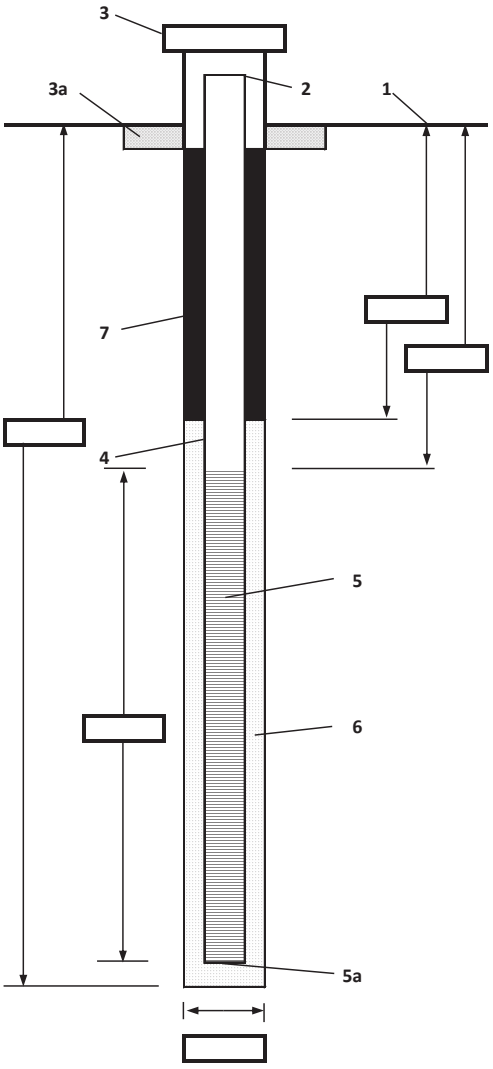
Estimated purge volume See Development Sheet

Comments _____

PROJECT NUMBER	SHEET 1 OF 1 WELL ID

RISER WELL COMPLETION DIAGRAM

PROJECT/CLIENT:		**LOCATION :**	
DRILLING CONTRACTOR:			
DRILLING METHOD AND EQUIPMENT USED:			
WATER LEVEL:	**START :**	**END :**	**LOGGED BY:**



1- Ground elevation at well _____

2- Top of casing elevation _____

3- Wellhead protection cover type _____
a) concrete pad dimensions _____

4- Dia./type of well casing _____

5- Type/slot/size of screen _____
a) End cap _____

6- Type of screen filter _____

7- Type of seal _____

Development method See Development Sheet

Development time See Development Sheet

Estimated purge volume See Development Sheet

Comments _____

WELL DEVELOPMENT FORM

PROJECT NO: **SITE ID:** **WELL ID:** **SHEET of**

PROJECT NAME	**WELL CONSTRUCTION DATA**	**BOREHOLE VOLUME FACTORS [BVF]**

CLIENT	**TIME/DATE WELL COMPLETED**	**CASING MATERIAL**	**CASING I.D. (in)**	**BOREHOLE DIAMETER (in)**	**CV / BVF (gal/lin ft)**
	AS-BUILT TOTAL DEPTH OF WELL (ft BTOC)	1" Sch40 PVC	1.049	4.5	**0.041 / 0.279**
EVENT	**CASING MATERIAL AND DIMENSIONS**	2" Sch40 PVC	2.067	4.5	**0.163 / 0.370**
DEVELOPER(S)	**SCREEN LENGTH (ft) /SCREEN TYPE**	2" Sch40 PVC	2.067	6	**0.163 / 0.370**
WEATHER/ TEMPERATURE	**DEPTH TO TOP FILTER PACK (ft BTOC)/FILTER PACK TYPE**	2" Sch40 PVC	2.067	8	**0.163 / 0.370**
DATE	**DEPTH TO WATER AT TIME OF DRILLING (ft BTOC)**	2" Sch40 PVC	2.067	10	**0.163 / 0.370**
START TIME	**HEIGHT OF WATER COLUMN AT TIME OF DRILLING (ft)**	4" Sch40 PVC	4.026	8	**0.653 / 0.370**
END TIME	**BOREHOLE DIAMETER (in)**	4" Sch40 PVC	4.026	10	**0.653 / 0.370**
TOTAL PURGE VOLUME	**VOLUME OF WATER ADDED DURING DRILLING (gal)**	All BVF calculations assume a filter pack porosity of 0.3.			

PRE-PURGE DEVELOPMENT DATA

PURGING EQUIPMENT:

(PUMP TYPE AND MATERIAL, OTHER APPARATUS)

IF PRODUCT IS PRESENT	
DEPTH TO PRODUCT (ft FROM TOC):	**THICKNESS OF PRODUCT (ft):**
PRODUCT DESCRIPTION:	

EQUIPMENT DECON PROCEDURE: _____ **PURGE WATER DISPOSAL METHOD:** _____

EQUIPMENT SERIAL NUMBERS: **TURBIDIMETER** **OTHER**

PRE-PURGE WATER COLUMN OBSERVATIONS AND RECOVERY CALCULATIONS

DEPTH TO WATER (ft BTOC)	
TOTAL DEPTH (ft BTOC)	
HEIGHT OF WATER COLUMN (ft)	
80% HEIGHT OF WATER COLUMN (ft)	
80% HEIGHT OF WATER COLUMN (ft BTOC)	
DROWNED SCREEN?	

PURGE VOLUME CALCULATIONS

For screen across the water table: Borehole + Casing Volume (BV) = [Casing Total Depth - Depth to Water] * BVF	**For a drowned screen:** Borehole + Casing Volume (BV) = [Casing Total Depth - Depth to Top Filter Pack]* BVF	For borehole volume factors (BVF), see uppermost section on the right side of this form, above.
BOREHOLE VOLUME (BV, gal) Calculated using the appropriate formula above.		
Casing Volume (CV, gal)		
3X Casing Volume (CV, gal) Recommended minimum purge vol.		

PURGE DATA

ACTIVITY [SURGE, PURGE, RECOVERY]	**TIME**	**WATER LEVEL (ft BTOC)**	**DRAW DOWN (ft)**	**TOTAL DEPTH (ft BTOC)**	**PURGED VOLUME (gallons or liters)**		**TURBIDITY (Qualitative or NTU)**	**NOTES [Flow data: pump intake depth, approximate flowrate, purged dry] [Water quality: color, odor, sheen, sediment in purge water or at TD]**
					THIS CYCLE	**CUMULATIVE**		

WELL DEVELOPMENT FORM

PROJECT NO: **SITE ID:** **WELL ID:** **SHEET of**

ADDITIONAL PURGE DATA

ACTIVITY [SURGE, PURGE, RECOVERY]	TIME	WATER LEVEL (ft BTOC)	DRAW DOWN (ft)	TOTAL DEPTH (ft BTOC)	PURGED VOLUME (gallons or liters)		TURBIDITY (Qualitative or NTU)	NOTES [Flow data: pump intake depth, approximate flowrate, purged dry] [Water quality: color, odor, sheen, sediment in purge water or at TD]
					THIS CYCLE	CUMULATIVE	IDEAL <50 NTU	

STABILIZATION DATA

START TIME: **END TIME:** **TOTAL VOLUME PURGE (GAL):** **STABILITY ACHIEVED: Y / N**

STABILIZATION EQUIPMENT:

(PUMP TYPE AND MATERIAL, OTHER APPARATUS)

PURGE WATER DISPOSAL METHOD:

EQUIPMENT DECON PROCEDURE

PUMP INTAKE DEPTH: (ft BTOC or ft BTOW)

MAX FLOWRATE: (mL/min or gal/min)

STABILIZE DRAWDOWN AT THIS FLOWRATE?

DEDICATED TUBING LEFT?

EQUIPMENT SERIAL NUMBERS:	YSI	TURBIDIMETER	OTHER				

CONVERSIONS: 1000 mL/min = 0.264 gal/min 1 gal/min = 1893 mL/min 1 gal = 3.785 L 1 L = 0.264 gal

FIELD WATER QUALITY PARAMETERS

TIME	WATER LEVEL (ft BTOC)	DRAW DOWN (ft)	CUMULATIVE PURGED VOLUME (gallons or Liters)	TEMPERATURE (°C or °F)	pH	CONDUCTIVITY (µS/cm)	ORP (mV)	D.O. (mg/L)	TURBIDITY (NTU)	COLOR	ODOR
				± 3% (min ± 0.2°C/0.36°F)	± 0.1	± 3%	± 10 mV	± 10%	± 10% or <10 NTU		

STANDARD OPERATING PROCEDURE

BE-SOP-25

Underground Utility Locates

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) describes the guidelines that will be used during underground utility locates. This SOP will be used to direct field personnel in the techniques and requirements for underground utility identification and clearance.

Underground utility identification and clearance is critical prior to subsurface investigation, drilling, and construction activities. Underground line locations must be known to ensure safe operations. Many states have laws that require all excavators or contractors engaging in subsurface work to notify utility companies at least 48 hours before beginning the work. The location and identification of these lines by the utility companies reduces the contractor's liability should lines be mis-located and damaged during subsurface activities. Underground utility lines are preferential pathways for organic vapor and liquid migration; therefore, knowing their location may aid in the site investigation and remediation processes.

2.0 PROCEDURES

When excavation, trenching, drilling, or other subsurface activities are anticipated, **a project team member must submit notification to the Alaska Digline (811 anywhere in Alaska or 1-800-478-3121)** and local utility companies where applicable. Proposed excavation and soil boring areas should be marked prior to the utility locate. In areas with known utilities, the utility company will conduct a survey of all proposed sample locations for underground utilities. Identified utilities will be marked according to the type of utility present. Typical markings include:

- Red – electric
- Yellow – gas line
- Orange – communication
- Blue – potable water
- Green – sewers and drain lines

Regardless of what method is used to locate underground utilities, never take their exact location for granted. Always begin each excavation and borehole slowly and cautiously, taking care to check for the presence of underground structures, lines, or indicator tape for at least the first 3 feet of depth; however, note that many utilities may be located deeper than 3 feet. If the soil is not too hard (i.e., gravelly), hand auger the first 3 feet of the borehole. Once drilled, check the first 3 feet with a (non-conductive) probe to make sure that no utilities are present in the sidewall of the borehole. If drilling on active military installations, follow their protocol, which will likely include completion of dig permits and obtaining signatures from facility engineering units.

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STANDARD OPERATING PROCEDURE

BE-SOP-29

GeoXH/Geo 7X GPS Location Survey

1.0 INTRODUCTION

The purpose of this Standard Operating Procedure (SOP) is to direct field personnel in the proper use of a Trimble GeoXH/Geo 7X global positioning system (GPS) unit for the collection of locations. This SOP applies to all personnel engaged in surveying locations with a handheld Trimble GeoXH or Geo 7X. Both units are considered mapping-grade, capable of sub-meter accuracy and should be used only when contract requirement allow for this resolution. If higher resolution/accuracy of surveyed locations is required, a survey-grade GPS should be used.

The Trimble GeoXH handheld GPS is a high precision, dual frequency, differential GPS with accuracy capabilities to the decimeter, after post-processing. The Geo 7X is also a dual frequency, differential GPS, but capable of logging precise carrier phase measurements and has 1-10 cm accuracy capabilities, after post-processing. A GeoXH or Geo 7X, both running Windows Mobile with Trimble Terrasync software, may be utilized, depending on accuracy requirements.

GPS uses 24 satellites and their associated ground stations to form a world-wide radio-navigation system. The GPS receiver (the handheld GeoXH/Geo 7X) determines the relative positions of features by using the geometry of intersecting ranges (space resection) created from the position of the receiver and the satellites it detects, and time, synchronized to universal time. A minimum of 4 satellites are needed to determine position; typically, more are required to achieve the rated accuracies.

Errors can be introduced into the GPS system from a variety of sources including atmospheric conditions and physical objects causing obstructions and reflected signals. Care must be taken to ensure the best conditions for collecting location data. A tool on the Trimble GeoXH/Geo 7X helps to plan the best time to collect locations by graphing satellite positions for the next 12 hours.

2.0 EQUIPMENT

The following equipment is necessary, but not limited to:

- Trimble GeoXH/Geo 7X handheld unit
- External Tornado or Zephyr 2 antenna and connection cable
- Range pole with level bubble and connection brackets
- Stylus
- Metal measuring tape (in feet and meters)
- Computer with internet connection and Pathfinder Office Software

Note that this SOP is intended to be used in conjunction with *Logbook Documentation and Field Notes* (BE-SOP-01).

3.0 INSTRUMENT

Prior to collecting location data, determine where the data is going to be collected, and where the nearest GPS base stations are located for differential correction of the data. The nearer the differential correction station, the greater the potential accuracy of the data. Typical base stations include continuously-operating reference stations (CORS) and UNAVCO stations. These are shown on maps at the National Geodetic Survey (NGS) website and UNAVCO website, respectively.

3.1 Setting up the Unit

1. Turn on the unit by pressing the green button at the bottom.
2. On the main screen, click on "GNSS Application Launcher." This will boot the GPS program. This program can also be launched by clicking on the Start icon ( ) and selecting "Terrasync."
3. Within the Terrasync software program, there are two stacked menus in the upper left-hand corner. They will be referred to in this SOP as the upper menu and the lower menu.
4. Click the down arrow on the upper menu and choose "Data." This allows to either create a new file to store data (click "Create" and enter the file name and height of the antenna), or to open an existing file (click "Existing File" on the lower menu, choose the appropriate file, and click "Open").
5. Check the number of satellites the unit is receiving signals from by clicking the down arrow in the upper menu and choosing "Status." In the lower menu choose "Skyplot." There should be at least 5 satellites for the unit to get lock. The satellites shown in black are the ones the unit is using to calculate position.
6. Check the settings for data collection by clicking the down arrow in the upper menu and choosing "Setup." Click the down arrow in the lower menu and choose "Options." These settings should typically be the following, although there may be exceptions based on site conditions. Refer to the work plan for details on survey setup.
    a. Logging Settings:
        - Accuracy Value for Display/Logging should be Horizontal, Post-processed.
        - Post-Processing Base Distance is determined from the nearest base station (see Section 5.2)
        - Use Accuracy-based Logging – Yes, and apply to all features
    b. Real Time Settings:
        - Choice 1 – Integrated SBAS
        - Choice 2 – Use Uncorrected GNSS
    c. GPS Settings:
        - Make sure that the GPS is connected
    d. Coordinate System:
        - Use Latitude/Longitude WGS 84, Height above ellipsoid
    e. Units:
        - Use US survey feet
    f. External Sensors – Typically none will be used

7. Set up the range pole, brackets, and external Tornado/Zephyr 2 antenna (if necessary). The internal antenna is suitable for many conditions; the Tornado/Zephyr 2 antenna can improve yield under canopy and improves accuracy for post-processing. Setup the antenna (both internal and external) by clicking the down arrow in the upper menu and choosing "Setup." Click the down arrow in the lower menu and choose "Logging Settings."
   a. Antenna Settings:
      § Measure Height To: Bottom of Antenna Mount for the external antenna or Bottom of Bracket for the internal.
      § Antenna Height: Use the measurement (to the thousandth of a meter) from the ground to the bottom of the antenna as show in the images below.



      § C Type: If using the external, choose "Tornado/Zephyr 2." If using the internal, choose "Internal."
      § Confirm: Choose how often to ask the antenna height (user preference).
      § Type: If using the external, choose "Tornado/Zephyr 2." If using the internal, choose "Internal."
8. Check the GPS status. Along the top of the screen is a notification bar.
   a. A battery icon shows the remaining power left in the battery. The left half shows the charge level of the receiver battery. The right side shows the status of the computer battery. If fully green, the battery is fully charged. Yellow indicates low power and red indicates critically low.
   b. A little satellite icon show with a number next to it shows the number of satellites that the unit is connected to for determining position. When there are not enough satellites to calculate position, the number flashes. If the GPS is not connected, two unconnected plugs will animate.
   c. When successfully locked to satellites for position, a double-headed arrow with a number above indicates the estimated accuracy. Typically this is showing horizontal accuracy in real-time (uncorrected).
   d. When collecting the location of a feature, a count appears indicating the number of seconds of occupation at that location. A bullseye with the count indicates a line or point feature rather than a point feature.

3.2 Collecting Locations

1. There are three types of locations, called features that can be collected with the GeoXH/ Geo 7X – points, lines, and areas.
2. To collect a point, place the GeoXH/Geo 7X unit or external antenna mounted on a survey rod on the location to collect and ensure that it will be stationary for the entire length of the occupation (approximately 1-2 minutes).
3. Click the down arrow in the upper menu and choose "Data." Click the down arrow in the lower menu and choose "Collect."

4. Click on the type of feature to collect. This will begin collecting data to log the point. Occupy the location for at least 60 seconds. If the estimated accuracy icon indicates poor accuracy, occupy the location for longer. As the point is being collected, use the keyboard to type a name of the point. Refer to the work plan for naming conventions.
5. When the time has been reached to collect the point, click "Done."
6. Review collected locations by using the Map feature. Click the down arrow of the upper menu and choose "Map." This will display a map of the features that have been collected.
7. When all features have been collected, close the file by choosing "Close."

Many additional features are available with the GeoXH/Geo 7X including offsets, background files, setting waypoints and navigating, using data dictionaries, taking photographs, and more. To use these features, refer to the GeoXH/Geo 7X User's Manual.

3.3 Download Data

Connect the GeoXH/Geo 7X device to a computer to download the data, follow these steps:

1. Make sure the device and the computer are switched on.
2. Make sure that the computer has the Windows Mobile Device Center (WMDC) for Windows Vista, 7 or 8, or ActiveSync for Windows XP or 2000 to be able to recognize the device when it is connected.
3. Connect the USB data cable to the device port and to the USB computer port.
4. WMDC or ActiveSync should automatically recognize the device and start a manager dialog box.
5. To transfer files manually, click on "File Management" and copy and paste files from the device to the computer. If the computer has Trimble Pathfinder Office software installed, click on the Data Transfer utility to download the location data via the software.
6. Save the files in the project folder and ensure that the Project Manager and GIS Manager know where the files are located.

3.4 Post Field

Once all data is downloaded to a computer, the data should be differentially corrected for maximum accuracy. Use Trimble Pathfinder Office software to differentially correct data automatically. Typically for projects in Alaska we are unable to differentially correct data real time in the field due to limited connectivity and this must be done after data collection. Base files are typically available 24 hours after the data is collected.

3.5 Troubleshooting and Maintenance

Additional details on the GeoXH/Geo 7X device can be find in the User's Manual, which is kept in the hard case with the GPS unit at all times. The following table shows some typical problems that occur with the GeoXH/Geo 7X.

Table 1 GeoXH / Geo 7X Troubleshooting

PROBLEM	POSSIBLE CAUSE	POSSIBLE SOLUTION
The handheld will not turn on.	The battery is dead.	Recharge or swap the battery.
The handheld is not charging.	The internal temperature has risen above the allowed maximum for charging (104°F).	Remove the unit from any external heat sources and the unit will automatically start charging again when the internal temperature has dropped.
Concentration is dropping very slowly back to zero after taking a reading.	There is an obstruction in the filter or probe.	Replace the filter and any tubing connected to the instrument probe.
The backlight does not come on when you tap the screen or press a button.	The backlight is not set to turn on in the Backlight control.	Tap  > Settings > System > Backlight to view the Backlight control and make sure that the brightness is not set to dark, and the turn on backlight box is checked.
The handheld is not receiving GNSS positions.	The integrated GNSS receiver is not activated.	Use the Connect or Activate GNSS/GPS command in the field software to open the GNSS COM port and activate the integrated GNSS receiver.
	Incorrect configuration of serial COM port.	When supplying GNSS data to an external device using the COM1 USB to serial converter cable, set the baud rate to the high-speed TSIP setting: 38400, 8, 1, Odd.
	The GNSS COM port is already in use. Only one application at a time can have the port open.	Do the following: · Exit the software that is using the GNSS COM port and then retry in your application. · Check that a GNSS application is not running in the background. Tap/Task Manager and then select and close (click End Task) any GNSS applications you are not using. · Make sure that connections are not left in use by the GNSS Connector software; close the application when you are not using the connections.
	The GNSS field software is using the wrong GNSS COM port.	Connect to COM2 if the GNSS field software uses NMEA messages, or COM3 for TSIP messages. For information on which protocol to use, check the documentation for the application.
	Not enough satellites are visible.	Move to a location where the receiver has a clear view of the sky and ensure the antenna is not obstructed. Alternatively, adjust the GNSS settings to increase productivity.
	The DOP (Dilution of Precision) value for the current position is above the maximum DOP setting.	Wait until the DOP value falls below the maximum DOP specified. Alternatively, adjust the GNSS settings to increase productivity.
	Wait for real-time is selected in the GNSS field software and the integrated receiver is waiting to receive real-time corrections.	If you are collecting data for post processing, clear the wait for real-time selection.
	External antenna connected but not receiving data.	The handheld can take up to two seconds to detect that an external antenna has been connected or disconnected.

4.0 REFERENCES

Trimble. 2012. *GeoExplorer® 3000 Series User Guide.* Version 1.00, Revision B. May.

Trimble. 2011. *GeoExplorer® 6000 Series User Guide.* Version 1.00, Revision A. February.

Trimble. 2017. Geo 7 Series *User Guide.* Revision F. Version 1.00 May.

STANDARD OPERATING PROCEDURE

BE-SOP-34

Field Sampling Protocol for PFAS

1.0 INTRODUCTION

This standard operating procedure (SOP) provides programmatic procedures for the handling and collection of environmental samples potentially contaminated with per- and polyfluoroalkyl substances (PFAS). Proper procedures are necessary to ensure the quality and integrity of the samples. This SOP focuses on field sampling protocol for collecting potentially PFAS-contaminated media and should be used in conjunction with other applicable SOPs. The proper handling and sample collection practices of potentially PFAS contaminated media should be undertaken so that potential cross-contamination does not occur.

A checklist, provided as Attachment 1, shall be used by the field team daily before the commencement of fieldwork to ensure the field team follows this protocol. A summary of the prohibited and acceptable items for PFAS investigation areas is included in Table 1 (Attachment 2).

Exceptions to anything stated in this SOP will be allowed on a case-by-case basis, provided it has been included in the work plan or a field change form and reviewed by the project team, and includes necessary precautions to prevent cross-contamination. Additional quality control sampling may also be required.

2.0 PFAS BACKGROUND

PFAS is a class of emerging contaminants that have been released into the environment from industrial and firefighting activities. Among the thousands of PFAS compounds are perfluoroalkyl acids (PFAAs), including perfluoroalkyl carboxylic acids (PFCAs) and perfluoroalkyl sulfonic acids (PFSAs), which contain chains of various lengths and carbon-fluorine bonds. Carbon-fluorine bonds are one of the strongest bonds in nature; therefore, PFAAs have distinct properties of strength, durability, heat-resistance, and stability. The two most commonly studied PFAAs are PFOA and PFOS.

PFAS are used in the manufacturing of intermediary products and hundreds of articles of commerce used in electronics, aerospace/defense, building/construction, alternative energy, automotive, semiconductors, military, healthcare, outdoor apparel/equipment, chemical/pharmaceutical manufacturing, and most notably in aqueous film forming foams (AFFF) used for fire training and firefighting. Of these hundreds of articles of commerce, many may be found in the sampling equipment and in the sampling environment in general (Table 1). Due care must be taken in the design and implementation of a PFAS sampling program as residual PFAS in these articles of commerce are a potential source of cross contamination.

3.0 PROCEDURES

The following procedures will be followed for the collection of samples for PFAS in various media. Because of the ubiquitous presence of PFAS, these procedures will be followed to prevent potential contamination of soil, sediment, surface water, or groundwater samples.

3.1 Field Equipment

Specific requirements for equipment use in collecting potentially PFAS contaminated media are identified below. Before use onsite, all field equipment and supplies will be considered using the Tiered Approach provided in Table 2 (Attachment 2) of this document.

- Do not use polytetrafluoroethene (PTFE)-containing materials (e.g., PTFE tubing, bailers, tape, plumbing tape/paste, or other PTFE materials) since PTFE contains fluorinated compounds. Field sampling items or equipment that contains Teflon® shall not be used.
- High-density polyethylene (HDPE), silicon materials are acceptable for sample collection, as they do not contain fluorinated compounds. Samples may not be stored in containers made of LDPE materials because PFAS can stick to LDPE and bias sample results low.
- When using liners to collect soil samples during direct-push technology or during conventional drilling and sampling methodologies, acetate or PVC liners are to be used.
- Use peristaltic pumps for groundwater sample collection at depths shallower than 25 feet. ProActive® SS Pumps with polyvinyl chloride (PVC) leads or Geotech® SS Geosub pumps can be used for groundwater sample collection at depths greater than 25 feet below ground surface (bgs). These pumps are constructed with stainless steel and will minimize introductions of PFAS. However, for groundwater sample depths greater than 150 feet bgs, a Grundfos® RediFlo™ pump (or similar) may be used because of the pumping limitations of stainless steel pumps.
- Some water-resistant inks (e.g., Rite in the Rain®) may be potential sources of PFAS. PFAS-free container labels should be filled out using a ballpoint pen that does not have water-resistant ink, if possible. , unless specifically not allowed per the scope of work or contract requirement. To avoid plastic coating or glue materials, do not use other brands of waterproof field books. Plastic clipboards, binders, or spiral hard cover notebooks are not acceptable.
- Field staff should try to avoid filling out container labels using felt pens and markers (e.g., certain Sharpie® products). Ballpoint pens can be used in the field for field documentation, as well as for labeling the sample containers and preparing the chain of custody.
- Preprinted standard (non-weatherproof) Avery™ sample labels will be used on sample containers. The sample labels will be placed on the containers after sampling is complete and the container lids are in place to prevent possible cross contamination.
- Use brand name polyethylene plastic bags (e.g., Ziploc®) for bagging
- Confirmed PFAS-free gel packs. Water ice cannot be shipped via Goldstreak®.
- Post-It Notes® are not allowed on project sites.
- Uncoated Tyvek® may be used if needed. If coated Tyvek is needed, an equipment blank from the coated Tyvek product must be collected prior to beginning field work.
- Items containing fluorosurfactants, and any item in the materials list that includes the term “fluoro” are not allowed on project sites.
- All sampling and/or decontamination equipment rented for a project must be evaluated for PFAS-bearing parts prior to use.
- Water used for activities such as drilling and monitoring well installation, development, and decommissioning, must be from a source documented as PFAS-free.

- Collecting equipment blanks using laboratory supplied PFAS free water prior to the start of field activities is recommended.

3.2 Field Clothing and Personal Protective Equipment

In addition to specific protocol for equipment in collecting potentially PFAS-contaminated media, specific clothing and personal protective equipment (PPE) must be used, and others must be avoided.

- As a top layer, do not wear water-resistant, waterproof, or stain-treated clothing during the field program. Recommendations for clothing in wet weather are in section 3.4. Field clothing made of synthetic and natural fibers (preferably cotton) are acceptable. Field clothing should be laundered without the use of fabric softener.
- Preferably, field gear should be of cotton construction and well laundered (i.e., washed a minimum of 6 times before use after purchase). New clothing may contain PFAS-related treatments; do not use new clothing while sampling or handling samples.
- Do not wear clothing or boots containing Gore-Tex™ during the sampling program, as it contains a PTFE membrane.
- Safety footwear will consist of steel-toed boots made with polyurethane and PVC, untreated leather boots, or well-worn leather boots. Newer leather boots may be worn if they are covered with polypropylene, polyurethane, or PVC boot covers.
- Field Vehicle upholstery may be treated with stain-resistant PFAS-containing products. Field clothing should not be placed directly on field vehicle upholstery. A well-laundered cotton blanket may be placed upon the vehicle seats to avoid direct contact for the duration of field work.
- Disposable nitrile gloves must be worn at all times. Further, a new pair of nitrile gloves shall be donned before the following activities at each sample location:
    - Decontamination of re-usable sampling equipment
    - Contact with sample bottles or water containers
    - Insertion of anything into the well (e.g., HDPE tubing, pump, bailer, etc.)
    - Insertion of silicon tubing into the peristaltic pump
    - Completion of monitor well purging, prior to sample collection
    - Handling of any quality assurance/quality control samples including field blanks and equipment
    - Blanks
    - After the handling of any non-dedicated sampling equipment, contact with non-decontaminated surfaces, or when judged necessary by field personnel

3.3 Sample Containers

Different laboratories may supply sample collection containers of varying sizes dependent on the type of media to be sampled (e.g., soil, groundwater). Pay attention to the type of container that is received so that PFAS collection protocol is followed.

- All samples should be collected in polypropylene or HDPE bottles. The screw cap will be made of polypropylene or HDPE and may be lined or unlined. However, if lined, the liner may not be made of PTFE or contain PFAS.
- Container labels will be completed using a pen after the caps have been placed back on each bottle.
- Glass sample containers (jars) and glass fiber filters should be avoided when collecting and filtering water samples due to the potential for adsorption of PFAS compounds. This is not considered to be significant when preparing tissue or other solid material on a glass slide or cutting board because the solid material is not in complete contact with the glass surface as it would be for a water sample.

3.4 Wet Weather

Field sampling occurring during wet weather (e.g., rainfall or snowfall) should be conducted while wearing appropriate clothing that will not pose a risk for cross contamination.

- Teams will avoid synthetic gear that has been treated with water-repellant finishes containing PFAS. Use rain gear made from polyurethane, vinyl, and wax, or rubber-coated materials.
- Teams should consider the use of a tent that can be erected over the top of the sample location and provide shelter from the rain. It should be noted that the canopy material is likely a treated surface and should be handled as such; therefore, gloves should be worn when setting up and moving the tent, changed immediately afterwards, and further contact with the tent should be avoided until all sampling activities have been finished and the team is ready to move on to the next sample location.

3.5 Equipment Decontamination

To minimize equipment decontamination, use PFAS-free disposable equipment wherever possible. Examples of disposable equipment include the following: disposable scoops or bowls and PVC liners. Non-disposable field sampling equipment, including oil/water interface meters, water level indicators, and other downhole equipment used at each sample location, will require cleaning between uses, as follows:

- Liquinox® soap is acceptable for use since the Safety Data Sheet does not list fluorosurfactants as an ingredient. However, Decon 90® will not be used during decontamination activities. Water used for the final rinse during decontamination of sampling equipment will be laboratory-certified "PFOS/PFOA-free" water.
- Rinse equipment with PFAS-free water and scrub equipment using a polyethylene or PVC plastic brush to get rid of particulates. Rinse equipment three times using PFAS-free water.
- For larger equipment (e.g., drill rig and large downhole drilling and sampling equipment), decontamination will be conducted with potable water using a high-pressure washer and then rinsed using potable water. Documentation of where the potable water was from (i.e., a fire hydrant on the base, a water station in a nearby town, etc.) will be made in the logbook by the FTL.
- Prior to use, as possible, ensure equipment used for decontamination (i.e., pressure washers) does not contain parts that may be sources of PFAS cross-contamination. In particular, Viton® O-rings should not be used.

- If methanol is to be used for decontamination, collect a blank to confirm it is PFAS-free prior to use.

3.6 Personnel Hygiene

In addition to ensuring that field clothing and PPE are compliant with PFAS handling protocol, personnel handling potentially PFAS-contaminated media should also be aware of the potential for cross contamination via personal hygiene products.

- Field personnel will not use cosmetics, moisturizers, hand cream, or other related products as part of their personal cleaning/showering routine on the morning of a sampling event, unless the products are applied to a part of the body that will be coved by clothing. These products may contain surfactants and represent a potential source of PFAS.
- Many manufactured sunblock and insect repellants contain PFAS and should not be brought or used onsite. Sunblock and insect repellants that are used onsite should consist of 100% natural ingredients, unless previously vetted by the project chemist. A list of acceptable sunscreens and insect repellents is provided in Table 1 (Attachment 2).
- For washroom breaks, field personnel will leave the exclusion zone and then remove gloves and overalls. Field personnel should wash as normal with extra time for rinsing with water after soap use.

3.7 Food Considerations

No food or drink shall be brought onsite, except for bottled water and hydration drinks (e.g., Gatorade®, Powerade®), which will only be allowed onsite and consumed within the staging area.

3.8 Visitors

To avoid potential cross contamination issues, all visitors need to remain to remain outside of the exclusion zone or a minimum of 30 feet from sampling areas.

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Attachment 1
Daily PFAS Protocol Checklist

Field Clothing and PPE

- ☐ Field crew in compliance with Tables 1 and 2 in Attachment 2
- ☐ Field crew has not used fabric softener on clothing
- ☐ Field crew has not used cosmetics, moisturizers, hand cream, or other related products on exposed body parts this morning
- ☐ Field crew has not applied unacceptable sunscreen or insect repellent

Field Equipment

- ☐ No PTFE containing materials on-site
- ☐ All sample materials made from stainless steel, HDPE, acetate, silicon, or polypropylene
- ☐ No waterproof field books on-site other than Rite in the Rain® products
- ☐ No plastic clipboards, binders, or spiral hard cover notebooks on-site
- ☐ No adhesives (Post-It Notes®) on-site
- ☐ Coolers filled with confirmed PFAS-free gel ice.

Sample Containers

- ☐ All sample containers made of HDPE or polypropylene. Samples are not stored in containers made of LDPE
- ☐ Caps are lined or unlined and made of HDPE or polypropylene

Wet Weather (as applicable)

- ☐ For personnel in direct contact with samples and/or sampling equipment, wet weather gear made of vinyl, polyurethane, PVC, wax or rubber-coated materials only

Equipment Decontamination

- ☐ "PFAS-free" water on-site for decontamination of sample equipment
- ☐ Liquinox® to be used as decontamination materials

Food Considerations

- ☐ No food or drink on-site with exception of bottled water and/or hydration drinks (i.e.,Gatorade® and Powerade®) that is available for consumption only in the staging area

If any applicable boxes cannot be checked, the Field Team Lead shall describe the noncompliance issues below and work with field personnel to address noncompliance issues prior to commencement of that day's work. Corrective action shall include removal of noncompliance items from the investigation area or removal of worker offsite until in compliance. Repeated failure to comply with PFAS sample protocols will result in the permanent removal of worker(s) from the investigation area.

Attachment 2

Table 1. Summary of Prohibited and Acceptable Items for PFAS Sampling

Prohibited Items	Acceptable Items
Field Equipment	
PTFE containing materials (PTFE synonyms include: Polytetrafluoroethylene; Poly[ethylene tetrafluoride]; Polytetrafluoroethene; Tetrafluoroethene polymer; Tetrafluoroethylene homopolymer; Ethene; tetrafluoro-; and homopolymer. Commercial names include: PTFE; Aflon; Algloflon; Chromosorb T; Fluon; Fluo-kem; Fluoroflex; Fluoroplast 4; Halon G 80; Heydeflon; Polifen; Politef; and Tarflen)	High-density polyethylene (HDPE)
LDPE sample containers	HDPE sample containers and acetate liners
PTFE tubing	Silicon or HDPE tubing
Waterproof field books not manufactured by Rite in-the Rain®	Loose-leaf paper (non- waterproof)
Plastic clipboards, binders, or spiral hardcover notebooks	Aluminum field clipboards or with Masonite
Markers	Ballpoint pens
Post-It Notes®	None
Chemical ice packs untested for PFAS	Regular ice, confirmed PFAS-free ice substitute
Drilling Lubricant: Excel Purity Paste; JetLube® TFW™ Multipurpose Thread Sealant; Vibra-Tite®	Gasoila® NT Non-PTFE Thread; Sealant Bentonite; Crisco
Equipment with Viton Components (evaluated on a case by case basis) Viton contains PTFE, but acceptable if parts will not come into contact with sample or sampling equipment.)	
Field Clothing and PPE	
New clothing or water resistant, waterproof, or stain-treated clothing, clothing containing Gore-Tex™	Well-laundered clothing, defined as clothing that has been washed 6 or more times after purchase, made of synthetic or natural fibers (preferably cotton)
Clothing laundered using fabric softener	No fabric softener
Boots containing Gore-Tex™	Boots made with polyurethane and PVC, well-worn or untreated leather boots, leather boots with boot covers
Coated Tyvek® (unless equipment blanks are collected)	Reflective safety vests, cotton clothing, synthetic under clothing, body braces
No cosmetics, moisturizers, hand cream, or other related products as part of personal cleaning/ showering routine on the morning of sampling, unless the products are applied to body parts that will be covered by clothing.	**Sunscreens** - Alba Organics Natural Sunscreen™, Yes To Cucumbers™, Aubrey Organics®, Jason® Natural Sun Block, Kiss my Face®, Baby sunscreens **Insect Repellents** - Jason® Natural Quit Bugging Me, Repel® Lemon Eucalyptus Insect repellent, All Terrain® Herbal Armor, California Baby® Natural Bug Blend™ Bug Repellent Spray, BabyGanics®, Off! Deep Woods® **Sunscreen and insect repellant -** Avon® Skin So Soft Bug Guard Plus **SPF 30 Lotion Sunscreens** - Alba Organics Natural Sunscreen™, Yes To Cucumbers™, Aubrey Organics®, Jason® Natural Sun Block, Kiss my Face®, Baby sunscreens

Table 1. Summary of Prohibited and Acceptable Items for PFAS Sampling (continued)

Prohibited Items	Acceptable Items
Sample Containers	
LDPE or glass containers	HDPE or polypropylene
PTFE-lined caps	Lined or unlined HDPE or polypropylene caps
Wet Weather	
Waterproof or resistant rain gear	Polyurethane, vinyl, wax or rubber-coated rain gear. Tent that is only touched or moved prior to and following sampling activities
Equipment Decontamination	
Decon 90®	Liquinox®
Water from an on-site well	Potable water from municipal drinking water supply
Food Considerations	
All food and drink, with exceptions noted on the right	Bottled water and hydration drinks (i.e., Gatorade® and Powerade®) to be brought and consumed only in the staging area

Table 2. Tiered Approach

Tier and Description	Action
Tier 1: Products that *will come into direct contact* with field samples include, but are not limited to, drilling grease, sampling equipment, sample containers, and well construction materials	These products will undergo the greatest scrutiny and requires chemist's, regulator, and client input to help evaluate the materials as a possible source of contamination[A] and as possible sampling or storage materials or both.
Tier 2: Products that *will not come into direct contact* with samples, but could be *reasonably expected to contain PFAS*, such as waterproof or nonstick products	Project team/affected person can review the Safety Data Sheet (SDS)[B] and if it shows PFAS, product should not be used. If product SDS does not indicate PFAS, confirm with chemist before use.
Tier 3: Products that *will not come into direct contact* with samples and are *not expected to contain PFAS*, such as ballpoint pens, zipper bags, and body braces	Project team/affected person can review SDS and if no PFAS, then appropriate to use.

[A] Tier 1 products will undergo the closest scrutiny, and a search of the primary literature and independent testing results may need to be conducted. It may be necessary to have Tier 1 products analyzed for PFAS to confirm that a specific batch or lot number does not contain PFAS. Alternate products will need to be evaluated/used if PFAS are identified in the product.

[B] SDS Check: To evaluate product SDS and/or manufacturing specs, check if the product contains anything with "fluoro" in the name or the acronyms TPE, FEP, ETFE, and/or PFA. If fluorinated compounds are not listed in the manufacturing specs and/or on the SDSs, product can be used

STANDARD OPERATING PROCEDURE

BE-SOP-38

Water Seep Sampling

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) describes the guidelines and procedures of collecting water seep samples. The methodologies discussed in this procedure is applicable for liquid samples, both aqueous and non-aqueous, from seeps and pools associated with seeps. These procedures are applicable for samples collected at the surface of seep pools and from the face of the seep.

2.0 MATERIALS AND EQUIPMENT

Collection of water from water seeps includes, but is not limited to:

- Logbook
- Waterproof pen
- Field datasheets (e.g., sample description sheets, etc.)
- Tape measure
- Survey stakes, flags (white)
- Sampling jars
- Preservatives
- Safety equipment
- Decontamination fluids and equipment
- Bottle labels
- Coolers and ice

2.1 Reagents

Reagents are used for the preservation of water seep samples including hydrochloric acid (HCl), nitric acid (HNO_3), sodium hydroxide (NaOH), sodium sulfite, and ascorbic acid. HCl, HNO_3, and NaOH are used to preserve water seep samples collected in the field for volatile organic compound (VOC), metals, and cyanide analyses respectively. It is not expected that water seep samples will contain free (residual) chlorine unless they are treated effluent samples or are collected near the outfall of a treated water effluent. If chlorine is suspected, the water will be tested for free chlorine using chlorine test strips according to manufacturer directions. If samples are collected for VOC, semi-volatile organic compound (SVOC), or cyanide analyses, samples that test positive for residual chlorine will require treatment with a reducing agent before sample preservation. Ascorbic acid is used as a reducing agent for samples collected for VOC and cyanide analyses, and sodium sulfite is used as a reducing agent for samples collected for SVOC analysis. Samples collected for oil analysis may sometimes be preserved with HCL or sulfuric acid to prevent degradation by microbial action.

Reagents used for decontamination of sampling equipment is found in the *Equipment Decontamination* SOP (BE-SOP-14). Non-aqueous samples are typically not preserved due to the uncertain nature of the matrix, which may evolve harmful gases upon addition of acid or base to the sample.

3.0 PROCEDURE

3.1 Sampling Preparation

Prior to conducting sampling activities, a sampling preparation meeting will be held by the team to discuss the proposed sampling strategy for the project-specific Work Plan. Site history, contaminant concerns, sampling methodology, individual responsibilities, sample shipment or delivery, health and safety issues, and lines of communication anticipated during the sampling event will be discussed.

3.2 Sample Collection from Seep Pools

Water seep samples will be collected using hand tools. Typically, seep samples are collected from just below the water surface where the seep has formed a pool. Sampling locations greater than 1 foot below water surface is considered outside the scope of the procedure. For situations where no pool is associated with the seep, sample collection is described in section 3.3.

Samples will be collected at a frequency specified in the project-specific Work Plan. Samples will be collected as follows:

- Don new PPE (gloves, etc.) before starting sample collection.
- Verify that all needed equipment is readily available and that the sample containers are new and have been properly prepared.
- Label container and sample-specific data sheet, if applicable.
- Using decontaminated or disposable sampling equipment, collect water from the sampling location by slightly submerging the sample container just below the water surface at a slight angle. If preservatives are in the sampling container, use a sampling container with no preservatives to collect the water seep and fill any pre-preserved sampling containers.
- Allow the container to fill with minimal agitation of the water. Be sure to avoid overfilling of the sample container by leaving a slight amount of headspace in the sample jar.
- Place the cap on the sample jar and tighten.
- Wipe the outside surface of the sample jar using a paper towel
- Place samples upright in a pre-chilled cooler immediately after sample collection.
- Record in the field logbook the sample identification, the sample collection location (sketch), the depth from which the sample was collected, and if a duplicate sample was collected, any discoloration or odor, and other pertinent details.
- Decontaminate any reusable sampling equipment or discard used disposable sampling equipment between samples. The *Equipment Decontamination* SOP (BE-SOP-14) will be followed for decontamination procedures.

3.3 Sample Collection from Direct Seeps

Samples will be collected at a frequency specified in the project-specific Work Plan. Samples will be collected as follows:

- Don new PPE (gloves, etc.) before starting sample collection.
- Verify that all needed equipment is readily available and that the sample containers are new and have been properly prepared.
- Label container and sample-specific data sheet, if applicable.

- Using decontaminated or disposable sampling equipment, collect water from the sampling location by placing sample container directly underneath or in the seep. Alternatively, a syringe can be used by placing the syringe directly in the seep, and then transferring collected liquid to the sample container. If preservatives are in the sampling container, use a sampling container with no preservatives to collect the water seep and fill any pre-preserved sampling containers.
- Allow the container to fill with minimal agitation of the water. Be sure to avoid overfilling of the sample container by leaving a slight amount of headspace in the sample jar.
- Place the cap on the sample jar and tighten.
- Wipe the outside surface of the sample jar using a paper towel
- Place samples upright in a pre-chilled cooler immediately after sample collection.
- Record in the field logbook the sample identification, the sample collection location (sketch), the depth from which the sample was collected, and if a duplicate sample was collected, any discoloration or odor, and other pertinent details.

Decontaminate any reusable sampling equipment or discard used disposable sampling equipment between samples. The *Equipment Decontamination* SOP (BE-SOP-14) will be followed for decontamination procedures.

3.4 Handling and Preservation

Samples will be collected using the appropriate unused sample containers (with preservative, if required by the analytical method) provided by the analytical laboratory. Sample containers will be labeled with the sample identification number, date and time of collection, sampler initials, and analysis requested. Samples will be maintained at 4 degrees Celsius (°C) ± 2 °C while in storage (if required by the analytical method). Samples will then be packaged and transported to the subcontracted laboratory for analysis.

3.5 Quality Assurance and Quality Control

Quality assurance and quality control samples will be collected in accordance with the *Quality Control Samples* SOP (BE-SOP-04) and the project-specific Work Plan.

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STANDARD OPERATING PROCEDURE

BE-SOP-53

Boat and Watercraft Operations

1.0 INTRODUCTION

This standard operating procedure (SOP) is a guideline addressing basic procedures for operation of boats and watercrafts. Detailed information may be found in the Boater's Handbook (Attachment A).

2.0 PROCEDURES

2.1 Personal Safety

Personnel are expected to ensure proper safety equipment is available prior to departure from land.

Personal Flotation Device (PFD) Use: The greatest risk to rescue personnel is that of drowning. The only adequate protection is by wearing a properly fitted, USCG approved type III (or better) PFD.

Brice personnel shall wear an approved PFD at all times while:

- Riding in or on any watercraft while moving under power.
- Engaged in any emergency response on or near the water.
- Engaged in any operation in the water.
- In any situation where the member is at risk for falling into the water.

Wearing a PFD is the single most important factor in surviving cold water immersion (ADNR, 2021). Cold water immersion kills in three ways:

1. Cold shock
    a. Within the first 2 – 3 minutes, gasping, hyperventilation, and panic occur.
2. Swim Failure:
    a. Within the first 30 minutes, loss of strength and dexterity in arms and legs, inability to keep head above water, swim, or self-rescue, and drowning if not wearing a PFD.
3. Immersion Hypothermia
    a. After 30 minutes or more, gradual cooling of the body's core temperature, eventual loss of useful consciousness, and drowning if not wearing a PFD.

2.2 Pre-Departure Check

Brice employees operating a watercraft are required to perform an inspection of the watercraft before leaving. These inspections are critical in the identification and avoidance of potential watercraft malfunctions/defects that may create potential health and safety issues. Boats will contain a first aid kit and communication and signaling devices for use in case of emergencies. At a minimum, check the following items before departure:

- PFDs
- Signal/communication devices
- Fire extinguishers

- Fuel and oil
- Hull
- Bilge/engine compartments
- Main and auxiliary engines
- Electrical/Electronics
- Ground tackle and dock lines
- First aid kit

2.3 Safe Boating Techniques

- Watercraft operators are expected to employ safe boating techniques at all times while operating the watercraft.
- Obey maritime laws.
- Avoid risk-taking when operating a watercraft.
- Minimum 2 employees to operate the boat.
- Operate the boat only in areas appropriate to the size and limitations of the boat
- Ensure any boat occupants have received an appropriate safety briefing regarding the location and proper use of safety, navigation, and communications equipment aboard the boat prior to departure.
- Operate watercrafts within reasonable speeds and especially when entering marinas whether or not there are posted speed limits.
- Watercrafts are to be operated at speeds that are safe for the conditions, recognizing that, in some circumstances (such as wind or fog) speeds are reduced to ensure safety.
- Never operate a watercraft under the influence of alcohol, narcotics, medications, or other drugs that are likely to affect your alertness or boating performance.
- Operating a watercraft when fatigued significantly increases injury risk by impairing boating skills or the inability to resist falling asleep.
- Brice strictly prohibits the use of mobile phones while operating watercrafts.

2.4 Boat Maintenance

In the event that a maintenance issue exists, employees are directed to advise the project manager, or boat captain.

Fuel contamination due to condensation is a persistent problem, especially in coastal areas. A water separator/fuel filter may prevent contamination and engine damage.

Wiring problems, engine and transmission overheating, and fuel leaks are the leading cause of fires aboard vessels. Inspect and maintain these potential problems before launch.

2.5 Inclement Weather

Always check the local weather forecast and water conditions before departing. Be alert to weather changes while boating, especially the buildup of dark, heavy clouds, which indicate wet weather ahead. If boating on saltwater, carry and use a tide book. Tidal currents can be very strong and cause rip currents or standing waves, especially when the current is in opposition to the wind. In these areas, it is more

appropriate to wait for the slack tide, which occurs when the tide changes directions. Note that current and wind greatly affect fuel consumption.

2.6 Boating Accidents

The boat operator involved in a collision, accident, or casualty shall render assistance as is practical and necessary to save other persons from danger or to minimize danger to the extent that the operator can do so without further danger to the boat and crew.

When it is safe to do so, the boat operator shall contact the appropriate authorities (if necessary) and their Project Manager to inform them of the accident and provide pertinent information.

Federal law requires the operator of a boat to file a boating accident report with State authorities if the accident results in any of the following:

- Loss of life
- A person disappears from the vessel under circumstances indicating death or injury
- Injury requiring medical treatment beyond first aid
- Property damage over $500.

An Accident Report Form (Attachment B) must be submitted within 48 hours in the event of death, disappearance, and injury cases.

3.0 REFERENCES

Alaska Department of Natural Resources. Office of Boating Safety. 2021. *Cold Water Poster.* Accessed 18 February 2021. http://dnr.alaska.gov/parks/boating/pdf/coldwaterposter.pdf

ATTACHMENTS

Boater's Handbook
Accident Report Form

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ALASKA
BOATER'S HANDBOOK



Ninth Edition, 2019



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Front cover photo:

Jason Johnson and his son, Jason, Jr., and Ethan Paul (middle) enjoy an outing on the Black River near Chalkyitsik.
Photo courtesy Kelli Toth

Although this media is not a National Association of State Boating Law Administrators-approved boating course, it is recognized by NASBLA to benefit boating safety.

The Alaska Boating Safety Program cooperates with the U.S. Coast Guard, U.S. Coast Guard Auxiliary, and other partners to produce educational programs and publications that promote safe and enjoyable boating, including this 2019 edition of the *Alaska Boater's Handbook*.



A guide to safe and enjoyable boating in Alaska



Aleut Community of St. Paul Island Ecosystem Conservation Office BSPISE summer program, Kids Don't Float education.

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Dear Alaskan Boaters,

The opportunities to enjoy Alaska's waterways are as broad as the Great Land itself. From pleasure sailing in the inlets of the Southeast to subsistence whaling in the arctic waters of the Northwest, boating is diverse. But the message is the same – always wear your life jacket, always carry emergency communication and always be familiar with self-rescue techniques.

The Alaska Boater's Handbook is intended to inform boaters of points to consider before departure, what to do when underway and how to handle emergencies on the water to ensure an experience that is both memorable and safe. Both longtime Alaskans and the newest visitors will benefit because education, preparation and preparedness are key to reducing boating fatalities. So please familiarize yourself with the information in the handbook. For even better protection against risk, consider taking a boating safety course that will bring you up to date on legal requirements, innovations such as inflatable life jackets and the latest information on cold-water immersion and other relevant topics.

In addition to the handbook, the Alaska Office of Boating Safety provides other resources for boaters. To learn more about those, call (907) 269-8704 or visit www.alaskaboatingsafety.org. You can also search for the Alaska Boating Safety Program on Facebook and "like" to receive information about our latest activities and programs.

Great adventure awaits the well-prepared and adventurous boater. From all of us at the Division of Parks and Outdoor Recreation, we wish you bon voyage. But for your own sake and the sake of your loved ones, please follow safe boating practices when on the water. File that float plan, avoid alcohol and most importantly, always wear a life jacket.

Sincerely,

Ricky Gease

Ricky Gease
Director, Division of Parks and Outdoor Recreation

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PREPARATION

INTRODUCTION

Alaska has a wide variety of boating opportunities, and the types of boats and activities are just as diverse. Alaska also has one of the highest non-commercial boating fatality rates in the nation. The statistics relating to boating fatalities in Alaska are:

- **5 out of 6 involve capsizing, swamping, ejection, or a fall overboard, resulting in a cold water immersion-related drowning**
- **9 out of 10 involve boats under 26 feet in length**
- **3 out of 4 involve powerboats**
- **9 out of 10 are adult males**
- **More Alaskans die in recreational boating incidents than die commercial fishing**

Because nearly all boating-related incidents involve operator controllable risk factors, most are both predictable and preventable. All boating entails some risk, and safe and enjoyable boating depends on effective risk management. The best skippers and paddlers know they must be able to anticipate, recognize and assess risks, avoid or control what they can, and minimize the effects of those they can't. The ability to do this hinges on the ability to master these four tenets: knowledge, skill, proper attitude, and unimpaired judgment.



Knowledge

The Alaska Office of Boating Safety highly recommends that all boaters take boating courses relevant to their type of boating and then continue to refresh and build on their knowledge over time.

Powerboaters should look for courses approved by the National Association of State Boating Law Administrators (NASBLA). Completing a NASBLA-approved boating safety course fulfills the mandatory boating education requirements of many states and may qualify boaters for discounts on their boat insurance. For more information on NASBLA, visit www.nasbla.org



Joe McCullough teaches an Alaska Water Wise course.

The U.S. Coast Guard Auxiliary, a civilian component of the U.S. Coast Guard, conducts NASBLA-approved boating classes in Alaska.

The Alaska Office of Boating Safety offers the NASBLA-approved **Alaska Water Wise** course and trains, certifies, and supports a statewide network of registered boating safety instructors who teach a variety of boating education programs in their communities. There are several classes available through the Alaska Office of Boating Safety at (907) 269-6041 or www.alaskaboatingsafety.org.

Marine safety instructor training and educational courses are also available through the Alaska Marine Safety Education Association (AMSEA). For more information, contact AMSEA at (907) 747-3287 or www.amsea.org.

Paddlers should look for courses specific to their sports, such as those sponsored by the American Canoe Association and American Whitewater. There are also several Alaska paddling organizations that can offer more information:

- Knik Canoers and Kayakers: www.kck.org
- Fairbanks Paddlers: www.fairbankspaddlers.org
- Alaska Sea Kayak Symposium: www.alaskaseakayaking.org

For online courses approved in Alaska, visit our website at www.alaskaboatingsafety.org.

Skills

All boaters should have the skills to operate their boats under a variety of conditions and deal with a variety of problems. Beginning boaters may have enough skill to operate a boat under ideal conditions, but events such as deteriorating weather or a mechanical breakdown can suddenly require a much higher level of skill than the boater possesses. Skills are developed with instruction, practice, and experience. It is important for boaters to recognize their skill level and avoid operating in conditions that could potentially exceed their abilities.

THE KEY TO SAFE BOATING

The four cornerstones of the prepared boater are:

- knowledge
- skill
- good judgment
- proper attitude

Attitude

Safe, enjoyable boating begins with the proper attitude. Alaska's waterways are a dynamic, ever-changing environment. Complacency, over-confidence, or carelessness are serious liabilities on a boat in Alaska. Avoid a "day trip" attitude, always have a contingency plan and prepare accordingly.

Judgment

Sound judgment, unimpaired by alcohol, drugs or fatigue, is a boater's most important tool. Boaters often have a choice of whether or not to put themselves and their passengers in a situation that could be beyond their skill or the capability of their boat or equipment. Be flexible in decision making; lives may depend on it.



REQUIRED EQUIPMENT

The federal and state laws requiring basic equipment on vessels are designed to save lives and reduce the need for rescue. Equipment required for a specific boat depends on many factors, including the size of the boat, source of propulsion, construction, and where and how the boat is used. The Alaska Requirements Summary (Page 5) incorporates the items required under state and federal law. Please note these requirements are the minimum — every boater should carry additional equipment appropriate for the boat and the operating conditions.

Federal Requirements

Federal requirements apply on all U.S. navigable waters. In Alaska, this includes all saltwater, rivers that empty into saltwater, and inland waterways designated as U.S. navigable waters under federal law. The requirements for non-commercial boats are found in the brochure "Federal Requirements and Safety Tips for Recreational Boats," or on the U.S. Coast Guard's website, www.uscgboating.org.

State Requirements

In Alaska, the state requirements are similar to the federal requirements and apply to all boats (except ship lifeboats, seaplanes, inspected passenger vessels, and water toys) on all waters of the state, including inland waters and saltwater within the territorial limits of the state. This section provides an overview of state requirements as of this printing.

Life Jackets

A personal flotation device (PFD) is either wearable (life jackets) or throwable (life rings, cushions), and designed to keep a person afloat in water.

Life jackets keep persons afloat by providing supplemental buoyancy. Buoyancy is the upward force exerted on anything in the water that is less dense than the water it displaces. A U.S. Coast Guard-approved life jacket provides at least 15.5 lbs. of supplemental buoyancy, allowing a person to float with little or no effort.

Life jackets were historically thought of simply as a substitute for swimming ability or boating experience. However, with increased understanding of the effects of cold water immersion, many Alaskan boaters are now realizing the importance of always wearing a life jacket when in an open boat or on deck.

ALASKA REQUIREMENTS SUMMARY

Requirements	Boats Under 16 Feet	Boats 16 feet to less than 26 feet	Boats 26 feet to less than 40 feet	Boats 40 feet to less than 65 feet
Life Jackets	One U.S. Coast Guard-approved life jacket for each person on board. Must be in serviceable condition, approved for the activity, and worn in accordance with the label and owner's manual. Persons under 13 must wear a life jacket when in an open boat, on the deck of a boat, or when being towed (i.e. tubing, waterskiing)			
Throwable Devices	Recommended but not mandatory.	Except for canoes and kayaks, one U.S. Coast Guard-approved throwable device. (i.e. seat cushion or throw ring)		
Sound Producing Devices	Boats less than 39.4 feet (12 meters) in length must be able to make an efficient sound signal (such as that made with a whistle or horn) to signal intentions and to signal position in periods of reduced visibility.			Boats 39.4 feet (12 meters) or more in length, a whistle or horn.
Visual Distress Signals	Night signals meeting federal requirements (33 CFR 175.110) between sunset and sunrise	Signals meeting federal requirements (33 CFR 175.110) for both day and night-time use. Exception: boats and open sailboats not equipped with mechanical propulsion and under 26 feet in length are <u>not</u> required to carry day signals. *Note: Pyrotechnic devices, if used to meet this requirement, must be current, serviceable and readily accessible. At the minimum, a total of three day/night combination devices or three day and three night devices must be carried.*		
Fire Extinguishers	At least one U.S. Coast Guard-approved B-I required for boats with inboard engines, living spaces, permanent fuel tanks or enclosed storage areas or hull voids not sealed or filled with flotation material		At least two B-I or one B-II U.S. Coast Guard-approved fire extinguishers	At least three B-I or one B-I and one B-II U.S. Coast Guard-approved fire extinguishers
Navigation Lights	Display required between sunset and sunrise and when visibility is restricted. International configuration required (varies with length and mode of operation). See the International Navigation Rules.			
Backfire Flame Arrestors	One U.S. Coast Guard-approved backfire control device on each carburetor of all inboard gasoline engines.			
Ventilation	Boats with permanently installed engines, closed compartments or permanent fuel tanks must have efficient natural or mechanical ventilation.			
Registration	A boat placed on state waters that is equipped with mechanical propulsion (gas, diesel or steam engines, and electric motors) and any vessel used in sport fishing charter activities must be registered and numbered with the Division of Motor Vehicles (AS 05.25.53. Certificate of Number must be carried onboard. Registration numbers and validation decals must be properly displayed on hull of boat. REV 3.11.19			

AlaskaBoatingSafety.org

Life jackets aid breathing by increasing the distance between airways and the water. They also assist with rescues and self-rescues, keep a person floating even if disabled or unconscious and offer protection in the event of an ejection. Some designs even offer insulation from cold water.

There are important legal requirements concerning life jackets:

- A U.S. Coast Guard-approved life jacket must be carried on board for each person on the boat and be "readily accessible" — the easiest way to ensure this is to wear it.
- Persons under 13 years old must wear a life jacket when on an open boat, on an open deck, or when being towed on water skis or other devices.
- Life jackets must be of the proper size and fit for the intended wearer. Adult sizes do not satisfy the legal requirements for children, or vice versa.
- Life jackets must be used in accordance with the manufacturer's label and owner's manual. Some life jackets must be worn to satisfy carriage requirements.
- Life jackets must be in serviceable condition, meaning they must be free of defects, such as missing or waterlogged flotation material, broken zippers, buckles, or straps. Special attention should be given to inflatable devices, which should be carefully maintained per manufacturer recommendations.



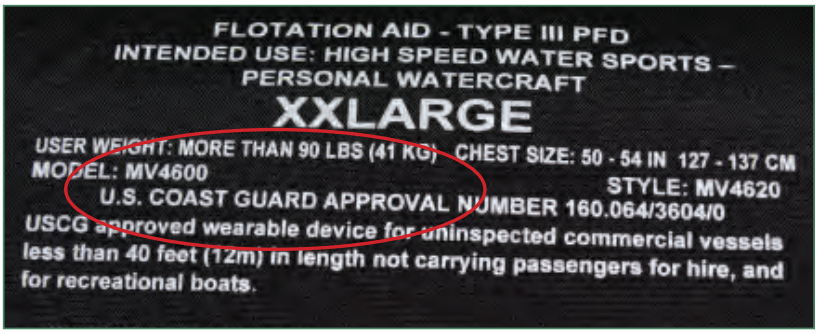
This life jacket is too big!



Proper life jacket fit impacts performance.

Life Jacket Selection

There is a wide variety of styles and colors of life jackets. No one life jacket is perfectly suited for all persons in all situations. For example, body shape is a consideration; some life jackets are equipped with several adjustment points enabling a custom fit. Some are designed for



Read the label to ensure a proper fit.

offshore use, and others for nearshore and calm water. Some have bright colors, such as fluorescent green or orange, greatly increasing the visibility of a person in the water and improving the chances of a successful rescue or recovery. Some, such as float coats and full body work suits, help slow heat loss when in the water.

You must wear the life jacket in accordance with the label. Check for age restrictions and "approved only when worn" directions. Read the manufacturer's label to determine if the life jacket is U.S. Coast Guard-approved for the intended use. Some devices are not approved for recreational boats. In these cases, a U.S. Coast Guard-approved device for each person must also be carried on the boat in order to meet federal and state requirements.

Finally, all life jackets perform differently in the water, and identical life jackets perform differently on various people. Everyone should test their life jackets in water (such as a lake or a pool) before taking them out



"...wear these jackets, left here at this place. Let my death not be in vain."

boating. Become familiar with equipment before an emergency arises. Not all life jackets are created equally. Choose the life jacket to fit your specific needs. Consider:

Swimming ability and confidence in water: Inflatable life jackets and some styles may not have the buoyancy a nearshore or offshore life jacket provides. If swimming ability and confidence are low, choose a life jacket with a higher number of newtons (or pounds of buoyancy).

Proximity to shore and self rescue: If nearshore and possessing strong swimming ability and confidence in water, an inflatable or lower number of newtons may be appropriate. If boating offshore, the preferred life jacket is an offshore PFD because they are most likely to turn an unconscious wearer face up in the water.

Type of body of water: If boating in whitewater where water is heavily aerated, a higher number of newtons or pounds of buoyancy is a better choice.

Custom fit (number of adjustment points): The more custom fit the life jacket, the better the performance in the water. Choose a life jacket with multiple adjustment points. A snug and comfortable fit is the best option.



Offshore



Nearshore



Whitewater



Nearshore



Float Coat



Inflatable

Cold water boating: If boating in cold water during cold weather months, a float coat can offer additional protection and reduce body heat loss.



Immersion suits (survival suits) completely cover the wearer, slowing heat loss in the water. Although most recreational boating deaths are an immediate onset emergency, it is a good idea to carry them onboard. Try them on first to ensure proper fit. Immersion suits are not a substitute for a life jacket, but it is a good idea to have them on board in the event of a delayed onset emergency. Practice getting an immersion suit on within one minute.

Life Jacket Loaner Boards



"The best type of life jacket is the one you WEAR!"

There are more than 700 life jacket loaner boards located throughout Alaska. This grass-roots program makes life jackets easily accessible primarily at boat launch ramps or popular boating areas. Anyone can borrow a life jacket, and often there are a variety of sizes available. Thirty-four lives have been saved thanks in part to borrowing a *Kids Don't Float* life jacket. Call the Alaska Office of Boating Safety at 907-269-6042 for more information on how to establish a life jacket loaner board in your area. Anyone can donate a gently used U.S. Coast Guard-approved life jacket to a life jacket loaner board.

Sound Signals

International Navigation Rules 32-37 (Part D) address the signals used when maneuvering, warning other boaters, and attracting attention. According to both federal and state law:

- Vessels less than 39 feet, four inches (12 meters) are not specifically required to carry a sound-producing device, such as a whistle or horn, but must have some means of making an "efficient sound signal." Fastening a whistle to each life jacket is a great way to meet this requirement.

- Vessels over 39 feet, four inches (12 meters) are required to carry a whistle or horn.



Various types of sound signals

Visual Distress Signals

Problems can occur for many reasons when boating, and even well-prepared boaters sometimes need help. In these situations, boaters must be able to alert others. Signals can help, but only if they are the right type for the conditions and are used properly.

- Visual distress signals are classified by the U.S. Coast Guard as day signals, night signals, or combination day and night signals.
- Boats under 16 feet in length, manually propelled boats, and open sailboats under 26 feet without engines are not required to carry day signals. However, those boats must carry night signals when operating between sunset and sunrise, and in situations where there is diminished visibility, such as fog or smoke.



Flares are a type of visual distress signal.

- Carry extra visual and sound signaling devices in clothing or life jacket pockets; in the event of getting separated from your boat, you will be glad you have these devices with you!
- Pyrotechnic devices should be packaged in a watertight container with the expiration date clearly marked on the outside.

If pyrotechnic devices (such as smoke signals and flares) are used to meet legal requirements, at least three must be carried. All devices are marked with an expiration date. If expired flares are carried as spares, put them in a separate container and clearly mark them “expired” and consider using them first. If the expired devices work, then the newer devices are still available as a backup.

Keep in mind that three flares don’t last long in an emergency. For this reason, many experienced boaters carry other signaling devices in addition to the requirements — for example, expired pyrotechnics. Other examples of devices to carry on your person include signal mirrors, white

LED lights, glow sticks on a string and distress flags.

Examples of visual distress signals that meet Coast Guard requirements include:

- Electric, automatic SOS distress light (night signal)
- Three orange smoke canisters (day signal)
- Orange flag with distress symbol (day signal)
- Three hand-held flares (day and night signal)
- Three red meteor aerial flares (day and night signal)
- Three parachute flares (day and night signal)



Distress flag



Signal flares

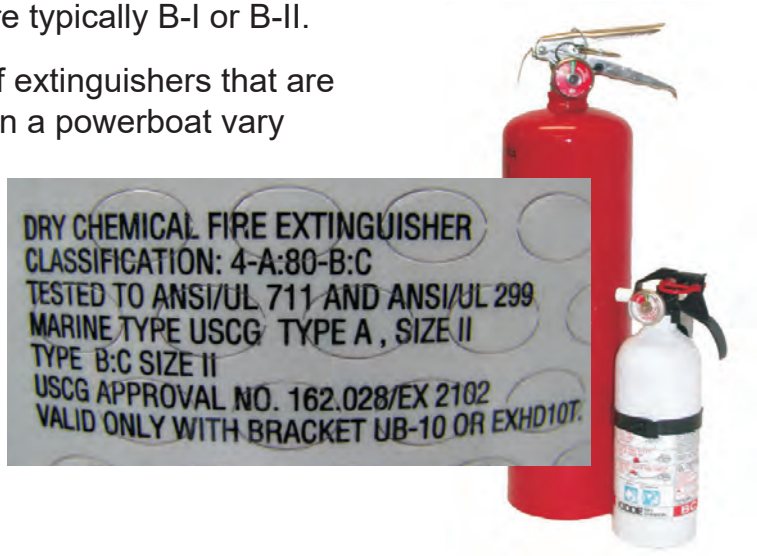
Fire Extinguishers

Fire extinguishers are required on all powerboats with enclosed engine compartments, permanently installed fuel tanks or enclosed areas that could trap fumes. Extinguishers are classified by the type of fire (A, B, C, or D) they are designed for and by size (I, II).

- **Class A**—ordinary combustible materials, such as wood, cloth, paper, rubber, and many plastics.
- **Class B**—flammable liquids, combustible liquids, petroleum, greases, tars, oils, oil-based paints, solvents, lacquers, alcohols, and flammable gases.
- **Class C**—involves energized electrical equipment.
- **Class D**—combustible metals, such as magnesium, titanium, zirconium, sodium, lithium, and potassium.

Extinguishers must have a label from the testing laboratory and have a U.S. Coast Guard approval number or specify “Marine Type USCG.”

Marine extinguishers are typically B-I or B-II.



The size and number of extinguishers that are required to be carried on a powerboat vary with the length of the boat. (See Alaska Requirements Summary, Page 5). Everyone on the boat should be familiar with the location and correct use of fire extinguishers. Fire drills are highly recommended.

Some additional points:

- Do not test a fire extinguisher (this breaks the seal and causes leakage). See label for additional information.
- Place extinguishers in readily-accessible locations, but NOT where a fire would be most likely to break out. For example, an extinguisher mounted inside a closed engine compartment may be impossible to reach in the event of a fire.
- Inspecting fire extinguishers should be a regular part of the pre-departure checklist. Dry chemical extinguishers should be inspected monthly and shaken to redistribute the agent.

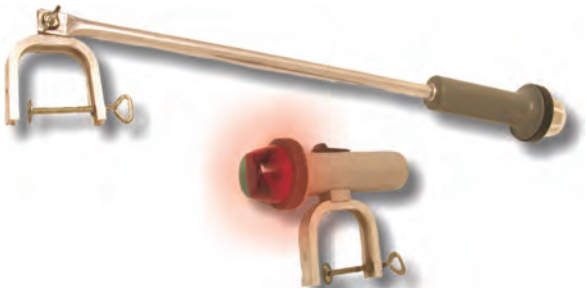
Navigation Lights and Shapes

International Navigation Rules 20-31 (Part C) address navigation lights and shapes (shapes are the daytime equivalent of navigation lights and may be balls, cones, cylinders or diamonds that are black in color). It is the boat operator's responsibility to learn and use these lights and shapes.

Boats on the waters of the state must display navigation lights **between sunset and sunrise and during periods of restricted visibility**.

The following summarizes the lighting requirements for non-commercial boats under 20 meters (65 feet, seven inches):

NOTE: Navigation light illustrations (Figures 1-6) can be found on the facing page.



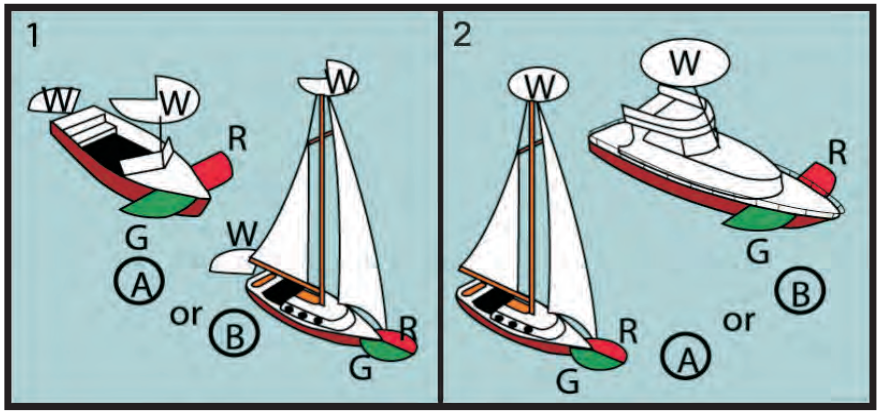
Powerboats must exhibit navigation lights as shown in Figure 1, except that boats less than 12 meters (39 feet, 4 inches) may show the lights in Figures 1 or 2. A power-driven boat of less than seven meters (23 feet) in length whose maximum speed does not exceed seven knots may instead exhibit an all-round white light and, if practicable, side lights. A sailboat operating under both machinery and sail power is considered a power-driven boat.

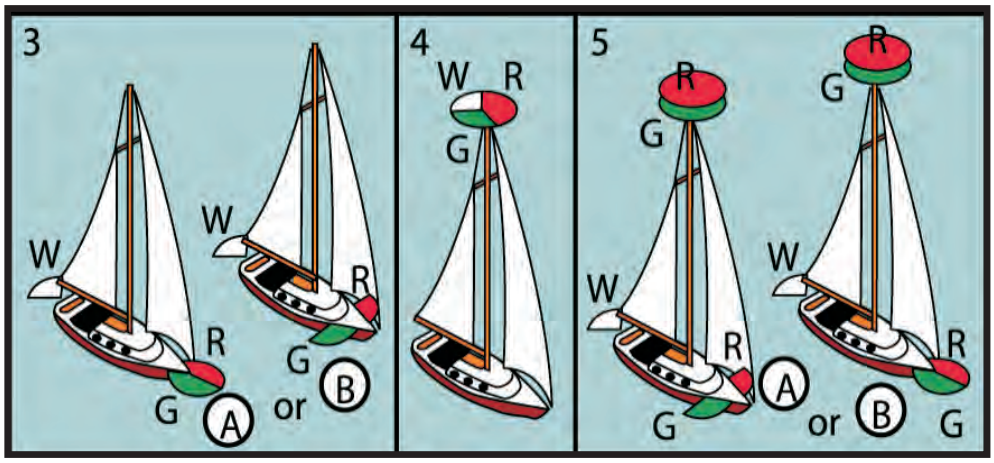
Sailboats under sail alone must exhibit navigation lights as shown in Figures 3 or 4, and may also display the lights shown in Figure 5. A sailboat of less than seven meters (23 feet) in length must either exhibit navigation lights as shown in Figures 3 or 4 or carry an electric torch or white light, which must be exhibited in sufficient time to prevent a collision (Figure 6).

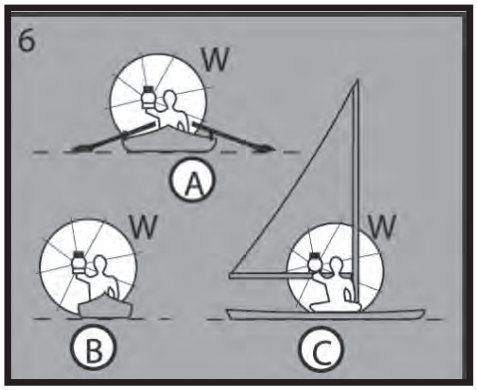
Boats under oars must either exhibit navigation lights as shown in Figures 3 or 4, or carry an electric torch or white light, which must be exhibited in sufficient time to prevent a collision (Figure 6).

Anchor lights must be displayed on power-driven vessels and sailboats. An anchor light is a round white light visible for two miles and exhibited forward where it can best be seen. Vessels less than seven meters (23 feet) are not required to display anchor lights unless anchored in or near a narrow channel, fairway, anchorage, or where other vessels normally navigate. Anchor lights are not required on vessels less than 20 meters anchored in a special anchorage designated by the Secretary of Transportation.

Navigation Light Illustrations (Figures 1-6)







COLOR CODE

W = White

R = Red

G = Green

Additional information, including all recognized signals and lighting, and shape requirements, can be found in the complete Navigation Rules, at:

https://www.navcen.uscg.gov/?pageName=navRuleChanges

PRE-DEPARTURE CHECKLIST

Power boaters can avoid inconvenience and potential danger by taking a few minutes before departure to check the following:

✓ Life jackets worn by each person (proper size, fit, and fastened)

✓ Emergency communication and distress signaling devices carried ON person

✓ Float plan prepared and transmitted to responsible party

✓ Passengers and load distributed properly, items secured from shifting

✓ Passenger briefing — how to start, stop and steer boat, clothing check, location and use of communications and emergency equipment

✓ Engine cut-off device worn by the operator

✓ Throwable flotation device attached to floating line

✓ Weather, forecast update and local observations

✓ Fire extinguisher(s) fully charged and mounted securely

✓ Ability to make an efficient sound signal (horn or whistle)

✓ U.S. Coast Guard-approved visual distress signals (check expiration dates)

✓ Boat registration current, properly displayed and certificate onboard

✓ Drain plugs installed, thru hull fittings leak-free, sea cocks closed

✓ Hoses/clamps, drive units/props, fuel lines/filters, blowers/backfire flame arrestors (inboards) inspected

✓ Scuppers clear, bilge clean

✓ Battery fully charged, secured, terminals covered

✓ Back-up manual bailing device(s) accessible and functional

✓ Back-up propulsion source (spare engine, sail, paddles or oars)

✓ Tools/parts e.g. spare batteries, fuses, spark plugs, belts, prop and nut

✓ Anchors (2), each with chain and line, one attached to the boat

✓ Food, water, shelter, and spare clothing

✓ First aid kit

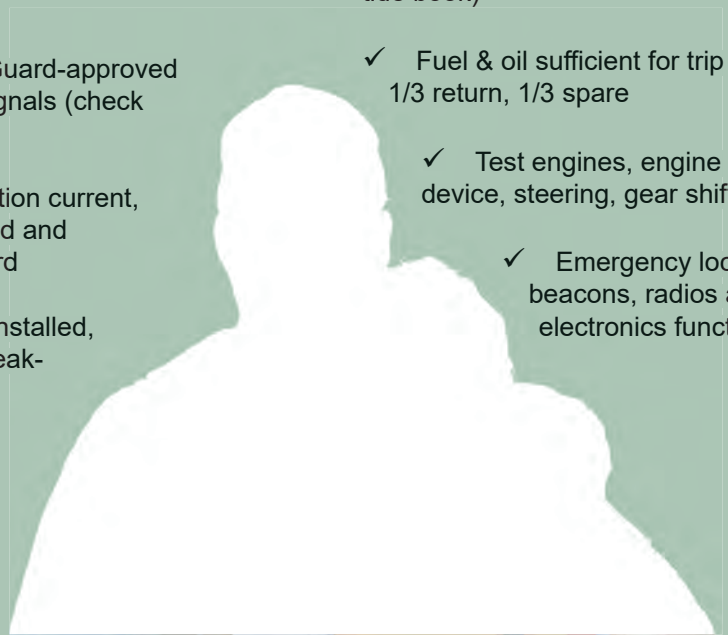
✓ Reboarding devices (foot sling, swim step, ladder)

✓ Navigation tools (e.g., GPS, chart plotter, depth sounder, compass, charts, tide book)

✓ Fuel & oil sufficient for trip — 1/3 out, 1/3 return, 1/3 spare

✓ Test engines, engine cut-off device, steering, gear shift and lights

✓ Emergency locator beacons, radios and other electronics functional



Backfire Flame Arrestors

Backfire flame arrestors are screen-like devices installed on inboard gas-engine carburetors. They help prevent flames produced by engine backfire from causing a fire and/or explosion. These devices must be kept clean and periodically inspected for damage. They are required on all motorboats with inboard gas engines manufactured after April 25, 1940.

There are two exceptions to this requirement: a vessel that has an attachment to the carburetor or has the engine located so that flames caused by engine backfire will be dispersed outside the vessel so neither the vessel nor the persons on board are endangered; or a vessel whose air and fuel intake system bears a U.S. Coast Guard-approval label stating that it is safe without a flame arrestor.

Ventilation

An enclosed space containing explosive vapors is a bomb waiting to go off. Any boat equipped with a gasoline engine installed inside an enclosed engine or fuel tank space (not open to the atmosphere) must have an efficient ventilation system to disperse explosive vapors.

Natural ventilation consists of at least two ventilation ducts fitted with cowls or the equivalent. At least one exhaust duct extending to the lower portion of the bilge, where fumes are most likely to accumulate, and at least one intake (supply) duct extending to a point midway to the bilge (or at least below the level of the carburetor air intake) are required.

Boats built after July 31,1980, are required to have powered ventilation (exhaust blower) for engine compartments that are not open to the atmosphere. Such boats are also required to display a warning label.

Butane and propane are even more dangerous than gasoline, so be diligent about checking inside the cabin and galley. Be sure the fuel tank enclosure is properly vented.

Before starting the engine, operate the blower for at least four minutes and check the engine compartment for gasoline vapors. Remember, your “nose knows!” If you smell vapors, do not start the engine.

REGISTRATION AND TITLING REQUIREMENTS

In the event of a boating emergency or boat theft, boat registration provides critical information such as a detailed boat description, owner contact information and hull identification number, and can substantially reduce the time and cost involved with responding to these cases.

All 50 states and six U.S. territories and commonwealths register boats. Under federal law, all boats equipped with machinery propulsion must be registered by the state in which principal use occurs. Once issued, this registration cannot be reassigned or transferred to another boat. Registration in Alaska is valid for a three-year period.


ALASKA BOAT REGISTRATION

EXP DATE
JUL 2012

NUMBER
AK-0000-P

DECAL NO
BE7233

HULL IDENTIFICATION NUMBER
NFL00000E000

OWNER NAME/ADDRESS
CAPT. JAMES COOK
2503 BLIGH DR.
ANCHORAGE AK 99500

This is a boat registration. Boat registrations include a Certificate of Number. This number is required by Alaska law.

In Alaska, exceptions to the state's registration requirement apply to:

- Any documented or undocumented boat with a current registration from another state (though not to exceed 90 consecutive days)
- Government boats (NOTE: Government recreational boats are not exempt under federal law)
- Ship lifeboats used solely for lifesaving purposes

- Boats documented by a foreign government, but not those documented within the U.S. territories or other states
- Boats not equipped with mechanical propulsion, such as canoes or kayaks, unless used for sport fish guiding

While non-motorized boats, such as canoes and kayaks, are not required to be registered in Alaska, having a registration can help aid in recovery efforts in the event of loss or theft.

A boat's registration (also referred to as the Certificate of Number) must always be kept on the boat when in use. An example of a boat registration is shown in the illustration on Page 18.

NOTE: The Alaska Department of Fish and Game vessel license for boats engaged in commercial fishing is not a boat registration.

How to Register

The boat owner must complete a state application for boat registration and present the application together with the appropriate fees to the Alaska Division of Motor Vehicles (DMV). An owner of a boat that has never had an Alaska registration must also provide one of the following documents to prove ownership:

— Manufacturer's Statement of Origin (new boats only)

— Carpenter's Certificate

— Bill-of-Sale from a dealer or the previous owner

— Title or Registration (Certificate of Number) from another state

— Affidavit of Ownership

Registration forms are available at any Alaska DMV office. Forms and additional information are also available online through the Alaska Office of Boating Safety's website at www.alaskaboatingsafety.org or the DMV website at www.state.ak.us/dmv/reg/boat.htm.

Registration Fees

Boats equipped with mechanical propulsion, including non-powered boats with auxiliary machinery propulsion (for three years):

Original registration/Certificate of Number, transfer of ownership, or renewal: $24

Duplicate registration/Certificate of Number or replacement decal: $5

Boats NOT equipped with mechanical propulsion (for three years):

Original registration/Certificate of Number, transfer of ownership, or renewal: $10

Duplicate registration/Certificate of Number or replacement decal: $5

Titling

Under Alaska Statute (AS 05.25.055), motorized boats over 24 feet must also be titled, to help keep track of ownership and discourage owners of derelict vessels from abandoning their ships in Alaska waterways. This statute applies to undocumented as well as documented vessels. If you sell your boat, you must transfer title to the new owner in order to be free of liability in the event of emergency, desertion or other misuse of the boat. If you are a documented boat owner from another state or country, you must have proof of title from your home state/country for presentation to authorities, if asked.



In Alaska, motorized boats over 24 feet must also be titled.

How to Title

The boat owner must complete a state application for boat title and present the application together with the appropriate fees to the Alaska Division of Motor Vehicles (DMV). An owner of a boat that has never had an Alaska title must also provide one of the following documents to prove ownership:

— Registration/Certificate of Number

— Proof of ownership, such as manufacturer's Statement of Origin (new boats only)

— Carpenter's Certificate

— Bill-of-Sale from a dealer or the previous owner or title or registration from another state

Titling forms are available at any Alaska DMV office. Forms and additional information are also available on the internet through the

Alaska Office of Boating Safety's website at www.alaskaboatingsafety.org or the DMV website at www.state.ak.us/dmv/reg/boat.htm.

Titling Fees

Boats over 24 feet must be titled in Alaska:

- Boat Title: $20
- Duplicate Boat Title: $20

Notification Requirements

The boat owner is required to notify the DMV in writing within 15 days of:

- Any change in address
- Theft (or recovery) of a registered boat
- Loss or destruction of a valid registration/Certificate of Number
- Transfer of all or part of the owner's interest in the boat
- Destruction or abandonment of the boat
- New boat owners of undocumented vessels must apply for a certificate of title within 30 days of purchase.

The boat owner is also required to surrender the registration/Certificate of Number to the DMV within 15 days if the Certificate of Number becomes invalid due to any of the following:

- U.S. Coast Guard documents the boat
- Owner transfers all of their ownership of the boat
- Boat is destroyed or abandoned
- Fees are not paid
- Application contains a fraudulent statement
- Boat is no longer principally used in Alaska
- Owner involuntarily loses their interest in the boat by legal process

Display of Number

If a boat is required to be registered, then the "AK" number assigned to the boat by the registration/Certificate of Number must be painted on or otherwise permanently attached to each side of the forward half of the boat. Boats not required to be registered are also not required to

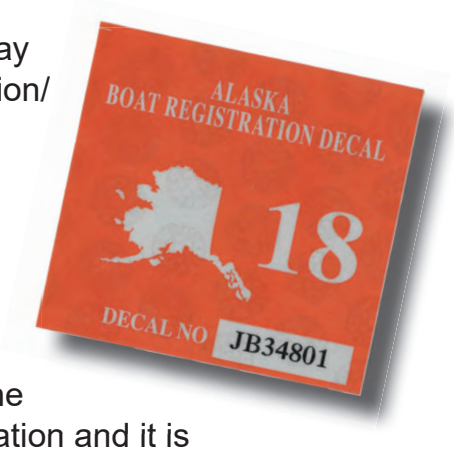
display the number, but doing so speeds identification in the event of an emergency or theft.

- Numbers must be plain, vertical block letters not less than three inches in height. Numbers must contrast with the color of the background and be distinctly visible and legible. They must read left to right and have either a space or hyphen that is the width of a letter or number (except the width of an I or a 1) between each group of letters and numbers (Example: AK 5678 AA or AK–5678–AA).



- A backing plate made of plastic or other suitable material may be used as a surface to place the number if the boat is an inflatable or if the boat is so configured that the number would not easily be seen if it was affixed to the hull or superstructure.
- Boat dealers may use a removable backing plate to display the number, but only if the boat is actually being tested or demonstrated.
- Only the registration number officially assigned to a boat may be displayed.

Display of Validation Decals



All boats required to be registered must display the validation decals issued with the registration/ Certificate of Number. The decals must be visible when the boat is in operation and displayed within six inches of the registration number on each side of the boat. Only a current decal may be displayed. Expired decals must be covered or removed.

Decals may be applied to a backing plate if the plate is attached to the boat in the proper location and it is impractical to attach the decal directly to the boat.

Hull Identification Number (HIN)

A hull identification number (HIN) is a unique serial number that identifies a specific boat, much like the vehicle identification number of an automobile.

State law requires a permanent HIN on every boat registered in Alaska. Manufacturers are required under federal law to put a HIN on the boat during construction. However, some boats, such as those manufactured before 1972 and homemade boats, don't have one assigned, so the owner must obtain a HIN from the DMV. HINs shall be permanently inscribed into the hull in accordance with 02 AAC 70.080. It is unlawful for a person to remove, alter, deface, destroy, or otherwise make a HIN illegible.

RECOMMENDED EQUIPMENT

Already reviewed are the **required** items for operating a vessel in Alaska. But there are additional items to consider that will help to ensure safe and enjoyable boating.

Anchor

Boats in Alaska are not required to have anchors onboard; however, it is highly advisable. An anchor is a safety item that could save the day. If you run out of fuel or your boat motor dies, an anchor can hold you steady while help is on the way.



Anchor with appropriately equipped rode (chain and anchor line)

Select the appropriate type and size of anchor for your boat and its usage. Also make sure you have the appropriate diameter and length of rode (anchor line and chain). Consider the size of the boat, the environment at the bottom of the water, the water conditions and the depth of the water (from the bow to the bottom). The length of the rode should be seven times longer than the depth of the water, depending on the weather conditions, the current, and the size of the boat. Wind, tides, current and other boats in the vicinity are some factors to consider when anchoring. See "Underway" for anchoring procedures.

Engine Cut-off Device

Most personal watercrafts and powerboats come with a manufacturer-equipped emergency engine cut-off device. This is a safety item that is



Always use an engine cut-off device to ensure your boat will stop running in the event that you go overboard or are disabled.

specifically designed to shut off the engine if the operator is separated from the helm. This critical piece of equipment can prevent overboard passengers from being struck by a spinning prop from an out-of-control boat that has lost its operator. This is also known as the “Circle of Death.”

Remember to always secure the cut-off device to your person before operating your vessel. There are two types of cut-off devices -- those that are manually attached to the motor via a lanyard, or electronic wireless devices, which detect when the operator is a certain distance from the helm or captain’s seat. If your boat does not come equipped with an engine cut-off device, consider installing one.

Reboarding Device

If you fall out of your boat, the surest way to safety is to get back in! A reboarding device, such as a built-in transom ladder, handhold, foothold or rope ladder, will help make it easier. Make sure any non-attached item, like a rope ladder, is easily accessible and can be attached quickly for fast retrieval from the water. A simple loop of line between cleats could make reboarding easy.

Emergency Communication Devices

Believe it or not, radios and other forms of electronic communication are not required on Alaska waters. Still, it is a key ingredient to having a safe boating outing — so much so that it warrants its own section.

EMERGENCY COMMUNICATION DEVICES

It is one thing to be out on the water enjoying yourself and have everything go as planned. In this scenario, the sun is shining, the water is calm and the boat responds to your every maneuver. But anyone who spends time in Alaska knows this is not always how the day turns out. Fast-approaching storms, powerful tides, mechanical breakdowns and – more often than not – human error can turn a tranquil day into an unexpected tragedy. Pushing a button on a device does not necessarily guarantee a timely rescue, but it is one more critical piece of safety equipment that highly enhances the chance of success if you do.

Of the recreational boating fatalities to date in Alaska, five of six followed a capsizing, swamping, ejection or fall overboard. Nine of 10 fatalities were adult male victims who were not wearing a life jacket or who were never found. Life-threatening situations arise in the blink of an eye, and regardless of swimming ability, boating experience, physical or mental strength, death can occur – and can occur quickly.

For this reason, it is imperative to have some way to call for help in the event of an emergency. Whether you are paddling a kayak, steering a skiff or standing on a paddleboard, having some sort of emergency communications device can quite literally save your life.

The challenge is choosing the right device for your activity and area. What might work for one person in one



Dashboard-mounted VHF radio

GET HELP WHEN YOU NEED IT

To stay as safe as possible on the water, consider carrying a combination of the following emergency communication and distress signaling devices. Some are required and others are recommended, but having several communications options as backup is just smart boating.

Emergency Locator Beacons

- EPIRB
- PLB
- Satellite Tracking Devices

Radios

- VHF Radios
- HF Radios

Phones

- Satellite phones
- Cellphones

Distress Signaling Devices

- Visual distress signals
- Sound signals



Handheld VHF radio

location may be ineffective for someone else in a different location or scenario. The size of your boat, your destination, your proximity to other people and especially the broadcast reach of the device all comes into play when choosing the right model. Research the options carefully, compare prices and resist the urge to make an uninformed purchase. Advice is helpful, but also consider the source. The tools your uncle needs while commercial fishing in the Bering Sea, such as a personal locator beacon, may be way more than you need for your weekend kayaking trip to Halibut Cove. Likewise, a cellphone you may carry when paddleboarding on Campbell Lake may not be helpful to a stranded boater in the middle of Prince William Sound.

The options below offer insights to familiarize you with what might work best for your particular needs. Above all, carry some sort of combination of the tools listed below. Having a tool to initiate a rescue, and a device to help pinpoint your location, is the ideal combination. In other words, have a backup to your backup, on your person.

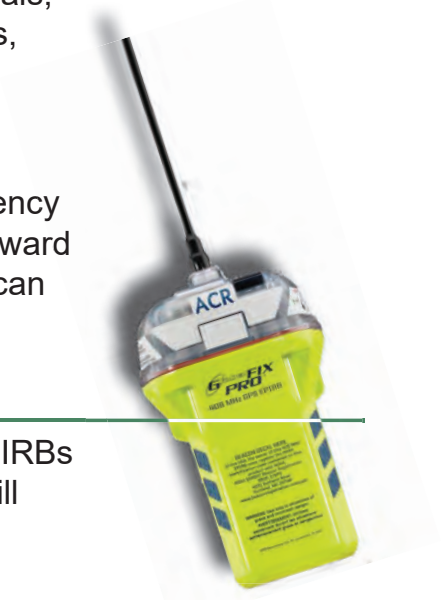
Immediate Help: Distress Signaling Devices

If you fall overboard, experience boat trouble or have any other sort of emergency, it is critical to perform functions to attract attention and receive help within the first ten minutes — especially if you are in the water. Even the most prepared boaters can find themselves in this situation, so know what to do, just in case. Visual distress and sound signals are part of the required equipment to have onboard in Alaska (See pages 9-11). But they are reiterated here, because this equipment, combined with the following options for emergency communication, will ensure a better chance of rescue if calling for help.

Distress signaling devices include visual distress signals, such as flares or mirrors; and sound signaling devices, such as a whistle or horn.

Emergency Locator Beacons

There are different types of devices within the emergency locator beacon family. Some are larger and geared toward large commercial vessels and some are smaller and can be carried on one's person.



EPIRB

Emergency Position-Indicating Radio Beacons, or EPIRBs can activate automatically or manually, either while still

mounted or when submerged in water. EPIRBs are linked to what is called the COSPAS SARSAT, a collaborative satellite system among the United States, Canada, France, and the Soviet Union to detect and aid in rescue.

- GPS? They can come with and without Global Positioning Systems
- Registration required? Yes, to particular boat, not a person
- Two-way communication? No
- Homing signal? Yes
- Cost? Starting at about $500 without GPS; the higher-priced units include GPS and are more reliable during search-and-rescue attempts
- Range: Interface with COSPAS SARSAT; range is practically limitless for reporting, and narrowing, a search
- Power mode? Battery; requires maintenance about every five years
- Ideal for: Boats, as they are larger and must be registered to a single vessel
- Pro: Some units will activate automatically in the case of a catastrophic emergency
- Con: Expensive, limited to one boat per unit.

PLB



Personal Locator Beacons, or PLBs, are smaller and more affordable than their larger counterpart above. Like EPIRBs, they utilize the COSPAS SARSAT system.

- GPS? On some but not all
- Registration required? Yes, to the individual
- Two-way communication? No
- Homing signal? Yes, 121.0MHz
- Cost? Prices as low as $300
- Range: They interface with COSPAS SARSAT. Range is practically limitless for reporting, and narrowing, a search.
- Power mode? Battery operated; batteries last up to five years.

- Ideal for: All recreational activities, as they are smaller, and can be kept on one's person at all times.
- Pro: Affordable, easy to carry and emit a homing signal on 121.0MHz radio frequency.
- Con: Must be activated and operated manually, which is not always an option.

Satellite Tracking Devices

Satellite tracking devices are one of the most recent products on the market. Rather than communicate with the COSPAS SARSAT system used by EPIRBs and PLBs, satellite tracking devices, such as the Spot or inReach, relay your position to a privately controlled satellite network, which will then relay your information to search-and-rescue personnel. There are different manufacturers of satellite emergency notification devices, also called SEND for short.



Satellite Emergency Notification Devices (SEND)

- GPS? Yes
- Registration required? Yes
- Two-way communication? Yes
- Homing signal? No
- Cost? Prices as low as $250; however they require a monthly service plan with fees ranging from about $12 to $35 per month
- Range: They interface on private satellite systems and relay information to local search-and-rescue, primarily the Alaska State Troopers.
- Power mode? Battery operated, rechargeable
- Ideal for: Boaters or other recreational activity. They are versatile, and can be used on land as well as water, so are good for those with varying outdoor interests.
- Pro: Two-way text communication available; different brands, prices vary. The products' websites track location.
- Con: Limited range, depending on which unit you choose, and they must be activated manually, which is not always an option. Some satellite networks are equitorial in nature only, limited by the tilt of the earth in northern regions such as Alaska.

Radios



Buying a radio does not automatically mean you will get the help you need in the event of an emergency. First, you must ensure that your dashboard-mounted radio is hard-wired to the boat's GPS, unless the radio comes GPS-equipped. Second, the radio must be registered and you must receive your unique Marine Mobile Service Identity, or MMSI, number (go to www.boatus.com/mmsi or www.usps.org/php/mmsi_new/index.php). Third, the MMSI number must be manually entered into your radio, per manual instructions. Finally, test the radio's operation and MMSI number delivery by making a routine test call to another equally equipped radio. If your radio has the "test" mode feature, you can call the U.S. Coast Guard Recue 21 system using the 003669999 MMSI and get an automatic acknowledgment.

Dashboard Mount or VHF handheld radios



There are two types of very high frequnecy (VHF) radios that can be used – those equipped with digital selective calling (DSC) and those without. Those with DSC can transmit much further than those without.

- GPS? Most radios today have GPS built in, but if they don't, they should be hard-wired to the GPS system. Some handheld radio varieties also have GPS capabilities.
- Registration required? No, but recommended. You will get a Maritime Mobile Service Identity (MMSI), which will help identify your location in an emergency.
- Two-way communication? Yes, and there is a broad reach among other boaters in the vicinity who could offer assistance.
- Homing signal? Some, but not all
- Cost? Relatively affordable, from $75 on up
- Range: Limited due to the curvature of the earth, mountains

and weather. Larger antennae can help but also be impractical. Most have a range between a three- and 12-mile radius, line-of-sight.

- Power mode: Dashboard-mounted radios are connected to the boat's electrical system, so have backup communications onboard, or carry a handheld, in case of engine/power failure.
- Ideal for: Boaters in an area with other boat traffic, within line-of-sight and who will hear your radio.
- Pro: Affordable and easy to install and use, and carry on your person.
- Con: Limited range and if the boat's electrical system fails, so does the radio. Handheld radios are only helpful if charged, on your person and waterproof.

KEEP IT WITH YOU

Alaskan boaters should ALWAYS carry communication and signaling devices ON THEIR PERSON, such as:

Communication: handheld waterproof VHF radio, cellphone in waterproof case, waterproof satellite phone

Signaling: whistle, signal mirror, small aerial flares, white LED light glowstick on a string, emergency locator beacon

A combination of both alert and locate devices ensures that search-and-rescue personnel can home in on the "final mile."

HF RADIOS

There are two types of high-frequency (HF) radios – HAM radios and Marine Single Sideband (SSB) radios. Both can be equipped with Digital Selective Calling (DSC). Because of the nature of DSC (a microburst digital transmission and not a voice transmission), DSC transmissions tend to transmit farther than a voice transmission. DSC distress transmissions can be automatically relayed from ship station to ship station until acknowledged as a distress. HAM radios are a specialty radio option not applicable to most recreational boaters.

- GPS? Most radios today have GPS built in, but if they don't, they should be hard-wired into your vessel to supply it.
- Registration required? Yes, Marine SSB radio systems require two FCC licenses — a Ship Station License and a Commercial Operators License. With a Ship Station License you will receive a 9-digit Maritime Mobile Service Identity (MMSI), which will help in the event of an emergency.
- Two-way communication? Yes, and broadcast
- Cost? SSB radios run $1,000 and higher and should be

installed by an FCC-licensed electronics technician.

- Range: Range is farther than that of VHF radios – hundreds of miles and even across oceans;
- Power mode: These radios require extensive battery life so have backup in case the boat's battery dies.
- Ideal for: Boaters who will routinely be out of cellphone and VHF range.
- Pro: They have a broad range that goes farther than just about any product out there.
- Con: Expensive to install and susceptible to poor weather or atmospheric conditions.

Phones

Two types – Satellite (SAT) phones and cellphone. Unlike cellphones, SAT phones use orbiting satellites for connections.

SATELLITE



- GPS? Yes
- Registration required? No
- Two-way communication? Yes, one-on-one communication with search-and-rescue personnel is possible, as is direct communication with others, such as family, to alert them to the situation at hand.
- Cost? SAT phones are costly, starting at about $1,000 if not on sale. Monthly calling plans are required as well, starting at about $35 per month for minimum usage, and with a per-minute charge.
- Range: SAT phones communicate with the closest satellite and must have line of site to reach it. In deep canyons and dense tree growth with a thick canopy, this can be tricky. However, most SAT phones can find at least one signal.
- Power mode: SAT phones require batteries for usage and can last about 30 hours, but vary. See your owner's manual for details.
- Ideal for: Boaters who will routinely be out of cell phone and

DEVICE ADVICE: *Choose the right communications for your boating needs*

Consider real-life issues:

- How long does the battery last? Is it rechargeable?
- Does it fit in your pocket or on your life jacket and if so how likely are you to always have it on you?
- Is it waterproof? Does it need a case? Is it on a lanyard so it can be kept close?
- Does it float? Does it need to float to work properly?
- How much does it cost? Are there added monthly service plan costs?
- Is it manually or automatically activated?
- Does it offer broad reach for nearby Good Samaritans, or one-on-one communication?
- What is the coverage? Anywhere, or limited by distance or geography?

Understand how satellite communications work:

- Before buying any satellite communications device, make sure its satellite coverage area is dependable and includes your intended destinations.
- Understand how your device communicates with rescue personnel, and its limitations.
- How long will it transmit an emergency signal? In what temperatures?
- Familiarize yourself with the device and its features well before heading out.

Register your device:

- Register devices so your vessel information is always available. Many DSC VHF radios in use are not connected to GPS, do not have an MMSI number assigned and have not been properly registered. This greatly diminishes its reach and hinders SAR professionals' ability to find you quickly in an emergency.
- EPIRBs and PLBs are required to be registered at www.beaconregistration.noaa.gov. You will receive a 15-character Unique Identifying Number (UIN). When activated, your device transmits the UIN to COSPAS-SARSAT satellites.

Prepare for potential problems:

- Before leaving shore, make sure everyone knows how to operate the emergency communications and distress signaling devices.
- Always carry some sort of backup communications, just in case.
- Make sure all devices are operational, batteries charged and properly secured in watertight (if applicable) cases/housing, on your person.
- If using a cellphone or satellite phone, pre-program the numbers of local emergency services (such as the U.S. Coast Guard) beforehand, just in case.

VHF radio range.

- Pro: They are rugged, waterproof and easy to use
- Con: Battery usage can dwindle if in areas where a direct satellite connection cannot be made. Rollover minutes can be use-it, or lose-it.

CELL



- GPS? Yes
- Registration required? No
- Two-way communication? Yes, one-on-one communication with SAR personnel is possible, as is direct communication with others, such as family, to alert them to the situation at hand.
- Cost? Investment in the phone is initially as low as a few hundred dollars, but a monthly cell phone plan must be subscribed to, and those costs vary, depending upon the cellphone provider.
- Range: Cellphone range varies from location to location, and depending upon the provider's network. Therefore cellphones are considered more of a backup, or "bonus" backup, than something that can be depended upon in the event of a boating emergency. Service can be spotty and not dependable.
- Power mode: Cellphones are electrically charged to stay at full power, but the batteries do eventually wear out. Also cold weather and cold-water immersion quickly drains the battery life.
- Ideal for: Users who will be in cellular range, know their service provider's coverage area and are familiar with their surroundings, and who have alternate forms of backup.
- Pro: Everyone knows how to dial 911. As a backup, a simple cellphone can often save the day. Dial *CG (*24) on an Alaska provider phone (any number with the 907 area code) to reach the U.S. Coast Guard Command Center.
- Con: Cellphones are extremely vulnerable to water damage and cannot send out automatic calls for help. The operator must manually make a call, and that is not often possible in

emergencies. Cellphones also do not have the broadcast reach of a radio, and cold water and weather can drain batteries fast.

Specialty communications

AIS MOB Devices, or Automatic Identification System Man Overboard Devices, are best used in areas of commercial boating traffic. When a MOB device is deployed, the person is depicted as a man overboard on computer screens in the wheelhouses of commercial vessels. The AIS is a lot like a PLB, but it is more suited to boating when others are relatively close by. These devices should be worn on your person. Most deploy automatically; some are equipped with digital selective calling (DSC) for better coverage area. The prices range from $250 to $750, depending on the model.

AIS A and B transceivers are becoming more popular among recreational boaters as well as large vessel operators. Not only do these transceivers help a vessel's navigation, but they also let other vessels with AIS A or B transceivers know where they are — and, consequently the U.S. Coast Guard, which monitors AIS vessel traffic in Alaska. Prices range from $500 for the B transceivers, to $1,500-plus for the A transceivers. For more information on A and B transceivers, please visit www.navcen.uscg.gov/?pageName=aismain.

OTHER BOATING LAWS

Prohibited Operation

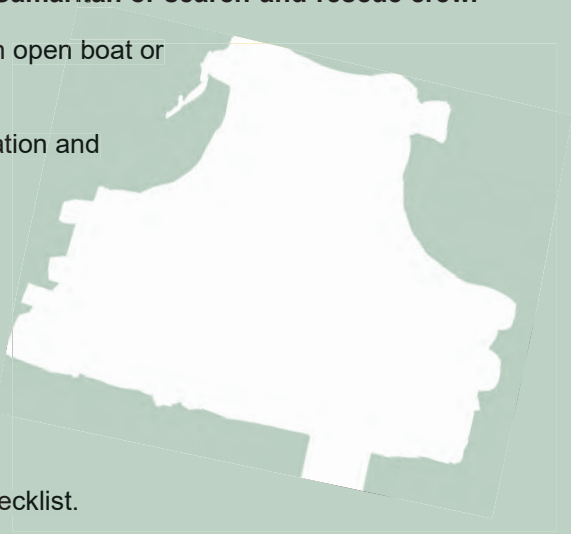
A person may not operate a boat on state waters for a recreational purpose or another purpose, or tow water skis, a surfboard, or a similar device, in a reckless or negligent manner so as to endanger the life or property of another person; or that is not equipped as required under state law. (Alaska Statute 05.25.060)

Owner's Civil Liability

Except as provided under AS 09.65.112 and AS 09.65.290, the owner of a boat is liable for injury or damage caused by the negligent operation of the owner's boat, whether the negligence consists of a violation of a state statute or the failure to exercise ordinary care in the operation of the boat as the rules of the common law require. The owner is not liable, however, unless the boat is used with the owner's express or implied consent. It is presumed that the boat is being operated with the knowledge and consent of the owner if, at the time of the injury or damage, it is under

BE RESCUE READY: *A checklist for success*

Besides having the proper emergency communications devices on hand, here are some other ways to become "Rescue Ready," either through self rescue or by seeking help from a nearby Good Samaritan or search-and-rescue crew.



- Wear a life jacket when on an open boat or on deck.
- Carry emergency communication and distress signaling devices on your person.
- Operators attach the engine cut-off device when underway.
- Equip the boat with at least one means of reboarding.
- Complete a pre-departure checklist.
- File a float plan.
- Brief all passengers on the location and operation of emergency communication devices, and how to stop, start and steer the boat.
- Check and monitor the weather often.
- Never boat under the influence of alcohol or drugs. Thirty percent of fatalities involve boating under the influence — leave it at the beach.

the control of the owner's spouse, father, mother, brother, sister, son, daughter or other member of the owner's immediate family. This statute does not relieve any other person from a liability the person would otherwise incur and does not authorize or permit recovery in excess of injury or damage actually incurred. (AS 05.25.040)

Impaired Boating

Boating under the influence includes consuming alcohol, illicit or prescription drugs. Alcohol use is involved, on average, in at least 28 percent of Alaska's boating fatalities. Alaska's laws that define driving under the influence and the penalties for conviction, also apply to boat operators. The Alaska Office of Boating Safety strongly encourages boaters and passengers to refrain from consuming alcohol or drugs when boating. Alcohol use:

- **Decreases balance**. Most alcohol-related boating deaths involve a fall overboard.

- **Affects vision**. Alcohol can seriously affect peripheral vision, night vision, and ability to focus.
- **Affects judgment**. Operators under the influence are more likely to take risks they normally wouldn't take, and are more likely to make the wrong decisions in a life-threatening situation.
- **Impairs reaction time**. In an emergency, sharp reflexes and quick, appropriate action can save the day. Even without alcohol, a boater's reaction time is affected by exposure to constant motion, sun, wind, and noise. Add alcohol and/or drugs, and the effects are multiplied.

Littering and Pollution Laws

It is unlawful to litter in either state or federal waters.



It is unlawful to litter in state or federal waters.

It is a violation of federal law to discharge raw sewage within three miles of the shoreline. Federal law requires an operable U.S. Coast Guard certified Marine Sanitation Device (MSD) be installed on boats with toilets when on U.S. navigable waters. MSDs must be locked when boating within the three mile proximity to the coastline.

The Federal Water Pollution Control Act prohibits the discharge of oil or hazardous or toxic substances in U.S. navigable waters. Under both Alaska and federal law, any release of oil into the water must be reported as soon as the person has knowledge of the discharge. Spills may be reported by contacting the nearest Department of Environmental Conservation Area Response Team and the U.S. Coast Guard.

Federal law also requires that boats 26 feet and longer on U.S. navigable waters post an oil pollution placard in the machinery space or bilge area, and a garbage placard be posted in a visible location.

Boating Accidents

The operator of a boat involved in a collision, accident, or casualty shall render assistance as is practicable and necessary to save other persons from danger or to minimize the danger to other persons to the extent that the operator can do so without serious danger to the operator's boat, crew, and passengers.(AS 05.25.030)

The operator must also give his or her name, address, and identification number of the boat in writing to each person injured in the collision, accident, or casualty and to the owner of property damaged in the collision, accident, or casualty.

Accident Reporting

For the purpose of gathering boating accident statistics, the boat operator or owner is required by law (AS 05.25.030) to file a written report if a boating accident occurs and results in:

- Loss of life.
- Disappearance.
- Injury requiring medical treatment beyond first aid.
- Property damage over $500.

Please submit the accident report to the Alaska Office of Boating Safety by mail, fax, or email.

Alaska Office of Boating Safety: 550 W. Seventh Ave., Suite 1380, Anchorage, AK 99501

FAX: (907) 269-8907

Email: officeofboatingsafety@alaska.gov

Accident report forms can be obtained from the back of this book, the Alaska Department of Public Safety and the U.S. Coast Guard, or may be downloaded online at www.alaskaboatingsafety.org.

MARINE LAW ENFORCEMENT

Boating regulations can be local, state, or federal and boaters are encouraged to check with area managers for the rules that apply. Jurisdictions can often overlap. State peace officers, including Alaska State Troopers and State Park Rangers, enforce state boating laws. U.S. Coast Guard boarding officers enforce federal boating laws.

Whenever approached by an officer, boaters must stop, or slow to a speed sufficient for safe steerage only, and permit the officer to come alongside to check for registration and safety equipment.

PRE-DEPARTURE CHECK

Along with skillful boat handling, thorough preparation is what distinguishes the better skippers from other boaters. This is especially true in Alaska. Boaters are often a long way from help and must be as self-sufficient as possible. Develop a pre-departure checklist that is specific to the boat and the way it is used.

The following is an example of a pre-departure checklist for a powerboat that incorporates both federal and Alaska requirements and some additional equipment and procedures. Keep in mind that while some of these items might only need to be checked periodically or before each season, others should be checked before each trip. An abbreviated, one-page example of this checklist can be found on page 16. Take a photo of it and keep it with you at all times for your pre-departure preparation. Other pre-departure checklists can be found at www.pledgetolive.org.

GETTING READY:

Prepare your own personal survival kit

- ❑ Communication and signaling devices (see box on Page 30)
- ❑ Shelter aids (such as an emergency blanket or large garbage bag)
- ❑ Personal health needs
- ❑ Fire starter (waterproof matches, lighter, starter material)

Contents will depend on each individual. Items should be multipurpose and regularly inspected.

Personal Flotation Devices (PFDs)

- U.S. Coast Guard-approved wearable life jacket for each person: properly sized, in serviceable condition, and worn and properly fastened when in an open boat or on an open deck.
- U.S. Coast Guard approved Type IV throwable PFD (seat cushion or throw ring): readily accessible, equipped with 1/4” (minimum) diameter floating line, and marked with boat registration number or vessel name.
- Survival (immersion) suits: carefully inspected, zippers waxed, and suits unzipped for putting on quickly.

Signals/Communication

- Sound signals: operational, capable of a four second blast, and audible for a ½ mile. If using a hand-held air horn, bring a spare can of air.
- Visual distress signals easily accessible and clearly marked. Pyrotechnic devices, such as flares, should be current.
- Emergency locator beacon: working, battery charged, and readily accessible (a must-have for off-shore and remote areas).
- VHF marine radio(s): working properly, spare batteries for hand-helds.
- Cellular phone: fully charged and in a waterproof bag or case.



Mirror

Whistle

Pyrotechnic flares

Fire Extinguishers

Make sure all fire extinguishers onboard are:

- Fully charged, with gauge, corrosion free, and clear nozzles.
- Securely mounted in a readily accessible location, but not where fire is likely to occur.
- Updated with current inspection tags (if required).

Fuel and Oil

- Calculate fuel needs based on the boat's fuel consumption and the trip plan. Follow the rule of thirds: 1/3 tank for the trip out, 1/3 for the trip back, and 1/3 to spare.
- Tank valves are in proper position.
- Portable fuel tanks are placed in open, well-ventilated areas.
- Vents are closed for storage and transport, opened for use, and caps are vapor tight and leak proof.
- Fuel lines and all fuel fittings are carefully inspected for leaks, kinks, cracks, or clogs.
- Fuel filters are checked for water/dirt contamination.
- Engine oil is checked and/or proper fuel/oil mixture is checked.
- Tanks larger than seven gallons are properly grounded and vented.

Hull

- Drain plug(s) are installed.
- Hull bottom and drive train are inspected for damage before launch. Ensure the hull bottom is clean.
- Registration numbers/validation decals or documented vessel name/port is properly displayed and legible.
- General inspection/walk around is complete.
- Galley and heating systems are secure, tanks properly installed, fuel lines secure, and connectors secure. No flammable material is stored near stoves and heaters.
- Marine sanitation devices are checked and working properly.
- Generator, stove, and engine exhaust ports are clear and unobstructed.
- Capacity plate and hull identification number (HIN) are visible and legible.
- A small rope ladder, step, or other reboarding device is attached to the boat and deployable in the event of capsizing or a fall overboard.

Bilge/Engine Compartments

- Ventilation ducts are clear and functional. Connections are secure for all closed compartments with potential for explosive vapors and potential ignition sources.
- Bilge area is clean and reasonably dry; this helps reduce the risk of a fire.
- Oil or waste is cleaned up to prevent an illegal discharge. Dispose of waste properly.
- Bilge pumps start, run, and shut off properly.
- “Sniff test” completed around the engine and bilge areas for fuel leaks or vapors before ventilating. If a fuel scent is detected, stop and search for the source.
- Engine compartment is ventilated for four minutes. Before starting engines, do the sniff test again. If an odor is



Wrangell, Alaska

detected after ventilating, stop and search for source before starting engine.

Main and Auxiliary Engines

- Propellers and drive units are inspected.
- Belts, hoses, and fittings are checked.
- Backfire flame arrestor is tight, clean, and in good condition (inboard gas engines).
- Seawater strainers are clean and in good condition.
- All fluid levels are checked.
- Water pump is operational when engine is running and the tell-tale water stream is observed (outboard).
- Engine(s) are secured on transom and clamps and/or bolts are tightened and secure (outboard).
- Exhaust hoses are inspected and each of the metallic exhaust components checked for cracks, leaking, rusting, or other deterioration. Replace if necessary.
- Test run all engines. Monitor gauges, test forward and reverse gears, steering, and emergency cut-off switches. Check fuel and cooling systems for leaks.

Electrical/Electronics

- Spark plugs have a bright and visible spark and show no fouling or corrosion. Wires and plugs are in good condition and firmly seated.
- Battery switches are operational.
- Volt meters are working. Confirm proper charging voltage.
- Batteries are fully charged with proper electrolyte level.
- Battery terminal connections are secure and corrosion free. Batteries encased in plastic boxes with terminals are covered and secured with a strap.
- Jumper cables are in good condition.
- Hand-held electronic devices (cellphone, marine radio, flashlight, emergency locator beacon, etc.) are tested and have spare batteries.
- Installed devices (depth finder, radio, GPS, bilge pump, horn, navigation lights, radar, gauges) are tested.

Ground Tackle and Dock Lines

- Main and lightweight “lunch hook” anchors are present, each with shackles, chain, and line. At least one anchor system is attached to the boat and at the ready.
- Anchors are selected for the size of the boat, bottom type, depth, and weather/water conditions.
- Sea anchor with 200 feet of line is onboard.
- Dock lines and spares are inspected for chafing and wear, stowed, and secured.
- Two or more docking fenders are readily accessible with line attached.

Other Items

- Manual bailing device (even if the boat has an electric bilge pump)
- Knife
- Sunglasses or goggles
- Hearing protection
- Foot pump and fabric repair materials (inflatables)
- First aid kit
- Watch or small clock
- Binoculars
- Means of manual propulsion (oars, paddles)
- Compass with headings list
- Radar reflector
- Depth soundings marked on oar, sounding pole or a line
- Plenty of water and food, tarp or tent, fire-making materials, and spare clothing in a waterproof bag (AKA: abandon boat bag).
- Survival raft, small inflatable, boat or dinghy
- Brimmed hat and sunscreen
- Warm hat and gloves
- Portable AM/FM radio
- Fuel additive for water contamination

- Push pole (river boats)
- Tools—anchor shackle key or rigging knife, fuel cap key, fuel and oil filter wrenches, assorted adjustable wrenches, screw drivers, open-end wrench set, pliers (slip joint, needle nose, locking), wire cutters, spark plug wrench, electrical repair kit, socket set and prop nut wrench.
- Spare parts—right size propeller, prop nut and thrust washer, propeller shear pin and/or cotter pin, spark plugs, various sized hose clamps, starter rope, fuses, fuel filter cartridge, belts, drain plugs, light bulbs, ignition and lock keys, water pump kit, starter solenoid, duct tape, bailing wire, hull repair materials. Consult a marine dealer or mechanic to determine what other spare parts are recommended for your specific boat.

Documents and Placards

- Boat registration/Certificate of Number or current certificate of documentation; proof of title on qualifying vessels
- Federally required certificate of compliance label (boats under 20 feet with inboard engines, manufactured after October 31, 1972) and pollution and garbage placards (boats over 26 feet)
- Other licenses and permits (moorage, fishing licenses, etc.)

Reference Materials

- Navigation Rules
- Owner's manuals
- Charts
- Maps
- Tide book
- Waterway guides
- Vessel log book
- Equipment repair manuals
- Alaska Boater's Handbook or supplement

PREVENTIVE MAINTENANCE

Mechanical breakdown is the most common powerboating problem. Insufficient or contaminated fuel, a poorly maintained electrical/ignition

system, fouled spark plugs, a damaged propeller, or a bad water pump are just a few of the culprits. To help prevent these problems, keep the boat clean, organized, and well maintained. Follow the maintenance recommendations in the owner's manual. Keep the boat, engine, and trailer maintenance records up to date and organized.

Fuel contamination due to condensation is an ever-present problem in Alaska, especially in coastal areas. Installing a water separator/fuel filter between the fuel tank and engine will go a long way in preventing fuel contamination and engine damage.

The leading causes of fires aboard vessels include wiring problems, engine and transmission overheating, and fuel leaks. Consider these potential problem areas when inspecting and maintaining a boat.

WEATHER AND TIDES



Alaska's weather can be harsh and turn an enjoyable boating experience into a life-threatening situation very quickly. Always check the local weather forecast and current weather and water conditions before leaving the house and before getting on the water. NEVER try to outrun a bad weather forecast. It is always better, however inconvenient and disappointing, to wait until conditions improve. Be alert to weather changes, especially the build up of dark, heavy clouds, which indicates wet weather ahead.

For detailed weather information, try the following sources:

- National Weather Service VHF/FM frequencies of 162.400, 162.425, 162.475 and 162.550 MHz in areas where available
- National Weather Service's website: www.arh.noaa.gov
- Alaska Weather Information Hotline
  - In Anchorage, call: 266-5145
  - In Fairbanks, call: 458-3745
  - In Juneau, call: 790-6850
  - Anywhere else in Alaska: 1-800-472-0391
  - Outside of Alaska: 1-907-266-5145

If boating on saltwater, always carry and use a tide book. Tidal currents can be very strong in some areas of Alaska and can cause dangerous rip currents (also known as an undertow) or standing waves, especially when the current is in opposition to the wind. In those areas, it is usually better to wait for the "slack," which occurs when the tide is changing directions. Remember that current and wind can greatly affect fuel consumption.

FUELING

Most boat fires, explosions, and fuel spills happen during or just after fueling. To help prevent this:

- Fuel before dark.
- Secure and cover batteries to prevent terminals from shorting and sparking fuel vapors.
- Do not smoke or strike matches.
- Shut off motors.
- Turn off all battery switches and electrical equipment.
- Close all cabin windows and doors.
- Make sure all tank vents are unobstructed.
- Ensure the boat's stability. Ask passengers to step on shore when fueling.
- Take portable tanks out of the boat to fill them.
- Know how much the fuel tanks can hold and don't overfill them. Avoid "topping off" tanks.



- Keep the fuel nozzle in contact with the tank while filling, to prevent static discharge.
- Fuel slowly.
- Don't rely on automatic nozzle shutoffs.
- Catch drips and wipe up any spilled gasoline with

oil absorbent pads. Discard on shore in a safe and environmentally responsible manner.

- Before starting the engine, ventilate engine compartment for at least four minutes, and sniff around to make sure there is no odor of gasoline anywhere in the boat.
- Keep bilges clean to avoid the risk of a fire.

FLOAT PLAN

Like the flight plans filed by pilots, boaters use float plans to provide critical information to those who will try to assist them in case of trouble. A sample plan is provided on the facing page. Some factors to consider when filing a plan:

1. **Assess the risk BEFORE you go.** Consider the condition of the boat and equipment and gather information about local boating hazards and the weather. Consult charts, local boaters, and tide tables and check both the weather forecast and existing conditions one last time. The operator's skill and ability should always be considered in relation to the prevailing conditions.
2. **Based on your risk assessment, make a GO/NO GO decision.** It is always better to be on shore wishing you were on the water than to be on the water wishing you were on shore. Consider the passengers' comfort levels as well as your own.
3. **Prepare the float plan.** If it's a "go," provide trip information to someone who can be relied upon. The plan should include a description of the boat and equipment, boat registration, the names of everyone on the boat, the planned destination and route, expected return time, and when and who to call for help. If the float plan can't be left with someone, place it in a window of your vehicle so others can read it. Notify the same person(s) if plans change and immediately upon return.

BOAT CAPACITY, LOADING AND STABILITY

Attention to capacity and proper loading is critical to safe boat operation. Overloading or imbalanced and shifting loads can seriously affect boat stability, which is dangerous even on calm water.

To help prevent overloading, a U.S. Coast Guard boat capacity plate is required to be installed by the manufacturer. The plate lists the maximum number of persons, total weight of passengers, and the maximum total weight of the passengers, gear, and motor. If the boat is designed to

ALASKA FLOAT PLAN

I. If Overdue, Contact: _____

Phone: _____

On (date): _____

II. Vessel Information: **Vessel Name:** _____

Boat Registration (or USCG documentation) Number: _____

Vessel type:	**Hull type:**	**Communication/Signals:**	**Survival Equipment:**
☐ Kayak	☐ Canvas / skin	☐ Installed Marine VHF	☐ Personal survival kits
☐ Canoe	☐ Plastic	☐ Handheld Marine VHF	☐ Tender/Raft/Dinghy
☐ River raft	☐ Fiberglass	☐ Single Side Band	☐ Water
☐ Row boat	☐ Wood	☐ EPIRB	☐ Spare Food
☐ Personal Water Craft	☐ Aluminum	☐ Flares	☐ Spare clothing
☐ Center console / skiff	☐ Inflatable	☐ Mirror	☐ Shelter (tent, tarp)
☐ Runabout / bow rider	☐ Rigid hull inflatable	☐ Cell # _____	☐ Matches/Lighter
☐ Cabin Cruiser / overnighter	☐ Other_____	☐ Other Signals _____	☐ Other_____
☐ Sailboat			

Length:_____ Engine(s) make _____ hp _____ Hull color: _____ Cabin/top color: _____

III. Vehicle Information:

License #: _____Make: _____Model: _____Year: _____Color: _____

Location vehicle is parked: _____

IV. Boat Trailer Information:

License #: _____Make: _____Model: _____Year: _____Color: _____

Location trailer is parked: _____

V. All Persons Onboard (POB):

Names / ages:	Phone:	Can Operate Boat? (Y/N)
- Skipper		yes

VI. Trip Plan:

Depart From:	Departure Date/Time:	To:	Arrive Date/Time:

Revised 01/2010

be equipped with an outboard engine, the plate will also display the maximum horsepower. Never exceed a boat's recommended capacity. If a capacity plate is not installed, use the formula below to estimate the number of persons the boat will safely carry in calm conditions. This formula only applies to powerboats less than 20 feet. The result gives the number of persons (150 lb/person average) that can be put aboard in calm weather conditions.

$$\frac{\text{Boat Length (ft) x Boat Width (ft)}}{15} = \text{Number of People}$$

Also consider the following:

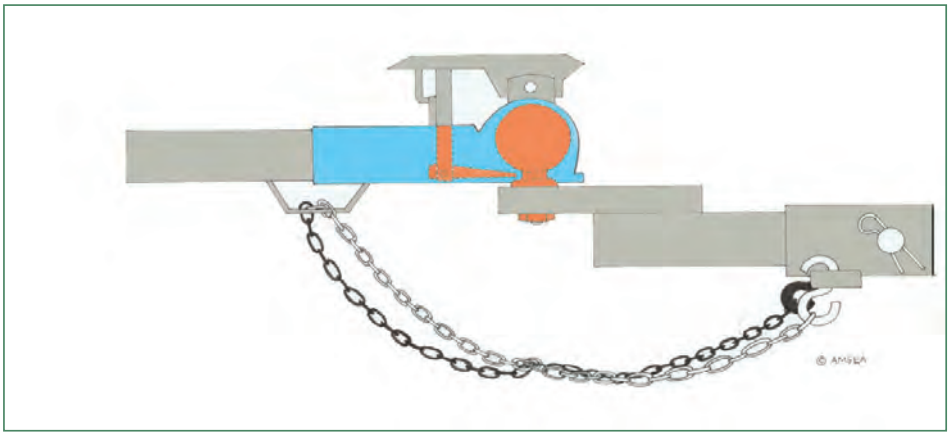
- Always use great care when loading and handing gear to a person already in the boat.
- Carefully secure heavy items from shifting.
- Properly position items and passengers evenly, and then adjust as necessary for safety and optimal boat performance.
- Proper trim (lateral, fore and aft) aids in boat handling, especially in smaller boats or when approaching the capacity limits.
- Instruct passengers in small boats to remain seated unless otherwise instructed.
- Don't stand while operating unless the boat is rigged for it and equipped with an emergency cut off cable.
- Keep shoulders inside gunwales.
- When retrieving an object outside the boat, either pull it toward the boat with a paddle or maneuver the boat alongside the object, then reach straight down for it without shifting weight or leaning over the side.

BOAT TRAILERING

Trailers are not often on the minds of boaters when preparing for a trip, except when something goes wrong. With a little planning and attention, trailer problems can be prevented. According to BoatUS, the top five reasons for trailer breakdowns are flat tires, bearing problems, axle problems, suspension problems, and tongue problems.

- Alaska law requires boat trailers to be registered.

- Boat trailers are subject to the lighting requirements of Title 13 of the Alaska Administrative Code.
- The driver of the towing vehicle must be able to safely stop in a reasonable distance. Check the function of the brakes on flat ground. Allow more time and distance for braking while towing. Booster brakes are best with heavy boats.
- Carefully follow the trailer manufacturer's recommendations for maintenance. Inspect and lubricate all moving parts frequently, especially wheel bearings.
- Does the tow vehicle have adequate power? Is the transmission capable of towing? Are adequate cooling systems installed?



Ball and coupler proper fit, chains crossed in X pattern

- Make sure the trailer isn't overloaded. Check these capacities before hauling:
  - Gross vehicle weight rating
  - Gross vehicle axle weight rating
  - Trailer tongue weight
  - Trailer capacity
- Adequate tie-downs are necessary at both bow and stern. The bow should be secured with the winch cable, winch post safety chain, and the boat's bow line. The stern should be secured with transom tie-downs.
- Hitches should be welded or bolted to the frame of the towing vehicle. Bumper hitches are not recommended.
- The tow ball and ball coupler must be the same size. Secure the ball coupler with a pin or lock after it has been placed onto the ball and closed.



- Two safety chains, crossed under the coupler, help prevent the trailer tongue from dropping to the ground in the event the coupling device fails. The chains must have a tensile strength at least equal to the weight of the trailer and be long enough to permit the turning of the vehicle. To prevent the chain hooks from bouncing out, it's usually best to face the open end of the hooks toward the boat, rather than toward the vehicle.
- Before departure, check overhead, side and engine drive unit clearances.
- Place all overhead antennas in the down position.
- Check and tighten all adjustable trailer components and bolt-on parts.
- Secure all loose items in the boat and tie boat covers down securely.
- Check wheel bolts for proper torque, test brakes, tighten winch cable and transom straps, check that ball and hitch are tight and locked, test lights, and check electrical connections.

Tire failures top the list of boat trailer breakdowns.

- Check all tires and spares (trailer and tow vehicle) for wear and proper inflation while cold.
- Carry a wheel jack, some flares and reflectors, a spare tire and wheel (with proper inflation), proper size jack and lug nut wrench, a set of wheel bearings, a seal and cup set, and some wheel bearing grease when on the road.
- Stop periodically during each trip to check wheel hubs/ bearings for overheating.

Launching

Be courteous. Avoid blocking ramps and docks when others are waiting to use the facility. Practice backing a trailer until proficient - the less time spent on the ramp, the better.

At ramp staging area:

1) Check for any engine or hull damage sustained during the drive.
2) Remove any covers, raise antennas.
3) Load and secure any gear going into the boat.
4) Check that drain plug(s) are in place and secure.
5) Check blower, lights, bilge pump, and electronics.
6) Remove any transom and side tie-down straps that are securing



the boat to the trailer.

7) Tilt engines/outdrives up, disengage travel bracket or transom saver(s).
8) Check that the ball hitch and safety chains are secure.
9) Unplug trailer lights.
10) Check that winch line and bow safety chain are secure and the winch ratchet stop engaged.
11) Keep wheel chocks easily accessible.

At the ramp:

1) All passengers should exit the vehicle.
2) Unlock vehicle doors and roll down driver's window.
3) Unfasten seat belt.
4) Scan the ramp for hazards or obstructions before backing.
5) While backing down the ramp, one person acts as lookout and is ready with wheel chocks.
6) Back down ramp until the boat floats or can be pushed off trailer. Don't immerse rear wheels of vehicle unless absolutely necessary.
7) Put vehicle in first gear (or park), shut off vehicle, put on parking brake and place chocks behind tires.
8) Hand the bow line to an assistant, and remove the bow safety chain and winch line hook.
9) Use the bow line to guide boat off trailer and secure it to the dock or shore, away from the launch area.
10) Promptly move vehicle and trailer away from the ramp area.

Retrieving

1) Raise outdrive/outboard motor.
2) Be cautious while winching the boat onto the trailer. Make sure the winch ratchet click-stop is properly engaged to prevent the handle from spinning in reverse. Watch for signs of a worn or damaged winch cable.
3) Once the boat is on the trailer, move the boat and trailer well away from the launch ramp.
4) Rinse trailer with fresh water following saltwater immersion.
5) Remove drain plugs and make sure the boat is de-watered before getting on the road.
6) Secure all tie-downs and straps.

Passenger Briefing

All passengers should know the rules while onboard and the basic functions of the boat in case something were to happen to the operator. Passengers should be aware of:



- The float plan and the alternate plan in case of problems or delays.
- How to start, shift gears, steer, and stop the boat.
- Stability rules - remain seated and refrain from sudden movement or reaching overboard for objects.
- The location of life jackets, rescue communication and signaling devices, survival kits, first aid kits, survival suits, and life rafts.
- How to use distress signals,such as waving arms, using whistles, mirrors, flares and white lights, and what each signal is for.
- How to use radios, battery switches, fuel valves, fire extinguishers, and emergency locator beacon(s).

THEFT PREVENTION

Nationwide, boat theft has become big business. To help prevent theft, consider the following:

- Take keys and valuables out and lock the boat and all hatches and storage compartments.
- Lock portable outboard motors to the boat.
- Engrave or permanently mark property with a driver's license number (include "AK" before the number and "DL" after the number) or boat registration number.
- Record property on an inventory list (include brand names and model numbers) and store in a safe place.
- Photograph or videotape the boat's exterior, interior, and property. Prepare notes to accompany photos.
- Install an audible alarm.
- Make sure the registration certificate and title is current and on the boat and keep a copy in a safe place at home.
- Secure small boats by chaining and locking them to a secure object or storing them in a locked garage, shed, or a location where others cannot easily see them. Make sure powerboat engines are disabled.
- Secure trailers by using a hitch lock (even when on the tow vehicle), immobilizing the trailer with a wheel lock, removing a trailer wheel and/or blocking up the frame, or placing a vehicle or other large object in front of it.



UNDERWAY

ENVIRONMENTAL ETHICS



- Federal law prohibits the discharge of plastic trash into U.S. navigable waters. Polystyrene cups, plastic bags, bait packages and monofilament line can kill or injure birds, fish and marine mammals. Reduce the amount of packaging and plastic taken aboard. Keep a sturdy garbage container on board and use it. Retrieve any trash that falls overboard.
- No human-generated waste, no matter how small, should be thrown overboard. Use restrooms on shore before departure and carry a portable toilet. Federal law requires that all boats with installed toilets also have a U.S. Coast Guard-approved Marine Sanitation Device (MSD).
- The Federal Water Pollution Act prohibits the discharge of oil or oily waste into U.S. waters. Never discharge fuel, oil, chemicals or contaminated bilge water into the water. Don't use soap or detergent to get rid of spilled oil. This practice doesn't dissolve the oil; it just breaks it down into smaller particles and forces it deeper into the water column where it can kill zooplankton and larval forms of fish, crab and shellfish.
- Encounters with marine mammals are always an exciting experience. However, federal law protects many marine mammal species. Boaters should stay at least 300 feet away from marine mammals, or more if animals appear to change their behavior. Time spent viewing particular animals should be kept to less than 30 minutes. Never try to pursue animals, restrict their path, or encircle them. Always leave them a clear escape route. If a marine mammal approaches, put the engine in neutral and let the animal pass. If an animal displays erratic behavior or appears disturbed, cautiously leave the area. Never handle young animals or feed animals.
- Many of our shoreline areas are very sensitive habitats. Please practice "leave no trace" techniques when on land.
- Avoid getting too close to bird rookeries. If you are too close, birds' behavior will be disrupted, causing unnecessary stress.

- Alaska has many special protected areas. Whenever boating in a new area, first contact local resource management agencies or landowners to obtain guidelines.
- Keep your boat bottom clean and the engine tuned for optimal performance and reduced emissions.
- Do heavy boat cleaning and maintenance away from the water. Routinely scrub decks with fresh water and a brush to reduce the need for heavy cleaners.
- Recycle used zincs.
- Don't idle engine(s) unnecessarily.

Aquatic Invasive Species

To report an invasive species, please call 1-877-INVASIV.

Aquatic invasive species (AIS) are nonindigenous species that invade local water bodies and can threaten native species, ecological stability, traditional human activities, our economy, and even human health. According to the Alaska Department of Fish and Game, Alaska is vulnerable to invasive species introduction through many pathways, including contaminated boats and fishing gear brought to our waterways. We can help prevent the spread of AIS by following these simple steps:

- Thoroughly clean and dry boats and equipment before transporting to other water bodies. Remove any visible mud, plants, fish or animals from the hull, trailer or other parts of your gear.
- Completely de-water boats and equipment, including any areas where water can be held, before transporting. Dump bait buckets, coolers, etc. on land.
- State regulations prohibit releasing plants, fish, or animals into a body of water unless they came out of that body of water.



Didemnum Vexillum is a saltwater sea squirt that can destroy native vegetation and even shellfish populations.



Elodea is the first invasive aquatic plant known in Alaska. It can impact freshwater resources and fish habitat.

U.S. AIDS TO NAVIGATION SYSTEM

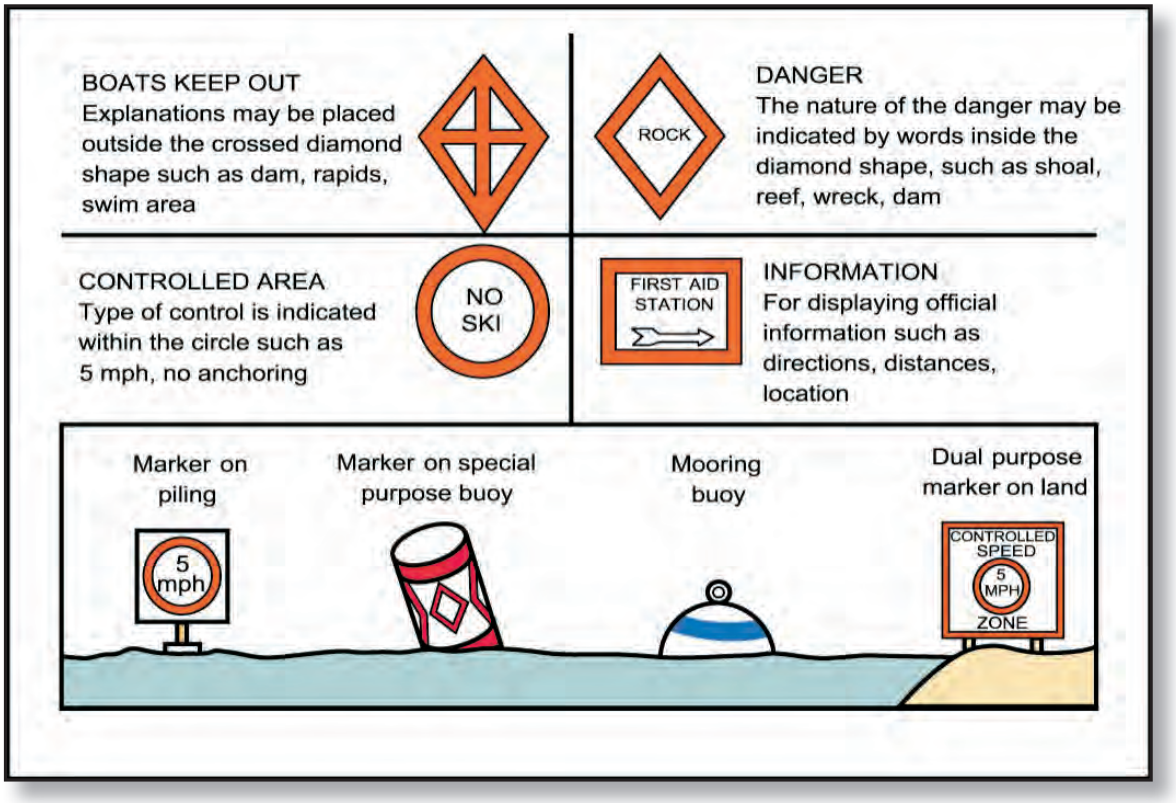
The U.S. Aids to Navigation System (ATONS) is a system of signs, buoys, day beacons, and other structures that incorporate specific shapes, colors, numbers, and lights to assist mariners with safe navigation.

Some types mark areas with restrictions, such as speed limits or no-wake zones; waters closed to boats, such as swim beaches; or waters with obstructions or other dangers. Others are placed to help boaters locate their position or safely navigate channels.

Although technically not an aid to navigation, mooring buoys are assigned a distinctive marking scheme under the aids to navigation system in order to promote easy identification and to avoid confusing them with other aids to navigation.

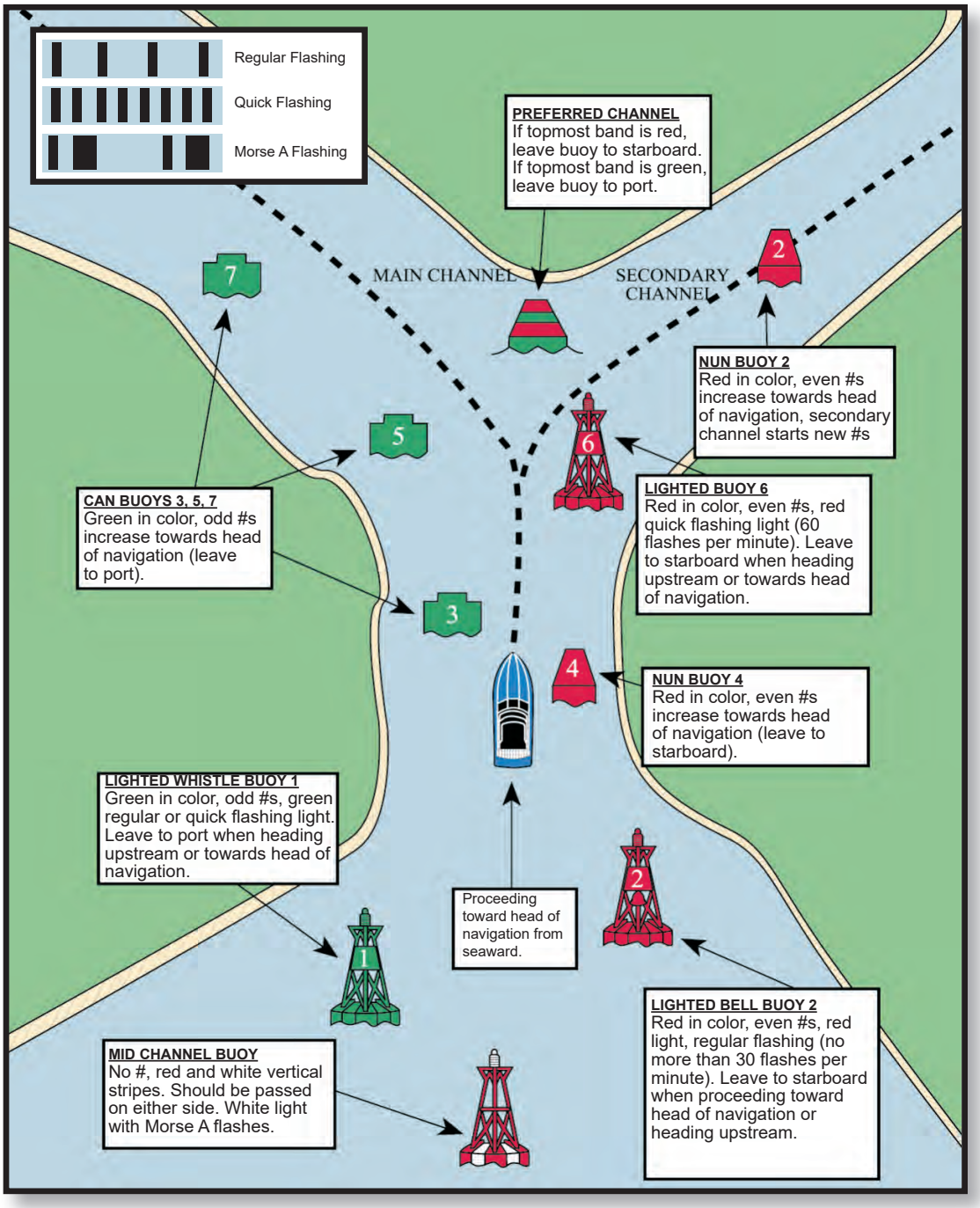
Other than a mooring buoy, it is a criminal offense to moor to, damage or interfere with aids to navigation. If you collide with or damage an aid to navigation, report it immediately to the U.S. Coast Guard or a local law enforcement officer.

Information and Regulatory Markers and Mooring Buoys



Lateral Aids (Channel Markers)

Channel markers assist vessels in navigating safe courses. Because they are numbered and depicted on nautical charts, they can also help boaters determine position. An easy way to remember how to steer the proper course, relative to channel markers, is the phrase “red, right returning.” Red channel markers should be on the boat’s right (starboard) side and green markers on the left (port) when proceeding north, upstream, or returning from open water to a harbor.

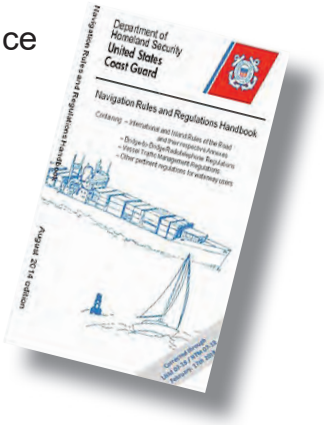


NAVIGATION RULES—STEERING AND SAILING

The International Regulations for Avoiding Collisions at Sea 1972 (72 COLREGS) are also known as the International Navigation Rules or simply "the Rules." Adopted under federal law, the Rules address navigation light requirements, sound signals, day shapes and emergency signals and contain the International Navigation Rules on Steering and Sailing (Rules 1-19, Part A) to help vessels stay clear of each other. In Alaska, the International Rules apply to all boats on all U.S. navigable waters where the U.S. Coast Guard has jurisdiction.

Please keep in mind that the Rules assign tasks but never confer entitlements. For example, although vessels in certain situations should "keep out of the way" of other vessels, the Rules never grant any vessel the "right of way." Also keep in mind that the ordinary practice of seamanship requires precaution and prudent action by all boaters, at all times, under all circumstances. Knowing the Rules is important, but boaters must also be constantly vigilant of the circumstances and be prepared to depart from the Rules, if necessary, to avoid a collision.

Boaters should obtain and become familiar with the complete Rules, available from a link on the Alaska Office of Boating Safety website www.alaskaboatingsafety.org or downloadable from the U.S. Coast Guard's site: www.navcen.uscg.gov/?pageName=navRuleChanges.



Following is a summary of some of the International Navigation Rules:

Responsibility (Rule 2)

- None of the Rules shall excuse anyone from the consequences of any neglect to comply with these Rules or of the neglect of any precaution required by the ordinary practice of seamen or by the special circumstances of the case.
- In using these Rules, be aware of all dangers of navigation and collision and any special circumstances, including the limits of the boats involved, which may require a departure from these Rules necessary to avoid immediate danger.

General Definitions [Selected] (Rule 3)

- **Vessel** — every description of watercraft, including non-displacement craft and seaplanes, used or capable of being used as a means of transportation on the water.

- **Power-driven vessel** — any vessel propelled by machinery.
- **Sailing vessel** — any vessel under sail except if under mechanical power.
- **Vessel engaged in fishing** — any vessel fishing with nets, lines, trawls or other fishing apparatus which restricts maneuverability, but does NOT include a vessel fishing with trolling lines or other fishing apparatus that does not restrict maneuverability.
- **Vessel not under command**—a vessel, which through some exceptional circumstance, is unable to maneuver as required by the Rules and is therefore unable to keep out of the way of another vessel.
- **Vessel restricted in ability to maneuver** — a vessel, which from the nature of its work is restricted in the ability to maneuver as required by the Rules and is therefore unable to keep out of the way of another vessel.
- **Vessel constrained by draft** — means a power-driven vessel that, because of its draft in relation to the available depth of the water, is severely restricted in the ability to deviate from its course.
- **Underway** — means a vessel is not at anchor, made fast to the shore or aground.
- **Length and breadth** — means a vessel's length overall and her greatest breadth (width).
- **Restricted visibility** — means any condition in which visibility is restricted by fog, mist, falling snow, heavy rain, sand or other similar causes.

Look-out (Rule 5)

Every vessel shall at all times maintain a proper look-out by sight and hearing as well as by all available means appropriate in the prevailing circumstances and conditions so as to make a full appraisal of the situation and the risk of collision.

Safe Speed (Rule 6)

Every vessel shall at all times proceed at a safe speed so that she can take proper and effective action to avoid collision and be stopped within a distance appropriate to the prevailing circumstances and conditions. In determining a safe speed the following factors shall be among those taken into account:

— The state of visibility.
— The traffic density, including concentrations of other vessels.
— The manageability of the vessel with special reference to stopping distance and turning ability in the prevailing conditions.
— At night, the presence of background light such as from shore lights or from back scatter from her own lights.
— The state of wind, sea and current, and the proximity of navigational hazards.
— The draft in relation to the available depth of water.

Risk of Collision (Rule 7)

Every vessel shall use all available means appropriate to the prevailing circumstances and conditions to determine if risk of collision exists. If there is any doubt such risk shall be deemed to exist.

Action to Avoid Collision (Rule 8)

(a) Any action shall be taken in accordance with the Rules of this Part and, if the circumstances of the case admit, be positive, made in ample time and with due regard to the observance of good seamanship.

(b) Any alteration of course and/or speed to avoid collision shall, if the circumstances of the case admit, be large enough to be readily apparent to another vessel observing visually or by radar; a succession of small alterations of course and/or speed should be avoided.

(c) If there is sufficient sea room, alteration of course alone may be the most effective action to avoid a close-quarters situation provided that it is made in good time, is substantial and does not result in another close-quarters situation.

(d) Action taken to avoid collision with another vessel shall be such as to result in passing at a safe distance. The effectiveness of the action shall be carefully checked until the other vessel is finally past and clear.

(e) If necessary to avoid collision or allow more time to assess the situation, a vessel may slacken her speed or take all way off by stopping or reversing her means of propulsion.

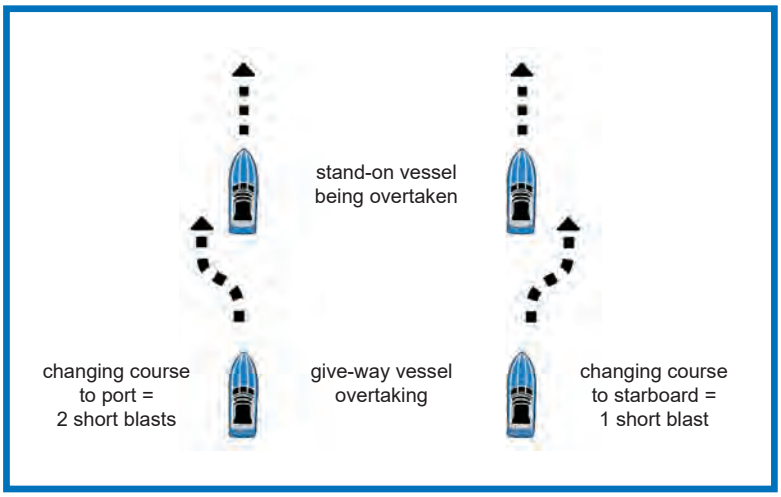
Narrow Channels (Rule 9)

When traveling along a narrow channel, keep as near to the outer limit of the channel or fairway, which lies to the boat's starboard side, as is safe and practical.

Overtaking (Rule 13)

The vessel overtaking any other shall keep out of the way of the vessel being overtaken. Be prepared to use a sound signal to indicate intentions.

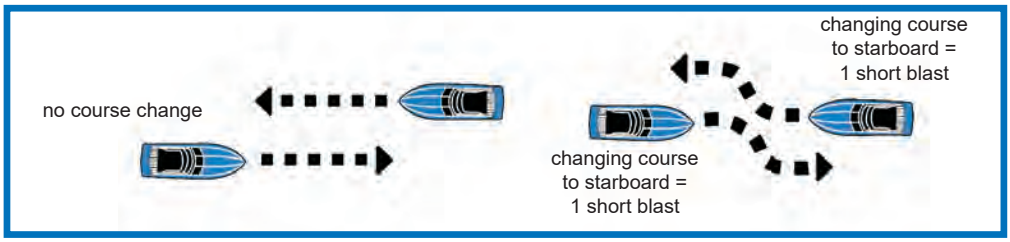
The following illustrates the proper maneuver and includes the appropriate (Rule 34) sound signals.



Head-On Situation (Rule 14)

Unless otherwise agreed, when two power-driven vessels are meeting on reciprocal or nearly reciprocal courses so as to involve risk of collision, each shall alter her course to starboard so that each shall pass on the port side of the other.

The following illustrates the proper maneuver and includes the appropriate (Rule 34) sound signal.

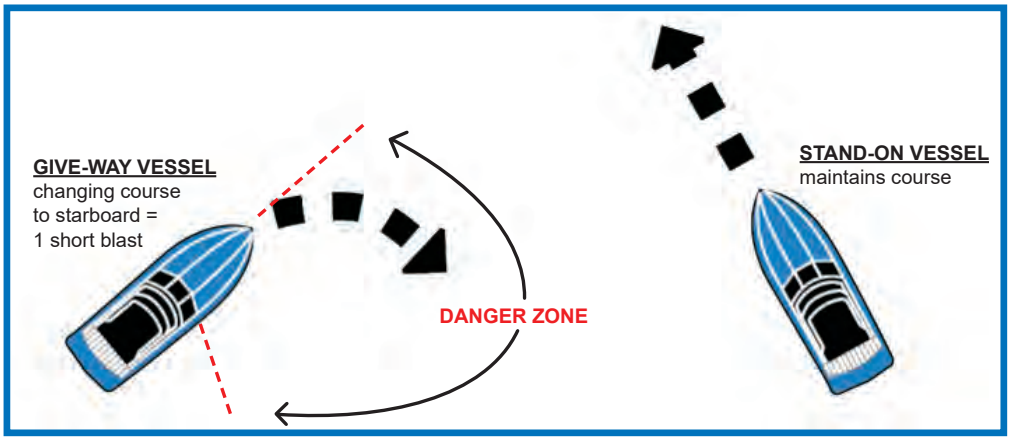


Crossing Situation (Rule 15)

When two power-driven vessels are crossing so as to involve risk of collision, the vessel which has the other on her own starboard side shall keep out of the way and shall, if the circumstances of the case admit, avoid crossing ahead of the other vessel.

A power-driven vessel crossing a river shall keep out of the way of a power-driven vessel ascending or descending the river.

The following illustrates the proper maneuver and includes the appropriate (Rule 34) sound signal.



Action by Give-Way Vessel (Rule 16)

Every vessel which is directed to keep out of the way of another vessel shall, so far as possible, take early and substantial action to keep well clear.

Action by Stand-On Vessel (Rule 17)

Where one of two vessels is to keep out of the way, the other shall keep her course and speed.

The latter vessel may, however, take action to avoid collision by her maneuver alone, as soon as it becomes apparent to her that the vessel required to keep out of the way is not taking appropriate action in compliance with these Rules.

When, from any cause, the vessel required to keep her course and speed finds herself so close that collision cannot be avoided by the action of the give-way vessel alone, she shall take such action as will best aid to avoid collision.

Responsibilities Between Vessels (Rule 18)

Except where Rules 9, 10 (compliance with official traffic separation schemes) and 13 otherwise require, the higher-listed vessels should give way to the lower-listed vessels:

(a) Power-driven vessel

(b) Sailing vessel

(c) Vessel engaged in fishing

(d) Vessel restricted in ability to maneuver

(e) Vessel not under command

Note: The determination that a vessel is “restricted in its ability to maneuver” is made by the vessel’s master. If that determination is made, the vessel shall also display the lights and shapes prescribed in Rule 27 accordingly.

Conduct of Vessels in Restricted Visibility (Rule 19)

When vessels are not in sight of each other when operating in or near an area with restricted visibility, every vessel shall proceed at a safe speed adapted to the prevailing circumstances and conditions of restricted visibility. A power-driven vessel must have its engines ready for immediate maneuver.

Every vessel shall have due regard to the prevailing circumstances and conditions of restricted visibility when complying with Rules 4 through 10.

Except where it has been determined that a risk of collision does not exist, every vessel that hears, apparently forward of her beam, the fog signal of another vessel, shall reduce speed to the minimum at which course can still be kept. The vessel shall, if necessary, take all way off and, in any event navigate with extreme caution until danger of collision is over.

Rendering Assistance

Under federal law, the master or person in charge of a vessel is obligated to provide assistance that can be safely provided to any individual in danger at sea. The master or person in charge is subject to a fine and/or imprisonment for failure to do so.

HOMELAND SECURITY

Since the events of September 11, 2001, boaters have an important role in helping to keep our nation’s waterways safe and secure.

Please follow these guidelines:

- Keep well clear of all military vessels, cruise-liners, tankers and other commercial ships.



- Slow to minimum speed when within 500 yards of any U.S. naval vessel and proceed as directed by the Commanding Officer of the naval or escort vessel.
- Do not approach within 100 yards of naval vessels. If you must enter this zone in order to ensure safe passage in accordance with the navigation rules, you MUST first contact the naval vessel or its escort on marine VHF channel 16 to seek direction.
- Violators of a Naval Vessel Protection Zone can face up to six years in prison and a $250,000 fine, not to mention a quick and severe response.
- Approaching certain other commercial vessels may also result in an immediate boarding.
- Observe and avoid all marked or designated security zones and other restricted areas.
- Avoid commercial port operation areas, especially those that involve military, cruise-line, or petroleum facilities.
- Do not stop or anchor beneath bridges.

Keep a look out for anything that appears to be out of the ordinary. Depending on the circumstances, suspicious activity may include:

- Persons renting or attempting to procure or borrow watercraft or offering cash on the spot for a vessel.
- Persons asking suspicious questions concerning the boat, such as how to start the engines or how much weight the boat can carry.
- Persons loitering around or photographing or creating diagrams of such things as the underside of bridges, established security zones, oil refineries or transfer facilities, military bases, military or government vessels, and the waterfront areas near those facilities or vessels.
- Vessels attempting to sell/deliver merchandise or drop off packages in waterfront areas.
- Persons who are throwing or retrieving unusual objects in or out of the water.

If encountering a situation that feels suspicious, report it immediately to local law enforcement, the U.S. Coast Guard, port security, or the National Response Center at 877-24 WATCH.



Do not approach or challenge suspects. Make some notes on the person's appearance, clothing, vehicle license plate, and type of boat.

By actively demonstrating a commitment to boating safety, we can help reduce the demand on limited law enforcement and rescue resources and show support for homeland security efforts.

For more information, visit America's Waterway Watch at http://americaswaterwaywatch.uscg.mil.

POWERBOATING

Any boat that is powered by a motor is considered a powerboat. Generally, a powerboat has a high power-to-weight ratio and a hull design that allows for easy planing, which allows for higher speed and improved handling. In Alaska, three out of four boating fatalities happens in a powerboat, and most of them occur in recreational boats, not commercial vessels. It is vitally important for powerboaters to educate themselves on safe operation and planning to avoid problems while out on the water. Here are some tips:

General

- When underway and operating a vessel, keep the engine cut-off device attached to you. This is especially important for solo operators. Wireless cut-off devices are now an option. If you somehow get tossed into the water, the boat will stop.
- Don't run at full throttle, but maintain enough speed to keep the hull "on step." This is called planing: It is easier on the engine, greatly improves fuel economy, and increases reaction time.
- Use a "Boater's Eye": Maintain a clear, unobstructed forward view at all times. Constantly scan the water back and forth for hazards. Avoid tunnel vision. Visually recognize and continually assess boat motion (momentum) or lack of motion.

The boat operator must be aware of boat speed, rate of turning, and progress toward or away from the objects nearby that are restricting operating room.

- When operating in an area where there are divers, be on the lookout for diving flags displayed on the boats. Boaters must stay at least 100 feet away from the flag unless they are operating in a no-wake zone. (See more on diving on Page 85)
- For waterskiing, boat operators should keep a minimum of a 200-foot wide “ski corridor” (100 feet on either side) to protect the skier from other boats and/or obstacles. A designated lookout or rear view mirror should also be used.
- Operate well within the limits of your skill and respect the capabilities of the boat.
- Develop proficiency with basic boater’s knots (bowline, figure eight, cleat hitch, anchor bend).
- Exercise caution when around commercial traffic. Give these vessels a wide berth. Don’t get caught between a tow boat and a barge. Slow down and keep a sharp eye for hazards in the water, because tow lines and fishing gear are not always clearly visible.
- Control boat wake when operating near moored boats or structures (docks, floating homes, and launch ramps).
- Be considerate around small or slow moving boats, swimmers, and water skiers. Maintain a distance of at least 100 feet from a boat towing a water skier.



Control boat wake when operating near moored boats or structures such as docks, floating homes and launch ramps.

Handling Rough Open Water



If rough weather is coming and can't be avoided, there are a number of things that can be done to prepare, including:

- Put on a life jacket if not already on.
- Place passengers and loads low and along the centerline. Secure all items to prevent shifting, and make sure passengers maintain three points of contact
- Consider pulling drain plugs to promote self-bailing. Prepare bailing devices.
- Consider donning immersion suits, at least to the waist.
- Establish radio contact with nearby boaters.
- Have a spare fuel filter and wrench handy, because rough conditions can stir up tank sediment.
- Brief passengers and assign tasks as necessary. Proceed to the nearest protected area.
- Avoid the middle of inlets, rounding a point of land, and the mouth of bays where wind, current, and seas collide.

When running into the waves:

- "Tack" back and forth at a 45-degree angle to the waves.
- Slow down to allow the bow to lift with oncoming waves instead of digging in.

When running in the same direction as the waves:

- Throttle and steering adjustments must be made constantly to avoid a "pitch pole" (stern over bow) down the wave face, a broach sideways, or taking a breaking wave over the stern.
- Avoid sudden stops or backing down into following seas.

In the event of an engine failure, use oars or a sea anchor (a plastic bucket with a hole in the bottom attached to the bow) to keep the bow into the waves.

Anchoring

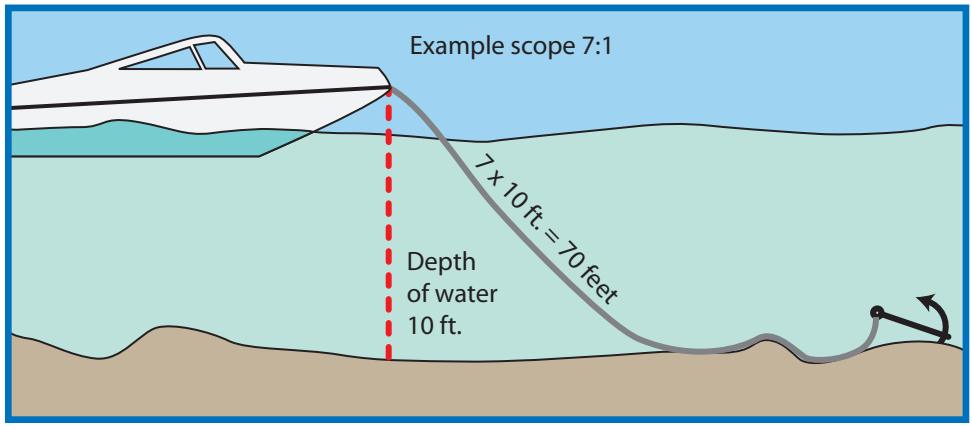
To anchor a boat, first select the appropriate type and size of anchor and the appropriate diameter and length of rode (anchor line and chain). Consider the size of the boat, the bottom type, the water conditions and the depth of the water (**measured from the bow to the bottom**). The length of the rode should be five to ten times longer than the depth of the water, depending on the weather conditions, the current, and the size of the boat. Don't forget to account for tidal fluctuation! See "Recommended Equipment" for information on anchor selection.

Prepare the anchor and rode in advance and firmly attach the anchor line to a secure point at the bow. Secure anchor and rode while underway to avoid accidental deployment.

- Bring the bow into the wind or current. When in areas with no current, put the engine in neutral and wait for the boat to stop moving forward.

RODE: line and chain attached to anchor

SCOPE: ratio of rode length to depth of the water



- Lower (do not throw) the anchor over the bow slowly.
- Back up slowly to straighten the anchor line and "set" the anchor.
- If an outboard or inboard with outdrive, raise the drive unit out of the water to prevent fouling the anchor line.
- Avoid anchoring from the stern. This squares the boat's flat transom directly into the wind, waves or current and can cause the boat to swamp, capsize or sink.
- Never leave an anchored boat unattended. Tides, current,

wind and wave conditions may change and can cause an anchor to foul or drag. Maintain an anchor watch.

- If the boat is small, consider taking it up onto shore (beyond the high water line) and securing it. Other options include using designated mooring buoys or setting up a “running line” (with a safety line) from the boat to the shore.
- Take communications and survival gear ashore in case you get separated from the boat.

River Boating

Whether by jetboat, airboat, inboard or outboard, powerboating on Alaska’s interior rivers is both an exhilarating recreational activity and an important means of access. River boating puts us in places that might otherwise be out of reach. However, the power of moving water is relentless and should never be underestimated.

Exercising good judgment and applying the right mix of skill, ability, and caution are never more important than when boating on rivers. Here are some important points to consider:

- Always wear a life jacket. Rivers contain many hazards and fast water — emergencies can develop quickly. River boats tend to be small and fast, capable of throwing passengers overboard without much warning. Currents and eddies can make self-rescue very difficult.



- Carry communication devices that are suitable for the area on your person. For example, cellphones are appropriate in some areas, but in remote areas, a VHF radio for contacting other boats may be a better choice.
- Reading the water is a much-needed skill while boating on rivers. This takes time and practice to develop.
- Match the boat design to the intended use. There are a lot of options out there—do your research, work with the boat dealer, and, if possible, test drive boats under similar conditions before purchase.
- Knowledge of the river is key. Always research and scout out new areas. Learn from the locals.
- Be aware of such river hazards as sweepers (overhanging trees), log jams, gravel bars, submerged objects, animals, wind, sun and other restricted visibility problems, and, of course, other boaters.
- If new to river boating, practice skills in safe areas first. River boaters should be skilled in turning with and against current, launching, landing and beaching, anchoring, and basic troubleshooting and repairs.
- It is best to stay in the deeper water found closer to the outside bank, while still keeping as far to the right as possible, allowing room for a boat coming from the other direction.
- Be particularly vigilant in narrow channels. Slow to the minimum speed needed when rounding tight river bends and blind corners. Consider using your sound-producing device to signal your presence.
- Learn the locations of popular bank fishing spots and be considerate of bank anglers in the water.
- Before launching, make sure to have an alternate propulsion source (oars, paddle, another engine) and anchor at the ready for immediate use. It is a good idea to warm up your engine before pushing away from the bank.
- When beaching, try to find places where the boat can be placed facing into the current. Otherwise, look for a slow channel or calm backwater pool. ALWAYS secure the boat to the shore.
- Follow the Navigation Rules and slow down when passing other boats on the river. When passing, make sure other boat operators see you and understand your intentions.

Personal Water Craft (PWC)



If new to operating a Personal Water Craft (PWC), take basic boating safety and PWC-specific courses and develop skills under the instruction of an experienced operator. Read the owner's manual carefully. It provides important information specific to the model, such as safety warnings and recommendations, load capacity and maintenance schedule.

PWCs are boats, and operators have the same responsibilities as other boaters. However, there are some important differences:

- PWCs handle differently than other boats. The water jet drive and shorter overall length make the PWC extremely responsive to even a small movement of the handlebars.
- PWCs are steered by directing the water jet steering nozzle while powering forward. Throttle must be applied for forward movement. When the operator releases the throttle, the ability to steer is eliminated, and the vessel will coast to a stop. However, on newer models, various off-throttle steerage features may exist. Please refer to your specific craft to know what your craft operational needs are.
- Start, ride and stop the water craft using the manufacturer's recommended water depth, and keep away from any underwater hazards or obstructions.
- Know your water craft minimum stopping distances, which may vary depending on the type of PWC and vehicle load and water conditions.
- There are both older, two-stroke and modern, four-stroke engine types, which require different maintenance and operational considerations, as well as hull types:
    1. Stand Up (1 person on board)
    2. Sport (1-2 person/s on board)
    3. Runabout (1-3 person/s on board)
- Weight load capacities range from one to three persons on board. Know your PWC and its requirements. (One style of craft held up to four persons, but these are no longer

produced). Simply put: Do not exceed the recommended weight load capacity.

- There are newer four-stroke sit-down models that may offer the following: off-throttle steering features, braking units, reverse and neutral. Some use a brake unit and some use natural water drag to effect a stop. It is important to understand the features of the various functions. Remember: Reverse features are not a brake!
- Attach the engine shut-off cord (lanyard) to the wrist of the operator, taking care that it does not wrap around the handlebars, thus impeding its ability to properly engage the engine shut-off in the event the operator falls off. The engine shut-off cord (lanyard) should be checked for damage before and after use. The wrist lanyard should always be worn when underway. A PWC has no directional control when stopped.
- Remove the lanyard from the boat when the PWC is unattended. On some PWC models there are a variety of different start controls such as, but not limited to: remote control fob keys, ignition keys and/or digitally coded engine shut-off cord keys for the ignition feature to be regulated or to start the craft.
- Most PWC fatalities are a result of collision. Constantly scan the water left and right and check both sides and behind you before turning. Throttle down before approaching your intended stopping area, while performing a safety scan.

Guidelines for PWC Operation:

- Know the boating laws and rules, and obey them.
- Read and follow the owner's manual of your model and year of PWC.
- Read all manufacturer warning labels. If any labels are missing contact your dealership and order replacements for your PWC.
- When transporting by a trailer, ensure that you are observing trailer laws and regulations. Make sure the trailer matches the craft's weight and hull design. Securely fasten the watercraft to prevent movement between the trailer and the craft.
- Carry on board all state and/or federally required equipment.
- If renting a PWC, research the boating rules that apply to the type of PWC you are renting before you depart.

- Ride within your limits and those of your passenger(s). Avoid aggressive maneuvers to reduce risk of loss of control, ejection or collision.
- When re-fueling, avoid possible explosion or fire due to flammable gas. Pull the lanyard key off the start button. Make sure you are in a well-ventilated area free from any source of flame or sparks (including pilot lights).
- Prior to starting the engine, ventilate the engine cover or open the seats to vent the engine compartment.
- Do not start the craft in enclosed areas. Exhaust gas contains carbon monoxide, a colorless, odorless poisonous gas. Inhaling carbon monoxide can cause serious brain injury or death. Operate in a well ventilated area.
- Conduct a pre-launch inspection of the craft interior and exterior to ensure all features are secure and functional. Use the proper safety protective equipment. Hint: Ensure your bilge plugs are in place! (drain plugs)
- Practice skills first in a safe area with an experienced operator.
- Be aware of your vessel operations and your fatigue limits.
- Check the water and weather conditions, and monitor the NOAA weather channel.
- Operate the PWC at safe speeds for the conditions.
- To help prevent passengers from falling overboard, avoid making quick turns and sudden accelerations. Advise passengers to hold on at all times. Look before making a turn.
- Operators must have the skill and ability to reboard the boat in deep water. Even the best method of deep water reboarding, from the rear of the boat, can be difficult in rough water and/or if the operator is tired.
- Stand-up type water craft have different operational needs. Refer to the owner's manual and abide by the manufacturer's recommendations.
- To avoid being stranded, refer to the manufacturer's recommendations on re-righting the particular model of PWC you are operating prior to driving. Know the proper righting procedure. Be sure to remove the lanyard key so the



engine is off. Water craft do not self-right. When righting a capsized water craft, reference the decal located astern on the watercraft. Failure to properly right a capsized PWC can possibly damage the engine from water in the exhaust system entering the engine.

- Never loan a PWC to an inexperienced person. Many PWC accidents involve operators who did not own the boat.
- Wear the appropriate personal protective gear. Wear a U.S. Coast Guard-approved life jacket that is properly sized and fitted tightly and designed for PWC use. Inflatable life jackets are not appropriate for PWCs.
- Refer to the manufacturer's recommendations and the current weather. In cool weather, use a dry suit with undergarments or a wet suit that matches the conditions you operate in. Wear foot protection and water gloves. Goggles/glasses are recommended, as is a whistle.
- A helmet protects your head but could contribute to neck injuries or loss of peripheral vision, depending upon what kind of helmet you wear. If you choose to do so consider the risks vs. the benefits.
- Slow to 10 mph when within 100 feet of another motorboat or a sailboat underway.



- Slow to no-wake speed when within 100 feet of anchored boats or paddle craft, or when within 200 feet of the shoreline, a swimmer, diver's flag, dock, or launch ramp.
- Obey regulatory markers such as "No Wake" zones and posted speed limit signs.
- Do not exceed the manufacturer's load capacity.
- Carry a waterproof radio and GPS with you at all times.
- File a float plan before launching with a trusted friend or family member
- Never ride after consuming drugs or alcohol, before or during operation.
- Do not operate in shallow water due to possible environmental impact and/or damage to the water jet pump, hull or water cooling system.
- Keep away from intake grate when the engine is on. Keep long hair or clothing, life jacket straps or lines clear; these can become entangled in moving parts, resulting in severe injury or drowning.
- Avoid boat wakes, waves or swell jumping and sharp turns. These maneuvers can increase the risk of injury, accidents or loss of your water craft.
- Avoid operating in the same area for extended periods.
- PWC operation may be restricted or prohibited on some waterways — check with local land managers.
- Do not board a PWC if the operator is applying throttle; shut the engine off or keep at idle.
- PWC manufacturers advise against operation after dark. Navigation lights are required between sunset and sunrise or in conditions of limited visibility.
- Stay current with any recall notices that may apply to your particular water craft.
- Severe internal injuries can occur if water is forced into body cavities as a result of falling into water or being near the jet thrust nozzle. Wear a long wetsuit bottom or clothing that provides adequate protection.

PWC SAFETY:

Avoid boat wakes, waves and swell jumping — as fun as it sounds, these maneuvers increase the risk of injury.



PADDLE SPORTS

Paddle sports are one of the fastest growing recreational activities in the United States, and as this trend grows, so does the number of accidents. In Alaska, paddling fatalities account for up to a quarter of all boating deaths each year. Nationally, statistics show that three out of four of the paddlers who died in boating accidents were not wearing a life jacket, and almost a third of those incidents were alcohol related.

Safe Paddling Tips

- All paddlers should know how to swim.
- Take hands-on training and read books and guides specific to the sport. Look for courses offered by instructors certified by the American Canoe Association and Alaska paddling organizations.
- A paddler without a life jacket is a sign of inexperience, regardless of swimming ability. Choose a style that has high visibility and a snug fit, without impeding mobility.
- Carry emergency communications and signaling devices on your person.
- Practice re-boarding in a safe environment, on your own, and with a buddy.
- Avoid paddling alone. In the event of a capsize, self-rescue can be very difficult.



- Like other sports, paddling requires the right gear. Purchase quality equipment.
- Be prepared to get wet and dress appropriately—consider wearing a dry suit, especially when paddling in rough water.
- Avoid standing up or moving about in a canoe or kayak as it greatly increases the chance of capsizing. If you must move, then maintain three points of contact at all times.
- Load the boat properly. Keep weight centered both from side to side and bow to stern. The lower and closer the load is to the boat's centerline, generally the more stable the boat will be, assuming there is adequate freeboard.
- When retrieving something from the water, reach with a paddle or guide the boat close to the object so you can grab the item from the water without leaning your shoulders over the gunwales.
- Plan ahead. Check weather and water conditions, and conduct thorough pre-departure checks before each trip. Avoid extreme conditions including weather, distance from shore, water conditions, and fast current beyond skill level.
- Always file a float plan and stick to it as much as possible.
- Trips should be planned in consideration of the least experienced group member. Make sure skill levels are adequate for the situation.

Canoeing

The majority of paddling fatalities are attributable to capsized canoes. Comply with the manufacturer's load recommendations. Canoes are generally not recommended for coastal waters unless they are decked, have extra flotation, and the paddler has extensive experience.

The American Canoe Association recommends that all paddlers be proficient in:

- Keeping a boat balanced under a variety of conditions and maneuvers.

SAFETY TIP: *Help rescuers reach the final mile*

Always wear emergency communication and signaling devices **on your person**, so in the event of an emergency rescuers can home in on your exact location. Mirrors, whistles, and especially such items as personal locator beacons can give rescuers the information they need to spot you in the middle of nowhere.

- Proper boarding—entries and exits.
- Maintaining a straight course when going forward, backward and stopping.
- Turning a boat in any direction quickly and efficiently.
- Performing self-rescues and assists.

Coastal Kayaking



Alaska has some of the most amazing sea kayaking in the world. But before venturing out into the gorgeous waters around the state, begin with proper instruction and practice. Both dryland and on-the-water instruction (in protected areas) are highly recommended.

- Wear a life jacket.
- Carry emergency communication and signaling devices on your person.
- Obtain and maintain essential skills in reboarding a capsized boat in open water, such as the paddle float self rescue and the two boat “T” rescue technique.
- Avoid powerboat traffic lanes. Strive for high visibility when around powerboats. Especially under conditions of limited visibility, rough water, or strong backlighting from the sun, groups of boats are far more easily seen than single boats. Wave paddles if necessary to attract the attention of approaching boats.
- When on the beach, move the boat well above the high tide line and tie it securely. Many a paddler has returned to the shore only to watch their boat float away on a high tide.
- Check the weather forecast before every departure and never try to outrun a bad weather forecast. Get frequent weather updates via VHF radio.
- Keep a lookout for large boat wakes and wave rebound off the shoreline, rocks and coastal cliff faces.
- Stay close to the shore and avoid paddling in strong winds or heavy chop. Cross open water where the distance is the shortest. Perform “Pan Pan” communication via radio before crossing heavy traffic lanes.

Swift Water Paddling

Some examples of boats used in rivers, streams and other swift water include **white-water kayaks, rafts and packrafts**. Paddling in swift water requires a skillset entirely different than that of flat or calm water paddling. The paddler needs to be extremely familiar with each kind of paddle stroke and able to quickly respond to changing conditions with the correct stroke. It is highly recommended to take paddling courses, swift-water rescue training and practice with paddlers of higher abilities.



- Learn and practice the universal river signals. Make sure other party members know them as well.
- Match skill and experience to the difficulty of the river. Before a trip, carefully review maps and determine the current and anticipated water levels and any possible evacuation routes.
- Rivers contain many hazards including waterfalls, rocks, strainers and sweepers, hydraulics or “holes” and challenging rapids. If in doubt, walk around.
- Always scout down river from the shore. Rivers are constantly changing, so don’t rely on what it looked like last season.
- Learn and be proficient in first aid and basic swift water rescue techniques. Carry throw bags and other appropriate rescue gear.
- If the boat is not designed with closed decks and bulkheads to displace water, install devices such as float bags. This is especially important for open canoes.
- Be alert on rivers used by powerboaters. Listen carefully, keep to the right side (especially around river bends) and be prepared to handle boat wakes. Carry a sound-producing device, as required by state law.

- If in a group, assign the most experienced paddlers to the lead and sweep (last) boats. All other boaters should stay in between. If you lose sight of the boat behind you, pull over and wait.
- It is strongly advised to wear a dry suit while paddling swift water in Alaska.

Packrafting

The American Packrafting Association, like the Alaska Office of Boating Safety, reiterates this vitally important message: Gain knowledge, acquire the abilites and practice the skills for your particular boating activity. Packrafting is a subcategory of swift water paddling that is growing exponentially in popularity, especially in Alaska, where the remoteness of so many of its rivers and streams necessitates on-foot backcountry travel. A packraft is light, ideally less than five pounds, inflatable, yet still durable enough to do the job of a larger, heavier boat designed for the same purposes.

The APA's Safety Code is detailed (see https://packraft.org/education/safety/ for more) and encourages rafters to know self-rescue, never travel alone, be in control of their boats, understand and be



Paddler's Checklist

- ❑ **A properly fitted life jacket.**
- ❑ **Emergency communication and signaling devices on your person, such as whistle, light, mirror, PLB.**
- ❑ **Avoid a day-trip mentality**
- ❑ **VHF radio, EPIRB, PLB, satellite phone, cellphone (whatever works in the area that you are paddling)**
- ❑ **De-watering device such as bilge pump, bailing bucket, sponge**
- ❑ **Repair kits for boat**
- ❑ **Maps, compass, GPS, nautical charts**
- ❑ **River knife on person**
- ❑ **Rescue devices: throw bag, paddle float, slings, ropes**
- ❑ **Dry bag with appropriate and extra clothing, rain gear**
- ❑ **First aid kit, personal medications**
- ❑ **Emergency shelter and sleeping bag**
- ❑ **Water and food**
- ❑ **Fire starting material (or stove and fuel)**
- ❑ **Helmet, paddling jacket and pants or a dry suit, spray skirt, neoprene gloves**
- ❑ **Sunscreen, proper footwear, eye protection**

able to read water conditions and, above all, wear a U.S. Coast Guard-approved life jacket appropriate for the activity and carry your emergency communication and signaling devices on your person. A satellite texting device is a popular choice among packrafters, although there are many other options available as well. (See Emergency Communications Devices, Page 25)

Other things to consider:

- Review trip plans prior to departing, and retain the ability to abort a trip in case of poor conditions or unsafe water.
- Keep the least skilled person in mind when choosing route locations. Paddle from your "lowest common denominator."
- Packrafts in any moving water with waves should have a spraydeck or whitewater deck, or if the boat is open without one, the boater should wear a drysuit or wet suit. Cold-water immersion, and even hypothermia, even in Alaska's nonglacial waters, is a real danger.
- A drysuit is especially recommended when using self-bailing packrafts.
- Packrafts require special care to prevent punctures and other damage, so carry them inside your pack when traveling on foot, and even in a stuffsack within your pack to avoid abrasion holes caused by rubbing against other items within the pack.
- If using a packraft and carrying more than 30 pounds, consider using boats that incorporate gear storage inside the air tubes, to offer boat stability and

Paddling and the law

❑ **Canoes, kayaks, stand up paddleboards and packrafts are all considered vessels and subject to Alaska boating regulation.**

❑ **Nonmotorized paddle craft do not need to be registered or titled under Alaska Statute, but doing so can help in the event of theft or loss.**

❑ **Those under the age of 13 must wear a U.S. Coast Guard-approved life jacket suitable to the activity.**

❑ **Helmets are not required by Alaska law but are recommended for some forms of paddlesports, especially in rivers.**

❑ **It is unlawful to operate a boat while under the influence of drugs or alcohol.**

❑ **It is against federal law to operate your vessel too closely to federally protected mammal species.**

keep gear dry. This requires that the boater carefully pack the boat without any metal or sharp plastic objects making contact with the tubes.

- Equip packrafts with stern and bowlines that a swimmer can grab onto.
- Learn how to get back into a flipped packraft, especially a loaded one, while holding your paddle. Learn how to help others get into their boats.
- Know how to make a fire and keep fire-starter and lighter/matches dry and on your person at all times.

Stand Up Paddleboarding



Although Stand Up Paddleboarding, or SUP, may look easy, life-threatening incidents can happen at any time and within moments. It is critical to learn how to avoid situations from happening, and how to respond to them if they do. SUP incidents and drowning deaths occur when paddlers are unexpectedly ejected from the board and are unable to successfully self-rescue, or rescue others. Such ejections become life threatening when paddlers are without a leash, life jacket, are paddling alone, or any combination of the above. Paddling in Alaska's cold water adds the additional threat of cold-water immersion.

Prior to paddling for the first time, beginner paddlers should learn how to hold the paddle, stroke, turn, and brace, how to read and respond to adverse weather conditions, particularly wind and tides, and how to prevent and respond to rescue situations. It is also critical to learn what apparel is appropriate for Alaska's air and water temperatures. These tips and techniques can be learned in basic SUP paddling classes on

flat water. Once paddlers have gained enough flatwater experience and confidence, they may consider trying ocean, down winding, whitewater, river, surfing, racing, fishing, or yoga, Pilates, or fitness paddling. There are specialized courses available in these disciplines to help you prepare. Only paddlers with a strong surfing background should try SUP surfing at Alaska shore breaks and bore tides. Without adequate surf knowledge and experience, paddlers can be a danger to themselves and others in the surf break lineup.

Other points to consider:

- SUPs are considered vessels and must carry required equipment, including a life jacket, sound-producing device and a light.
- Carry emergency communication and signaling devices on your person.
- Wear a life jacket, leash, and a whistle. Dogs on SUPs should have life jackets with handles.
- All SUP paddlers, including children, MUST be able to swim proficiently and be physically able to self-rescue.
- Children on SUPs should not be left unsupervised. SUPs are not a toy. SUPs are boats and can easily drift away.
- Understand that should a fall occur, the best flotation device beyond your life jacket is the paddleboard, and that every attempt should be made to self-rescue onto the paddleboard as quickly as possible. A leash will ensure that the board does not drift away rapidly.



Affix a Paddle Smart "If Found" sticker on your board to reconnect you to your boat and would-be rescuers.

- Choose appropriate paddling attire such as dry suits, wetsuits, or swimsuits and learn which leashes will work for which paddling (coiled or straight and ankle, calf, or waist attached).
- File a float plan and leave one with your vehicle or trusted person. Write your name, phone number, and an emergency contact name and phone number on the paddleboard itself. The same information should be located on your person. Should you be separated from your board, this information may prove life saving.

- Boards that are bare may help sell the freedom of stand up paddleboarding in advertisements, but bare boards in Alaska are dangerous. Stand up paddleboards should include webbing to hold emergency as well as comfort gear.
- Emergency gear includes a first aid kit, matches, space blankets, and a mirror. Comfort gear includes a water bottle, high-calorie snacks, sunglasses, and extra layers such as rain gear, hat, and gloves.
- Carry a tow line or throw bag especially when paddling with less experienced paddlers or children.
- Be aware of wind and tidal conditions and stay along the coast within swimming distance to the shore or just outside the surf break. If possible, always start upwind and end your paddle downwind. A wristwatch and/or GPS tracking device will help keep track of your progress, particularly in changing weather conditions.



Always wear a life jacket and attach an ankle leash when using a stand up paddleboard.

- If you plan on performing fitness activities (such as yoga or Pilates) on the paddleboard, use an anchor to stabilize the paddleboard, avoid falling, and prevent the board from drifting away should you fall. Make sure that the line on the anchor is long enough to secure the anchor.
- If you choose to wear a waist belt life jacket to allow for freedom in your movement (particularly during a fitness class), consider also carrying an extra life jacket secured to the paddleboard.
- All SUP instructors should have certified training, water sports insurance, and appropriate permits. Paddlers should verify an instructor's credentials before taking a class.

- Inflatable paddleboards should be fully inflated to the recommended PSI per the instruction manual.
- Lights should be mounted if paddling at night, and should be all-round white lights as required by law.
- Paddlers should understand that they are taking a risk when paddling alone and take every preventative measure to ensure their own safety.
- Consider washing your board after each use to minimize the chances of spreading aquatic invasive species.

OTHER WATER ACTIVITIES

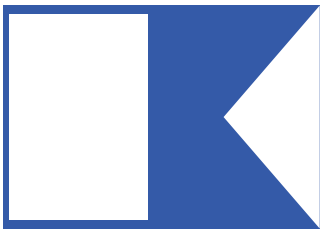
Recreational boaters must share waterways with various other craft and users. When underway, always maintain a proper lookout. Scan the water back and forth constantly for hazards such as logs, submerged and exposed rocks, shallow areas, kayaks, and other boats. This becomes especially important in situations with limited visibility such as when facing into the sun, when in fog, in conditions with rough water, when rounding points, or when navigating narrow winding passages. Boat operators should understand the unique characteristics of other watercraft operation and regulations in order to boat safely and legally.

Diving

Diving is a popular activity in Alaska. Boat operators need to be aware of divers in the water and be able to recognize diving flags.



Diver Down Flag



Alpha Flag

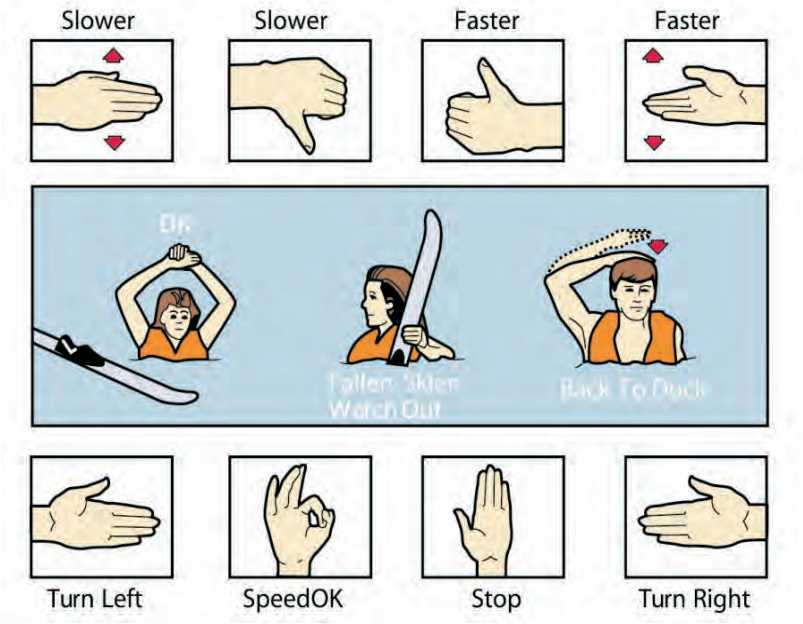
- Alaska law recognizes that a red flag with a white diagonal stripe (a “diver’s flag”) indicates a person is engaged in diving in the immediate area. Displaying the diver’s flag is not required by law and does not in itself restrict the use of the water.
- International Navigation Rules also require a blue and white “Alpha” flag be displayed on boats engaged in diving operations.

- When operating in an area where a diving flag is displayed, boaters must stay at least 100 feet away from the flag unless they are operating at no-wake speed.

Water Skiing

To make water skiing safer and more enjoyable, boat operators and skiers should observe the following:

- Operate only between sunrise and sunset.
- Boat operators must either have another person (12 years of age or older) onboard as a lookout or have a rear view mirror installed on the boat.
- The boat operator should keep a minimum of a 200-foot wide "ski corridor" (100 feet on either side) to protect the skier from other boats and/or obstacles.
- A boat operator may not tow a person on water skis, a surfboard, or a similar device, in a reckless or negligent manner so as to endanger the life or property of another person (AS 05.25.060 (1)).
- Skiers should wear a life jacket that is approved by the U.S.



Boat operator and skier should agree on recognized hand signals prior to departure.

Coast Guard for the activity. It is a legal requirement for those being towed under the age of 13 to wear a life jacket. Inflatable life jackets are not appropriate for water skiing.

HUNTING AND FISHING

Nationwide, hunters and anglers account for one in three boating fatalities. According to the National Rifle Association, many more hunters die from drowning than by gunshot. Records show the average sportsman who dies on the water is an adult male in a small open motorboat on relatively calm water on a sunny day. Most were not wearing a life jacket and died by drowning, not hypothermia.



- Unless a boat is designed for it, avoid hauling heavy fishing pots and nets over the stern.
- Avoid standing up or moving about when casting or shooting (especially in a canoe). Shoot or cast from a well balanced or seated position.
- When retrieving objects from the water (such as fish, decoys or dogs) either move the boat to the object or draw it toward the boat with a paddle and keep shoulders inside the gunwales.
- Consider yourself a boater, carry all required and recommended equipment, and take a boating course.
- Avoid boating under the influence. Sensible sportsmen already know alcohol, drugs and guns don't mix!
- File a float plan and stick to it.
- Many new styles of life jackets are available that are comfortable and don't restrict movement. Sportsmen should always wear a life jacket when in a boat and when hunting and fishing waterways on foot.

EMERGENCIES

SURVIVING COLD WATER

Cold water immersion plays a significant role in the majority of Alaska's boating fatalities. Generally accepted by researchers to be water temperatures below 70 degrees Fahrenheit, cold water is virtually all water in Alaska.

Causes of Cold Water Immersion

The following are the leading causes of cold water immersion:

Swamping and/or capsizing – due to overloading, poorly secured or shifting loads, improper boat handling in rough water, loss of power or steerage, anchoring from the stern, wrapping an anchor, mooring, or pot line around a drive unit, or taking a wave over the transom during a sudden stop.



Ejection – primarily caused by improper lookout, resulting in a collision with another boat, hitting a submerged object such as a log, or running aground while underway. The risk of ejection also exists when operating a boat in restricted visibility such as fog or in the dark, and during the fall with diminishing daylight.

Falling overboard – most commonly due to slipping, a loss of balance while standing or moving around the boat, striking another boat or object, sudden grounding, or when reaching for objects overboard.

Swimming to retrieve a drifting boat – a loose boat drifting away produces an almost irresistible impulse to intentionally leave a place of safety to swim after it. Don't.

Effects of Cold Water Immersion

Most of Alaska's boating fatalities involve cold water immersion that, according to research, kills in several ways:

1. INITIAL REACTION — COLD SHOCK RESPONSE

- Within the first 1-3 minutes
- Involuntary gasping and hyperventilation, panic and vertigo, can result in water inhalation

- Higher risk of drowning if not wearing a life jacket

2. SHORT TERM IMMERSION — COLD INCAPACITATION

- Within 10-30 minutes of immersion
- Localized cooling of extremities affects muscles and nerves, impairing their function
- Arms and legs become stiff and unresponsive. Activities such as swimming, re-boarding a boat, using a radio or distress signal, or holding on to a floating object becomes difficult or impossible.
- Higher risk of drowning (even good swimmers) if not wearing a life jacket

3. LONG TERM IMMERSION — IMMERSION HYPOTHERMIA

- After at least 30 minutes of immersion, depending on factors
- Gradual cooling of the body core will occur at a rate dependent upon factors including water temperature, clothing worn, body type, physical condition/physical activity.
- As body core temperature falls, hypothermia symptoms will range from mild to severe, eventually leading to unconsciousness.
- Higher risk of drowning if not wearing a life jacket.

Prepare for Cold Water Immersion

Most immersion events happen quickly and unexpectedly. So, while prevention is best, it is also important to be prepared. Taking these simple steps will help ensure the best possible outcome:

- Always wear a life jacket when in an open boat or on an open deck. Trying to put your life jacket on in cold water is extremely difficult (if not impossible) and costs precious time and energy.
- Carry emergency communication and distress signaling



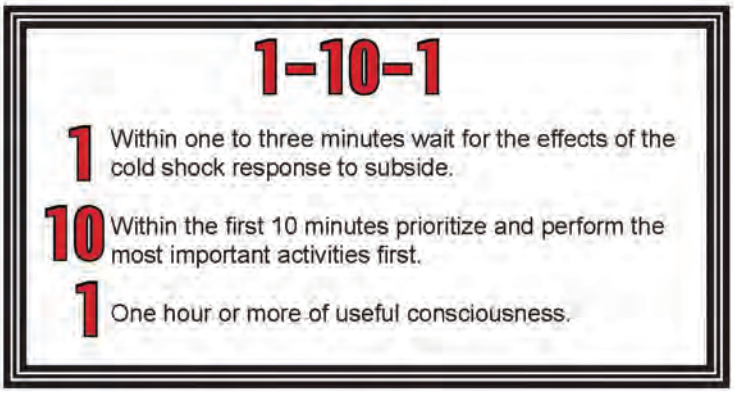
*Without a life jacket, it is very difficult to keep the airway clear during the **cold shock response** stage, which could result in drowning.*

devices ON YOUR PERSON. Such items as an emergency locator beacon, a small handheld VHF radio or cellphone, a whistle, and some visual distress signals may save the day. Today's devices are smaller, lighter, and easy to carry.

- Unless the boat is designed so that a person in the water can easily get back into the boat unassisted, equip the boat with a re-boarding device, such as a rope ladder, foot sling, or a swim platform.
- Carry survival suits. Make sure they are well maintained and readily accessible.
- Practice re-boarding your boat, donning immersion suits quickly, signaling, transmitting MAYDAYs, rescuing a person overboard, and other cold-water survival techniques described in this section. Drills are fun and build skill and confidence. In-water cold water survival classes are available at AlaskaBoatingSafety.org.

Surviving Cold Water Immersion

Surviving cold water immersion depends on adequate flotation to prevent drowning, and timely self-rescue or rescue by others. Wearing a life jacket, carrying a communication and distress signaling device, the ability and confidence to swim, a controlled entry into the water, surface conditions, length of time in the water, associated injuries or medical conditions, and alcohol use can all influence the outcome.



According to Canadian physiologist Gordon Giesbrecht, who studies the effects on humans of such extreme environments as cold water immersion, the phrase "1-10-1" is an easy way to remember what to do in the event of a sudden cold water immersion. Note: this information does not apply to all persons in all cases, but it does give a general idea of how long you have to rescue yourself, and reminds you not to panic: While time may be of the essence, you still can remain calm and take command of your rescue.

1 Minute

The initial reaction/cold shock response stage usually passes within the first few minutes. Wait for effects of cold shock to subside. According to Michael Tipton, another expert in the field of cold water immersion, resist the urge to fight the water; float first. A life jacket is designed to float a person in the water on their back at a 45 degree angle. Float first on your back and wait for gasping and hyperventilation to subside. Understanding that this stage will soon pass may help reduce panic.

10 Minutes

Once breathing is under control, most people have at least 10 minutes to take the actions necessary for self-rescue or for obtaining rescue before incapacitation occurs. Do not waste time and energy removing shoes or clothing. Even small amounts of air trapped in clothing will provide some buoyancy and thermal protection. Perform the most important functions first:

- If not already worn, attempt to don life jackets or survival suits, and then assist others in doing so.
- Account for any other members of the party. Check around and under the boat.
- Alert and Locate. If not already deployed (and depending on the circumstances), activate an emergency communication and/or distress signaling device such as an emergency locator beacon, transmit a MAYDAY on a VHF marine radio, or call 911 (or *24) on a phone. If in range of others, activate visual and sound distress signals.
- Get all persons as much out of the water as possible. Water transfers heat much faster than air of the same temperature. For example, if the boat is not overturned, use the boat's re-boarding devices and practiced techniques to get back in. If overturned, climb on top of the hull. If separated from the boat use any other available objects to get as much of your body out of the water as possible, even if it feels colder.
- Make a plan, and do not give up. A hopeful outlook is much more productive in an emergency situation.

The Swim/Don't Swim Decision

Staying with or near a floating boat may be the best choice, especially if the event was witnessed or emergency communication was successful. Even if capsized or swamped, a boat may offer supplemental flotation and is far easier for potential rescuers to spot than is a person in the

water. Swimming in cold water can reduce in-water survival time, and the average person will lose more heat faster by swimming than by remaining still. Distances can be deceiving when on the water, and safety can look closer than it really is. According to Professor Dr. Michel B. Ducharme, situational factors should be considered when making the swim/don't swim decision:

- Whether or not a life jacket or survival suit is worn
- Whether a place of safety is close (less than 800 yards away or 45 minutes swimming time based on fitness level and swimming ability, and wearing a life jacket)
- The likelihood of rescue by others; i.e., the event was witnessed or others are aware of, and are responding to the emergency
- The ability to get in or on top of the boat or other object to get some or all of your body out of the water
- Whether you would be abandoning a place of relative safety to try to swim



The "huddle" position helps preserve heat, keeps you together to better be spotted by rescuers, and can be a way to aid an injured person in the water.

- Whether calm or moving water (e.g. a river)
- Physical ability and medical condition of the party members.

Swimming in open water:

Use a "head out" breaststroke or modified backstroke, using just forearms and lower legs. Keep upper arms and elbows close to the sides of chest, upper legs close together and knees slightly bent. Move in an even and sustained pace and conserve energy.

If there is more than one person and they are in the "huddle" position (above), one person at a time may be able to propel the group, perhaps taking turns.

Use floating objects to pull body out of water

Swimming in rivers or other moving water:

- Point feet downstream, knees bent slightly and feet up to avoid foot entrapment.

- Maintain body at a 45-degree angle to the current, with head pointing to the bank of choice. The force of the current on the upstream side of your body will help to “ferry” you toward that bank.
- Use a modified backstroke. Use your feet, arms and legs to fend off rocks and other objects.
- If necessary be prepared to quickly flip onto your stomach and into a head-first position to scramble over “strainers” or other obstacles to keep from becoming pinned against them by the current.

1 Hour

Even in very cold water people may have 30 minutes or more before body core temperature begins to drop. If unable to self-rescue, the priority may now become slowing the rate of heat loss to extend useful consciousness and survival time. Keep movement to a minimum. Protect areas of high heat loss (e.g., head, neck, armpits, groin, sides of the torso) as much as possible.

If in open water, some life jacket designs will allow the person to use the “Heat Escape Lessening Position.” (H.E.L.P.) Test the life jacket first to make sure it does: Grasp the shoulders of your life jacket by crossing your arms, or place hands in arm pits and cross lower legs and raise your knees as close to your chest as possible while still maintaining position in the water.

Small groups can form a tight “Huddle” by intertwining arms so that bodies work together to possibly slow heat loss. Small children and injured or unconscious persons can be placed in the center of the huddle to be supported by the group. Persons in a group should tie themselves together to keep from becoming separated.

In any case, be prepared to activate visual and sound distress signals when potential rescuers are in range.

Person Overboard Response

1. Everyone put on a life jacket (if they aren’t worn already).
2. Keep eyes on the victim at all times. If



Designate a lookout while launching a rescue effort, so they can keep eyes on any victim falling overboard while the boat driver maneuvers closer.

possible, assign a person on the boat to serve as the lookout.

3. Throw supplemental flotation, ideally with attached floating line to the person immediately. (e.g. life ring, seat cushion, horse shoe buoy.)



Approach a victim in the water from downwind and/or down current.

4. Approach the person from downwind or downstream if possible. To avoid the risk of striking the victim with the boat, when close enough to reach for the person, use an oar, paddle, or other item to pull them to the boat. Or, use a throw ring or cushion with a line attached to pull the person to the boat.
5. Don't go into the water for the victim, except as a last resort.
6. Direct passengers as necessary to assist and/or to balance the boat, then assist the person in getting out of the water. If pulling a victim in over the stern, all engines should be stopped.
7. Treat the victim to your level of training.

Treating Immersion Hypothermia

The goals for treating immersion hypothermia patients are:



Approach victims in the water carefully so you don't accidently run over them. Use caution transferring them into the boat to avoid further injury or capsize.

Handling gently because cold heart muscle and vasculature of severely hypothermic patients are vulnerable to physical exertion, jarring, or moving from a horizontal to vertical position too quickly.

Providing basic life support as necessary.

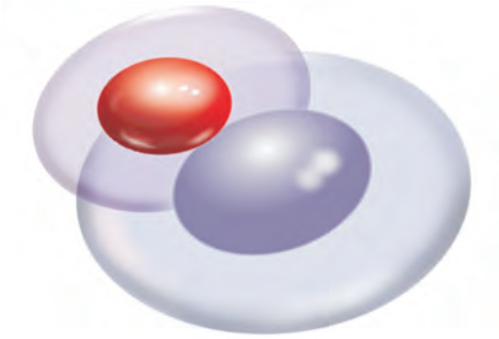
Preventing further heat loss by removing wet clothing, drying victims off and putting them in dry clothes and a sleeping bag or blankets and vapor barrier. Shivering is good.

Securing transport to medical care for moderately to severely hypothermic patients.

A person found unconscious in cold water, even if they appear dead, may still have a chance for survival. If the victim was known to be submerged for an hour or less (or if the time of submersion is unknown), providing basic life support to your level of training and obtaining medical help quickly could save a life. Emergency medical responders are taught "a cold water immersion victim isn't dead until they are warm and dead."

CARBON MONOXIDE POISONING

Carbon monoxide (CO) poisoning, the leading cause of accidental poisoning death in America, has been identified recently as a serious problem on our nation's waters. CO (known as "The Silent Killer") is an odorless, colorless, tasteless gas, formed by the incomplete combustion of hydrocarbon fuel, which can cause seizures, unconsciousness and death. CO binds to red blood cells 240 times more aggressively than oxygen, displacing oxygen and causing metabolic asphyxiation (suffocation). Depending on the concentration, CO poisoning can happen very quickly, sometimes with just a few breaths.



Carbon monoxide binds to red blood cells displacing oxygen

Boaters should be aware of improperly vented or malfunctioning cabin

DID YOU KNOW?

Carbon monoxide (CO) poisoning can happen very quickly, but on a boat can sometimes be mistaken for seasickness. If you begin to feel ill, consider your surroundings, and the possibility of exposure to too much CO, as a culprit.

heating systems, grills and propane appliances and exhaust gases produced by generators and engines. These all produce CO.

Exhaust fumes and CO can accumulate in areas such as enclosed cabin spaces and under swim platforms. Prevent CO poisoning aboard your vessel by taking these precautions:

- Use care in running the engine or boat's generator continuously when the boat is closed up in cold or bad weather, particularly when the boat is not in motion.
- Do not use small, portable gas generators on boats.
- Be alert to any indication that exhaust fumes are present and ventilate accordingly.
- CO detectors should be installed and maintained in enclosed areas.
- Everyone on board should keep well clear of engine and generator exhaust ports that are running.
- If there is a need to be around swim platforms or exhaust ports for any reason, first shut the engines down and then allow sufficient time for fumes to dissipate.
- Be mindful of the wind direction if idling the motor; even if you are in a boat with the three-sided canopy, don't assume enough fresh air is flowing to disperse the exhaust.
- Be sure to have your engine and generator exhaust systems regularly inspected by a professional. If you notice a change in the sound or appearance of the exhaust system, shut the unit down and have it inspected and repaired by a competent mechanic.

Because CO is difficult to detect by sight or smell and poisoning can happen so quickly, there is often little warning. CO poisoning is difficult to diagnose because it often is mistaken for seasickness, and also has a wide range of vague symptoms:

- Fatigue and headache are most common.
- Symptoms of dizziness, vomiting, muscular twitching, weakness and sleepiness.
- Gray or ashen appearance.

If someone feels dizzy or loses consciousness while onboard, consider the possibility of CO poisoning. If you suspect someone could be suffering from CO poisoning, remove them from the suspected source

and into fresh air immediately. Be prepared to provide basic life support to your level of training, and call for medical assistance.

FIRE

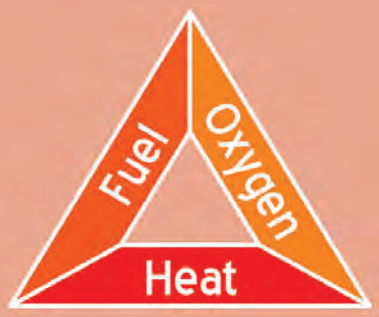
The key to putting out a fire on a powerboat is eliminating any of the fire's three ingredients: fuel, oxygen or heat. Often the easiest to remove is oxygen—by using a fire extinguisher. Fire extinguishers use agents that either cool or smother the fire, such as water, carbon dioxide, halon, dry chemical or dry powder.

If a fire breaks out:

1. Alert passengers. Direct them to put on lifejackets if not already on, gather survival gear and prepare to go into the water if necessary.
2. Keep the fire downwind; turn the boat so flames and smoke blow away from the craft, rather than over it.
3. Cut off oxygen to the area of the fire.
4. Use the P.A.S.S. system to extinguish the fire:
   - P: PULL the pin.
   - A: AIM the extinguisher nozzle at the source (at base of flames).
   - S: SQUEEZE the handle.
   - S: SWEEP back and forth.
5. Don't try to save some of the charge for a re-flash; a B-I extinguisher empties in less than 10 seconds; instead, carry a spare extinguisher.
6. Transmit a MAYDAY if necessary.
7. As a last resort, abandon ship. Stay together and use cold water survival techniques.

STOP THE FLAMES

Use the P.A.S.S. system to extinguish a fire:
• PULL the pin.
• AIM the extinguisher nozzle at the source (at base of flames).
• SQUEEZE the handle.
• SWEEP back and forth.



TAKING ON WATER

1. Direct passengers to put on their life jackets if not already wearing them, and gather survival gear.
2. Re-distribute weight to balance the boat.
3. Secure doors and hatches.
4. Pump and bail. Start bilge pumps and get manual dewatering

devices in use.

5. Locate leak source and take measures to stop or reduce leak. If unsuccessful and near shore, consider beaching the boat.
6. Shut off engines if the leak is from the cooling system.



7. If hull is breached, an inboard engine can act as a bilge pump. Shut off engine, close sea cock, disconnect cooling water intake hose, restart engine and use the water intake hose to pump out the boat.
8. Transmit MAYDAY if necessary.
9. As a last resort abandon ship, but stay with the boat if it is floating. Stay together and use cold water survival techniques. See Swim/ Don't Swim section, on Page 91, for more.

RUNNING AGROUND

Besides causing expensive damage to the boat and engine, striking underwater objects or the bottom can cause passengers to be suddenly thrown forward, often resulting in injury and/or ejection into the cold water. Running aground is usually caused by inattention. This can be avoided by taking these simple steps:



- Carefully study charts of the area before a trip to identify shallow areas, rocks and other hazards.
- Be aware of the tide cycle or changes in river volume.
- Always maintain a close watch while underway, constantly scanning the water.
- In shallow water, proceed SLOWLY and use charts, a depth finder and an observer.

If you do run aground, first ensure the safety of passengers. Next:

- Assess the situation.

- Check for hull damage.
- If the boat is not firmly grounded, consider lightening the load and, if safe, rocking the boat back and forth to free it. If the tide is coming in, and the hull is not damaged, it may be possible to wait a few minutes to regain flotation.
- Another method is to use an anchor or sea anchor to pull the boat into deeper water.
- If the boat can not be freed, stabilize it and secure fuel tanks and vents.
- Prepare signaling devices and consider calling for help.

MECHANICAL BREAKDOWN

Mechanical breakdown is the most common powerboating problem. If you encounter problems on the water, consult owner's manuals and try some of the following before calling for help:

Problem: Engine turns over but won't start

- Check if safety shut-off cable is disconnected.
- Check if fuel is getting to the engine (fuel line not primed, kinked, bad connection, tank vent closed).
- Check if engine is flooded.
- Check for spark.

Problem: Engine doesn't turn over or the solenoid clicks but starter does not engage

- Check that the gear shift is in the neutral position.
- Check that the battery switch is in the "on" position.
- Check that battery terminals, cables, and connections are clean and secure.
- Check ALL ignition system fuses, including under engine cowling (outboards).
- Check starter solenoid.
- Check connections at starter motor.

Problem: Engine runs poorly

- Check if fuel line priming bulb is full of fuel and firm
- Check if fuel tank vent is closed.

- Check fuel lines and connections for kinks, pinches, obstructions and poor connections, and check fuel filters for contamination (water or other agents).
- Check fuel and fluid levels.
- Check for overheating.

Problem: Engine stops suddenly

- Check if engine cut-off device became disconnected or the ignition key was turned off.
- Check fuel and oil levels.
- Check if fuel tank vent is closed.



- Check fuel line connections.
- Check for engine overheating.
- Check for propeller fouling.

Problem: Engine overheats

- Shut down immediately until problem solved.
- Check oil levels.
- Check water intakes and cooling system for fouling, obstructions or leaks.
- Check water pump operation.
- Check engine trim to make sure water intake is below the water line.



EMERGENCY COMMUNICATIONS

Emergency Radio Procedures

There are three types of emergency radio messages:

SECURITE — to notify others of bad weather or other hazards (pronounced say-cure-eh-tay).

PAN-PAN — to notify others of a very urgent situation regarding vessel or personal safety. In a Pan-Pan the situation is urgent, but for the time being does not pose an immediate danger to anyone's life or to the vessel itself (pronounced pon-pon).

MAYDAY — to notify others when experiencing an immediate threat to life or vessel.

WHAT IS THE PROBLEM?

Here are a few examples of calls that would fall under each of the emergency radio messages categories:

• SECURITE: A storm is coming in from the north and seas are picking up rapidly.

• PAN-PAN: A group of paddlers is crossing a heavy traffic zone.

• MAYDAY: Our boat is taking on water and we need immediate help.

EMERGENCY RADIO CALL PROCEDURES

1. MAKE SURE RADIO IS ON
2. SELECT CHANNEL 16
3. PRESS & HOLD TRANSMIT BUTTON
4. CLEARLY SAY: ***MAYDAY, MAYDAY, MAYDAY***
5. ALSO GIVE:
   - **VESSEL NAME & DESCRIPTION**
   - **POSITION/LOCATION**
   - **NATURE OF EMERGENCY**
   - **NUMBER OF PEOPLE ON BOARD**
6. RELEASE TRANSMIT BUTTON
7. WAIT 10 SECONDS — IF NO RESPONSE, REPEAT

16

VHF-FM

CONFIRM ALL PERSONS WEARING LIFE JACKETS!

www.alaskaboatingsafety.org

If you get a response, be prepared to give the following information:

Vessel description:

Length:_____ Propulsion type:_____

Color:_____ Registration #:_____

On-scene weather:

Wind speed:_____ Wind direction:_____

Sea height:_____ Swell direction:_____

Visibility:_____ Ceiling:_____

Emergency radio and survival equipment onboard:_____

Radio frequencies available:_____

Operator's name and phone:_____

Owner's name and phone:_____

Home port:_____

Digital Selective Calling

In addition to sending a distress call, or MAYDAY, boaters should also consider activating the red digital selective calling (DSC) emergency button on their MMSI-equipped and registered radio to “alert all stations.”

- A distinctive red “DISTRESS” button is located on the face of a DSC radio, and some handheld radios.
- Manufacturers are required to install DSC on any marine VHF radio model developed after June 1999 (except handheld models).
- DSC radios automatically send (once pushed) a DISTRESS alert to those in the immediate area who are also equipped with a DSC radio, without having to use the usual voice calling/distress channels.
- DSC radios automatically and silently maintain a listening watch on the appropriate DSC channel (VHF 70, or 2187.5 kHz).
- The benefits of DSC are greatly enhanced when the radio is connected to the boat’s global positioning system (GPS) unit.

To be able to use the DISTRESS alert function, boaters must first obtain a Maritime Mobile Service Identity (MMSI) number. This nine-digit number electronically identifies a specific boat and must be programmed into the radio. MMSI numbers may be obtained from www.boatus.com/mmsi/, 1-800-563-1536; SeaTow, 1-800-4SEATOW; U.S. Power Squadrons, www.usps.org; or Shine Micro, www.shinemicro.com.

The U.S. Coast Guard’s Rescue 21 Digital Selective Calling emergency contact system is operational in some parts of Alaska; in addition, those in the immediate area with DSC can receive the distress signal for relay purposes. For more information on where Rescue 21 is operational, contact the U.S. Coast Guard at (907) 428-4200.

Emergency Cellular Procedures

Where there is cellphone coverage, it is possible to call the U.S. Coast Guard directly by dialing *CG (*24). Alaska is the only state where *CG is still operational, however the call must be placed from an Alaska cellular phone provider.



1. First give your phone number in case you are disconnected.
2. Give your name and a boat description.
3. Give your position/location.
4. Explain the nature of your problem.
5. Give the number of people on board.
6. REPEAT your cellphone number before ending your call.
7. Keep as calm as possible and speak slowly and clearly so you can be understood.

Single Side Band (SSB)

The U.S. Coast Guard can be reached by HF/SSB radio on 4125 MHz.

Emergency Locator Beacons

Emergency locator beacons are highly effective tracking transmitters that aid in the detection and location of boats, aircraft, and people in distress. When activated, these radio beacons interface on the 406MHz frequency with COSPAS-SARSAT, an international satellite-based search and rescue alert detection and information distribution system.

There are two main types of beacons that are appropriate for boating in Alaska:

- Emergency Position Indicating Radio Beacons (EPIRBs) are installed on vessels. There are two categories: Category 1 beacons automatically deploy and activate when in contact with the water, but can also be manually deployed and activated or manually activated while in its bracket. Category 2 beacons manually deploy.
- Personal Locator Beacons (PLBs) work much the same way as EPIRBs, but are carried by a person and must be manually deployed and activated by the user. When selecting a PLB for boating, consider models that are waterproof, will float and are small enough that you will always carry it on your person when on the boat.

When selecting an emergency locator beacon, consider ease of activation under a variety of conditions and the length of time the unit will operate following activation.

It is important that the EPIRB or PLB be registered (and the information updated every year) so that rescuers can access the vessel's or PLB owner's emergency contact information. Registration is available online



at www.beaconregistration.noaa.gov.

Once communication has been established, be prepared to deploy signaling devices when search and rescue is nearby.

If You See a Flare:

To improve an emergency responder's ability to quickly locate a mariner in distress, a technique known as the "Fist Method" has been developed to assist in accurately determining the position of the flare in relation to yourself, the reporting source.

The Fist Method: To estimate the distance of a flare from your position, the responder needs to determine the height of the flare above the horizon. To do this, hold your arm straight out in front of you and make a closed fist. Hold the bottom of your fist on the horizon with the thumb side pointing up. Picture in your mind the flare that you saw, compare the height of the flare at its peak to your fist. Was it one knuckle or two from the horizon? Or more? By using this method, responders can estimate how far away the flare is from you.



CONTACTS

Boating Education

- Alaska Office of Boating Safety (907) 269-6041
  www.alaskaboatingsafety.org
- Alaska Water Wise courses (907) 269-8704
  www.alaskaboatingsafety.org
- Alaska Marine Safety Education Association (907) 747-3287
  www.amsea.org
- American Canoe Association, www.americancanoe.org
- BoatUS Foundation, www.boatus.com
- Fairbanks Paddlers, www.fairbankspaddlers.org
- Kids Don't Float Education Program, 907-269-8705
- Knik Canoers and Kayakers, www.kck.org
- National Association of State Boating Law Administrators,
  www.nasbla.org
- USCG Auxiliary courses, www.cgaux.org
- USCG Boating Safety Division, www.uscgboating.org

Accident Reporting

Mail to:
Alaska Office of Boating Safety
550 W. Seventh Ave., Suite 1380
Anchorage, AK 99501

Fax to:
(907) 269-8907

Email to:
officeofboatingsafety@alaska.gov

Reporting Oil Spills

Both state and federal agencies must be contacted in the event of an oil spill.

State:

Department of Environmental Conservation

- Southeast Area (907) 465-5340
- Northern Area (907) 451-2121
- Central Area (907) 269-3063

- 1-800-478-9300 (after normal business hours)

Federal:

- U.S. Coast Guard National Response Center 24-hour Hotline 1-800-424-8802

Ports and Harbors

- Anchorage (907) 343-6200
- Bristol Bay (907) 246-6168
- Cordova (907) 424-6400
- Dillingham (907) 842-1069 (seasonal number)
- Haines (907) 766-2448
- Homer (907) 235-3160
- Juneau (907) 586-5255
- Kenai (907) 283-7535
- Ketchikan (907) 228-5632
- Kodiak (907) 486-8080
- Petersburg (907) 772-4688
- Sand Point (907) 383-2331
- Seldovia (907) 234-7886
- Seward (907) 224-3138
- Sitka (907) 747-3439
- Skagway (907) 983-2628
- Valdez (907) 835-4981
- Whittier (907) 472-2330
- Wrangell (907) 874-3736

Other

- Alaska Weather Information Hotline
  -In Anchorage, call: 266-5145
  -In Fairbanks, call: 458-3745
  -In Juneau, call: 790-6850
  -Anywhere else in Alaska: 1-800-472-0391
  -Outside of Alaska: 1-907-266-5145
- Cook Inlet Keepers (for a bilge pillow), www.inletkeeper.org

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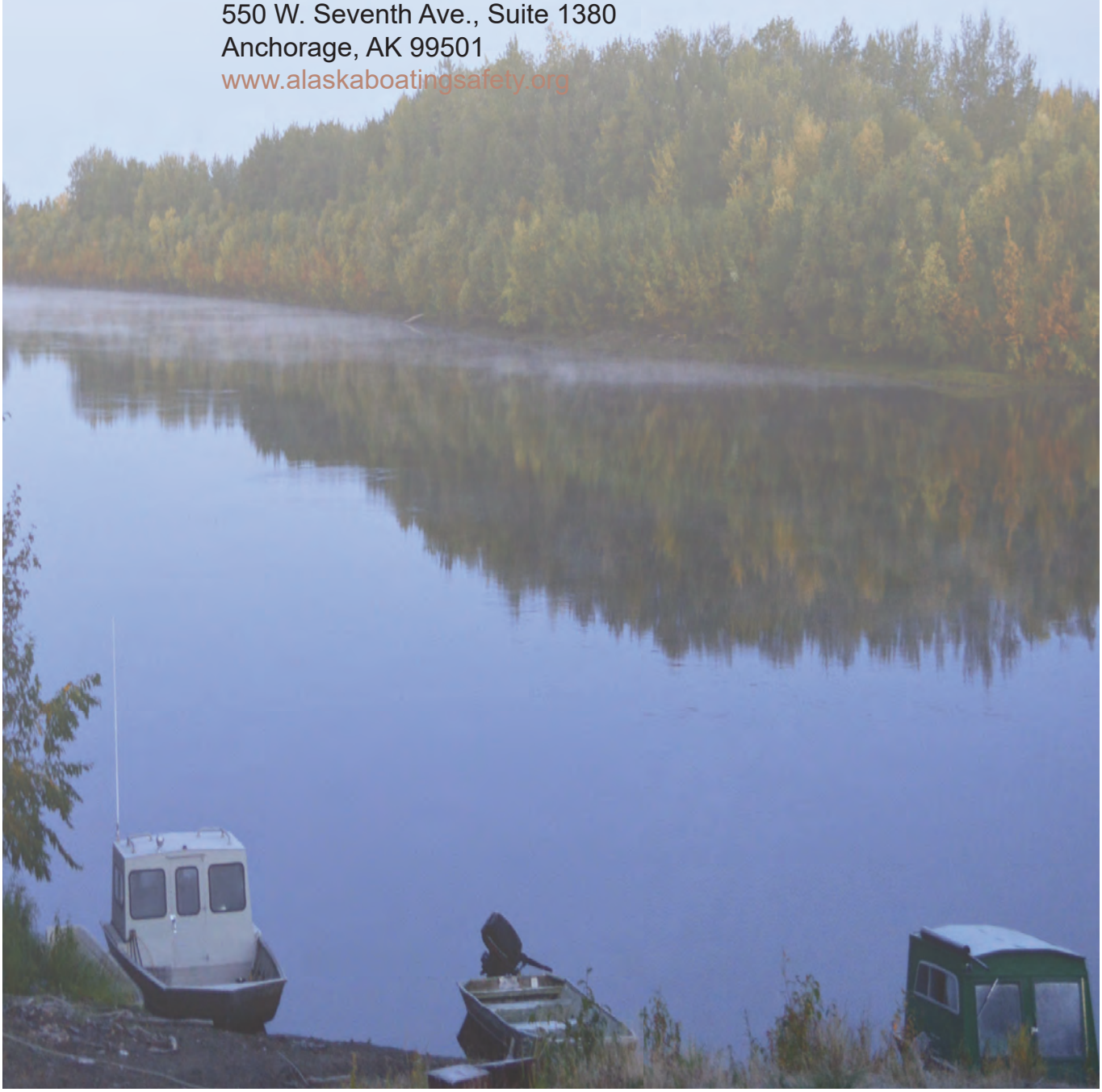
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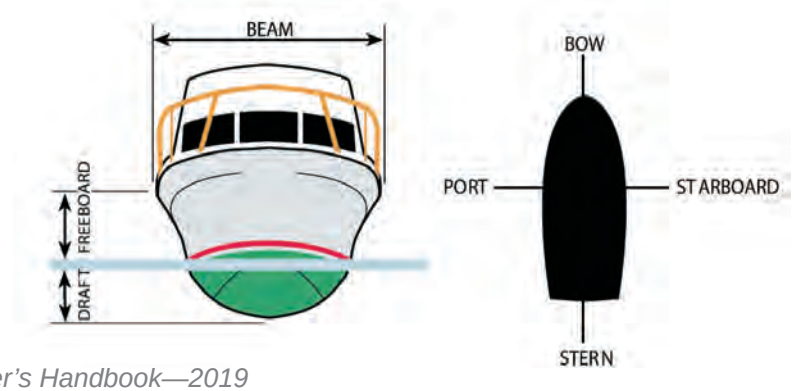
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Department of Natural Resources
Division of Parks and Outdoor Recreation
Alaska Office of Boating Safety
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Anchorage, AK 99501
www.alaskaboatingsafety.org



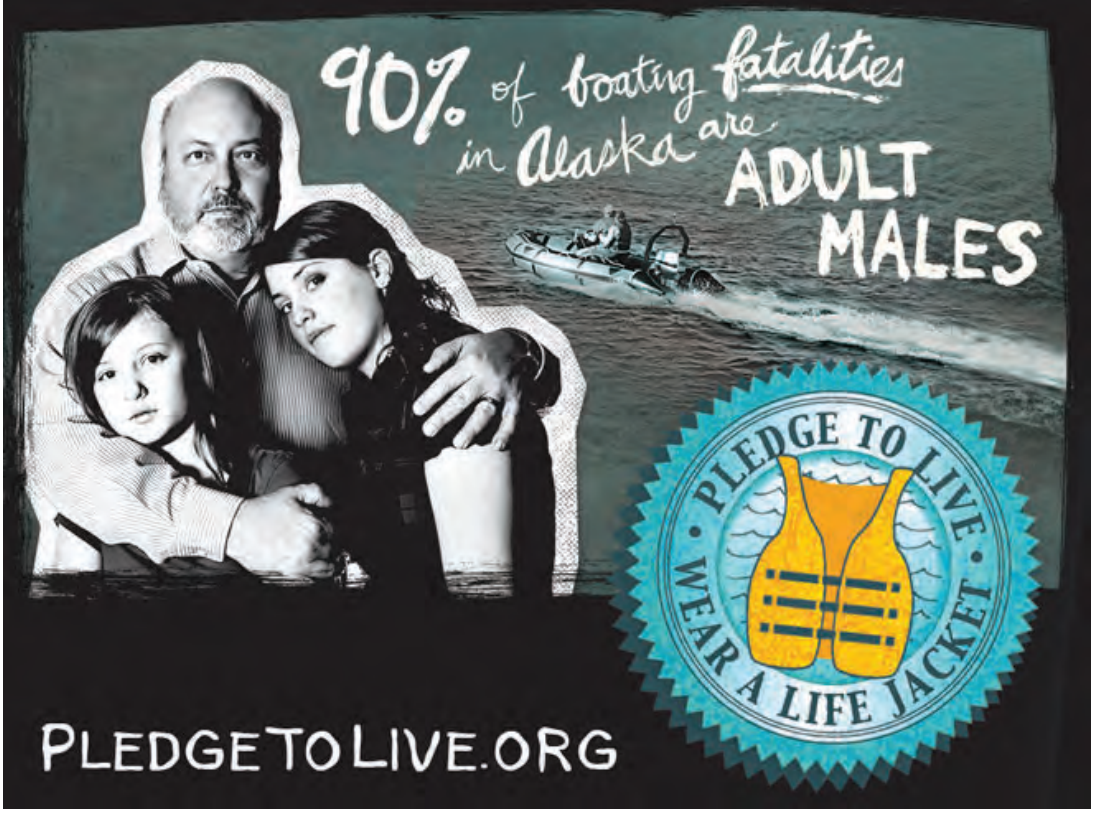
BOATING TERMS

- **Amidships**—Center of boat with reference to its length and/or sometimes its width.
- **Aft**—Toward the stern of a boat.
- **Beam**—The boat's maximum width.
- **Bilge**—Lower internal part of a boat's hull.
- **Boat**—Every description of watercraft used or capable of being used as a means of transportation on the water.
- **Bow**—Forward part of a boat.
- **Bulkhead**—A vertical partition separating compartments.
- **Draft**—The depth of water a boat draws.
- **Fathom**—Six feet.
- **Fore**—To or at the front of the boat.
- **Freeboard**—Height of boat from the waterline to the deck or gunwale.
- **Gunwale**—Top, outer edge of boat's hull.
- **Helm**—The wheel or tiller controlling the rudder.
- **Hull**—Body of a boat.
- **Motorboat**—Any boat propelled by machinery, including any sailboat under power.
- **Port**—Side of boat to the left when facing forward.
- **Starboard**—Side of boat to the right when facing forward.
- **Stern**—Back end of a boat.
- **Transom**—Flat planking across the stern of a boat.
- **Trim**—Fore and aft balance of a boat.
- **Underway**—Boat in motion. Technically, a boat is underway when not moored, at anchor or aground.



Boater's Toolbox:

Float plan
Marine weather
Tide tables
Life jacket selector tool
Pre-departure checklist



Notes



Notes


Make them promise
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Notes

Alaska's boating fatalities:

- Nine out of ten are adult males
- Nine out of ten occur from open boats under 26 feet
- Five of six are cold water related drownings following a sudden capsize, swamping, or fall overboard

I, _____pledge to always wear my life jacket because:

_____

_____

_____

_____



Visit PledgeToLive.org for a trip planner, E-float plan, weather, tides, and much more.

Notes



Notes



This publication is dedicated to Mr. Jeff Johnson, Alaska's first Boating Law Administrator, and state employee for more than 30 years.

RESCUE READY



Always wear a life jacket when in an open boat or on an open deck.



Carry emergency communication and distress signaling devices on your person.



Attach the engine cut-off device when underway.



Equip the boat with at least one means of reboarding.



File a float plan and find more information at PledgeToLive.com

For classes, presentations, and educational resources visit:
AlaskaBoatingSafety.org

Alaska Boating Safety Program

AK Boat

STATE OF ALASKA

(Rev. 10/09)

ALASKA BOATING ACCIDENT REPORT

CASE NO.

For the purpose of gathering accident statistics only, the operator (owner, if the operator is unable to) of a boat used for non-commercial purposes or registered by the State Alaska Department of Motor Vehicles, is required to submit a report in writing whenever an accident results in: loss of life or disappearance from a vessel; an injury which requires medical treatment beyond first aid; property damage in excess of $500; or complete loss of the vessel. Federal law requires that in death, disappearance, and injury cases, reports must be submitted within 48 hours and in other cases within 10 days. Submit completed reports to: State of Alaska, Office of Boating Safety, 550 W. 7th Ave., Suite 1380, Anchorage, AK 99501, or fax to: (907) 269-8907, or e-mail to: officeofboatingsafety@alaska.gov. This form is provided to assist the operator in filing the required written report.

Please type or print — COMPLETE ALL BLOCKS. (INDICATE THOSE NOT APPLICABLE BY "NA")

PERSON MAKING REPORT

NAME	TELEPHONE NUMBER	DATE

ADDRESS

☐ Operator ☐ Other (describe)
☑ Owner

ACCIDENT DATA

DATE OF ACCIDENT	TIME AM ○ PM ○	NAME OF BODY OF WATER	LOCATION ON THE WATER

NUMBER OF VESSELS INVOLVED	NEAREST CITY OR TOWN	BOROUGH

WEATHER
☐ Clear ☐ Rain
☐ Cloudy ☐ Snow
☐ Fog ☐ Hazy
☐ Other _____

WATER CONDITIONS
☐ Calm
☐ Choppy (waves 6" to 2')
☐ Rough (waves 2' to 6')
☐ Very rough (waves greater than 6')
☐ Strong current

TEMPERATURE
(Estimate)
Air _____ °F
Water _____ °F

WIND
☐ None
☐ Light (0-6 mph)
☐ Moderate (7-14 mph)
☐ Strong (15-25 mph)
☐ Storm (over 25 mph)

VISIBILITY

DAY	NIGHT
☐ Good	☐
☐ Fair	☐
☐ Poor	☐

Were weather forecasts <u>available</u> to the operator before or during the use of the vessel? ☐ Available before ☐ Available during ☐ Not available

Were weather reports <u>used</u> by the operator before or during the use of the vessel? ☐ Used before ☐ Used during ☐ Not used

TYPE OF OPERATION AT TIME OF ACCIDENT
(check all applicable)

☐ Non-Commercial
☐ Commercial

☐ Cruising
☐ Changing direction
☐ Changing speed
☐ Drifting
☐ Towing another vessel
☐ Being towed
☐ Rowing/Paddling
☐ Sailing
☐ Launching
☐ Docking/Undocking
☐ At anchor
☐ Tied to dock/Mooring buoy
☐ Racing
☐ Other (describe) _____
_____
☐ Fishing
☐ Hunting
☐ Making repairs
☐ Starting engine
☐ Whitewater activity
☐ Waterskiing/Towed sports

CONTRIBUTING FACTORS (check all applicable)

☐ Alcohol use
☐ Drug use
☐ Excessive speed
☐ Improper anchoring
☐ Improper loading
☐ Overloading
☐ Improper lookout
☐ Operator inattention
☐ Operator inexperience
☐ Language barrier
☐ Navigation rules violation
☐ Failure to vent
☐ Dam/lock
☐ Force of wake/wave
☐ Hazardous waters
☐ Heavy weather
☐ Hull failure
☐ Ignition of fuel or vapor
☐ Starting in gear
☐ Sharp turn
☐ Restricted vision (e.g. fog)
☐ Equipment failure
☐ Missing/inadequate aids to navigation (e.g. buoy, daymarker)
☐ Inadequate on-board navigation lights
☐ People on gunwale, bow or transom
☐ Other (describe) _____
_____

TYPE OF ACCIDENT (check all applicable)

☐ Capsizing ☐ Grounding ☐ Sinking
☐ Flooding/Swamping
☐ Fire/Explosion - fuel
☐ Fire/Explosion - non-fuel
☐ Carbon monoxide exposure
☐ Person left boat voluntarily
☐ Person fell overboard
☐ Person fell on/within boat
☐ Person struck by boat
☐ Sudden medical condition
☐ Person electrocuted
☐ Person struck by propellor or propulsion unit
☐ Mishap of skier, tuber, wakeboarder, etc.
☐ Person ejected from boat (caused by collision or manuever)
☐ Collision with recreational boat
☐ Collision with commercial boat (e.g. tug, barge)
☐ Collision with fixed object (e.g. dock, bridge)
☐ Collision with submerged object (e.g. stump,cable)
☐ Collision with floating object (e.g. log, buoy)
☐ Other (describe) _____
_____

ACCIDENT DESCRIPTION: Describe what happened (sequence of events) and contributing factors, including any failure of machinery or equipment. Describe any damage to vessels or other property. Include a diagram, if applicable. Continue on additional sheets, if necessary.

(COMPLETE OTHER SIDE)

ESTIMATED PROPERTY DAMAGE

TOTAL ESTIMATED AMOUNT	BOAT AND CONTENTS	OTHER BOAT(S) AND CONTENTS	OTHER PROPERTY
$	$	$	$

INJURED (If more than 2 injured, attach additional forms)

NAME OF INJURED	☐ Male ☐ Female	Birth Date	TELEPHONE NUMBER
ADDRESS			WAS PFD WORN? ☐ Yes ☐ No
MEDICAL TREATMENT BEYOND FIRST AID? ☐ Yes ☐ No ADMITTED TO HOSPITAL? ☐ Yes ☐ No	DESCRIBE NATURE AND EXTENT OF INJURY		
NAME OF INJURED	☐ Male ☐ Female	Birth Date	TELEPHONE NUMBER
ADDRESS			WAS PFD WORN? ☐ Yes ☐ No
MEDICAL TREATMENT BEYOND FIRST AID? ☐ Yes ☐ No ADMITTED TO HOSPITAL? ☐ Yes ☐ No	DESCRIBE NATURE AND EXTENT OF INJURY		

DECEASED or DISAPPEARED (If more than 2 fatalities, attach additional forms)

NAME OF VICTIM	VICTIM ADDRESS	WAS PFD WORN? ☐ Yes ☐ No
BIRTH DATE ☐ Male ☐ Female	CAUSED BY? ☐ Drowning ☐ Disappearance ☐ Unknown ☐ Other (describe) _____	
NAME OF VICTIM	VICTIM ADDRESS	WAS PFD WORN? ☐ Yes ☐ No
BIRTH DATE ☐ Male ☐ Female	CAUSED BY? ☐ Drowning ☐ Disappearance ☐ Unknown ☐ Other (describe) _____	

BOAT NO. 1 (Reporting vessel)

NAME OF OPERATOR	OPERATOR ADDRESS		
☐ Male ☐ Female OPERATOR TELEPHONE NUMBER	DATE OF BIRTH Mo Day Year	OPERATOR'S EXPERIENCE ☐ None ☐ Under 100 hours ☐ Over 100 hours	INSTRUCTION IN BOATING SAFETY ☐ State course ☐ U.S. Power Squadrons ☐ USCG Auxiliary ☐ Other (specify) ☐ bone
NAME OF OWNER	OWNER ADDRESS		
OWNER TELEPHONE NUMBER	NUMBER OF PEOPLE ON BOARD	NUMBER OF PEOPLE BEING TOWED	RENTED BOAT? ☐ Yes ☐ No
BOAT REGISTRATION OR DOCUMENTATION NUMBER	STATE	HULL IDENTIFICATION NUMBER	BOAT NAME
BOAT MANUFACTURER	LENGTH BEAM DRAFT	MODEL	YEAR BUILT

TYPE OF BOAT	HULL MATERIAL	ENGINE	PROPULSION	PERSONAL FLOTATION DEVICES (PFDs):
☐ Open motorboat ☐ Cabin motorboat ☐ Auxiliary sail ☐ Sail (only) ☐ Rowboat ☐ Canoe/Kayak ☐ Personal watercraft (PWC) ☐ Pontoon boat ☐ Houseboat ☐ Other (specify) _____	☐ Wood ☐ Aluminum ☐ Steel ☐ Fiberglass ☐ Rubber/Vinyl/Canvas ☐ Rigid hull inflatable ☐ Other (specify)	☐ Outboard ☐ Inboard ☐ Inboard-Sterndrive (I/O) ☐ None	☐ Propeller ☐ Water Jet ☐ Air Thrust ☐ Manual ☐ Sail	Was boat adequately equipped with Coast Guard approved PFDs? ☐ Yes ☐ No Were PFDs worn? ☐ Yes ☐ No

FUEL	NUMBER OF ENGINES MANUFACTURER	FIRE EXTINGUISHERS
☐ Gasoline ☐ Diesel ☐ Electric ☐ None	TOTAL HORSEPOWER	ON BOARD? ☐ Yes ☐ No How many? ___ Type _____ USED? ☐ Yes ☐ No How many? ___ Type _____

BOAT NO. 2 (If more than 2, attach additional forms)

NAME OF OPERATOR	OPERATOR ADDRESS	
OPERATOR TELEPHONE NUMBER	BOAT REGISTRATION OR DOCUMENTATION NUMBEw	
NAME OF OWNER	OWNER ADDRESS	
OWNER TELEPHONE NUMBER	NUMBER OF PEOPLE ON BOARD	NUMBER OF PEOPLE BEING TOWED

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NAME	ADDRESS	TELEPHONE NUMBER
NAME	ADDRESS	TELEPHONE NUMBER
SIGNATURE OF PERSON COMPLETING REPORT		DATE

ADDITIONAL SPACE PROVIDED FOR FURTHER ACCIDENT DESCRIPTION

Submit Button

Print

STANDARD OPERATING PROCEDURE

BE-SOP-61

Working around Drill Rigs

1.0 INTRODUCTION

This Standard Operating Procedure (SOP) describes the guidelines that should be followed when working around a drill rig, traveling to and from a drilling site, moving the drill rig and tools from one location to another onsite, or providing maintenance on a drill rig or drilling tool. This SOP should be used to direct field personnel in the techniques and requirements for working with and maintaining drill rigs.

2.0 FIELD SAFETY OFFICER (FSO)

Every drill crew will have a designated Field Safety Officer (FSO - often the drill rig operator). The FSO has the authority to enforce safety on the drilling site. A rig worker's first safety responsibility is to listen to the safety directions of the FSO. Responsibilities specific to the FSO include:

- Understanding and communicating proper maintenance of tools and equipment and general "housekeeping" on the drill rig to promote and ensure a safe work environment.
- Ensuring the operator (who may be the safety supervisor) has had adequate training and exposure to the drill rig, operating controls, and operating capabilities.
- Inspecting the drill rig daily for structural damage, loose bolts and nuts, proper tension of chain drives, loose or missing guards or protective covers, fluid leaks, damaged hoses, and or damaged pressure gauges and pressure relief valves.
- Checking and testing all safety devices, such as emergency shutdown switches, at least daily and preferably at the start of a drilling shift. Drilling should not be permitted until all emergency shutdown and warning systems are working correctly.
- Ensuring that emergency devices are not wire-grounded, bypassed, or removed.
- Checking that all gauges, warning lights, and control levers are functioning properly and listening for unusual sounds upon starting the engine.
- Ensuring that all new drill rig workers are informed of safe operating practices on and around the drill rig and that each new employee reads and understands the safety and operations and maintenance manuals.
- Instructing a crew worker in drilling safety and observing the new worker's progress towards understanding safe operating practices.
- Ensuring that there is a first-aid kit, blood borne pathogen kit, and a fire extinguisher on each drill rig and on each additional vehicle and ensuring that they are properly maintained.
- Ensuring that crew members are well trained and capable of using first-aid kits, fire extinguisher, and all other safety devices and equipment.

3.0 SAFETY DURING START-UP AND DRILLING OPERATIONS

The Brice project manager (PM) and safety personnel are responsible for determining the appropriate procedures to be followed to ensure drilling work is performed safely, and must review local, state, and

federal laws and regulations that are applicable to each project. If required, client drilling guidelines and/or procedures will be implemented.

Prior to drilling, the PM and FSO will ensure that an Accident Prevention Plan and/or Site-Specific Health and Safety Plan and Activity Hazard Analyses have been developed. Drill rigs must be operated safely in accordance with manufacturer's operating procedures.

The FSO observes drilling start-up and operations to ensure adherence to safety requirements. The operator must not attempt to exceed manufacturers' ratings of speed, force, torque, pressure, flow, etc. The drill rig and tools must be used only for the purposes for which they are intended and designed.

3.1 Utilities

Safety requirements established in the *Underground Utilities Locate* SOP (BE-SOP-25) must be observed during drilling operations.

3.2 Personal Protective Equipment (PPE)

For most drilling projects, PPE will include a safety hard hat, safety shoes, safety glasses, and close-fitting but comfortable clothes, without loose ends, straps, draw strings, belts, or otherwise unfastened parts that might catch on some rotating or translating component of the drill rig. Rings and jewelry should not be worn during work shifts.

For some drilling operations, the environment or regulations may dictate additional PPE be used. The design and composition of the PPE must be determined jointly by the management of the drilling organization and the FSO. Such equipment might include, but is not limited to, face, ear, or reflective clothing protection. Each drill rig worker should wear noise reducing ear protectors when appropriate. When drilling is performed in chemically-or radiologically- contaminated ground, special protective equipment and clothing may be required. Additional information regarding PPE is provided in the project Accident Prevention Plan and/or Site-Specific Health and Safety Plan. The client can also have specific requirements concerning PPE. This must be addressed prior to any work and included in the Site-Specific Health and Safety Plan.

3.3 Housekeeping and Drill Rig Maintenance

It is critical for safe field operations that the FSO understands and fulfills the responsibility for maintenance and housekeeping on and around the drill rig. General housekeeping requirements are established in the *Housekeeping* SOP (BE-SOP-57).

3.4 Clearing the Work Area

Prior to drilling, adequate site clearing and leveling should be performed in accordance with the *Clearing, Grubbing Operations* SOP (BE-SOP-58) to provide a safe working area.

3.5 Saftey During Travel

The individual who transports a drill rig on and off a drilling site must observe traffic safety requirements established in the *Site Traffic* SOP (BE-SOP-59).

3.6 First Aid

A first-aid kit will be available and well maintained on each drill site. At least one or more members of each drill crew will be trained to perform first aid. Training should be provided or sponsored by the American Red Cross or a similar organization. For drilling operations, it is particularly important that the individual responsible for first aid be able to recognize the symptoms and be able to provide first aid for electrical shock, heart attack, stroke, broken bones, eye injury, and cuts or abrasions to the skin.

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STANDARD OPERATING PROCEDURE

BE-SOP-79

Waste Management

1.0 INTRODUCTION

This standard operating procedure (SOP) includes general procedures for managing wastes generated during environmental investigation and removal activities. The primary objective of this SOP is to provide general guidance and management tools for managing wastes generated during investigation and removals in accordance with applicable regulatory requirements. This plan provides general procedures for characterizing, accumulating, tracking, transporting, and disposing of waste consistent with regulations and contractual agreements.

The following guidelines have been developed for collecting, storing, and disposing of wastes derived from investigation activities. Investigation-derived waste (IDW) generated during typical field work may include the following:

- IDW soil, consisting of drill cuttings and soil produced during soil boring
- Aqueous IDW from equipment decontamination and purged groundwater
- Other IDW consisting of personal protective equipment (PPE), spent sampling materials (e.g., direct-push liners), plastic sheeting, and general refuse (e.g., paper towels and plastic)
- Recyclable materials

This document describes general waste management requirements, as well as procedures for handling IDW, offsite shipment of waste and materials, and recordkeeping.

Note regarding per- and polyfluoroalkyl substances (PFAS): Department of Defense (DoD) has special guidelines for the destruction of materials containing PFAS. See Section 4.10 of the Work Plan for details.

2.0 REGULATORY PROGRAM

Site work will be conducted in a manner consistent with the ADEC regulations, Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) regulations, RCRA, TSCA, USDOT, and other bodies of regulation as applicable. Under CERCLA, onsite activities must meet applicable or relevant and appropriate requirements (ARARs) of federal and state regulations and laws. CERCLA Section 121 further states that only substantive requirements of these regulations and laws are ARARs for onsite activities.

Offsite activities (e.g., offsite waste transportation and disposal) must meet all substantive and administrative requirements.

The regulations considered in the development of this SOP include, but are not limited to, those described in the following sections.

2.1 Resource Conservation and Recovery Act

The regulations set forth in Title 40, Code of Federal Regulations (40 CFR), Parts 239 through 299 are known as the Resource Conservation and Recovery Act (RCRA) or the Solid Waste Disposal Act. These regulations set forth requirements for determining whether a waste is considered a RCRA-hazardous waste based on the process generating the waste (listed hazardous waste) or determined by analyses (characteristic hazardous waste). RCRA further defines federal waste management requirements, including storage, labeling, transport, and disposal.

The following parts apply to wastes that will be generated during the investigation activities:

- 40 CFR 260 defines solid and hazardous waste under RCRA.
- 40 CFR 261 provides federal regulations for hazardous identification and classification for RCRA hazardous waste.
- 40 CFR 262 provides federal regulations for storing, shipping, labeling, and reporting for RCRA hazardous waste.

2.2 U.S. Department of Transportation

Requirements under 49 CFR 171 to 178 will apply to all offsite shipments of United States Department of Transportation (DOT) hazardous materials or hazardous waste. It is the responsibility of an appropriately trained individual to verify that the requirements of 49 CFR 171 to 178 are met. All personnel involved with packaging and transportation of hazardous materials (as defined by 49 CFR 171) must be trained in accordance with 49 CFR 172.700 to 800. The Project Manager will verify that staff handling and managing waste have the appropriate training.

2.3 Toxic Substances Control Act

The United States Environmental Protection Agency (EPA) regulates multiple chemicals through regulations provided in 40 CFR 761 (i.e., Toxic Substances Control Act [TSCA]).

3.0 INVESTIGATION-DERIVED WASTE

Wastes will be managed based on media type. The sections below establish these management practices. All IDW will be managed in accordance with the federal, state, and local regulations.

3.1 Soil

Soil cuttings generated during field activities will be managed following an approved method as specified in the project-specific QAPP Worksheet #14/16.

3.2 Liquids

All monitoring well development and purge water, and decontamination water should be disposed of following an approved method as specified in the project-specific QAPP Worksheet #14/16.

3.3 Other Waste

It is expected that PPE, disposable sampling equipment (direct-push liners), and other field-related items will be generated during field activities. These may include, but are not limited to, the following items:

- Gloves (nitrile or otherwise)
- Chemical-resistant coveralls (Tyvek or otherwise)
- Disposable plastic direct-push liners
- Plastic buckets
- Paper towels
- Plastic sheeting

These materials will be generated in small quantities during field activities. It is assumed that used materials will be municipal solid waste and will be accumulated and disposed of as such. Unused equipment or equipment that can be decontaminated will be reused to the extent practicable. If any of the above noted items come into contact with hazardous wastes, they will be containerized separately and disposed of using generator knowledge along with the hazardous waste media.

4.0 WASTE CHARACTERIZATION

Waste classification determinations will be made using process knowledge and laboratory analysis. Brice field personnel will be responsible for segregating potentially hazardous wastes from nonhazardous wastes onsite. Additionally, incompatible wastes (e.g., flammable and corrosive wastes) will be segregated. Wastes of the same matrix, compatible contamination, similar contaminant concentrations, and source may be aggregated to facilitate accumulation and disposal. Do not mix wastes with different expected contaminants or contaminant concentrations; this could cause additional wastes to be disposed of as hazardous waste.

Uncontaminated waste such as general trash will be characterized using process knowledge and generally will be classified as municipal solid waste.

4.1 Waste Characterization Sampling

Waste characterization will be conducted during the field investigations at the sampling frequency and analyses specified in the approved project-specific UFP-QAPP.

5.0 GENERAL WASTE MANAGEMENT REQUIREMENTS

IDW will be accumulated in containers in an area identified or approved by the facility point-of-contact. IDW accumulation areas will contain appropriate emergency response equipment. The Project- specific Health and Safety Plan identifies the specific emergency response procedures and equipment. Spill control equipment (e.g., sorbent pads) will be available in the IDW accumulation areas and where liquids are transferred from one vessel to another.

Containers will be inspected upon arrival at the site to confirm that the equipment is not in disrepair and does not contain any contamination or contents. If a container is in disrepair, is contaminated, or already contains a waste, it will be immediately rejected and documented.

5.1 Supersacks and Other Soil Containers

Supersacks will be labeled on at least two sides with a unique ID that will be tracked daily. Supersacks will be stored at each site or accumulated in a central area as identified in the site specific workplan. If any tears or rips are observed in the outside layer of the supersacks, they will be overbagged in a new supersack as soon as possible, which will be relabeled with the same ID.

Large accumulations of supersacks (>50) must be tracked by location, so that hazardous supersacks can be pulled from the accumulation area and stored separately. Supersacks that are expected to be hazardous must be stored separately and labeled with a Hazardous Waste sticker, with all relevant information included. Spray adhesive may be used to adhere Hazardous Waste stickers.

5.2 Small Containers/Drums

The following guidelines relate to drums and small non-bulk containers:

- Only new drums will be used. Do not use reconditioned drums purchased from an outside source. It is acceptable to reuse new drums from the site that are in good condition and have been steam cleaned.
- Drum will have UN approval numbers embossed on the bottom or stenciled on the side.
- Drums should either be 1A1 non-removable-head-type drums with bungs for liquids or 1A2 removal-head-type drums without bungs for solids or liquids. Bung holes in the lid are acceptable for special applications, but bung holes in the side of the drum are never acceptable.
- No penetrating dents are allowed that could affect the integrity of the drum. Pay special attention to any dents at the drum seams. Use the highest level of integrity standards for drums intended to contain liquids.
- Each drum will be provided with its own label, and labels will be visible.
- Drums will remain covered/closed except when removing or adding waste to the drum. Lids should fit correctly, and the gasket must be in good condition. Lids will be properly secured at the end of each workday. Closed means rings on, bolts tightened down.
- All bungs are tight and closed when not adding or removing waste.
- Drums will be disposed of with the contents. If the contents are removed from the drums for offsite transportation and treatment or disposal, then the drums will be decontaminated prior to reuse or before leaving the site.
- Drums containing liquids or hazardous waste will be provided with secondary containment and may not be located near a storm water inlet or conveyance.
- The outside of the drums must be free of any residues.
- Adequate aisle space (e.g., 30 inches) will be provided for containers such as 55-gallon drums or Super Sacks to allow the unobstructed movement of personnel and equipment. A row should be no more than two containers wide.
- When possible, containers will be segregated by waste type and accumulation dates.

Brice field personnel responsible for the work at each site will perform the following tasks:

- Inspect all drums on arrival and document the inspection on the Drum Inspection Checklists (Attachment 1). All drums not meeting the necessary standards will be rejected by field personnel, and any rejections will be documented on the Container Inspection Checklists.
- Document the delivery of drums containing waste to the accumulation area on a waste tracking log.
- Confirm that drums are not filled greater than two-thirds capacity.
- Once filled, inspect drums to verify that lids are closed and secured when not actively being filled.

5.3 Container Labeling

Brice field personnel will be responsible for labeling waste containers in accordance with RCRA. Labels will include the type of waste, location from which the waste was generated, and the accumulation start date.

Brice field personnel will be responsible for labeling waste containers and stockpiles as follows:

- At the point of generation, waste will be labeled as “Analysis Pending” or “Waste Material” (or similar). This label will be used until the analytical results are received and reviewed. This label will include the accumulation start date, site/source location, project name, project number, IDW type (contaminants), and field observations.
- Waste drums will be transferred to the facility-identified temporary location **daily**, when a drum becomes three-quarters full of compatible material, at the completion of work at a site where multiple drums have been generated, and prior to receipt of analytical results. Once the analytical results are received and a waste classification is made, “Analysis Pending” labels will immediately be replaced with one of the following labels:
- EXAMPLE:
  - “Hazardous Waste”: Preprinted or handwritten labels with the following information:
    - Accumulation start date (date waste first placed into the container)
    - Generator name
    - Generator address
    - Phone number (Brice Project Manager)
    - United States Environmental Protection Agency (EPA) identification (ID) number:
    - RCRA waste code(s) (to be determined)
    - Proper DOT shipping name (to be determined)
    - Before transport, the manifest number must be added (for containers of less than 110-gallon capacity)
  - “Non-Hazardous Waste”: Handwritten or pre-printed labels with the following information:
    - Generator name
    - Generator address
    - Phone number (Brice Project Manager)
    - Waste-specific information (e.g., contaminated soil)

Examples of nonhazardous and hazardous waste labels are shown below:





5.4 Waste Accumulation Time Limits

Hazardous wastes may only be accumulated for 90 days from the accumulation start date (the date that first waste is placed into a container). Other wastes will be removed from the site as soon as possible.

The date of generation (or accumulation start date) is the day that a waste is first placed in a container (e.g., drum, roll-off box, or portable tank, or in a stockpile outside of the Area of Contamination).

In situ sample results used for waste characterization will be obtained as soon as possible after the waste is generated to prevent exceeding the 90-day limit in the event that waste is characterized as hazardous.

5.5 IDW Accumulation Area Inspections

IDW accumulation areas will be inspected at least weekly for malfunctions, deterioration, discharges, and leaks that could result in a release. Any deficiencies observed or noted during inspection will be corrected immediately. Appropriate measures may include transfer of waste from a leaking container to a new container, replacement of liner or cover, or repair of containment berm.

Inspections will be recorded. Any deficiency and an explanation of the deficiency correction(s) will be documented. Copies of the report will be maintained onsite and available for review. An accumulation area inspection form is provided in Attachment 1.

5.6 Waste Tracking Log

A project-specific waste tracking log will be used to track waste from generation to final disposition.Wastes will be logged on this form the day waste is generated and placed into containers. Transportation of wastes will be inventoried the day of transportation from the site using the waste tracking log.

6.0 OFFSITE SHIPMENT OF WASTE AND MATERIALS

Hazardous or nonhazardous wastes or recyclable materials generated during project activities will be handled in accordance with industry standards and state and federal regulations as specified in the approved project-specific Work Plan. Applicable regulations include, but are not limited to, the following:

- RCRA: 40 CFR 260, 261, 262, 263, 268, and 279
- TSCA: 40 CFR 761
- Hazardous Materials Transportation Act: 49 CFR 171-179
- 18 AAC 60, Solid Waste Management
- 18 AAC 62, Hazardous Waste

6.1 Shipping Requirements

Prior to offsite disposal of any waste, an approval package for each waste stream will be prepared. This package will include a waste profile naming the generator of the waste, analytical summary table(s) applicable to the waste, land disposal restriction (LDR) notification for any hazardous wastes, a completed waste manifest (when possible), and any other applicable information necessary for the generator to complete its review and sign the disposal package.

The signed profile will then be submitted to the designated offsite facility operator for acceptance and approval. Once the approval letter is received from the designated facility operator, transportation can be scheduled.

RCRA hazardous wastes must be transported using a uniform hazardous waste manifest and must be manifested separately from non-RCRA wastes. A nonhazardous waste manifest will be used for non-RCRA wastes. When possible, manifests will be preprinted before mobilization to the field. The generator requires 72 hours to review and approve pre-printed manifests.

When items are added or changed in the field, a copy of the manifest will be transmitted to the generator by fax, allowing reasonable time for review and approval. At the discretion of the generator, some nonhazardous wastes can be shipped on a bill-of-lading only. Wastes (hazardous or nonhazardous) that cannot be recycled or otherwise used will be manifested to a treatment, storage, and disposal facility (TSDF) permitted by EPA. The TSDF will meet the requirements for TSDFs as identified in 40 CFR 264–268.

Additionally, each shipment of waste will have a weight ticket. An LDR notification/certification is also required for hazardous wastes. This form also requires the generator's signature and submission to the designated facility.

6.2 Manifests

Hazardous and nonhazardous materials, substances, or wastes identified for handling and removal from the site will be packaged, labeled, marked, and manifested according to applicable state and federal regulations (40 CFR 263). The generator will sign the manifest after verifying its accuracy and completeness.

Brice will submit generator copies of manifests to the facility owner/operator. The original generator copy of the hazardous waste manifest signed by transporters and the TSDF, as well as certificates of disposal, destruction, and/or treatment, will be provided to the owner/operator.

The manifest form will also include the following information:

- Transporter information including name, address, contact name and telephone number, and EPA ID number
- Designated facility information including name, address, telephone number, and EPA ID number
- Site name including street and mailing address (if different)
- DOT proper shipping name (e.g., UN 3077, Hazardous Waste Solid, n.o.s., 9, PG III [D008])
- Type and number of container(s)
- Quantity of waste (volumetric estimate)
- Task order or job number
- Profile number
- 24-hour emergency phone number

Brice will be responsible for the following:

- Obtaining necessary profiles
- Preparing exception reports when required by 40 CFR 262.42 and 40 CFR 761.215
- Preparing LDR notification forms (required for hazardous waste)
- Confirming that the waste (both hazardous and nonhazardous) is ultimately disposed of at the designated facility

RCRA and non-RCRA wastes will be manifested separately. TSCA wastes will also be manifested separately. Manifests, shipping papers, and profiles will be submitted to the generator for review a minimum of 3 full working days before shipping offsite. The contractor will provide the generator a copy of the manifest.

The generator and the transporter must sign the manifest prior to the load of waste leaving the site. The original signed manifest will be returned to the address of the generator.

If the signed hazardous waste manifest from the designated facility is not received within 35 days, the generator must contact the transporter or the designated facility to determine the status of the waste.

6.3 Transportation

Each transportation vehicle and load of waste will be inspected and documented before it leaves the site. The quantities of waste leaving the site should be recorded on a transportation and disposal log. A contractor licensed for commercial transportation will transport nonhazardous wastes. When wastes are hazardous, the transporter will have an EPA identification number, and will comply with transportation requirements outlined in 49 CFR 171-179 (DOT) and 40 CFR 263.11 and 263.31 (Hazardous Waste Transportation).

The transporter will be responsible for weighing loads at a certified scale. For each load of material, weight measurements will be obtained for each full and empty container, dump truck, or tanker truck. Disposal quantities will be calculated as the difference between the weight of the full and empty container or dump truck. Weights will be recorded on the waste manifest.

The transporter must notify Brice immediately of any delays, problems, or violations of transport regulations that may occur during transport of materials. Additionally, the transporter will observe the following practices when hauling and transporting wastes offsite:

- Minimize impacts to general public traffic
- Repair road damage caused by construction and/or hauling traffic
- Clean up waste spilled in transit
- Line and cover trucks and trailers used for hauling contaminated waste to prevent releases
- Decontaminate vehicles prior to reuse
- Personnel involved in offsite disposal activities will follow safety and spill response procedures outlined in the Health and Safety Plan.
- No materials from other projects will be combined with materials from these sites.

7.0 SECURITY/EMERGENCY/RESPONSE

Site access in all working areas will be limited to authorized personnel during work activities. A sign-in log will be maintained by the Brice Field Team Leader for documenting entry and exit of all personnel.

Waste accumulation areas (temporary waste staging at the work area) will contain emergency response equipment and spill equipment appropriate to the wastes' hazards. Signage will be included that provides 24-hour emergency response contact and phone number. The Health and Safety Plan identifies the project emergency response procedures and equipment, including emergency response contacts and phone numbers.

In addition to the Health and Safety Plan procedures, hazardous waste accumulation areas, if needed, will be provided with (1) fire extinguishers if wastes known or suspected to be flammable or ignitable are present, (2) decontamination equipment, and (3) radio equipment available to all staff working in accumulation areas. Spill control equipment (e.g., sorbent pads) will be available in the waste accumulation areas and where liquids are transferred from one vessel/container to another.

8.0 SPILLS DURING WASTE HANDLING

All spills will be reported internally as indicated in the Site-specific Health and Safety Plan. Refer to this plan for emergency response procedures and additional reporting requirements. The definition of a release includes any "spilling, leaking, pumping, pouring, emitting, emptying, discharging, injecting, escaping, leaching, dumping, or disposing into the environment (including the abandonment or discarding of barrels, containers, and other closed containers)" of any potentially hazardous chemical, substance, and/or material.

It is important that the Project Manager also be immediately notified of spills/releases and other environmental compliance-related incidents (e.g., permit exceedance, notice of violation, and regulatory violation) or near-loss environmental incidents. The Project Manager will evaluate the spill or release to determine agency reporting requirements (e.g., National Response Center or state agency). Immediate internal spill reporting is critical to assure compliance applicable agency spill reporting requirements because EPA requires that certain spills/releases be reported within 15 minutes. Any spills or releases that occur during the project will be reported as required by 18 AAC 75/18 AAC 78.

Spill control equipment (e.g., sorbent pads) will be available in the waste accumulation areas and where liquids are transferred from one vessel to another. Sorbent used on spills of ignitable wastes/materials should not be used past their capacity and will be containerized with additional sorbent or overpacked to prevent draining of liquid. Any fire protection provisions outlined in the Site-Specific Health and Safety Plan must be adhered to.

9.0 TRAINING

Field staff who will manage hazardous or potentially hazardous IDW, including the preparation of shipping documents (e.g., manifests), will meet the hazardous waste generator training requirements of 40 CFR 265.16 and DOT (49 CFR 171 – 179) through the following:

- Occupational Safety and Health Administration 1910.120 Hazardous Waste Operations and Emergency Response training
- On-the-job training, including the following:
  - Site-Specific Health and Safety Plan review, which requires each site worker and guest to review and sign the plan
  - Activity hazard analysis and daily safety meetings
  - Project-Specific UFP-QAPP review

10.0 RECORDKEEPING

The following records and documents will be maintained:

- Transportation and offsite disposal documentation, including:
  - Copies of the profiles and associated characterization data
  - The transporter-signed manifest as well as the fully executed manifests, and copies of the following: LDR notifications and certifications, bills of lading, and weight tickets
  - Designated offsite facility waste receipts and certificates of disposal or destruction
- Training records
- Inspection records

11.0 REFERENCES

Alaska Department of Environmental Conservation (ADEC). 2022. *Field Sampling Guidance.* January.

ATTACHMENTS

Inspection Forms

INCOMING DRUM INSPECTION FORM

Project: _____

Drum arrival date: _____

Number of drums: _____

Inspector/company: _____

DRUM IS IN GOOD CONDITION, NO RUST OR HOLES	**Y**	**N**
Residual contamination/waste/material in or on drum (look under liner if installed):		
Drum has UN Code on bottom		
Drum has lid that fits		
Drum ring and bolt are in place and function		

Example of Full UN code: 1A1/Y1.4/150/10 USA/M1234 3 mm

1A1 = Packaging identification code Y1.4 = Y = performance code

1.4 = maximum specific gravity 150 = hydrostatic test pressure

10 = year manufactured USA = country of origin

M1234 = manufacturers registered symbol 3 mm = minimum thickness for reuse

Please include photos of any unsatisfactory items.

Comments (if rejected include why) :

Drums accepted: signature of inspector _____

Drums rejected: signature of inspector _____

WASTE STORAGE INSPECTION FORM

INSPECTION DATE: _____

PROJECT NAME/LOCATION: _____

PROJECT NUMBER:	**INSPECTOR:**

Are all containers clearly and properly labeled (Analysis Pending, Haz/Non-Haz, Non-Potable Water, PCB, etc.) and labels visible?	YES	NO	N/A
Accumulation start date marked on containers?	YES	NO	N/A
Hazardous Wastes are stored in designated area for 90 days or less	YES	NO	N/A

IF NO, *Provide container ID#:* _____

Confirm the status of the container and affix the appropriate label IMMEDIATELY.

Drums: in good condition (no holes, rust, etc.?) Are lids in place and bolted?	YES	NO	N/A

IF NO, *Provide container ID#:* _____

Describe corrective action or explain why drum is not closed: _____

Portable tanks: in good condition? Are lids in place, valves closed?	YES	NO	N/A

IF NO, *Provide container ID#:* _____

Describe corrective action or explain why tank is not closed: _____

Roll-off boxes: in good condition? Are the tarps/covers in good condition and securely fastened?	YES	NO	N/A

IF NO, *Provide container ID#:* _____

Describe corrective action or explain why roll-off is not closed: _____

Soil stockpiles, is liner and berm secure and intact?	YES	NO	N/A
Cover is in place and secure?	YES	NO	N/A

IF NO, *Provide container ID#:* _____

Describe corrective action or explain why stockpile not lined and covered: _____

Secondary containment, are there signs of failure? (ripped liner, liquids on ground around tank, stained soil)	YES	NO	N/A
IF YES, *Provide container ID#:*			
Estimate quantity of material released:			
Affected surface:			
Describe corrective action:			
REPORT TO PM; COMPLETE HITS REPORT			
Is there evidence of release from the waste containers (liquid in secondary containment, etc.)?	YES	NO	N/A
IF YES, *Provide container ID#:*			
Estimate quantity of material released:			
Describe corrective action:			
EMERGENCY RESPONSE EQUIPMENT:			
Telephones/radios easily accessible in case of emergency and working?	YES	NO	N/A
Is unused absorbent material nearby for spill control?	YES	NO	N/A
Decontamination equipment available? PPE available?	YES	NO	N/A
Is fire extinguisher accessible, fully charged and seal intact?	YES	NO	N/A
IF NO, *Provide Area:*			
Describe corrective action:			
Confirm that there is unobstructed access to all containers.	YES	NO	N/A
IF NO, *Describe corrective action:*			
Are the areas around the containers free of material or other debris?	YES	NO	N/A
IF NO, *Provide container ID#:*			
Describe corrective action:			
Is the Waste Tracking Log up to date and reflect what is in the waste storage area?	YES	NO	N/A
If no, please update the waste tracking log immediately.			

Notes:
Containers = drums, rolloffs, frac tanks, poly tanks, etc.

STANDARD OPERATING PROCEDURE

BE-SOP-87

Working with Hand Tools

1.0 INTRODUCTION

This standard operating procedure (SOP) is for all individuals who will work with hand tools.

2.0 GUIDELINES

Hand tools must be kept in proper working order. All tools must be inspected before each use and all employees must be trained to use tools with proper safety.

3.0 TOOL USE

Hand tools will be kept in good condition (undamaged handles and proper working edges) that are not cracked or mushroomed with the potential to chip or create flying objects.

When using hand tools, the tools will:

- Be used within their designated capacity,
- Not be carried or left in a position that could cause injury to employees,
- Be put in storage when work is finished,
- Disconnected from their sources and pressures in lines released prior to any repair work.

4.0 PERSONAL PROTECTIVE EQUIPMENT

It is critical to use proper personal protective equipment (PPE) when using hand tools. When using hand tools, proper PPE will be implemented:

- Glove selection based on hand tool: leather work gloves versus cut resistant; and
- Safety glasses with side shields

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APPENDIX E
FIELD FORMS

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SOIL BORING LOG

Sheet _____ of _____

Project:	Project Number:	Client:	Boring No.
Address, City, State		Drilling Contractor:	
Logged By:	Date: Started:	Drilling Method and Equipment Used:	
Drill Crew:	Completed:		
	Backfilled:		
	Groundwater Depth:	Elevation:	Total Depth of Boring:

Depth (feet)	Sample Interval	Inches Driven	Inches Recovered	PID (ppm)	Time	**Soil Description:** Soil Name, USCS Group Symbol, Color, Relative Density or Consistency, Soil Structure, Moisture Content, Mineralogy, additional facts
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						

Civil Engineering

FIELD NOTES FROM DRILLING

Date:_____ End Time:_____ Start Time:_____

Notetaker Name:_____ Boring No.:_____

Surface conditions:

SOIL BORING LOG

Sheet _____ of _____

Project:	Project Number:	Client:	Boring No.
Address, City, State		Drilling Contractor:	
Logged By:	Date: Started:	Drilling Method and Equipment Used:	
	Completed:		
Drill Crew:	Backfilled:		
	Groundwater Depth:	Elevation:	Total Depth of Boring:

Depth (feet)	Sample Interval	Inches Driven	Inches Recovered	PID (ppm)	Time	**Soil Description:** Soil Name, USCS Group Symbol, Color, Relative Density or Consistency, Soil Structure, Moisture Content, Mineralogy, additional facts
1						
2						
3						
4						
5						
6						
7						
8						
9						
10						
11						
12						
13						
14						
15						
16						

SOIL BORING LOG

Sheet _____ of _____

Project:	Project Number:	Client:	Boring No.

Depth (feet)	Sample Interval	Inches Driven	Inches Recovered	PID (ppm)	Time	**Soil Description:** Soil Name, USCS Group Symbol, Color, Relative Density or Consistency, Soil Structure, Moisture Content, Mineralogy, additional facts
17						
18						
19						
20						
21						
22						
23						
24						
25						
26						
27						
28						
29						
30						
31						
32						
33						
34						
35						
36						

Waste Tracking Form (Example)

Container Type	Container Number	Date of Origination	Origin (Site)	Waste Stream Description	Media	Approximate Quantity	Unit	Waste Characterization Sample ID	Manifest Number	Date Shipped	Final Disposition

Chain-of-Custody Report

Collection Organization: **Chain-of-Custody:** **Cooler ID:** **NPDL Number:**

Project Number: **Laboratory:** **Bill To:** **Report To:**

COC Sample ID	Loc ID	Collection Date	Collection Time	Sampler	Quantity	Type	Volume	Preservative	Matrix	Analyses Requested Group	QC	TAT	Notes:

Special Instructions:

Relinquish By: Signature/Printed Name Date/Time

Relinquish By: Signature/Printed Name Date/Time

Received By: Signature/Printed Name Date/Time

Received By: Signature/Printed Name Date/Time

WELL DEVELOPMENT FORM

WELL ID:_____

Project Name:		Total Depth (BTOC):	
Project Number:		Depth to Water (BTOC):	
Sampling Team:		Water Column (ft):	
Date:		Casing Volume (gal):	
Start Time:		Screen Interval:	
End Time:		Measured Stick-up:	
Depth to Top of Product (BTOC):		Depth to Oil/Water Interface (BTOC):	

Diameter	Volume (gal/lin ft)
1"	0.041
2"	0.163
3"	0.367
4"	0.653
8"	2.61

Method of Purging (circle one):

Pump: SUB BLDR PERIST OTHER:	Bailer: TEFLON SS OTHER:
Pump Type: Flow Rate (gpm):	Required Pulls:
Pump Time:	Vol. Purged (gal):

WELL DEVELOPMENT DATA

Activity (surge, purge, recovery)	Time	Water Level (ft BTOC)	Drawdown (ft BTOC)	Cumulative Purged Volume (gal)	Turbidity (NTU)	Notes (clarity, odor, color, particulates, etc)

Note: Well is developed when 1) GW is clear to the unaided eye, **or** 2) turbidity is <100 NTU, **or** 3) TD is re-established due to sediment removal, **or** 4) 3 GW parameters have stabilized (4, if using temperature).
If well can be purged dry: first purge well dry, then allow to refill with formation water. If recovery rate is too slow, add up to one well casing volume of potable water. With water in well, surge for approximately 10 minutes. Add more water, as necessary. Purge well dry again to complete the development process.
The goal of well development is to repair damage caused during drilling and well implacement to the area immediately adjacent to the well to ensure proper hydraulic connection to the aquifer.

Comments:

References: ADEC, 2013. Monitoring Well Guidance, September.
ASTM D5521, 2018. Standard Guide for Development of Ground-Water Monitoring Wells in Granular Aquifers. ASTM International.

PID Calibration Log

Project Name/Location:

Project Number:

Equipment Make and Model:

Serial Number:

Calibration Gas: Isobutylene

Date	Zero/Fresh Air (ppm)		Span {ppm)		Initials	Date	Zero/Fresh Air (ppm)		Span (ppm)		Initials
	Standard	Reading	Standard	Reading			Standard	Reading	Standard	Reading	

Record of Well Construction

Project	Project Number	Client	Boring No.
Address, City, State		**Drilling Contractor**	

Logged by	Date	Started	Drilling Method and Equipment Used
Drill Crew		Completed	
	Groundwater Depth	Elevation	Total Depth

Depth (feet)	Diagram	Field Installation Information
		_____ Surface Monument (material _____)
		_____ Surface Seal
		_____ Bentonite Seal
		_____ Casing (material _____)
		_____ Screen (material _____)
		_____ Screen Filter (material _____)
		_____ Surface Elevation
		_____ Casing Elevation
		_____ Casing Stickup
		_____ Depth of Well
		_____ Depth of Boring
		_____ Depth to Groundwater from _____ on (date) _____
		Development Method _____
		Development Time and Purge Volume _____

Record of Well Construction

Field Notes from Drilling		
Date	End Time	Start Time
Note-Taker Name		Boring Number
Surface Conditions		

Turbidity Meter Calibration Verification Check

Project Name/Location: _____

Project Number: _____

Equipment Make and Model(s): _____ & _____

Date	Time	Serial #:			Serial #:			Initials
		_____NTU	_____NTU	_____NTU	_____NTU	_____NTU	_____NTU	

Date	Time	Serial #:			Serial #:			Initials
		_____NTU	_____NTU	_____NTU	_____NTU	_____NTU	_____NTU	

WELL PURGE AND SAMPLING FORM

SITE ID: **WELL ID:** **PAGE:** **of**

PROJECT NAME	**WELL CONDITION**	**DIAMETER**	**O.D.**	**I.D.**	**VOLUME (GAL/LIN FT)**
CLIENT	**DAMAGE PRESENT**	1" Sch40	1.315"	1.049"	0.05
SITE	**DEPTH TO WATER (FROM TOC)**	2" Sch40	2.375"	2.067"	0.17
SAMPLER(S)	**TOTAL DEPTH (FROM TOC)**	3" Sch40	3.5"	3.068"	0.38
WEATHER/ TEMPERATURE	**HEIGHT OF WATER COLUMN**	4" Sch40	4.5"	4.026"	0.66
DATE	**1 WELL VOLUME**	6" Sch40	6.625"	6.065"	1.5
START TIME	**3 WELL VOLUMES**	8" Sch40	8.625"	7.981"	2.6
END TIME	**DROWNED SCREEN?**	2" Sch80	2.375"	1.939"	0.15

SAMPLING DATA

SAMPLE TYPE (GW, PRODUCT, OTHER):

COLLECTION METHOD: PUMP TYPE, OTHER

SAMPLING APPARATUS

TUBING SIZE/TYPE:

IF PRODUCT IS PRESENT **DESCRIPTION:**

DEPTH TO PRODUCT (ft FROM TOC): **THICKNESS OF PRODUCT (ft):**

EQUIPMENT DECON PROCEDURE:

FLOW RATE		**SET DEPTH OF TUBING (ft btoc or ft btow)**
Purging		
Sampling		

SAMPLING NOTES:

1000 mL/min = 0.264 gal/min

1 gal/min = 1893 mL/min

1 gal = 3.785 L **1 L = 0.264 gallons**

DURING SAMPLING:

IF USING HYDRASLEEVE: DEPLOYED AT DEPTH (FT BTOC): DEPTH TO WATER AT TIME OF DEPLOYMENT (FT BOTC):

BOTTLE LOT NUMBER/S:

EQUIPMENT SERIAL NUMBERS: **YSI** **Turbidimeter** **Other**

FIELD WATER QUALITY PARAMETERS

Time	**Cumulative Purged Volume (Gallons)**	**Water Level (ft BTOC)**	**Draw Down**	**Temperature (°F or °C)**	**pH**	**Conductivity (µS/cm)**	**ORP (mV)**	**D.O. (mg/L)**	**Turbidity (NTU)**	**Color**	**Odor**
				± 3% (min ±0.2°C/0.36°F)	± 0.1	± 3%	± 10mV	± 10% or 0.2 mg/L	± 10% or min 1		

FINAL PURGE DATA: **START TIME:** **END TIME:** **CUMULATIVE VOLUME:** **MAX FLOWRATE WITH STABLE DRAWDOWN:**

ANALYTICAL SAMPLE INFORMATION

SAMPLE DESCRIPTION: (color, free product, odor, turbidity)

Sample ID	**Date**	**Time**	**Matrix**	**Containers**	**QC**	**Analysis/ Preservative**									**Remarks**

YSI Calibration Log

Project Name/Location: _____

Project Number: _____

Equipment Make and Model(s): _____ & _____

Serial Number(s): _____ & _____

Serial Num.	Date	Temp.	pH (3 pt.)		Cond. (us/cm)		ORP (mV)		DO (100%)		Initials
			Standard	Reading	Standard	Reading	Standard	Reading	Atm. Press. (mmHg)	Reading (%)	

Serial Num.	Date	Temp.	pH (3 pt.)		Cond. (us/cm)		ORP (mV)		DO (100%)		Initials
			Standard	Reading	Standard	Reading	Standard	Reading	Atm. Press. (mmHg)	Reading (%)	

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APPENDIX F
LABORATORY CERTIFICATIONS AND STANDARD OPERATING PROCEDURES

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CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

Pace Analytical – South Carolina

106 Vantage Point Drive
West Columbia, SC 29172

Fulfills the requirements of

ISO/IEC 17025:2017

and the

U.S. Department of Defense (DoD) Quality Systems Manual for Environmental Laboratories (DoD QSM V5.4)

In the field of

TESTING

This certificate is valid only when accompanied by a current scope of accreditation document.
The current scope of accreditation can be verified at www.anab.org.

Jason Stine, Vice President

Expiry Date: 18 November 2025

Certificate Number: L2224

This laboratory is accredited in accordance with the recognized International Standard ISO/IEC 17025:2017.
This accreditation demonstrates technical competence for a defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

and

U.S. Department of Defense (DoD) Quality Systems Manual for Environmental Laboratories (DoD QSM V5.4)

Pace Analytical – South Carolina

106 Vantage Point Drive
West Columbia, SC 29172
Erin Boyd
803-227-2702

TESTING

Valid to: **November 18, 2025** Certificate Number: **L2224**

Environmental

Non-Potable Water		
Technology	**Method**	**Analyte**
GC	EPA 8151A	2,4,5-T
GC	EPA 8151A	2,4D
GC	EPA 8151A	2,4DB
GC	EPA 8151A	Dalapon
GC	EPA 8151A	Dicamba
GC	EPA 8151A	Dichloroprop
GC	EPA 8151A	Dinoseb
GC	EPA 8151A	MCPA
GC	EPA 8151A	MCPP
GC	EPA 8151A	Silvex(2,4,5 TP)
GC/MS	EPA 8270E	0,0,0-Triethylphosphorothioate
GC/MS	EPA 8270E	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 8270E	1,2,4-Trichlorobenzene
GC/MS	EPA 8270E	1,2-Dichlorobenzene
GC/MS	EPA 8270E	1,3-Dichlorobenzene
GC/MS	EPA 8270E	1,3,5-Trinitrobenzene
GC/MS	EPA 8270E	1,4-Benzoquinone
GC/MS	EPA 8270E	1,4-Dichlorobenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270E	1,4-Dinitrobenzene
GC/MS	EPA 8270E	1,4-Naphthoquinone
GC/MS	EPA 8270E	1-Chloronaphthalene
GC/MS	EPA 8270E	1-Methylnaphthalene
GC/MS	EPA 8270E	1-Naphthylamine
GC/MS	EPA 8270E	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 8270E	2,3,5,6-Tetrachlorophenol
GC/MS	EPA 8270E	2,4,5-Trichlorophenol
GC/MS	EPA 8270E	2,4,6-Trichlorophenol
GC/MS	EPA 8270E	2,4-Dichlorophenol
GC/MS	EPA 8270E	2,4-Dimethylphenol
GC/MS	EPA 8270E	2,4-Dinitrophenol
GC/MS	EPA 8270E	2,4-Dinitrotoluene
GC/MS	EPA 8270E	2,6-Dichlorophenol
GC/MS	EPA 8270E	2,6-Dinitrotoluene
GC/MS	EPA 8270E	2-Acetylaminofluorene
GC/MS	EPA 8270E	2-Chloronaphthalene
GC/MS	EPA 8270E	2-Chlorophenol
GC/MS	EPA 8270E	2-Methylnaphthalene
GC/MS	EPA 8270E	2-Methylphenol
GC/MS	EPA 8270E	2-Naphthylamine
GC/MS	EPA 8270E	2-Nitroaniline
GC/MS	EPA 8270E	2-Nitrophenol
GC/MS	EPA 8270E	2-Picoline
GC/MS	EPA 8270E	3,3'-Dichlorobenzidine
GC/MS	EPA 8270E	3-Methylcholanthrene
GC/MS	EPA 8270E	3-Nitroaniline
GC/MS	EPA 8270E	4,6-Dinitro-2-methylphenol
GC/MS	EPA 8270E	4-Aminobiphenyl
GC/MS	EPA 8270E	4-Bromophenylphenylether
GC/MS	EPA 8270E	4-Chloro-3-methylphenol
GC/MS	EPA 8270E	4-Chloroaniline
GC/MS	EPA 8270E	4-Chlorophenylphenylether
GC/MS	EPA 8270E	4-Nitroaniline
GC/MS	EPA 8270E	4-Nitrophenol
GC/MS	EPA 8270E	5-Nitro-o-toluidine

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270E	7,12-Dimethylbenzo(a)anthracene
GC/MS	EPA 8270E	Acenaphthene
GC/MS	EPA 8270E	Acenaphthylene
GC/MS	EPA 8270E	Acetophenone
GC/MS	EPA 8270E	Anthracene
GC/MS	EPA 8270E	Atrazine
GC/MS	EPA 8270E	Benzaldhyde
GC/MS	EPA 8270E	Benzidine
GC/MS	EPA 8270E	Benzo(a)Anthracene
GC/MS	EPA 8270E	Benzo(a)pyrene
GC/MS	EPA 8270E	Benzo(b)fluoranthene
GC/MS	EPA 8270E	Benzo(g,h,i)perylene
GC/MS	EPA 8270E	Benzo(k)fluoranthene
GC/MS	EPA 8270E	Benzoic acid
GC/MS	EPA 8270E	Benzyl alcohol
GC/MS	EPA 8270E	Biphenyl
GC/MS	EPA 8270E	bis(2-Chloroethoxy)methane
GC/MS	EPA 8270E	bis(2-Chloroethyl)ether
GCMS	EPA 8270E	Bis (2-Chloro-1-methylethyl) ether
GC/MS	EPA 8270E	bis(2-Ethylhexyl)phthalate
GC/MS	EPA 8270E	Butylbenzylphthalate
GC/MS	EPA 8270E	Caprolactam
GC/MS	EPA 8270E	Carbazole
GC/MS	EPA 8270E	Chrysene
GC/MS	EPA 8270E	Chlorobenzilate
GC/MS	EPA 8270E	Dibenzo(a,h)anthracene
GC/MS	EPA 8270E	Dibenzo(a,e)pyrene
GC/MS	EPA 8270E	Dibenzofuran
GC/MS	EPA 8270E	Diethylphthalate
GC/MS	EPA 8270E	Dimethoate
GC/MS	EPA 8270E	Dimethylphthalate
GC/MS	EPA 8270E	Di-n-butylphthalate
GC/MS	EPA 8270E	Di-n-octylphthalate
GC/MS	EPA 8270E	Disulfoton
GC/MS	EPA 8270E	Ethyl methanesulfonate
GC/MS	EPA 8270E	Fluoranthene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270E	Fluorene
GC/MS	EPA 8270E	Hexachlorobenzene
GC/MS	EPA 8270E	Hexachlorobutadiene
GC/MS	EPA 8270E	Hexachlorocyclopentadiene
GC/MS	EPA 8270E	Hexachloroethane
GC/MS	EPA 8270E	Hexachloropropene
GC/MS	EPA 8270E	Indene
GC/MS	EPA 8270E	Indeno(1,2,3-c,d)pyrene
GC/MS	EPA 8270E	Isodrin
GC/MS	EPA 8270E	Isophorone
GC/MS	EPA 8270E	Isosafrole
GC/MS	EPA 8270E	m+p-Cresol
GC/MS	EPA 8270E	m-Dinitrobenzene
GC/MS	EPA 8270E	Methyl methacrylate
GC/MS	EPA 8270E	Methyl methanesulfonate
GC/MS	EPA 8270E	Methyl parathion
GC/MS	EPA 8270E	Naphthalene
GC/MS	EPA 8270E	Nitrobenzene
GC/MS	EPA 8270E	N-Nitrosodiethylamine
GC/MS	EPA 8270E	N-Nitrosodimethylamine
GC/MS	EPA 8270E	N-Nitrosodi-n-butylamine
GC/MS	EPA 8270E	n-Nitroso-di-n-propylamine
GC/MS	EPA 8270E	n-Nitrosodiphenylamine
GC/MS	EPA 8270E	N-Nitrosomethylethylamine
GC/MS	EPA 8270E	N-Nitrosomorpholine
GC/MS	EPA 8270E	N-Nitrosopiperidine
GC/MS	EPA 8270E	N-Nitrosopyrrolidine
GC/MS	EPA 8270E	o-Cresol
GC/MS	EPA 8270E	o-Toluidine
GC/MS	EPA 8270E	Parathion
GC/MS	EPA 8270E	Pentachlorobenzene
GC/MS	EPA 8270E	Pentachloroethane
GC/MS	EPA 8270E	Pentachloronitrobenzene
GC/MS	EPA 8270E	Pentachlorophenol
GC/MS	EPA 8270E	Phenacetin
GC/MS	EPA 8270E	Phenanthrene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270E	Phenol
GC/MS	EPA 8270E	Phorate
GC/MS	EPA 8270E	Pronamide
GC/MS	EPA 8270E	Pyrene
GC/MS	EPA 8270E	Pyridine
GC/MS	EPA 8270E	Safrole
GC/MS	EPA 8270E	Tetraethyl dithiopyrophosphate
GC/MS	EPA 8270E	Thionazine
GC/MS	EPA 8270E	Tributyl phosphate
GC/MS	EPA 8270E	p-Phenylenediamine
GC/MS	EPA 8270E SIM	Acenaphthene
GC/MS	EPA 8270E SIM	Acenaphthylene
GC/MS	EPA 8270E SIM	Anthracene
GC/MS	EPA 8270E SIM	Benzo(a)anthracene
GC/MS	EPA 8270E SIM	Benzo(a)pyrene
GC/MS	EPA 8270E SIM	Benzo(b)fluoranthene
GC/MS	EPA 8270E SIM	Benzo(g,h,i)perylene
GC/MS	EPA 8270E SIM	Benzo(k)fluoranthene
GC/MS	EPA 8270E SIM	Chrysene
GC/MS	EPA 8270E SIM	Dibenz(a,h)anthracene
GC/MS	EPA 8270E SIM	1,4-Dioxane
GC/MS	EPA 8270E SIM	Fluoranthene
GC/MS	EPA 8270E SIM	Fluorene
GC/MS	EPA 8270E SIM	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 8270E SIM	1-Methylnaphthalene
GC/MS	EPA 8270E SIM	2-Methylnaphthalene
GC/MS	EPA 8270E SIM	Naphthalene
GC/MS	EPA 8270E SIM	Pentachlorophenol
GC/MS	EPA 8270E SIM	Phenanthrene
GC/MS	EPA 8270E SIM	Pyrene
GC/MS	EPA 625.1	Acenaphthene
GC/MS	EPA 625.1	Acenaphthylene
GC/MS	EPA 625.1	Aniline
GC/MS	EPA 625.1	Anthracene
GC/MS	EPA 625.1	Benzidine
GC/MS	EPA 625.1	Benzo(a)anthracene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 625.1	Benzo(a)pyrene
GC/MS	EPA 625.1	Benzo(b)fluoranthene
GC/MS	EPA 625.1	Benzo(g,h,i)perylene
GC/MS	EPA 625.1	Benzo(k)fluoranthene
GC/MS	EPA 625.1	Benzoic acid
GC/MS	EPA 625.1	Benzyl alcohol
GC/MS	EPA 625.1	4-Bromophenyl phenyl ether
GC/MS	EPA 625.1	Butyl benzyl phthalate
GC/MS	EPA 625.1	Carbazole
GC/MS	EPA 625.1	bis (2-Chloro-1-methylethyl) ether
GC/MS	EPA 625.1	4-Chloro-3-methyl phenol
GC/MS	EPA 625.1	4-Chloroaniline
GC/MS	EPA 625.1	bis(2-Chloroethoxy)methane
GC/MS	EPA 625.1	bis(2-Chloroethyl)ether
GC/MS	EPA 625.1	2-Chloronaphthalene
GC/MS	EPA 625.1	2-Chlorophenol
GC/MS	EPA 625.1	4-Chlorophenyl phenyl ether
GC/MS	EPA 625.1	Chrysene
GC/MS	EPA 625.1	n-Decane
GC/MS	EPA 625.1	Dibenzo(a,h)anthracene
GC/MS	EPA 625.1	Dibenzofuran
GC/MS	EPA 625.1	2,3-Dichloroaniline
GC/MS	EPA 625.1	3,3'-Dichlorobenzidine
GC/MS	EPA 625.1	2,4-Dichlorophenol
GC/MS	EPA 625.1	2,6-Dichlorophenol
GC/MS	EPA 625.1	Diethylphthalate
GC/MS	EPA 625.1	Dimethyl phthalate
GC/MS	EPA 625.1	3,3'-Dimethylbenzidine
GC/MS	EPA 625.1	2,4-Dimethylphenol
GC/MS	EPA 625.1	Di-n-butyl phthalate
GC/MS	EPA 625.1	4,6-Dinitro-2-methylphenol
GC/MS	EPA 625.1	2,4-Dinitrophenol
GC/MS	EPA 625.1	2,4-Dinitrotoluene
GC/MS	EPA 625.1	2,6-Dinitrotoluene
GC/MS	EPA 625.1	Di-n-octylphthalate
GC/MS	EPA 625.1	1,2-Diphenylhydrazine(as azobenzene)

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 625.1	bis(2-Ethylhexyl)phthalate
GC/MS	EPA 625.1	Fluoranthene
GC/MS	EPA 625.1	Fluorene
GC/MS	EPA 625.1	Hexachlorobenzene
GC/MS	EPA 625.1	Hexachlorobutadiene
GC/MS	EPA 625.1	Hexachlorocyclopentadiene
GC/MS	EPA 625.1	Hexachloroethane
GC/MS	EPA 625.1	Indeno(1,2,3-c,d)pyrene
GC/MS	EPA 625.1	Isophorone
GC/MS	EPA 625.1	1-Methylnaphthalene
GC/MS	EPA 625.1	2-Methylnaphthalene
GC/MS	EPA 625.1	2-Methylphenol
GC/MS	EPA 625.1	3+4-Methylphenol
GC/MS	EPA 625.1	N,N-Diethyl-m-toluamide (DEET)
GC/MS	EPA 625.1	Naphthalene
GC/MS	EPA 625.1	Nitrobenzene
GC/MS	EPA 625.1	2-Nitrophenol
GC/MS	EPA 625.1	4-Nitrophenol
GC/MS	EPA 625.1	N-Nitrosodimethylamine
GC/MS	EPA 625.1	N-Nitrosodi-n-propylamine
GC/MS	EPA 625.1	N-Nitrosodiphenylamine (Diphenylamine)
GC/MS	EPA 625.1	n-Octadecane
GC/MS	EPA 625.1	Pentachlorophenol
GC/MS	EPA 625.1	Phenanthrene
GC/MS	EPA 625.1	Phenol
GC/MS	EPA 625.1	Piperonyl butoxide (PIP)
GC/MS	EPA 625.1	Pyrene
GC/MS	EPA 625.1	alpha-Terpineol
GC/MS	EPA 625.1	1,2,4-Trichlorobenzene
GC/MS	EPA 625.1	2,4,6-Trichlorophenol
GC/MS	EPA 8260D	1,1,1,2-Tetrachloroethane
GC/MS	EPA 8260D	1,1,1-Trichloroethane
GC/MS	EPA 8260D	1,1,2,2-Tetrachloroethene
GC/MS	EPA 8260D	1,1,2-Trichloroethane
GC/MS	EPA 8260D	1,1-Dichloroethane
GC/MS	EPA 8260D	1,1-Dichloroethene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260D	1,1-Dichloropropene
GC/MS	EPA 8260D	1,2,3-Trichlorobenzene
GC/MS	EPA 8260D	1,2,3-Trichloropropane
GC/MS	EPA 8260D	1,2,4-Trichlorobenzene
GC/MS	EPA 8260D	1,2,4-Trimethylbenzene
GC/MS	EPA 8260D	1,2-Dibromo-3-chloropropane
GC/MS	EPA 8260D	1,2-Dibromoethane (EDB)
GC/MS	EPA 8260D	1,2-Dichlorobenzene
GC/MS	EPA 8260D	1,2-Dichloroethane
GC/MS	EPA 8260D	1,2-Dichloropropane
GC/MS	EPA 8260D	1,3,5-Trimethylbenzene
GC/MS	EPA 8260D	1,3-Dichlorobenzene
GC/MS	EPA 8260D	1,3-Dichloropropane
GC/MS	EPA 8260D	1,4-Dichlorobenzene
GC/MS	EPA 8260D	1,4-Dioxane
GC/MS	EPA 8260D	2,2-Dichloropropane
GC/MS	EPA 8260D	2-Butanone (MEK)
GC/MS	EPA 8260D	2-Chloroethylvinyl ether
GC/MS	EPA 8260D	2-Chlorotoluene
GC/MS	EPA 8260D	2-Hexanone
GC/MS	EPA 8260D	3,3-Dimethyl-1-butanol
GC/MS	EPA 8260D	4-Chlorotoluene
GC/MS	EPA 8260D	4-Methyl-2-pentanone
GC/MS	EPA 8260D	Acetone
GC/MS	EPA 8260D	Acetonitrile
GC/MS	EPA 8260D	Acrolein
GC/MS	EPA 8260D	Acrylonitrile
GC/MS	EPA 8260D	Allyl chloride
GC/MS	EPA 8260D	Benzene
GC/MS	EPA 8260D	Benzyl chloride
GC/MS	EPA 8260D	Bromobenzene
GC/MS	EPA 8260D	Bromochloromethane
GC/MS	EPA 8260D	Bromodichloromethane
GC/MS	EPA 8260D	Bromoform
GC/MS	EPA 8260D	Bromomethane
GC/MS	EPA 8260D	Carbon disulfide

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260D	Carbon tetrachloride
GC/MS	EPA 8260D	Chlorobenzene
GC/MS	EPA 8260D	Chloroethane
GC/MS	EPA 8260D	Chloroform
GC/MS	EPA 8260D	Chloromethane
GC/MS	EPA 8260D	Chloroprene
GC/MS	EPA 8260D	cis-1,2-Dichloroethene
GC/MS	EPA 8260D	cis-1,3-Dichloropropene
GC/MS	EPA 8260D	Cyclohexane
GC/MS	EPA 8260D	Cyclohexanone
GC/MS	EPA 8260D	Dibromochloromethane
GC/MS	EPA 8260D	Dibromomethane
GC/MS	EPA 8260D	Dichlorodifluoromethane
GC/MS	EPA 8260D	Diisopropyl ether (IPE)
GC/MS	EPA 8260D	Ethanol
GC/MS	EPA 8260D	Ethyl ether
GC/MS	EPA 8260D	Ethyl methacrylate
GC/MS	EPA 8260D	Ethylbenzene
GC/MS	EPA 8260D	Ethyl-Tert-Butyl Ether
GC/MS	EPA 8260D	Freon 113
GC/MS	EPA 8260D	Hexachlorobutadiene
GC/MS	EPA 8260D	Isobutyl alcohol
GC/MS	EPA 8260D	Isopropylbenzene
GC/MS	EPA 8260D	m+p-Xylenes
GC/MS	EPA 8260D	Methacrylonitrile
GC/MS	EPA 8260D	Methyl Acetate
GC/MS	EPA 8260D	Methyl iodide
GC/MS	EPA 8260D	Methyl methacrylate
GC/MS	EPA 8260D	Methyl tertiary butyl ether (MTBE)
GC/MS	EPA 8260D	Methylcyclohexane
GC/MS	EPA 8260D	Methylene chloride
GC/MS	EPA 8260D	Naphthalene
GC/MS	EPA 8260D	n-Butylbenzene
GC/MS	EPA 8260D	n-Propylbenzene
GC/MS	EPA 8260D	o-Xylene
GC/MS	EPA 8260D	p-Isopropyltoluene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260D	Propionitrile
GC/MS	EPA 8260D	sec-Butylbenzene
GC/MS	EPA 8260D	Styrene
GC/MS	EPA 8260D	Tert-Amyl Alcohol (TAA)
GC/MS	EPA 8260D	Tert-Amyl Methyl Ether (TAME)
GC/MS	EPA 8260D	Tert-Butyl Alcohol (TBA)
GC/MS	EPA 8260D	Tert-Butyl Formate (TBF)
GC/MS	EPA 8260D	tert-Butylbenzene
GC/MS	EPA 8260D	Tetrachloroethene
GC/MS	EPA 8260D	Tetrahydrofuran
GC/MS	EPA 8260D	Toluene
GC/MS	EPA 8260D	Total Xylenes
GC/MS	EPA 8260D	trans-1,2-Dichloroethene
GC/MS	EPA 8260D	trans-1,3-Dichloropropene
GC/MS	EPA 8260D	trans-1,4-Dichloro-2-butene
GC/MS	EPA 8260D	Trichloroethene
GC/MS	EPA 8260D	Trichlorofluoromethane
GC/MS	EPA 8260D	Vinyl acetate
GC/MS	EPA 8260D	Vinyl chloride
GC/MS	EPA 8260D SIM	1,4-Dioxane
GC/MS	EPA 624.1	Acetone
GC/MS	EPA 624.1	Acetonitrile
GC/MS	EPA 624.1	Acrolein
GC/MS	EPA 624.1	Acrylonitrile
GC/MS	EPA 624.1	Benzene
GC/MS	EPA 624.1	Bromochloromethane
GC/MS	EPA 624.1	Bromodichloromethane
GC/MS	EPA 624.1	Bromoform
GC/MS	EPA 624.1	Bromomethane (Methyl bromide)
GC/MS	EPA 624.1	2-Butanone (MEK)
GC/MS	EPA 624.1	Carbon disulfide
GC/MS	EPA 624.1	Carbon tetrachloride
GC/MS	EPA 624.1	Chlorobenzene
GC/MS	EPA 624.1	Chloroethane
GC/MS	EPA 624.1	2-Chloroethylvinylether
GC/MS	EPA 624.1	Chloroform

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	EPA 624.1	Chloromethane (Methyl chloride)
GC/MS	EPA 624.1	Dibromochloromethane
GC/MS	EPA 624.1	1,2-Dibromoethane (EDB)
GC/MS	EPA 624.1	1,2-Dichlorobenzene
GC/MS	EPA 624.1	1,3-Dichlorobenzene
GC/MS	EPA 624.1	1,4-Dichlorobenzene
GC/MS	EPA 624.1	Dichlorodifluoromethane
GC/MS	EPA 624.1	1,1-Dichloroethane
GC/MS	EPA 624.1	1,2-Dichloroethane
GC/MS	EPA 624.1	1,1-Dichloroethene
GC/MS	EPA 624.1	cis-1,2-Dichloroethene
GC/MS	EPA 624.1	trans-1,2-Dichloroethene
GC/MS	EPA 624.1	1,2-Dichloropropane
GC/MS	EPA 624.1	cis-1,3-Dichloropropene
GC/MS	EPA 624.1	trans-1,3-Dichloropropene
GC/MS	EPA 624.1	Diisopropyl ether (IPE)
GC/MS	EPA 624.1	1,4-Dioxane
GC/MS	EPA 624.1	Ethylbenzene
GC/MS	EPA 624.1	Methyl methacrylate
GC/MS	EPA 624.1	Methyl tertiary butyl ether (MTBE)
GC/MS	EPA 624.1	Methylene chloride
GC/MS	EPA 624.1	Naphthalene
GC/MS	EPA 624.1	Styrene
GC/MS	EPA 624.1	1,1,2,2-Tetrachloroethane
GC/MS	EPA 624.1	Tetrachloroethene
GC/MS	EPA 624.1	Toluene
GC/MS	EPA 624.1	1,2,4-Trichlorobenzene
GC/MS	EPA 624.1	1,1,1-Trichloroethane
GC/MS	EPA 624.1	1,1,2-Trichloroethane
GC/MS	EPA 624.1	Trichloroethene
GC/MS	EPA 624.1	Trichlorofluoromethane
GC/MS	EPA 624.1	1,2,4-Trimethylbenzene
GC/MS	EPA 624.1	1,3,5-Trimethylbenzene
GC/MS	EPA 624.1	Vinyl acetate
GC/MS	EPA 624.1	Vinyl chloride
GC/MS	EPA 624.1	Xylenes (total)

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	SM 6200B-2011	Benzene
GC/MS	SM 6200B-2011	Bromobenzene
GC/MS	SM 6200B-2011	Bromochloromethane
GC/MS	SM 6200B-2011	Bromodichloromethane
GC/MS	SM 6200B-2011	Bromoform
GC/MS	SM 6200B-2011	Bromomethane (Methyl bromide)
GC/MS	SM 6200B-2011	n-Butylbenzene
GC/MS	SM 6200B-2011	sec-Butylbenzene
GC/MS	SM 6200B-2011	tert-Butylbenzene
GC/MS	SM 6200B-2011	Carbon tetrachloride
GC/MS	SM 6200B-2011	Chlorobenzene
GC/MS	SM 6200B-2011	Chloroethane
GC/MS	SM 6200B-2011	Chloroform
GC/MS	SM 6200B-2011	Chloromethane (Methyl chloride)
GC/MS	SM 6200B-2011	2-Chlorotoluene
GC/MS	SM 6200B-2011	4-Chlorotoluene
GC/MS	SM 6200B-2011	Dibromochloromethane
GC/MS	SM 6200B-2011	1,2-Dibromoethane (EDB)
GC/MS	SM 6200B-2011	Dibromomethane (Methylene bromide)
GC/MS	SM 6200B-2011	1,2-Dichlorobenzene
GC/MS	SM 6200B-2011	1,3-Dichlorobenzene
GC/MS	SM 6200B-2011	1,4-Dichlorobenzene
GC/MS	SM 6200B-2011	Dichlorodifluoromethane
GC/MS	SM 6200B-2011	1,1-Dichloroethane
GC/MS	SM 6200B-2011	1,2-Dichloroethane
GC/MS	SM 6200B-2011	1,1-Dichloroethene
GC/MS	SM 6200B-2011	cis-1,2-Dichloroethene
GC/MS	SM 6200B-2011	trans-1,2-Dichloroethene
GC/MS	SM 6200B-2011	1,2-Dichloropropane
GC/MS	SM 6200B-2011	1,3-Dichloropropane
GC/MS	SM 6200B-2011	2,2-Dichloropropane
GC/MS	SM 6200B-2011	1,1-Dichloropropene
GC/MS	SM 6200B-2011	cis-1,3-Dichloropropene
GC/MS	SM 6200B-2011	trans-1,3-Dichloropropene
GC/MS	SM 6200B-2011	Diisopropyl ether (IPE)
GC/MS	SM 6200B-2011	Ethylbenzene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC/MS	SM 6200B-2011	Hexachlorobutadiene
GC/MS	SM 6200B-2011	Isopropylbenzene (Cumene)
GC/MS	SM 6200B-2011	p-Isopropyltoluene (p-Cymene)
GC/MS	SM 6200B-2011	Methyl tertiary butyl ether (MTBE)
GC/MS	SM 6200B-2011	4-Methyl-2-pentanone
GC/MS	SM 6200B-2011	Methylene chloride
GC/MS	SM 6200B-2011	Naphthalene
GC/MS	SM 6200B-2011	n-Propylbenzene
GC/MS	SM 6200B-2011	Styrene
GC/MS	SM 6200B-2011	1,1,1,2-Tetrachloroethane
GC/MS	SM 6200B-2011	1,1,2,2-Tetrachloroethane
GC/MS	SM 6200B-2011	Tetrachloroethene
GC/MS	SM 6200B-2011	Toluene
GC/MS	SM 6200B-2011	1,1,2-Trichloro-1,2,2-Trifluoroethane
GC/MS	SM 6200B-2011	1,2,3-Trichlorobenzene
GC/MS	SM 6200B-2011	1,2,4-Trichlorobenzene
GC/MS	SM 6200B-2011	1,1,1-Trichloroethane
GC/MS	SM 6200B-2011	1,1,2-Trichloroethane
GC/MS	SM 6200B-2011	Trichloroethene
GC/MS	SM 6200B-2011	Trichlorofluoromethane
GC/MS	SM 6200B-2011	1,2,3-Trichloropropane
GC/MS	SM 6200B-2011	1,3,5-Trimethylbenzene (Mesitylene)
GC/MS	SM 6200B-2011	1,2,4-Trimethylbenzene
GC/MS	SM 6200B-2011	Vinyl chloride
GC/MS	SM 6200B-2011	m+p - Xylenes
GC/MS	SM 6200B-2011	o-Xylene
GC	EPA 8081B	4,4'-DDD
GC	EPA 8081B	4,4'-DDE
GC	EPA 8081B	4,4'-DDT
GC	EPA 8081B	Aldrin
GC	EPA 8081B	alpha-BHC
GC	EPA 8081B	alpha-Chlordane
GC	EPA 8081B	beta-BHC
GC	EPA 8081B	Chlordane
GC	EPA 8081B	delta-BHC
GC	EPA 8081B	Dieldrin

Non-Potable Water		
Technology	**Method**	**Analyte**
GC	EPA 8081B	Endosulfan I
GC	EPA 8081B	Endosulfan II
GC	EPA 8081B	Endosulfan sulfate
GC	EPA 8081B	Endrin
GC	EPA 8081B	Endrin Aldehyde
GC	EPA 8081B	Endrin Ketone
GC	EPA 8081B	gamma-BHC (Lindane)
GC	EPA 8081B	gamma-Chlordane
GC	EPA 8081B	Heptachlor
GC	EPA 8081B	Heptachlor Epoxide
GC	EPA 8081B	Methoxychlor
GC	EPA 8081B	Mirex
GC	EPA 8081B	Toxaphene
GC	EPA 8082A	Aroclor 1016
GC	EPA 8082A	Aroclor 1221
GC	EPA 8082A	Aroclor 1232
GC	EPA 8082A	Aroclor 1242
GC	EPA 8082A	Aroclor 1248
GC	EPA 8082A	Aroclor 1254
GC	EPA 8082A	Aroclor 1260
GC	EPA 8082A	Aroclor 1262
GC	EPA 8082A	Aroclor 1268
GC	EPA 608.3	Aldrin
GC	EPA 608.3	gamma-BHC (Lindane)
GC	EPA 608.3	alpha-BHC
GC	EPA 608.3	beta-BHC
GC	EPA 608.3	delta-BHC
GC	EPA 608.3	Chlordane
GC	EPA 608.3	cis-Chlordane
GC	EPA 608.3	trans-Chlordane
GC	EPA 608.3	4,4'-DDD
GC	EPA 608.3	4,4'-DDE
GC	EPA 608.3	4,4'-DDT
GC	EPA 608.3	Dieldrin
GC	EPA 608.3	Endosulfan I
GC	EPA 608.3	Endosulfan II
GC	EPA 608.3	Endosulfan sulfate

Non-Potable Water		
Technology	**Method**	**Analyte**
GC	EPA 608.3	Endrin
GC	EPA 608.3	Endrin aldehyde
GC	EPA 608.3	Endrin ketone
GC	EPA 608.3	Heptachlor
GC	EPA 608.3	Heptachlor epoxide
GC	EPA 608.3	Methoxychlor
GC	EPA 608.3	Toxaphene
GC	EPA 608.3	Aroclor 1016
GC	EPA 608.3	Aroclor 1221
GC	EPA 608.3	Aroclor 1232
GC	EPA 608.3	Aroclor 1242
GC	EPA 608.3	Aroclor 1248
GC	EPA 608.3	Aroclor 1254
GC	EPA 608.3	Aroclor 1260
HPLC	EPA 8330A	2-Amino-4,6-dinitrotoluene
HPLC	EPA 8330A	4-Amino-2,6-dinitrotoluene
HPLC	EPA 8330A	1,3-Dinitrobenzene
HPLC	EPA 8330A	2,4-Dinitrotoluene
HPLC	EPA 8330A	2,6-Dinitrotoluene
HPLC	EPA 8330A	HMX
HPLC	EPA 8330A	Nitrobenzene
HPLC	EPA 8330B	Nitrocellulose
HPLC	EPA 8330B	Nitroguanidine
HPLC	EPA 8330A	2-Nitrotoluene
HPLC	EPA 8330A	3-Nitrotoluene
HPLC	EPA 8330A	4-Nitrotoluene
HPLC	EPA 8330A	RDX
HPLC	EPA 8330A	Tetryl
HPLC	EPA 8330A	1,3,5-Trinitrobenzene
HPLC	EPA 8330A	2,4,6-Trinitrotoluene
HPLC	EPA 8330B	2-Amino-4,6-dinitrotoluene
HPLC	EPA 8330B	4-Amino-2,6-dinitrotoluene
HPLC	EPA 8330B	1,3-Dinitrobenzene
HPLC	EPA 8330B	2,4-Dinitrotoluene
HPLC	EPA 8330B	2,6-Dinitrotoluene
HPLC	EPA 8330B	HMX

Non-Potable Water		
Technology	**Method**	**Analyte**
HPLC	EPA 8330B	Nitrobenzene
HPLC	EPA 8330B	Nitroglycerin (NG)
HPLC	EPA 8330B	2-Nitrotoluene
HPLC	EPA 8330B	3-Nitrotoluene
HPLC	EPA 8330B	4-Nitrotoluene
HPLC	EPA 8330B	RDX
HPLC	EPA 8330B	Tetryl
HPLC	EPA 8330B	1,3,5-Trinitrobenzene
HPLC	EPA 8330B	2,4,6-Trinitrotoluene
HPLC	EPA 8330B	3,5-Dinitroaniline
HPLC	EPA 8330B	Pentaerythritol tetranitrate (PETN)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Fluorotelomer sulfonate 8:2 [1H,1H,2H,2H-perfluorodecane sulfonate] (8:2 FTS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Fluorotelomer sulfonate 4:2 [1H,1H,2H,2H-perfluorohexane sulfonate] (4:2 FTS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Fluorotelomer sulfonate 6:2 [1H,1H,2H,2H-perfluorooctane sulfonate] (6:2 FTS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	GenX (HFPO-DA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-1-butanesulfonate (PFBS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-n-butanoic acid (PFBA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-1-decanesulfonate (PFDS)

Non-Potable Water		
Technology	**Method**	**Analyte**
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-n-decanoic acid (PFDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-n-dodecanoic acid (PFDoA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-1-heptanesulfonate (PFHpS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-n-heptanoic acid (PFHpA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-1-hexanesulfonate (PFHxS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-n-hexanoic acid (PFHxA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-1-nonanesulfonate (PFNS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-n-nonanoic acid (PFNA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorooctanesulfonate (PFOS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-1-octanesulfonamide (PFOSA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-n-octanoic acid (PFOA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-n-pentanoic acid (PFPeA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-1-pentansulfonate (PFPeS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-n-tetradecanoic acid (PFTeDA)

Non-Potable Water		
Technology	**Method**	**Analyte**
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-n-tridecanoic acid (PFTrDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-n-undecanoic acid (PFUDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-methylperfluoro-1-octanesulfonamide (MeFOSA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-ethylperfluoro-1-octanesulfonamide (EtFOSA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	1H,1H,2H,2H-perfluorododecane sulfonate (10:2FTS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-Ethyl Perfluorooctane sulfonamido ethanol (EtFOSE)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-Methyl Perfluorooctane sulfonamido ethanol (MeFOSE)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Sodium dodecafluoro-3H-4, 8-dioxanonanoate (NaDONA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	9Cl-PF3ONS
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	11Cl-PF3OUDS
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorododecanesulfonic acid (PFDOS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorohexadecanoic acid (PFHxDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorooctadecanoic acid (PFODA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorobutanoic acid (PFBA)

Non-Potable Water		
Technology	**Method**	**Analyte**
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoropentanoic acid (PFPeA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorohexanoic acid (PFHxA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoroheptanoic acid (PFHpA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorooctanoic acid (PFOA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorononanoic acid (PFNA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorodecanoic acid (PFDA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoroundecanoic acid (PFUnA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorododecanoic acid (PFDoA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorotridecanoic acid (PFTrDA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorotetradecanoic acid (PFTeDA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorobutanesulfonic acid (PFBS)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoropentanesulfonic acid (PFPeS)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorohexanesulfonic acid (PFHxS)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoroheptanesulfonic acid (PFHpS)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorooctanesulfonic acid (PFOS)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorononanesulfonic acid (PFNS)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorodecanesulfonic acid (PFDS)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorododecanesulfonic acid (PFDoS)
LC/MS/MS	EPA Draft Method 1633 Version 2	1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS)
LC/MS/MS	EPA Draft Method 1633 Version 2	1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS)
LC/MS/MS	EPA Draft Method 1633 Version 2	1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS)

Non-Potable Water		
Technology	**Method**	**Analyte**
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorooctanesulfonamide (PFOSA)
LC/MS/MS	EPA Draft Method 1633 Version 2	N-methyl perfluorooctanesulfonamide (NMeFOSA)
LC/MS/MS	EPA Draft Method 1633 Version 2	N-ethyl perfluorooctanesulfonamide (NEtFOSA)
LC/MS/MS	EPA Draft Method 1633 Version 2	N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)
LC/MS/MS	EPA Draft Method 1633 Version 2	N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)
LC/MS/MS	EPA Draft Method 1633 Version 2	N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE)
LC/MS/MS	EPA Draft Method 1633 Version 2	N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE)
LC/MS/MS	EPA Draft Method 1633 Version 2	Hexafluoropropylene oxide dimer acid (HFPO-DA)
LC/MS/MS	EPA Draft Method 1633 Version 2	4,8-Dioxa-3H-perfluorononanoic acid (ADONA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoro-3-methoxypropanoic acid (PFMPA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoro-4-methoxybutanoic acid (PFMBA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)
LC/MS/MS	EPA Draft Method 1633 Version 2	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)
LC/MS/MS	EPA Draft Method 1633 Version 2	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA)
LC/MS/MS	EPA Draft Method 1633 Version 2	3-Perfluoropropyl propanoic acid (3:3FTCA)
LC/MS/MS	EPA Draft Method 1633 Version 2	2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA)
LC/MS/MS	EPA Draft Method 1633 Version 2	3-Perfluoroheptyl propanoic acid (7:3FTCA)
GC	EPA 8015C	Diesel Range Organics
GC	EPA 8015C	WI-Diesel Range Organics
GC	EPA 8015C	Gasoline Range Organics
GC	EPA 8015C	WI-Gasoline Range Organics
GC	RSK - 175	Methane, Ethane, Ethene

Non-Potable Water		
Technology	**Method**	**Analyte**
GC	EPA 8011	1,2-Dibromoethane (EDB)
GC	EPA 8011	1,2-Dibromo-3-chloropropane (DBCP)
GC	FL-PRO	FL-PRO
ICP	EPA 6010D	Aluminum
ICP	EPA 6010D	Antimony
ICP	EPA 6010D	Arsenic
ICP	EPA 6010D	Barium
ICP	EPA 6010D	Beryllium
ICP	EPA 6010D	Cadmium
ICP	EPA 6010D	Calcium
ICP	EPA 6010D	Chromium
ICP	EPA 6010D	Cobalt
ICP	EPA 6010D	Copper
ICP	EPA 6010D	Iron
ICP	EPA 6010D	Lead
ICP	EPA 6010D	Magnesium
ICP	EPA 6010D	Manganese
ICP	EPA 6010D	Molybdenum
ICP	EPA 6010D	Nickel
ICP	EPA 6010D	Potassium
ICP	EPA 6010D	Selenium
ICP	EPA 6010D	Silver
ICP	EPA 6010D	Sodium
ICP	EPA 6010D	Thallium
ICP	EPA 6010D	Tin
ICP	EPA 6010D	Vanadium
ICP	EPA 6010D	Zinc
ICP/MS	EPA 200.8	Aluminum
ICP/MS	EPA 200.8	Antimony
ICP/MS	EPA 200.8	Arsenic
ICP/MS	EPA 200.8	Barium
ICP/MS	EPA 200.8	Beryllium
ICP/MS	EPA 200.8	Boron
ICP/MS	EPA 200.8	Cadmium
ICP/MS	EPA 200.8	Calcium
ICP/MS	EPA 200.8	Chromium
ICP/MS	EPA 200.8	Cobalt

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP/MS	EPA 200.8	Copper
ICP/MS	EPA 200.8	Iron
ICP/MS	EPA 200.8	Lead
ICP/MS	EPA 200.8	Magnesium
ICP/MS	EPA 200.8	Manganese
ICP/MS	EPA 200.8	Molybdenum
ICP/MS	EPA 200.8	Nickel
ICP/MS	EPA 200.8	Potassium
ICP/MS	EPA 200.8	Selenium
ICP/MS	EPA 200.8	Silicon
ICP/MS	EPA 200.8	Silver
ICP/MS	EPA 200.8	Sodium
ICP/MS	EPA 200.8	Thallium
ICP/MS	EPA 200.8	Tin
ICP/MS	EPA 200.8	Titanium
ICP/MS	EPA 200.8	Vanadium
ICP/MS	EPA 200.8	Zinc
ICP/MS	EPA 6020B	Aluminum
ICP/MS	EPA 6020B	Antimony
ICP/MS	EPA 6020B	Arsenic
ICP/MS	EPA 6020B	Barium
ICP/MS	EPA 6020B	Beryllium
ICP/MS	EPA 6020B	Cadmium
ICP/MS	EPA 6020B	Calcium
ICP/MS	EPA 6020B	Chromium
ICP/MS	EPA 6020B	Cobalt
ICP/MS	EPA 6020B	Copper
ICP/MS	EPA 6020B	Iron
ICP/MS	EPA 6020B	Lead
ICP/MS	EPA 6020B	Magnesium
ICP/MS	EPA 6020B	Manganese
ICP/MS	EPA 6020B	Nickel
ICP/MS	EPA 6020B	Potassium
ICP/MS	EPA 6020B	Selenium
ICP/MS	EPA 6020B	Silver
ICP/MS	EPA 6020B	Sodium

Non-Potable Water		
Technology	**Method**	**Analyte**
ICP/MS	EPA 6020B	Thallium
ICP/MS	EPA 6020B	Tin
ICP/MS	EPA 6020B	Vanadium
ICP/MS	EPA 6020B	Zinc
CVAA	EPA 1631E	Low Level Mercury
CVAA	EPA 7470A / EPA 245.1	Mercury
Gravimetric	EPA 1664B	Oil & Grease
Titration	SM 2320B-2011	Alkalinity
Calculation	SM 2320B-2011	Bicarbonate Alkalinity
Calculation	SM 2320B-2011	Carbonate Alkalinity
Calculation	SM 2320B-2011	Hydroxide Alkalinity
Calculation	SM 4500-CO2 D	Carbon Dioxide (CO2)
Photometric	SM 2120F-2011	Color
Photometric	SM 2120B-2011	Platinum Cobalt Color
UV/VIS	SM 3500-Fe B-2011	Ferrous Iron
Titration	SM 4500-S2 F-2011	Sulfide
Wet Oxidation	EPA 9060A	TOC
Wet Oxidation	SM 5310C-2014	TOC
Titration	SM 2340C-2011	Total Hardness
Filtration	SM 2540C-2015	Total Dissolved Solids (TDS)
Filtration	SM 2540D-2015	Total Suspended Solids (TSS)
UV/VIS	SM 4500-CN E-2016	Total Cyanide
UV/VIS	EPA 9012B	Total Cyanide
UV/VIS	EPA 9065	Phenolics
UV/VIS	EPA 9066	Phenolics
IC	EPA 9056A	Fluoride
IC	EPA 9056A	Chloride
IC	EPA 9056A	Sulfate
IC	EPA 9056A	Bromide
IC	EPA 9056A	Nitrate
IC	EPA 9056A	Nitrite
IC	EPA 300.0	Fluoride
IC	EPA 300.0	Chloride
IC	EPA 300.0	Sulfate

Non-Potable Water		
Technology	**Method**	**Analyte**
IC	EPA 300.0	Bromide
IC	EPA 300.0	Nitrate
IC	EPA 300.0	Nitrite
IC	EPA 218.6	Hexavalent chromium
IC	EPA 7199	Hexavalent chromium
UV/VIS	EPA 7196A	Hexavalent chromium
Discrete Analyzer	SM 3500-Cr B-2011	Hexavalent chromium
Pensky-Martens	EPA 1010A	Ignitability
Electrode	EPA 9040C	Corrosivity
Electrode	SM 4500-H B-2011	Corrosivity
Electrode	EPA 120.1	Specific Conductance
Electrode	EPA 180.1	Turbidity
Photometric	Sec. 7.3.3 SW-846	Reactive Cyanide
Titration	Sec. 7.3.4 SW-846	Reactive Sulfide
UV/VIS	EPA 353.2	Nitrate
UV/VIS	EPA 353.2	Nitrite
UV/VIS	EPA 353.2	Nitrate-Nitrite
UV/VIS	EPA 365.1	Phosphorus/ Orthophosphate
Gas Diffusion / UV/VIS	EPA 350.1	Ammonia - N
UV/VIS	EPA 351.2	TKN
UV/VIS	SM 5220D-2011	COD
GC	MADEP-EPH-MOD	Extractable Petroleum Hydrocarbons (EPH) Modified
GC	MADEP-VPH-MOD	Volatile Petroleum Hydrocarbons (VPH) Modified
Preparation	**Method**	**Type**
Organic Preparation	EPA 3520C	Organic Prep. of Water by Continuous Liquid-Liquid
Organic Preparation	EPA 3535A	Solid-Phase Extraction (SPE)
Organic Cleanup	EPA 3620B	Florisil Cleanup Procedure
Organic Cleanup	EPA 3660B	Sulfur Cleanup Procedure
Organic Cleanup	EPA 3665A	Sulfuric Acid Cleanup Procedure
Waste Dilution	EPA 3580A	Waste Dilution
Volatile Organic Preparation	EPA 5030B	Purge-and-Trap for Aqueous Samples
Volatile Organic Preparation	EPA 5035	Closed-System Purge-and-Trap and extraction for Volatile Organics in Soil and Waste Samples
Volatile Organic Preparation	EPA 3585	Waste Dilution for Volatile Organics

Non-Potable Water		
Technology	**Method**	**Analyte**
Inorganic Preparation	EPA 3005A	Preparation of Waters by Hotblock
Inorganic Preparation	EPA 1311	Toxicity Characteristic Leaching Procedure (TCLP)
Inorganic Metals Preparation	EPA 3010A	Acid Digestion of Aqueous Samples and TCLP/SPLP Extracts for ICP analysis
Organic Cleanup	EPA 3640	GPC Cleanup Procedure

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC	EPA 8151A	Dalapon
GC	EPA 8151A	Dicamba
GC	EPA 8151A	Dichloroprop
GC	EPA 8151A	MCPP
GC	EPA 8151A	MCPA
GC	EPA 8151A	2,4D
GC	EPA 8151A	Silvex(2,4,5 TP)
GC	EPA 8151A	2,4,5-T
GC	EPA 8151A	2,4DB
GC	EPA 8151A	Dinoseb
GC/MS	EPA 8270E	1,2,4,5-Tetrachlorobenzene
GC/MS	EPA 8270E	1,2,4-Trichlorobenzene
GC/MS	EPA 8270E	1,2-Dichlorobenzene
GC/MS	EPA 8270E	1,3-Dichlorobenzene
GC/MS	EPA 8270E	1,4-Dichlorobenzene
GC/MS	EPA 8270E	1-Methylnaphthalene
GC/MS	EPA 8270E	2,3,4,6-Tetrachlorophenol
GC/MS	EPA 8270E	2,4,5-Trichlorophenol
GC/MS	EPA 8270E	2,4,6-Trichlorophenol
GC/MS	EPA 8270E	2,4-Dichlorophenol
GC/MS	EPA 8270E	2,4-Dimethylphenol
GC/MS	EPA 8270E	2,4-Dinitrophenol
GC/MS	EPA 8270E	2,4-Dinitrotoluene
GC/MS	EPA 8270E	2,6-Dichlorophenol

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270E	2,6-Dinitrotoluene
GC/MS	EPA 8270E	2-Chloronaphthalene
GC/MS	EPA 8270E	2-Chlorophenol
GC/MS	EPA 8270E	2-Methylnaphthalene
GC/MS	EPA 8270E	2-Methylphenol
GC/MS	EPA 8270E	2-Nitroaniline
GC/MS	EPA 8270E	2-Nitrophenol
GC/MS	EPA 8270E	3,3'-Dichlorobenzidine
GC/MS	EPA 8270E	3-Nitroaniline
GC/MS	EPA 8270E	4,6-Dinitro-2-methylphenol
GC/MS	EPA 8270E	4-Bromophenylphenylether
GC/MS	EPA 8270E	4-Chloro-3-methylphenol
GC/MS	EPA 8270E	4-Chloroaniline
GC/MS	EPA 8270E	4-Chlorophenylphenylether
GC/MS	EPA 8270E	4-Nitroaniline
GC/MS	EPA 8270E	4-Nitrophenol
GC/MS	EPA 8270E	Acenaphthene
GC/MS	EPA 8270E	Acenaphthylene
GC/MS	EPA 8270E	Acetophenone
GC/MS	EPA 8270E	Anthracene
GC/MS	EPA 8270E	Atrazine
GC/MS	EPA 8270E	Benzaldhyde
GC/MS	EPA 8270E	Benzidine
GC/MS	EPA 8270E	Benzo(a)Anthracene
GC/MS	EPA 8270E	Benzo(a)pyrene
GC/MS	EPA 8270E	Benzo(b)fluoranthene
GC/MS	EPA 8270E	Benzo(g,h,i)perylene
GC/MS	EPA 8270E	Benzo(k)fluoranthene
GC/MS	EPA 8270E	Benzoic acid
GC/MS	EPA 8270E	Benzyl alcohol
GC/MS	EPA 8270E	Biphenyl
GC/MS	EPA 8270E	bis(2-Chloroethoxy)methane
GC/MS	EPA 8270E	bis(2-Chloroethyl)ether
GCMS	EPA 8270E	Bis (2-Chloro-1-methylethyl) ether
GC/MS	EPA 8270E	bis(2-Ethylhexyl)phthalate
GC/MS	EPA 8270E	Butylbenzylphthalate

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270E	Caprolactam
GC/MS	EPA 8270E	Carbazole
GC/MS	EPA 8270E	Chrysene
GC/MS	EPA 8270E	Dibenzo(a,h)anthracene
GC/MS	EPA 8270E	Dibenzofuran
GC/MS	EPA 8270E	Diethylphthalate
GC/MS	EPA 8270E	Dimethylphthalate
GC/MS	EPA 8270E	Di-n-butylphthalate
GC/MS	EPA 8270E	Di-n-octylphthalate
GC/MS	EPA 8270E	Fluoranthene
GC/MS	EPA 8270E	Fluorene
GC/MS	EPA 8270E	Hexachlorobenzene
GC/MS	EPA 8270E	Hexachlorobutadiene
GC/MS	EPA 8270E	Hexachlorocyclopentadiene
GC/MS	EPA 8270E	Hexachloroethane
GC/MS	EPA 8270E	Indeno(1,2,3-c,d)pyrene
GC/MS	EPA 8270E	Isophorone
GC/MS	EPA 8270E	m+p-Cresol
GC/MS	EPA 8270E	Naphthalene
GC/MS	EPA 8270E	Nitrobenzene
GC/MS	EPA 8270E	N-Nitrosodimethylamine
GC/MS	EPA 8270E	n-Nitroso-di-n-propylamine
GC/MS	EPA 8270E	n-Nitrosodiphenylamine
GC/MS	EPA 8270E	N-Nitrosopyrrolidine
GC/MS	EPA 8270E	o-Cresol
GC/MS	EPA 8270E	Pentachlorophenol
GC/MS	EPA 8270E	Phenanthrene
GC/MS	EPA 8270E	Phenol
GC/MS	EPA 8270E	Pyrene
GC/MS	EPA 8270E	Pyridine
GC/MS	EPA 8270E	n-Nitrosopiperidine
GC/MS	EPA 8270E	n-Nitrosomethylethylamine
GC/MS	EPA 8270E	p-Phenylenediamine
GC/MS	EPA 8270E	2-Picoline
GC/MS	EPA 8270E	1-Naphthylamine
GC/MS	EPA 8270E	n-Nitrosodiethylamine

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270E	n-Nitrosomorpholine
GC/MS	EPA 8270E	Phenacetin
GC/MS	EPA 8270E	Pentachloronitrobenzene (Quintozene)
GC/MS	EPA 8270E	2-Naphthylamine
GC/MS	EPA 8270E	n-Nitroso-di-n-butylamine
GC/MS	EPA 8270E	4-Aminobiphenyl
GC/MS	EPA 8270E	o-Toluidine
GC/MS	EPA 8270E	5-Nitro-o-toluidine
GC/MS	EPA 8270E SIM	Acenaphthene
GC/MS	EPA 8270E SIM	Acenaphthylene
GC/MS	EPA 8270E SIM	Anthracene
GC/MS	EPA 8270E SIM	Benzo(a)anthracene
GC/MS	EPA 8270E SIM	Benzo(a)pyrene
GC/MS	EPA 8270E SIM	Benzo(b)fluoranthene
GC/MS	EPA 8270E SIM	Benzo(g,h,i)perylene
GC/MS	EPA 8270E SIM	Benzo(k)fluoranthene
GC/MS	EPA 8270E SIM	Chrysene
GC/MS	EPA 8270E SIM	Dibenz(a,h)anthracene
GC/MS	EPA 8270E SIM	1,4-Dioxane
GC/MS	EPA 8270E SIM	Fluoranthene
GC/MS	EPA 8270E SIM	Fluorene
GC/MS	EPA 8270E SIM	Indeno(1,2,3-cd)pyrene
GC/MS	EPA 8270E SIM	1-Methylnaphthalene
GC/MS	EPA 8270E SIM	2-Methylnaphthalene
GC/MS	EPA 8270E SIM	Naphthalene
GC/MS	EPA 8270E SIM	Pentachlorophenol
GC/MS	EPA 8270E SIM	Phenanthrene
GC/MS	EPA 8270E SIM	Pyrene
GC/MS	EPA 8260D	1,1,1,2-Tetrachloroethane
GC/MS	EPA 8260D	1,1,1-Trichloroethane
GC/MS	EPA 8260D	1,1,2,2-Tetrachloroethene
GC/MS	EPA 8260D	1,1,2-Trichloroethane
GC/MS	EPA 8260D	1,1-Dichloroethane
GC/MS	EPA 8260D	1,1-Dichloroethene
GC/MS	EPA 8260D	1,1-Dichloropropene
GC/MS	EPA 8260D	1,2,3-Trichlorobenzene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260D	1,2,3-Trichloropropane
GC/MS	EPA 8260D	1,2,4-Trichlorobenzene
GC/MS	EPA 8260D	1,2,4-Trimethylbenzene
GC/MS	EPA 8260D	1,2-Dibromo-3-chloropropane
GC/MS	EPA 8260D	1,2-Dibromoethane (EDB)
GC/MS	EPA 8260D	1,2-Dichlorobenzene
GC/MS	EPA 8260D	1,2-Dichloroethane
GC/MS	EPA 8260D	1,2-Dichloropropane
GC/MS	EPA 8260D	1,3,5-Trimethylbenzene
GC/MS	EPA 8260D	1,3-Dichlorobenzene
GC/MS	EPA 8260D	1,3-Dichloropropane
GC/MS	EPA 8260D	1,4-Dichlorobenzene
GC/MS	EPA 8260D	1,4-Dioxane
GC/MS	EPA 8260D	2,2-Dichloropropane
GC/MS	EPA 8260D	2-Butanone (MEK)
GC/MS	EPA 8260D	2-Chloroethylvinyl ether
GC/MS	EPA 8260D	2-Chlorotoluene
GC/MS	EPA 8260D	2-Hexanone
GC/MS	EPA 8260D	4-Chlorotoluene
GC/MS	EPA 8260D	4-Methyl-2-pentanone
GC/MS	EPA 8260D	Acetone
GC/MS	EPA 8260D	Acetonitrile
GC/MS	EPA 8260D	Acrolein
GC/MS	EPA 8260D	Acrylonitrile
GC/MS	EPA 8260D	Allyl chloride
GC/MS	EPA 8260D	Benzene
GC/MS	EPA 8260D	Benzyl chloride
GC/MS	EPA 8260D	Bromobenzene
GC/MS	EPA 8260D	Bromochloromethane
GC/MS	EPA 8260D	Bromodichloromethane
GC/MS	EPA 8260D	Bromoform
GC/MS	EPA 8260D	Bromomethane
GC/MS	EPA 8260D	Carbon disulfide
GC/MS	EPA 8260D	Carbon tetrachloride
GC/MS	EPA 8260D	Chlorobenzene
GC/MS	EPA 8260D	Chloroethane

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260D	Chloroform
GC/MS	EPA 8260D	Chloromethane
GC/MS	EPA 8260D	Chloroprene
GC/MS	EPA 8260D	cis-1,2-Dichloroethene
GC/MS	EPA 8260D	cis-1,3-Dichloropropene
GC/MS	EPA 8260D	Cyclohexane
GC/MS	EPA 8260D	Cyclohexanone
GC/MS	EPA 8260D	Dibromochloromethane
GC/MS	EPA 8260D	Dibromomethane
GC/MS	EPA 8260D	Dichlorodifluoromethane
GC/MS	EPA 8260D	Diisopropyl ether (IPE)
GC/MS	EPA 8260D	Ethyl ether
GC/MS	EPA 8260D	Ethyl methacrylate
GC/MS	EPA 8260D	Ethylbenzene
GC/MS	EPA 8260D	Freon 113
GC/MS	EPA 8260D	Hexachlorobutadiene
GC/MS	EPA 8260D	Isobutyl alcohol
GC/MS	EPA 8260D	Isopropylbenzene
GC/MS	EPA 8260D	m+p-Xylenes
GC/MS	EPA 8260D	Methacrylonitrile
GC/MS	EPA 8260D	Methyl Acetate
GC/MS	EPA 8260D	Methyl iodide
GC/MS	EPA 8260D	Methyl methacrylate
GC/MS	EPA 8260D	Methyl tertiary butyl ether (MTBE)
GC/MS	EPA 8260D	Methylcyclohexane
GC/MS	EPA 8260D	Methylene chloride
GC/MS	EPA 8260D	Naphthalene
GC/MS	EPA 8260D	n-Butylbenzene
GC/MS	EPA 8260D	n-Propylbenzene
GC/MS	EPA 8260D	o-Xylene
GC/MS	EPA 8260D	p-Isopropyltoluene
GC/MS	EPA 8260D	Propionitrile
GC/MS	EPA 8260D	sec-Butylbenzene
GC/MS	EPA 8260D	Styrene
GC/MS	EPA 8260D	tert-Butylbenzene
GC/MS	EPA 8260D	Tetrachloroethene

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC/MS	EPA 8260D	Tetrahydrofuran
GC/MS	EPA 8260D	Toluene
GC/MS	EPA 8260D	Total Xylenes
GC/MS	EPA 8260D	trans-1,2-Dichloroethene
GC/MS	EPA 8260D	trans-1,3-Dichloropropene
GC/MS	EPA 8260D	trans-1,4-Dichloro-2-butene
GC/MS	EPA 8260D	Trichloroethene
GC/MS	EPA 8260D	Trichlorofluoromethane
GC/MS	EPA 8260D	Vinyl acetate
GC/MS	EPA 8260D	Vinyl chloride
GC/MS	EPA 8260D SIM	1,4-Dioxane
GC	EPA 8081B	4,4'-DDD
GC	EPA 8081B	4,4'-DDE
GC	EPA 8081B	4,4'-DDT
GC	EPA 8081B	Aldrin
GC	EPA 8081B	alpha-BHC
GC	EPA 8081B	alpha-Chlordane
GC	EPA 8081B	beta-BHC
GC	EPA 8081B	Chlordane
GC	EPA 8081B	delta-BHC
GC	EPA 8081B	Dieldrin
GC	EPA 8081B	Endosulfan I
GC	EPA 8081B	Endosulfan II
GC	EPA 8081B	Endosulfan sulfate
GC	EPA 8081B	Endrin
GC	EPA 8081B	Endrin Aldehyde
GC	EPA 8081B	Endrin Ketone
GC	EPA 8081B	gamma-BHC (Lindane)
GC	EPA 8081B	gamma-Chlordane
GC	EPA 8081B	Heptachlor
GC	EPA 8081B	Heptachlor Epoxide
GC	EPA 8081B	Methoxychlor
GC	EPA 8081B	Mirex
GC	EPA 8081B	Toxaphene
GC	EPA 8082A	Aroclor 1016
GC	EPA 8082A	Aroclor 1221

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
GC	EPA 8082A	Aroclor 1232
GC	EPA 8082A	Aroclor 1242
GC	EPA 8082A	Aroclor 1248
GC	EPA 8082A	Aroclor 1254
GC	EPA 8082A	Aroclor 1260
GC	EPA 8082A	Aroclor 1262
GC	EPA 8082A	Aroclor 1268
HPLC	EPA 8330A	2-Amino-4,6-dinitrotoluene
HPLC	EPA 8330A	4-Amino-2,6-dinitrotoluene
HPLC	EPA 8330A	1,3-Dinitrobenzene
HPLC	EPA 8330A	2,4-Dinitrotoluene
HPLC	EPA 8330A	2,6-Dinitrotoluene
HPLC	EPA 8330A	HMX
HPLC	EPA 8330A	Nitrobenzene
HPLC	EPA 8330A	2-Nitrotoluene
HPLC	EPA 8330A	3-Nitrotoluene
HPLC	EPA 8330A	4-Nitrotoluene
HPLC	EPA 8330A	RDX
HPLC	EPA 8330A	Tetryl
HPLC	EPA 8330A	1,3,5-Trinitrobenzene
HPLC	EPA 8330A	2,4,6-Trinitrotoluene
GC	EPA 8015C	Diesel Range Organics
GC	EPA 8015C	WI-Diesel Range Organics
GC	EPA 8015C	Gasoline Range Organics
GC	EPA 8015C	WI-Gasoline Range Organics
GC	FL-PRO	FL-PRO
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-ethylperfluoro-1-octanesulfonamidoacetic acid (EtFOSAA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Fluorotelomer sulfonate 8:2 [1H,1H,2H,2H-perfluorodecane sulfonate] (8:2 FTS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Fluorotelomer sulfonate 4:2 [1H,1H,2H,2H-perfluorohexane sulfonate] (4:2 FTS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Fluorotelomer sulfonate 6:2 [1H,1H,2H,2H-perfluorooctane sulfonate] (6:2 FTS)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	GenX (HFPO-DA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-methylperfluoro-1-octanesulfonamidoacetic acid (MeFOSAA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-1-butanesulfonate (PFBS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-n-butanoic acid (PFBA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-1-decanesulfonate (PFDS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-n-decanoic acid (PFDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-n-dodecanoic acid (PFDoA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-1-heptanesulfonate (PFHpS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-n-heptanoic acid (PFHpA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-1-hexanesulfonate (PFHxS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-n-hexanoic acid (PFHxA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-1-nonanesulfonate (PFNS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-n-nonanoic acid (PFNA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorooctanesulfonate (PFOS)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-1-octanesulfonamide (PFOSA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-n-octanoic acid (PFOA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-n-pentanoic acid (PFPeA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-1-pentansulfonate (PFPeS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-n-tetradecanoic acid (PFTeDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-n-tridecanoic acid (PFTrDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluoro-n-undecanoic acid (PFUDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-methylperfluoro-1-octanesulfonamide (MeFOSA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-ethylperfluoro-1-octanesulfonamide (EtFOSA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	1H,1H,2H,2H-perfluorododecane sulfonate (10:2FTS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-Ethyl Perfluorooctane sulfonamido ethanol (EtFOSE)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	N-Methyl Perfluorooctane sulfonamido ethanol (MeFOSE)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Sodium dodecafluoro-3H-4, 8-dioxanonanoate (NaDONA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	9Cl-PF3ONS

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	11Cl-PF3OUDS
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorododecanesulfonic acid (PFDOS)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorohexadecanoic acid (PFHxDA)
LC/MS/MS	PFAS by LCMSMS Compliant with QSM 5.4 Table B-15	Perfluorooctadecanoic acid (PFODA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorobutanoic acid (PFBA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoropentanoic acid (PFPeA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorohexanoic acid (PFHxA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoroheptanoic acid (PFHpA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorooctanoic acid (PFOA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorononanoic acid (PFNA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorodecanoic acid (PFDA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoroundecanoic acid (PFUnA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorododecanoic acid (PFDoA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorotridecanoic acid (PFTrDA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorotetradecanoic acid (PFTeDA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorobutanesulfonic acid (PFBS)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoropentanesulfonic acid (PFPeS)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorohexanesulfonic acid (PFHxS)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoroheptanesulfonic acid (PFHpS)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorooctanesulfonic acid (PFOS)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorononanesulfonic acid (PFNS)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorodecanesulfonic acid (PFDS)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorododecanesulfonic acid (PFDoS)
LC/MS/MS	EPA Draft Method 1633 Version 2	1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS)
LC/MS/MS	EPA Draft Method 1633 Version 2	1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS)
LC/MS/MS	EPA Draft Method 1633 Version 2	1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorooctanesulfonamide (PFOSA)
LC/MS/MS	EPA Draft Method 1633 Version 2	N-methyl perfluorooctanesulfonamide (NMeFOSA)
LC/MS/MS	EPA Draft Method 1633 Version 2	N-ethyl perfluorooctanesulfonamide (NEtFOSA)
LC/MS/MS	EPA Draft Method 1633 Version 2	N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)
LC/MS/MS	EPA Draft Method 1633 Version 2	N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)
LC/MS/MS	EPA Draft Method 1633 Version 2	N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE)
LC/MS/MS	EPA Draft Method 1633 Version 2	N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE)
LC/MS/MS	EPA Draft Method 1633 Version 2	Hexafluoropropylene oxide dimer acid (HFPO-DA)
LC/MS/MS	EPA Draft Method 1633 Version 2	4,8-Dioxa-3H-perfluorononanoic acid (ADONA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoro-3-methoxypropanoic acid (PFMPA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoro-4-methoxybutanoic acid (PFMBA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)
LC/MS/MS	EPA Draft Method 1633 Version 2	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)
LC/MS/MS	EPA Draft Method 1633 Version 2	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA)
LC/MS/MS	EPA Draft Method 1633 Version 2	3-Perfluoropropyl propanoic acid (3:3FTCA)
LC/MS/MS	EPA Draft Method 1633 Version 2	2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA)
LC/MS/MS	EPA Draft Method 1633 Version 2	3-Perfluoroheptyl propanoic acid (7:3FTCA)
HPLC	EPA 8330B MOD	2-Amino-4,6-dinitrotoluene
HPLC	EPA 8330B MOD	4-Amino-2,6-dinitrotoluene
HPLC	EPA 8330B MOD	1,3-Dinitrobenzene
HPLC	EPA 8330B MOD	2,4-Dinitrotoluene
HPLC	EPA 8330B MOD	2,6-Dinitrotoluene
HPLC	EPA 8330B MOD	HMX
HPLC	EPA 8330B MOD	Nitrobenzene
HPLC	EPA 8330B MOD	Nitrocellulose
HPLC	EPA 8330B MOD	Nitroguanidine
HPLC	EPA 8330B MOD	Nitroglycerin (NG)
HPLC	EPA 8330B MOD	2-Nitrotoluene
HPLC	EPA 8330B MOD	3-Nitrotoluene
HPLC	EPA 8330B MOD	4-Nitrotoluene
HPLC	EPA 8330B MOD	RDX
HPLC	EPA 8330B MOD	Tetryl
HPLC	EPA 8330B MOD	1,3,5-Trinitrobenzene
HPLC	EPA 8330B MOD	2,4,6-Trinitrotoluene
HPLC	EPA 8330B MOD	3,5-Dinitroaniline
HPLC	EPA 8330B MOD	Pentaerythritol tetranitrate (PETN)
ICP	EPA 6010D	Aluminum
ICP	EPA 6010D	Antimony
ICP	EPA 6010D	Arsenic
ICP	EPA 6010D	Barium
ICP	EPA 6010D	Beryllium
ICP	EPA 6010D	Cadmium
ICP	EPA 6010D	Calcium
ICP	EPA 6010D	Chromium
ICP	EPA 6010D	Cobalt
ICP	EPA 6010D	Copper

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
ICP	EPA 6010D	Iron
ICP	EPA 6010D	Lead
ICP	EPA 6010D	Magnesium
ICP	EPA 6010D	Manganese
ICP	EPA 6010D	Molybdenum
ICP	EPA 6010D	Nickel
ICP	EPA 6010D	Potassium
ICP	EPA 6010D	Selenium
ICP	EPA 6010D	Silver
ICP	EPA 6010D	Sodium
ICP	EPA 6010D	Thallium
ICP	EPA 6010D	Tin
ICP	EPA 6010D	Vanadium
ICP	EPA 6010D	Zinc
ICP/MS	EPA 6020B	Aluminum
ICP/MS	EPA 6020B	Antimony
ICP/MS	EPA 6020B	Arsenic
ICP/MS	EPA 6020B	Barium
ICP/MS	EPA 6020B	Beryllium
ICP/MS	EPA 6020B	Cadmium
ICP/MS	EPA 6020B	Calcium
ICP/MS	EPA 6020B	Chromium
ICP/MS	EPA 6020B	Cobalt
ICP/MS	EPA 6020B	Copper
ICP/MS	EPA 6020B	Iron
ICP/MS	EPA 6020B	Lead
ICP/MS	EPA 6020B	Magnesium
ICP/MS	EPA 6020B	Manganese
ICP/MS	EPA 6020B	Nickel
ICP/MS	EPA 6020B	Potassium
ICP/MS	EPA 6020B	Selenium
ICP/MS	EPA 6020B	Silver
ICP/MS	EPA 6020B	Sodium
ICP/MS	EPA 6020B	Thallium
ICP/MS	EPA 6020B	Vanadium
ICP/MS	EPA 6020B	Zinc

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
CVAA	EPA 7471B	Mercury
Titration	Walkley-Black	TOC
UV/VIS	EPA 9012B	Total Cyanide
IC	EPA 9056A	Bromide
IC	EPA 9056A	Chloride
IC	EPA 9056A	Fluoride
IC	EPA 9056A	Sulfate
IC	EPA 9056A	Nitrate
IC	EPA 9056A	Nitrite
IC	EPA 300.0	Fluoride
IC	EPA 300.0	Chloride
IC	EPA 300.0	Sulfate
IC	EPA 300.0	Bromide
IC	EPA 300.0	Nitrate
IC	EPA 300.0	Nitrite
IC	EPA 7199 / EPA 3060A	Hexavalent chromium
UV/VIS	EPA 7196A / EPA 3060A	Hexavalent chromium
Pensky-Martens	EPA 1010A	Ignitability
Electrode	EPA 9045D	Corrosivity
Photometric	Sec. 7.3.3 SW-846	Reactive Cyanide
Titration	Sec. 7.3.4 SW-846	Reactive Sulfide
Filtration	EPA 9095B	Paint Filter Test
UV/VIS	EPA 365.1 MOD	Phosphorus
UV/VIS	EPA 353.2 MOD	Nitrate
UV/VIS	EPA 353.2 MOD	Nitrite
UV/VIS	EPA 353.2 MOD	Nitrate-Nitrite
Gas Diffusion / UV/VIS	EPA 350.1	Ammonia - N
UV/VIS	EPA 351.2 MOD	TKN
GC	MADEP-EPH MOD	Extractable Petroleum Hydrocarbons (EPH) Modified
GC	MADEP-VPH-MOD	Volatile Petroleum Hydrocarbons (VPH) Modified
Preparation	**Method**	**Type**
Organic Preparation	EPA 3550C	Preparation of Soil by Sonication
Organic Preparation	EPA 3546	Microwave Extraction

Solid and Chemical Materials		
Technology	**Method**	**Analyte**
Organic Cleanup	EPA 3620B	Florisil Cleanup Procedure
Organic Cleanup	EPA 3660B	Sulfur Cleanup Procedure
Organic Cleanup	EPA 3665A	Sulfuric Acid Cleanup Procedure
Organic Cleanup	EPA 3640C	GPC Cleanup Procedure
Volatile Organic Preparation	EPA 5035	Closed-System Purge-and-Trap and extraction for Volatile Organics in Soil and Waste Samples
Volatile Organic Preparation	EPA 3585	Waste Dilution for Volatile Organics
Waste Dilution	EPA 3580A	Waste Dilution
Inorganic Preparation	EPA 3050B	Preparation of Soils by Hotblock
Inorganic/Organic Preparation	EPA 1311	Toxicity Characteristic Leaching Procedure (TCLP)
Inorganic/Organic Preparation	EPA 1312	Synthetic Precipitation Leaching Procedure (SPLP)
Inorganic Metals Preparation	EPA 3010A	Acid Digestion of Aqueous Samples and TCLP/SPLP Extracts

Biological Tissue		
Technology	**Method**	**Analyte**
GC	EPA 8081B	4,4'-DDE
GC	EPA 8081B	4,4'-DDT
GC	EPA 8081B	Aldrin
GC	EPA 8081B	alpha-BHC
GC	EPA 8081B	alpha-Chlordane
GC	EPA 8081B	beta-BHC
GC	EPA 8081B	Chlordane
GC	EPA 8081B	delta-BHC
GC	EPA 8081B	Dieldrin
GC	EPA 8081B	Endosulfan I
GC	EPA 8081B	Endosulfan II
GC	EPA 8081B	Endosulfan sulfate
GC	EPA 8081B	Endrin
GC	EPA 8081B	Endrin Aldehyde
GC	EPA 8081B	Endrin Ketone
GC	EPA 8081B	gamma-BHC (Lindane)
GC	EPA 8081B	gamma-Chlordane
GC	EPA 8081B	Heptachlor
GC	EPA 8081B	Heptachlor Epoxide
GC	EPA 8081B	Methoxychlor
GC	EPA 8081B	Toxaphene

Biological Tissue		
Technology	**Method**	**Analyte**
GC	EPA 8082A	Aroclor 1016
GC	EPA 8082A	Aroclor 1221
GC	EPA 8082A	Aroclor 1232
GC	EPA 8082A	Aroclor 1242
GC	EPA 8082A	Aroclor 1248
GC	EPA 8082A	Aroclor 1254
GC	EPA 8082A	Aroclor 1260
GC	EPA 8082A	Aroclor 1262
GC	EPA 8082A	Aroclor 1268
GC/MS	EPA 8270E	1,1'-Biphenyl
GC/MS	EPA 8270E	1-Methylnaphthalene
GC/MS	EPA 8270E	2-Methylnaphthalene
GC/MS	EPA 8270E	Acenaphthene
GC/MS	EPA 8270E	Acenaphthylene
GC/MS	EPA 8270E	Anthracene
GC/MS	EPA 8270E	Atrazine
GC/MS	EPA 8270E	Benzo(a)anthracene
GC/MS	EPA 8270E	Benzo(b)fluoranthene
GC/MS	EPA 8270E	Benzo(g,h,i)perylene
GC/MS	EPA 8270E	Benzo(k)fluoranthene
GC/MS	EPA 8270E	Chrysene
GC/MS	EPA 8270E	Dibenzo(a,h)anthracene
GC/MS	EPA 8270E	Dibenzofuran
GC/MS	EPA 8270E	Dimethoate
GC/MS	EPA 8270E	Disulfoton
GC/MS	EPA 8270E	Fluoranthene
GC/MS	EPA 8270E	Fluorene
GC/MS	EPA 8270E	Hexachlorobenzene
GC/MS	EPA 8270E	Indeno(1,2,3-c,d)pyrene
GC/MS	EPA 8270E	Methyl parathion
GC/MS	EPA 8270E	Naphthalene
GC/MS	EPA 8270E	Phenanthrene
GC/MS	EPA 8270E	Phorate
GC/MS	EPA 8270E	Pronamide

Biological Tissue		
Technology	**Method**	**Analyte**
GC/MS	EPA 8270E	Pyrene
Preparation	**Method**	**Type**
Organic Preparation	EPA 3540C	Soxhlet Extraction

AFFF (Aqueous Film Forming Foams) Products		
Technology	**Method**	**Analyte**
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorobutanoic acid (PFBA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoropentanoic acid (PFPeA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorohexanoic acid (PFHxA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoroheptanoic acid (PFHpA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorooctanoic acid (PFOA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorononanoic acid (PFNA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorodecanoic acid (PFDA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoroundecanoic acid (PFUnA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorododecanoic acid (PFDoA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorotridecanoic acid (PFTrDA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorotetradecanoic acid (PFTeDA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorobutanesulfonic acid (PFBS)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoropentanesulfonic acid (PFPeS)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorohexanesulfonic acid (PFHxS)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoroheptanesulfonic acid (PFHpS)

AFFF (Aqueous Film Forming Foams) Products		
Technology	**Method**	**Analyte**
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorooctanesulfonic acid (PFOS)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorononanesulfonic acid (PFNS)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorodecanesulfonic acid (PFDS)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorododecanesulfonic acid (PFDoS)
LC/MS/MS	EPA Draft Method 1633 Version 2	1H,1H,2H,2H-Perfluorohexane sulfonic acid (4:2FTS)
LC/MS/MS	EPA Draft Method 1633 Version 2	1H,1H,2H,2H-Perfluorooctane sulfonic acid (6:2FTS)
LC/MS/MS	EPA Draft Method 1633 Version 2	1H,1H,2H,2H-Perfluorodecane sulfonic acid (8:2FTS)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluorooctanesulfonamide (PFOSA)
LC/MS/MS	EPA Draft Method 1633 Version 2	N-methyl perfluorooctanesulfonamide (NMeFOSA)
LC/MS/MS	EPA Draft Method 1633 Version 2	N-ethyl perfluorooctanesulfonamide (NEtFOSA)
LC/MS/MS	EPA Draft Method 1633 Version 2	N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)
LC/MS/MS	EPA Draft Method 1633 Version 2	N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)
LC/MS/MS	EPA Draft Method 1633 Version 2	N-methyl perfluorooctanesulfonamidoethanol (NMeFOSE)
LC/MS/MS	EPA Draft Method 1633 Version 2	N-ethyl perfluorooctanesulfonamidoethanol (NEtFOSE)
LC/MS/MS	EPA Draft Method 1633 Version 2	Hexafluoropropylene oxide dimer acid (HFPO-DA)
LC/MS/MS	EPA Draft Method 1633 Version 2	4,8-Dioxa-3H-perfluorononanoic acid (ADONA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoro-3-methoxypropanoic acid (PFMPA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoro-4-methoxybutanoic acid (PFMBA)
LC/MS/MS	EPA Draft Method 1633 Version 2	Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)
LC/MS/MS	EPA Draft Method 1633 Version 2	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid (9Cl-PF3ONS)
LC/MS/MS	EPA Draft Method 1633 Version 2	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)

AFFF (Aqueous Film Forming Foams) Products		
Technology	**Method**	**Analyte**
LC/MS/MS	EPA Draft Method 1633 Version 2	Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA)
LC/MS/MS	EPA Draft Method 1633 Version 2	3-Perfluoropropyl propanoic acid (3:3FTCA)
LC/MS/MS	EPA Draft Method 1633 Version 2	2H,2H,3H,3H-Perfluorooctanoic acid (5:3FTCA)
LC/MS/MS	EPA Draft Method 1633 Version 2	3-Perfluoroheptyl propanoic acid (7:3FTCA)

Note:

1. This scope is formatted as part of a single document including Certificate of Accreditation No. L2224.

Jason Stine, Vice President

THE STATE of ALASKA
GOVERNOR MICHAEL J. DUNLEAVY

Department of Environmental Conservation

DIVISION OF SPILL PREVENTION AND RESPONSE
Contaminated Sites Program
Laboratory Approval Program

555 Cordova Street
Anchorage, Alaska 99501
Main: 907.465.5390
Fax: 907.269.7649
cs.lab.cert@alaska.gov

December 3, 2021

Daniel J. Wright
Pace Analytical Services - West Columbia, SC
106 Vantage Point Drive
West Columbia, SC 29172

RE: Contaminated Sites Laboratory Approval **20-002**

Thank you for submitting a completed application to the Alaska Department of Environmental Conservation's Contaminated Sites Laboratory Approval Program (CS-LAP), on November 2, 2021. Based on your lab's Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP) approval through the ANSI-ASQ National Accreditation Board (ANAB), Pace Analytical Services - West Columbia, SC, located at the above address, is granted ***Approved*** status to perform the analyses listed in the attached *Scope of Approval*, for Alaska contaminated sites projects, including underground storage tanks and leaking underground storage tank sites (UST/LUST), under the July 1, 2017 amendments to 18 AAC 78. This approval is effective December 3, 2021 and expires on ***December 18, 2024***.

Be aware that in accordance with 18 AAC 78.815(b) and 18 AAC 78.815(e), **any** changes in your lab's NELAP and/or DoD-ELAP approval status for **any** analytes in **any** methods or **any** matrices must be reported to the CS-LAP within 3 business days. This includes any suspension of any analyte(s) due to failed Performance Testing (PT) or Performance Evaluation (PE) samples. **FAILURE TO REPORT A CHANGE IN STATUS WILL RESULT IN REVOCATION OF ALL CS-LAP APPROVALS FOR ALL ANALYTES AND ALL METHODS IN ALL MATRICES FOR A PERIOD OF ONE YEAR.** Notification should be in writing sent to cs.lab.cert@alaska.gov. We recommend also contacting the CS-LAP by telephone to verify that the message was received.

If you have any questions, please contact the CS-LAP at (907) 465-5390, or by email at cs.lab.cert@alaska.gov. Labs are also highly encouraged to join the CS-LAP listserv by going to http://list.state.ak.us/mailman/listinfo/cs.lab.approval.

Respectfully,

Brian England

Attachment: Scope of Approval

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
120226-60-0	Soil	10:2 Fluorotelomer sulfonic acid	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
120226-60-0	Water	10:2 Fluorotelomer sulfonic acid	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
763051-92-9	Soil	11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
763051-92-9	Water	11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
-	Soil	4:2 Fluorotelomersulfonate	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
-	Water	4:2 Fluorotelomersulfonate	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
-	Soil	6:2 Fluorotelomersulfonate	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
-	Water	6:2 Fluorotelomersulfonate	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
-	Soil	8:2 Fluorotelomersulfonate	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
-	Water	8:2 Fluorotelomersulfonate	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
756426-58-1	Soil	9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
756426-58-1	Water	9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
13252-13-6	Soil	Hexafluoropropylene oxide dimer acid (HFPO-DA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
13252-13-6	Water	Hexafluoropropylene oxide dimer acid (HFPO-DA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
4151-50-2	Soil	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
4151-50-2	Water	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
1691-99-2	Soil	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
1691-99-2	Water	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
2991-50-6	Soil	N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
2991-50-6	Water	N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
31506-32-8	Soil	N-Methyl perfluorooctane sulfonamide (MeFOSA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
31506-32-8	Water	N-Methyl perfluorooctane sulfonamide (MeFOSA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
24448-09-7	Soil	N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
24448-09-7	Water	N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
2355-31-9	Soil	N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
2355-31-9	Water	N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
375-73-5	Soil	Perfluorobutanesulfonic acid (PFBS)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
375-73-5	Water	Perfluorobutanesulfonic acid (PFBS)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
375-22-4	Soil	Perfluorobutanoic acid (PFBA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
375-22-4	Water	Perfluorobutanoic acid (PFBA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
335-77-3	Soil	Perfluorodecane sulfonic acid (PFDS)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
335-77-3	Water	Perfluorodecane sulfonic acid (PFDS)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
335-76-2	Soil	Perfluorodecanoic acid (PFDA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
335-76-2	Water	Perfluorodecanoic acid (PFDA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
79780-39-5	Soil	Perfluorododecanesulfonic acid (PFDOS)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
79780-39-5	Water	Perfluorododecanesulfonic acid (PFDOS)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
307-55-1	Soil	Perfluorododecanoic acid (PFDoA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
307-55-1	Water	Perfluorododecanoic acid (PFDoA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
375-92-8	Soil	Perfluoroheptane sulfonic acid (PFHpS)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
375-92-8	Water	Perfluoroheptane sulfonic acid (PFHpS)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
375-85-9	Soil	Perfluoroheptanoic acid (PFHpA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
375-85-9	Water	Perfluoroheptanoic acid (PFHpA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
67905-19-5	Soil	Perfluorohexadecanoic acid (PFHxDA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
67905-19-5	Water	Perfluorohexadecanoic acid (PFHxDA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
355-46-4	Soil	Perfluorohexanesulfonic acid (PFHxS)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
355-46-4	Water	Perfluorohexanesulfonic acid (PFHxS)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
307-24-4	Soil	Perfluorohexanoic acid (PFHxA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
307-24-4	Water	Perfluorohexanoic acid (PFHxA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
-	Soil	Perfluorononanesulfonic acid (PFNS)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
-	Water	Perfluorononanesulfonic acid (PFNS)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
375-95-1	Soil	Perfluorononanoic acid (PFNA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
375-95-1	Water	Perfluorononanoic acid (PFNA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
16517-11-6	Soil	Perfluorooctadecanoic acid (PFODA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
16517-11-6	Water	Perfluorooctadecanoic acid (PFODA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
-	Soil	Perfluorooctanesulfonamide (PFOSA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
-	Water	Perfluorooctanesulfonamide (PFOSA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
1763-23-1	Soil	Perfluorooctanesulfonic acid (PFOS)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
1763-23-1	Water	Perfluorooctanesulfonic acid (PFOS)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
335-67-1	Soil	Perfluorooctanoic acid (PFOA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
335-67-1	Water	Perfluorooctanoic acid (PFOA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
-	Soil	Perfluoropentanesulfonic acid (PFPeS)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
-	Water	Perfluoropentanesulfonic acid (PFPeS)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
2706-90-3	Soil	Perfluoropentanoic acid (PFPeA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
2706-90-3	Water	Perfluoropentanoic acid (PFPeA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
376-06-7	Soil	Perfluorotetradecanoic acid (PFTA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
376-06-7	Water	Perfluorotetradecanoic acid (PFTA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
72629-94-8	Soil	Perfluorotridecanoic acid (PFTrDA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
72629-94-8	Water	Perfluorotridecanoic acid (PFTrDA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
2058-94-8	Soil	Perfluoroundecanoic acid (PFUnA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
2058-94-8	Water	Perfluoroundecanoic acid (PFUnA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
919005-14-4	Soil	Sodium dodecafluoro-3H-4, 8-dioxanonanoate (NaDONA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB
-	Water	Sodium dodecafluoro-3H-4, 8-dioxanonanoate (NaDONA)	PFAS by LCMSMS Compliant with QSM 5.3 Table B-15	ANAB

Accredited Laboratory

A2LA has accredited

PACE ANALYTICAL NATIONAL, LLC

Mt. Juliet, TN

for technical competence in the field of

Environmental Testing

In recognition of the successful completion of the A2LA evaluation process that includes an assessment of the laboratory's compliance with ISO/IEC 17025:2005, the 2009 TNI Environmental Testing Laboratory Standard, and the requirements of the Department of Defense Environmental Laboratory Accreditation Program (DoD ELAP) and the requirements of the Department of Energy Consolidated Audit Program (DOECAP) as detailed in version 5.4 of the DoD Quality System Manual for Environmental Laboratories (QSM), accreditation is granted to this laboratory to perform recognized EPA methods as defined on the associated A2LA Environmental Scope of Accreditation. This accreditation demonstrates technical competence for this defined scope and the operation of a laboratory quality management system (refer to joint ISO-ILAC-IAF Communiqué dated April 2017).

Presented this 29th day of November 2023.

Mr. Trace McInturff, Vice President, Accreditation Services
For the Accreditation Council
Certificate Number 1461.01
Valid to November 30, 2025

For the tests to which this accreditation applies, please refer to the laboratory's Environmental Scope of Accreditation.

SCOPE OF ACCREDITATION TO ISO/IEC 17025:2017

PACE ANALYTICAL NATIONAL, LLC
12065 Lebanon Road
Mt. Juliet, TN 37122
Blake Judge Phone: 615 773 9770

ENVIRONMENTAL

Valid To: November 30, 2025 Certificate Number: 1461.01

In recognition of the successful completion of the A2LA evaluation process, (including an assessment of the laboratory's compliance with the 2009 TNI Environmental Testing Laboratory Standard, the requirements of the DoD Environmental Laboratory Accreditation Program (DoD ELAP) and the requirements of the Department of Energy Consolidated Audit Program (DOECAP) as detailed in version 5.4 of the DoD/DOE Quality Systems Manual for Environmental Laboratories (QSM), and ISO/IEC 17025:2017 accreditation, is granted to this laboratory to perform recognized EPA methods using the following testing technologies and in the analyte categories identified below:

Testing Technologies

Demands, Gas Chromatography, Gas Chromatography/Mass Spectrometry, Gravimetry, HPLC, HPLC/MS/MS, Hazardous Waste Characteristics Tests, Ion Chromatography, FIMS AA Cold Vapor, ICP, ICP-MS, MBAS, Misc. electrodes (pH, F, O), Titrimetry, Turbidity, Microbiology, Air, Bioassay, Gamma Spectrometry, Alpha Spectrometry, KPA, Liquid Scintillation, GFAA

*Solid Hazardous Waste methods, Microbiology, Air Testing and Bioassay are accredited to the requirements of the DoD ELAP and DOECAP.

Environmental Analyses				
Parameter/Analyte	**Potable Water**	**Nonpotable Water**	**Solid Hazardous Waste**	
			Aqueous*	**Solid***
Metals				
Aluminum	EPA 200.7	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Antimony	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Arsenic	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Barium	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Beryllium	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B

5202 Presidents Court, Suite 220 | Frederick, MD 21703-8398 | Phone: 301 644 3248 | Fax: 240 454 9449 | www.A2LA.org

Environmental Analyses				
Parameter/Analyte	**Potable Water**	**Nonpotable Water**	**Solid Hazardous Waste**	
			Aqueous*	**Solid***
Boron	EPA 200.7	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Cadmium	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Calcium	EPA 200.7	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Chromium	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Cobalt	EPA 200.7	EPA 200.7	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Copper	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Iron	EPA 200.7	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Isotopic Uranium	----------	----------	EPA 6020, 6020A, 6020B	EPA 6020, 6020A, 6020B
Lead	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Lithium	EPA 200.7	EPA 200.7	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Magnesium	EPA 200.7	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Manganese	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Mercury	EPA 245.1	EPA 245.1	EPA 7470 A	EPA 7471 A, B
Molybdenum	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Nickel	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Phosphorus	EPA 200.7	EPA 200.7	EPA 6010 B, C, D	EPA 6010 B, C, D
Potassium	EPA 200.7	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Selenium	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B

Environmental Analyses				
Parameter/Analyte	**Potable Water**	**Nonpotable Water**	**Solid Hazardous Waste**	
			Aqueous*	**Solid***
Silver	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Sodium	EPA 200.7	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Strontium	EPA 200.7	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Thallium	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Tin	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Titanium	EPA 200.7	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Thorium	----------	EPA 200.8	EPA 6020, 6020A, 6020B	EPA 6020, 6020A, 6020B
Uranium	EPA 200.8	EPA 200.8	EPA 6020, 6020A, 6020B	EPA 6020, 6020A, 6020B
Vanadium	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Zinc	EPA 200.7 EPA 200.8	EPA 200.7 EPA 200.8	EPA 6010 B, C, D EPA 6020, 6020A, 6020B	EPA 6010 B, C, D EPA 6020, 6020A, 6020B
Metals Preparation	EPA 200.2	EPA 200.2	EPA 3015 A	EPA 3051 A EPA 3050 B
Nutrients				
Ammonia (as N)	----------	EPA 350.1 SM 4500 NH_3 B-2011 (prep) SM 4500 NH_3 G-2011	EPA 350.1 SM 4500 NH_3 B-2011 (prep) SM 4500 NH_3 G-2011	EPA 350.1 SM 4500 NH_3 B-2011 (prep) SM 4500 NH_3 G-2011
Kjeldahl Nitrogen	----------	EPA 351.2 SM 4500 N_{org} D-2011	----------	----------
Organic Nitrogen (as N)	----------	SM 4500 N_{org} D 2011	----------	----------
Nitrate (as N)	EPA 300.0 SM 4110 B-2011 EPA 353.2 SM 4500-NO3 F-2011	EPA 300.0 SM 4110 B-2011 EPA 353.2 SM 4500 NO_3 F-2011 SM 4500 NO_3 F-2016	EPA 9056, 9056 A	EPA 9056, 9056 A

Environmental Analyses				
Parameter/Analyte	**Potable Water**	**Nonpotable Water**	**Solid Hazardous Waste**	
			Aqueous*	**Solid***
Nitrate-nitrite (as N)	EPA 300 .0 SM 4110 B-2011 EPA 353.2 SM 4500 NO3 F-2011	EPA 300.0 SM 4110 B- 2011 EPA 353.2 SM 4500 NO_3 F-2011 SM 4500 NO_3 F-2016	EPA 9056, 9056 A	EPA 9056, 9056 A
Nitrite (as N)	EPA 300.0 EPA 353.2 SM 4110 B-2011 SM 4500 NO^3F-2011	EPA 300.0 EPA 353.2 SM 4110 B-2011 SM 4500 NO3 F-2011	EPA 9056, 9056 A	EPA 9056, 9056 A
Orthophosphate (as P)	EPA 365.2 SM 4500 P E-2011	EPA 365.2 SM 4500 P E-2011	----------	EPA 9056, 9056 A
Total Phosphorus	----------	EPA 365.1 EPA 365.4 SM 4500 P H-2011 (prep) SM 4500 P B-2011 (prep)	----------	----------
Anion Preparation	----------	----------	----------	Prep: 300 Rv 2.1
Demands				
Biological Oxygen Demand	----------	SM 5210 B-2011 SM 5210 B-2016	----------	----------
Carbonaceous BOD	----------	SM 5210 B-2011 SM 5210 B-2016	----------	----------
Chemical Oxygen Demand	----------	EPA 410.4 SM 5220 D-2011	----------	----------
Dissolved Organic Carbon	SM 5310 C-2011	SM 5310 B-2011 SM 5310 B-2014	EPA 9060 A	
Total Organic Carbon	SM 5310 C-2011	SM 5310 B-2011 SM 5310 B-2014	EPA 9060 A	Walkley Black Mod.
Dissolved Oxygen	----------	SM 4500 O G-2016	----------	----------
Dissolved Carbon	----------	SM 5310 B-2014	----------	----------
Inorganic Carbon	----------	SM 5310 B-2014	----------	----------
Extractable Organic Halides	----------	----------	----------	EPA 9023
Total Organic Halides	----------	SM 5320 B-2010	EPA 9020 B	EPA 9076
Wet Chemistry				
% Ash	----------	----------	----------	ASTM D5468 ASTM D482
Acidity	----------	SM 2310 B-2011	----------	----------
Alkalinity	SM 2320 B-2011	EPA 310.1 EPA 310.2 SM 2320 B-2011	----------	----------
Bromide	EPA 300.0 SM 4110 B-2011	EPA 300.0 SM 4110 B-2011	EPA 9056, 9056 A	EPA 9056, 9056 A
BTU	----------	----------	----------	ASTM D240

Environmental Analyses				
Parameter/Analyte	**Potable Water**	**Nonpotable Water**	**Solid Hazardous Waste**	
			Aqueous*	**Solid***
Carbon Dioxide	SM 4500– CO2 D – 2011	SM 4500-CO2 D-2011		
Chlorite	EPA 300.1	EPA 300.1	EPA 300.1	EPA 300.1
Chlorate	EPA 300.0 EPA 300.1	EPA 300.0 EPA 300.1	EPA 9056, 9056A EPA 300.1	EPA 9056, 9056A EPA 300.1
Chloride	EPA 300.0 SM 4110 B – 2011	EPA 300.0 SM 4110 B-2011	EPA 9056, 9056 A	EPA 9056, 9056 A
Chlorine	SM 4500 Cl G – 2011	SM 4500 Cl G-2011	----------	----------
Color	SM 2120 B-2011	SM 2120 B-2011	----------	----------
Cyanide	EPA 335.4 SM 4500 CN B, C-2011 prep & (distillation) SM 4500 CN E-2011 (analysis)	EPA 335.4 SM 4500 CN B, C-2011 prep & (distillation) SM 4500 CN E-2011 (analysis) SM 4500 CN E-2016	EPA 9010 C EPA 9012 B	EPA 9012 B EPA 9010 C
Cyanide Amenable to Chlorination	EPA 335.4 SM 4500 CN B-2011 (prep) SM 4500 CN G-2011	EPA 335.4 SM 4500 CN B - 2011 (prep) SM 4500 CN G-2011 SM 4500 CN E-2016	EPA 9010 C EPA 9012 B	EPA 9010 C EPA 9012 B
Density (Specific Gravity)	----------	SM 2710 F-2011	----------	----------
Total Dissolved Solids	SM 2540 C-2011	SM 2540 C-2011	----------	----------
Fractional Organic Carbon and Organic Matter	----------	----------	----------	ASTM D2974-07A
Fluoride	EPA 300.0 SM 4110 B-2011	EPA 300.0 SM 4110 B-2011 SM 4500 F B-2011 (prep) SM 4500 F C-2011	EPA 9056, 9056 A	EPA 9056, 9056 A
Hardness	EPA 130.1 SM 2340 B-2011	EPA 130.1 EPA 200.7 SM 2340 B-2011	EPA 6010 B, C, D	----------
Hexavalent Chromium	EPA 218.6 SM 3500 Cr B-2011 SM 3500 Cr C-2011	EPA 218.6 M SM 3500 Cr B-2011 SM 3500 Cr C-2011	EPA 7196 A EPA 7199	EPA 7196 A Prep EPA 3060 A EPA 7199
Iron (Ferrous)	----------	SM 3500 Fe B-2011	----------	----------
MBAS (Surfactants)	SM 5540 C-2011	SM 5540 C-2011	----------	----------
Total Suspended Solids	SM 2540 D-2011	SM 2540 D-2011 SM 2540 D-2015	----------	----------

Environmental Analyses				
Parameter/Analyte	**Potable Water**	**Nonpotable Water**	**Solid Hazardous Waste**	
			Aqueous*	**Solid***
Oil and Grease	----------	EPA 1664 A EPA 1664 B	EPA 9070 A EPA 1664 A EPA 1664 B	EPA 9071 B
Oxidation Reduction Potential	SM 2580 B	SM 2580 B	SM 2580 B	SM 2580 B Modified
Perchlorate	EPA 314 Mod.	EPA 314 Mod.	EPA 314 Mod.	EPA 314 Mod.
pH	EPA 150.1 SM 4500-H B-2011	EPA 150.1 SM 4500-H B-2011	EPA 9040 B EPA 9040 C	EPA 9045 C EPA 9045 D
Phenols	EPA 420.1 EPA 420.4 SM 5530 D-2005	EPA 420.1 EPA 420.4 SM 5530 D-2005	EPA 9066	----------
Salinity	----------	SM 2520 B-2011	----------	----------
Settleable Solids	----------	SM 2540 F-2011 SM 2540 F-2015	----------	----------
Specific Conductance	EPA 120.1 SM 2510 B-2011	EPA 120.1 SM 2510 B-2011	EPA 9050 A	EPA 9050 A
Sulfide	----------	SM 4500-S2 D-2011	----------	EPA 9030 B EPA 9034
Sulfate	EPA 300.0 SM 4110 B-2011	EPA 300.0 SM 4110 B-2011	EPA 9056, 9056 A	EPA 9056, 9056 A
Sulfite	----------	4500-SO_3 B-2011	----------	----------
Total Solids	----------	SM 2540 B-2011 SM 2540 B-2015	----------	SM 2540 G (20^{th})
Turbidity	SM 2130 B-2011	EPA 180.1 SM 2130 B-2011	----------	----------
UV 254	SM 5910 B-2011	SM 5910 B-2011	----------	----------
Volatile Residue	----------	EPA 160.4 SM 2540 E-2011 SM 2540 E-2015	----------	----------
Microbiology*				
Fecal Coliform	----------	EPA 1681 Colilert-18 SM 9223 B-2016	EPA 1681	EPA 1681
Total Coliform	SM 9223 B-2004	SM 9223 B-2004 SM 9223 B-2016	----------	----------
Escherichia coli	SM 9223 B-2004	SM 9223 B-2004 SM 9223 B-2016	----------	----------
Legionella	Legiolert	Legiolert		
Heterotrophic Bacteria	SM 9215 B-2000	SM 9215 B-2000	----------	----------
Purgeable Organics (Volatiles)				
1,1,1,2-Tetrachloroethane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
1,1,1-Trichloroethane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D

Environmental Analyses				
Parameter/Analyte	**Potable Water**	**Nonpotable Water**	**Solid Hazardous Waste**	
			Aqueous*	**Solid***
1,1,2,2-Tetrachloroethane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
1,1,2-Trichloro-1,2,2-trifluoroethane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
1,1,2-Trichloroethane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
1,1-Dichloroethane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
1,1-Dichloroethene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
1,1-Dichloropropene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
1,2,3-Trichlorobenzene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
1,2,3-Trichloropropane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
1,2,3-Trimethylbenzene	----------	EPA 624.1	EPA 8260 B, C, D	EPA 8260 B, C, D
1,2,4-Trichlorobenzene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
1,2,4-Trimethylbenzene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
1,2-Dibromo-3-chloropropane	----------	EPA 624.1 SM 6200 B-2011 EPA 8011	EPA 8260 B, C, D	EPA 8260 B, C, D
1,2-Dibromomethane (EDB)	----------	EPA 624.1 SM 6200 B-2011 EPA 8011	EPA 8260 B, C, D	EPA 8260 B, C, D
1,2-Dichlorobenzene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
1,2-Dichloroethane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
1,2-Dichloropropane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
1,3,5-Trichlorobenzene	----------	EPA 624.1	EPA 8260 B, C, D	EPA 8260 B, C, D
1,3,5-Trimethylbenzene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
1,3-Butadiene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
1,3-Dichlorobenzene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
1,3-Dichloropropane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
1,4-Dichlorobenzene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
1,4-Dioxane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D (Includes SIM)	EPA 8260 B, C, D (Includes SIM)
1-Butanol	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D

Environmental Analyses				
Parameter/Analyte	**Potable Water**	**Nonpotable Water**	**Solid Hazardous Waste**	
			Aqueous*	**Solid***
1-Methylnaphthalene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
2,2,4-Trimethylpentane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
2,2-Dichloropropane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
2-Butanone (MEK)	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
2-Chloroethyl Vinyl Ether	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
2-Chlorotoluene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
2-Hexanone	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
2-Methylnaphthalene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
2-Nitropropane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
3,3-dimethyl-1-butanol	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
4-Chlorotoluene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
4-Ethyltoluene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
4-Methyl-2-pentanone (MIBK)	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Acetone	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Acetonitrile	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Acrolein	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Acrylonitrile	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Allyl Chloride	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Benzene	----------	EPA 602 EPA 624.1 SM 6200 B-2011	EPA 8021 B EPA 8260 B, C, D OK DEQ	EPA 8021 B EPA 8260 B, C, D OK DEQ
Bromobenzene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260B, C, D	EPA 8260 B, C, D
Bromochloromethane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Bromodichloromethane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Bromoethane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Bromoform	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D

Environmental Analyses				
Parameter/Analyte	**Potable Water**	**Nonpotable Water**	**Solid Hazardous Waste**	
			Aqueous*	**Solid***
Bromomethane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Carbon Disulfide	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Carbon Tetrachloride	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Chlorobenzene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Chloroethane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Chloroform	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Chloromethane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Chloroprene (2-chloro-1,3-Butadiene)	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
cis-1,2-Dichloroethene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
cis-1,3-Dichloropropene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
cis-1,4-Dichloro-2-Butene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Cyclohexane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Cyclohexanone	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Dibromochloromethane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Dibromomethane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Dichlorodifluoromethane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Dicyclopentadiene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Diethyl Ether	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Diisopropyl Ether (DIPE)	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Ethanol	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D EPA 8015C	EPA 8260 B, C, D EPA 8015C
Ethyl Acetate	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Ethyl Methacrylate	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Ethylbenzene	----------	EPA 602 EPA 624.1 SM 6200 B-2011	EPA 8021 B EPA 8260 B, C, D OK DEQ	EPA 8021 B EPA 8260 B, C, D OK DEQ
Ethyl-tert-butyl-ether (ETBE)	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D

Environmental Analyses				
Parameter/Analyte	**Potable Water**	**Nonpotable Water**	**Solid Hazardous Waste**	
			Aqueous*	**Solid***
Gasoline Range Organics	----------	----------	EPA 8015 B, C, D EPA 8260 B, C, D NWTPH GX OA-1 WI GRO MADEP VPH MT VPH KS LRH AK 101 OK DEQ	EPA 8015 B, C, D EPA 8260 B, C, D NWTPH GX OA-1 WI GRO MADEP VPH MT VPH KS LRH AK 101 OK DEQ
C5-C6 Aliphatic Hydrocarbons	----------	----------	WA DOE VPH	WA DOE VPH
>C6-C8 Aliphatic Hydrocarbons	----------	----------	WA DOE VPH VPH LA	WA DOE VPH VPH LA
>C8-C10 Aliphatic Hydrocarbons	----------	----------	WA DOE VPH VPH LA	WA DOE VPH VPH LA
C8-C10 Aromatic Hydrocarbons	----------	----------	WA DOE VPH VPH LA	WA DOE VPH VPH LA
Hexachlorobutadiene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Hexachloroethane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Iodomethane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Iso-butyl Alcohol	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Isopropanol	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Ethylbenzene	----------	EPA 602 EPA 624.1 SM 6200 B-2011	EPA 8021 B EPA 8260 B, C	EPA 8021 B EPA 8260 B, C
Ethyl Methacrylate	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C	EPA 8260 B, C
Ethyl-tert-butyl-ether (ETBE)	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C	EPA 8260 B, C
42-Hexanone	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C	EPA 8260 B, C
Hexachlorobutadiene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C	EPA 8260 B, C
Isopropylbenzene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Methacrylonitrile	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Methanol	----------	----------	EPA 8015C	EPA 8015C
Methyl Acetate	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Methyl Methacrylate	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Methylcyclohexane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D

Environmental Analyses				
Parameter/Analyte	**Potable Water**	**Nonpotable Water**	**Solid Hazardous Waste**	
			Aqueous*	**Solid***
Methylene Chloride	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Methyl-tert-butyl-ether (MTBE)	----------	EPA 624.1 EPA 6200B- 2011	EPA 8021 B EPA 8260 B, C, D OK DEQ	EPA 8021 B EPA 8260 B, C, D OK DEQ
m-Xylene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Naphthalene	----------	EPA 624.1 SM 6200B-2011	EPA 8021 B EPA 8260 B, C, D OK DEQ	EPA 8021 B EPA 8260 B, C, D OK DEQ
n-Butylbenzene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
n-Heptane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
n-Hexane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
n-Octane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
n-Propylbenzene	----------	EPA 624.1 SM 6200B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
o-Xylene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Pentachloroethane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
p-Isopropyltoluene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Propene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Propionitrile	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
p-Xylene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
sec-Butylbenzene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Styrene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
t-Amyl Alcohol	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
t-Butyl Formate	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
tert-Amyl ethyl ether	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Tert-Amyl-methyl-ether (TAME)	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
tert-Butyl Alcohol (TBA)	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
tert-Butylbenzene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Tetrachloroethene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D

Environmental Analyses				
Parameter/Analyte	**Potable Water**	**Nonpotable Water**	**Solid Hazardous Waste**	
			Aqueous*	**Solid***
Tetrahydrofuran	----------	EPA 624.1 SM 6200B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Toluene	----------	EPA 602 EPA 624.1 SM 6200 B-2011	EPA 8021 B EPA 8260 B, C, D OK DEQ	EPA 8021 B EPA 8260 B, C, D OK DEQ
trans-1,2-Dichloroethene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
trans-1,3-Dichloropropene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
trans-1,4-Dichloro-2-Butene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Trichloroethene	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Trichlorofluoromethane	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Trihalomethanes	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Vinyl Acetate	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Vinyl Chloride	----------	EPA 624.1 SM 6200 B-2011	EPA 8260 B, C, D	EPA 8260 B, C, D
Xylenes, total	----------	EPA 602 EPA 624.1 SM 6200 B-2011	EPA 8021 B EPA 8260 B, C, D OK DEQ	EPA 8021 B EPA 8260 B, C, D OK DEQ
Purgeables Preparation	----------	----------	EPA 5030 C	EPA 5035 A EPA 3585
Extractable Organics (Semivolatiles)				
1,2,3,4-Tetrachlorobenzene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
1,2,3,5-Tetrachlorobenzene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
1,2,4,5-Tetrachlorobenzene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
1,2,4-Trichlorobenzene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
1,2-Dichlorobenzene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
1,2-Diphenylhydrazine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
1,3,5-Trinitrobenzene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
1,3-Dichlorobenzene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
1,3-Dinitrobenzene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
1,4-Dichlorobenzene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
1,4-Dinitrobenzene		EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
1,4-Dioxane	----------	EPA 625.1 SIM	EPA 8270 C, D, E SIM (Isotopic dilution)	EPA 8270 C, D, E SIM (Isotopic dilution)
1,4-Naphthoquinone	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
1,4-Phenylenediamine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
1-Chloronaphthalene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E

Environmental Analyses				
Parameter/Analyte	**Potable Water**	**Nonpotable Water**	**Solid Hazardous Waste**	
			Aqueous*	**Solid***
1-Methylnaphthalene	----------	EPA 625.1 (Includes SIM)	EPA 8270 C, D, E (Includes SIM)	EPA 8270 C, D, E (Includes SIM)
1-Naphthylamine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
2,2-Oxybis(1-chloropropane)	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
2,3,4,6-Tetrachlorophenol	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
2,4,5-Trichlorophenol	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
2,4,6-Trichlorophenol	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
2,4-Dichlorophenol	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
2,4-Dimethylphenol	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
2,4-Dinitrophenol	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
2,4-Dinitrotoluene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
2,6-Dichlorophenol	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
2,6-Dinitrotoluene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
2,6-Toluenediisocyanate		EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
2-Acetylaminofluorene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
2-Chloronaphthalene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
2-Chlorophenol	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
2-Methyl-4,6-Dinitrophenol	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
2-Methylnaphthalene	----------	EPA 625.1 (Includes SIM)	EPA 8270 C, D, E (Includes SIM)	EPA 8270 C, D, E (Includes SIM)
2-Methylphenol	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
2-Naphthylamine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
2-Nitroaniline	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
2-Nitrodiphenylamine		EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
2-Nitrophenol	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
2-Picoline	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
3,3'-Dichlorobenzidine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
3,3-Dimethylbenzidine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
3-Methylcholanthrene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
3-Methylphenol	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
3-Nitroaniline	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
4,4'-Methylenebis(2-chloroaniline)		EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
4-Aminobiphenyl	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
4-Bromophenylphenylether	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
4-Chloro-3-methylphenol	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
4-Chloroaniline	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
4-Chlorophenyl Phenyl Ether	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
4-Methylphenol	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
4-Nitro Quinoline-1-Oxide	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
4-Nitroaniline	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
4-Nitrophenol	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
5-Nitro-2-Toluidine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E

Environmental Analyses				
Parameter/Analyte	**Potable Water**	**Nonpotable Water**	**Solid Hazardous Waste**	
			Aqueous*	**Solid***
7,12-Dimethylbenz (a)anthracene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
7H-Dibenzo(c,g)carbazole	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Acenaphthene	----------	EPA 625.1 (Includes SIM)	EPA 8270 C, D, E (Includes SIM)	EPA 8270 C, D, E (Includes SIM)
Acenaphthylene	----------	EPA 625.1 (Includes SIM)	EPA 8270 C, D, E (Includes SIM)	EPA 8270 C, D, E (Includes SIM)
Acetophenone	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Alpha Terpineol	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Aniline	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Anthracene	----------	EPA 625.1 (Includes SIM)	EPA 8270 C, D, E (Includes SIM)	EPA 8270 C, D, E (Includes SIM)
Aramite	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Atrazine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Benzaldehyde	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Benzal Chloride	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Benzenethiol		EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Benzidine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Benzo (a) Anthracene	----------	EPA 625.1 (Includes SIM)	EPA 8270 C, D, E (Includes SIM	EPA 8270 C, D, E (Includes SIM)
Benzo (a) Pyrene	----------	EPA 625.1 (Includes SIM)	EPA 8270 C, D, E (Includes SIM)	EPA 8270 C, D, E (Includes SIM)
Benzo (b) Fluoranthene	----------	EPA 625.1 (Includes SIM)	EPA 8270 C, D, E (Includes SIM)	EPA 8270 C, D, E (Includes SIM)
Benzo (ghi) Perylene	----------	EPA 625.1 (Includes SIM)	EPA 8270 C, D, E (Includes SIM)	EPA 8270 C, D, E (Includes SIM)
Benzo (k) Fluoranthene	----------	EPA 625.1 (Includes SIM)	EPA 8270 C, D, E (Includes SIM)	EPA 8270 C, D, E (Includes SIM)
Benzo(j)fluoranthene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Benzoic Acid	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Benzotrichloride	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Benzyl Alcohol	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Benzyl Chloride	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Biphenyl (1,1-)	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Bis (2-chloroethoxy) methane	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Bis (2-chloroethyl) Ether	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Bis (2-ethylhexyl) phthalate	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Butyl benzyl phthalate	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Caprolactam	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Carbazole	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Chlorobenzilate	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Chrysene	----------	EPA 625.1 (Includes SIM)	EPA 8270 C, D, E (Includes SIM)	EPA 8270 C, D, E (Includes SIM)
cis-Diallate	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
cis-Isosafrole	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Dibenzo (a,e) pyrene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Dibenzo (a,h) acridine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E

Environmental Analyses				
Parameter/Analyte	**Potable Water**	**Nonpotable Water**	**Solid Hazardous Waste**	
			Aqueous*	**Solid***
Dibenzo (a,h) anthracene	----------	EPA 625.1	EPA 8270 C, D, E (Includes SIM)	EPA 8270 C, D, E (Includes SIM)
Dibenzo (a,i) pyrene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Dibenzo (a,j) acridine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Dibenzofuran	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Diesel Range Organics / Oil Range Organics / Residual Range Organics	----------	----------	EPA 8015 B, C, D FL PRO OA2 TN EPH TX 1005 WI DRO NWTPH Dx NWTPH ID MADEP EPH MT EPH NJ EPH KS MRH-HRH 8270C DRO MO AK 102 AK 103 EPA 8270 C, D, E OK DEQ TX 1006	EPA 8015 B, C, D FL PRO OA2 TN EPH TX 1005 WI DRO NWTPH Dx NWTPH ID MADEP EPH MT EPH NJ EPH KS MRH-HRH 8270C DRO MO AK 102 AK 103 EPA 8270 C, D, E OK DEQ TX 1006
C10-C12 Aliphatic Hydrocarbons	----------	----------	WA DOE EPH LA EPH	WA DOE EPH LA EPH
C12-C16 Aliphatic Hydrocarbons	----------	----------	WA DOE EPH LA EPH	WA DOE EPH LA EPH
C16-C21 Aliphatic Hydrocarbons	----------	----------	WA DOE EPH LA EPH	WA DOE EPH LA EPH
C21-C34 Aliphatic Hydrocarbons	----------	----------	WA DOE EPH LA EPH	WA DOE EPH LA EPH
C10-C12 Aromatic Hydrocarbons	----------	----------	WA DOE EPH LA EPH	WA DOE EPH LA EPH
C12-C16 Aromatic Hydrocarbons	----------	----------	WA DOE EPH LA EPH	WA DOE EPH LA EPH
C16-C21 Aromatic Hydrocarbons	----------	----------	WA DOE EPH LA EPH	WA DOE EPH LA EPH
C21-C34 Aromatic Hydrocarbons	----------	----------	WA DOE EPH LA EPH	WA DOE EPH LA EPH
Diethyl Phthalate	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Dimethoate	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Dimethyl Phthalate	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Di-n-butyl Phthalate	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Di-n-octyl Phthalate	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Dinoseb	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Diphenyl Ether	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Diphenyl Ketone (Benzophenone)	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Diphenylamine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Disulfoton	----------	----------	EPA 8270 C, D, E	EPA 8270 C, D, E

Environmental Analyses				
Parameter/Analyte	**Potable Water**	**Nonpotable Water**	**Solid Hazardous Waste**	
			Aqueous*	**Solid***
2-Ethosyethanol	----------	EPA 8015B, 8015C Rv3, 8015D	EPA 8015B, 8015C Rv3, 8015D	EPA 8015B, 8015C Rv3, 8015D
Ethylene Glycol	----------	----------	EPA 8015 B, C, D	EPA 8015 B, C, D
Ethyl Methanesulfonate	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Famphur	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Fluoranthene	----------	EPA 625.1 (Includes SIM)	EPA 8270 C, D, E (Includes SIM)	EPA 8270 C, D, E (Includes SIM)
Fluorene	----------	EPA 625.1 (Includes SIM)	EPA 8270 C, D, E (Includes SIM)	EPA 8270 C, D, E (Includes SIM)
Hexachlorobenzene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Hexachlorobutadiene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Hexachlorocyclopentadiene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Hexachloroethane	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Hexachlorophene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Hexachloropropene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Hydroquinone	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Indene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Indeno (1,2,3-cd) Pyrene	----------	EPA 625.1 (Includes SIM)	EPA 8270 C, D, E (Includes SIM)	EPA 8270 C, D, E (Includes SIM)
Isodrin	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Isophorone	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Kepone	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Methapyrilene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Methyl Methanesulfonate	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Mirex		EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Naphthalene	----------	EPA 625.1 (Includes SIM)	EPA 8270 C, D, E (Includes SIM)	EPA 8270 C, D, E (Includes SIM)
n-Decane	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Nitrobenzene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
n-Nitrosodiethylamine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
n-Nitrosodimethylamine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
n-Nitroso-di-n-butylamine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
n-Nitrosodi-n-propylamine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
n-Nitrosodiphenylamine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
n-Nitrosomethylethylamine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
n-Nitrosomorpholine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
n-Nitrosopiperidine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
n-Nitrosopyrrolidine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
n-Octadecane	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
O,O,O-Triethyl phosphorothioate	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
o-Toluidine (2-Methylaniline)	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Parathion Ethyl	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Parathion Methyl	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E

Environmental Analyses				
Parameter/Analyte	**Potable Water**	**Nonpotable Water**	**Solid Hazardous Waste**	
			Aqueous*	**Solid***
p-Dimethlaminoazobenzene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Pentachlorobenzene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Pentachloroethane	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Pentachloronitrobenzene	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Pentachlorophenol	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Phenacetin	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Phenanthrene	----------	EPA 625.1 (Includes SIM)	EPA 8270 C, D, E (Includes SIM)	EPA 8270 C, D, E (Includes SIM)
Phenol	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Phorate	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Phthalic Anhydride	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Polynuclear Aromatic Hydrocarbons	----------	EPA 625.1 (Includes SIM)	EPA 8270 C, D, E (Includes SIM)	EPA 8270 C, D, E (Includes SIM)
Propylene Glycol	----------	EPA 8015 B, C, D	EPA 8015 B, C, D	EPA 8015 B, C, D
Pronamide	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Pyrene	----------	EPA 625.1 (Includes SIM)	EPA 8270 C, D, E (Includes SIM)	EPA 8270 C, D, E (Includes SIM)
Pyridine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Quinoline	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Safrole	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Sulfotepp	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Tetra Ethyl Lead	----------	----------	EPA 8270 C, D, E	EPA 8270 C, D, E
Thionazin	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
trans-Diallate	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
trans-Isosafrole	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Triethyl Glycol	----------	EPA 8015B, 8015C Rv 3, 8015D	EPA 8015B, 8015C Rv 3, 8015D	EPA 8015B, 8015C Rv 3, 8015D
Triclosan	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
tris-(2,3-dibromopropyl) phosphate	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
α, α-Dimethylphenethylamine	----------	EPA 625.1	EPA 8270 C, D, E	EPA 8270 C, D, E
Pesticides/Herbicides/ PCBs				
Atrazine	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Azinphos Methyl	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Bolstar	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Butachlor	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Carbophenothion	----------	----------	EPA 8141 B	EPA 8141 B
Chlorpyrifos	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Coumaphos	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Cyanazine	----------	----------	EPA 8141 B	EPA 8141 B
Demeton-O & -S	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Diazinon	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Dichlorvos	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Dimethoate	----------	EPA 1657 Mod.	EPA 8141 B	EPA 8141 B
Disulfoton	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
EPN	----------	EPA 1657 Mod.	EPA 8141 B	EPA 8141 B

Environmental Analyses				
Parameter/Analyte	**Potable Water**	**Nonpotable Water**	**Solid Hazardous Waste**	
			Aqueous*	**Solid***
Ethion	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Ethoprop	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Famphur	----------	----------	EPA 8141 B	EPA 8141 B
Fensulfothion	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Fenthion	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Malathion	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Merphos	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Mevinphos	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Naled	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Parathion Ethyl	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Parathion Methyl	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Phorate	----------	----------	EPA 8141 B	EPA 8141 B
Phosmet	----------	----------	EPA 8141 B	EPA 8141 B
Ronnel	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Simazine	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Stirophos	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Sulfotepp	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
TEPP	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Tetrachlorvinphos	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Tokuthion (Prothiofos)	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
Trichloronate	----------	EPA 1657 A Mod.	EPA 8141 B	EPA 8141 B
4,4'-DDD	----------	EPA 608.3	EPA 8081 A, B	EPA 8081 A, B
4,4'-DDE	----------	EPA 608.3	EPA 8081 A, B	EPA 8081 A, B
4,4'-DDT	----------	EPA 608.3	EPA 8081 A, B	EPA 8081 A, B
Aldrin	----------	EPA 608.3	EPA 8081 A, B	EPA 8081 A, B
alpha-BHC	----------	EPA 608.3	EPA 8081 B	EPA 8081 B
beta-BHC	----------	EPA 608.3	EPA 8081 A, B	EPA 8081 A, B
Chlordane	----------	EPA 608.3	EPA 8081 A, B	EPA 8081 A, B
Chlordane (Alpha)	----------	EPA 608.3	EPA 8081 A, B	EPA 8081 A, B
Chlordane (Gamma)	----------	EPA 608.3	EPA 8081 A, B	EPA 8081 A, B
delta-BHC	----------	EPA 608.3	EPA 8081 A, B	EPA 8081 A, B
Dieldrin	----------	EPA 608.3	EPA 8081 A, B	EPA 8081 A, B
Endosulfan I (alpha)	----------	EPA 608.3	EPA 8081 A, B	EPA 8081 A, B
Endosulfan II (beta)	----------	EPA 608.3	EPA 8081 A, B	EPA 8081 A, B
Endosulfan sulfate	----------	EPA 608.3	EPA 8081 A, B	EPA 8081 A, B
Endrin	----------	EPA 608.3	EPA 8081 A, B	EPA 8081 A, B
Endrin aldehyde	----------	EPA 608.3	EPA 8081 A, B	EPA 8081 A, B
Endrin ketone	----------	EPA 608.3	EPA 8081 A, B	EPA 8081 A, B
gamma-BHC	----------	EPA 608.3	EPA 8081 A, B	EPA 8081 A, B
Heptachlor	----------	EPA 608.3	EPA 8081 A, B	EPA 8081 A, B
Heptachlor Epoxide	----------	EPA 608.3	EPA 8081 A, B	EPA 8081 A, B
Hexachlorobenzene	----------	EPA 608.3	EPA 8081 A, B	EPA 8081 A, B
Methoxychlor	----------	EPA 608.3	EPA 8081 A, B	EPA 8081 A, B
Toxaphene	----------	EPA 608.3	EPA 8081 A, B	EPA 8081 A, B
PCB-1016 (Arochlor)	----------	EPA 608.3	EPA 8082, 8082 A	EPA 8082, 8082 A
PCB-1221	----------	EPA 608.3	EPA 8082, 8082 A	EPA 8082, 8082 A
PCB-1232	----------	EPA 608.3	EPA 8082, 8082 A	EPA 8082, 8082 A
PCB-1242	----------	EPA 608.3	EPA 8082, 8082 A	EPA 8082, 8082 A

Environmental Analyses				
Parameter/Analyte	**Potable Water**	**Nonpotable Water**	**Solid Hazardous Waste**	
			Aqueous*	**Solid***
PCB-1248	----------	EPA 608.3	EPA 8082, 8082 A	EPA 8082, 8082 A
PCB-1254	----------	EPA 608.3	EPA 8082, 8082 A	EPA 8082, 8082 A
PCB-1260	----------	EPA 608.3	EPA 8082, 8082 A	EPA 8082, 8082 A
PCB-1262	----------	EPA 608.3	EPA 8082, 8082 A	EPA 8082, 8082 A
PCB-1268	----------	EPA 608.3	EPA 8082, 8082 A	EPA 8082, 8082 A
2,4,5-T	----------	----------	EPA 8151 A, EPA 8321B 2007	EPA 8151 A, EPA 8321B 2007
2,4,5-TP (Silvex)	----------	----------	EPA 8151 A, EPA 8321B 2007	EPA 8151 A, EPA 8321B 2007
2,4-D	----------	----------	EPA 8151 A, EPA 8321B 2007	EPA 8151 A, EPA 8321B 2007
2,4-DB	----------	----------	EPA 8151 A, EPA 8321B 2007	EPA 8151 A, EPA 8321B 2007
Dalapon	----------	----------	EPA 8151 A, EPA 8321B 2007	EPA 8151 A, EPA 8321B 2007
Dicamba	----------	----------	EPA 8151 A, EPA 8321B 2007	EPA 8151 A, EPA 8321B 2007
Dichloroprop	----------	----------	EPA 8151 A, EPA 8321B 2007	EPA 8151 A, EPA 8321B 2007
Dinoseb	----------	----------	EPA 8151 A, EPA 8321B 2007	EPA 8151 A, EPA 8321B 2007
MCPA	----------	----------	EPA 8151 A, EPA 8321B 2007	EPA 8151 A, EPA 8321B 2007
MCPP	----------	----------	EPA 8151 A, EPA 8321B 2007	EPA 8151 A, EPA 8321B 2007
Pentachlorophenol	----------	----------	EPA 8151 A	EPA 8151 A
Organic Preparation				
Microextraction	----------	----------	EPA 3511	----------
Separatory funnel	----------	----------	EPA 3510 C EPA 3510 C RVE	----------
Sonication	----------	----------	----------	EPA 3550 B, C
Soxtherm	----------	----------	----------	EPA 3541
Microwave	----------	----------	----------	EPA 3546
Clean up	----------	----------	EPA 3580 A EPA 3630 C EPA 3660 B EPA 3665 A	EPA 3580 A EPA 3630 C EPA 3660 B EPA 3665 A
Explosives				
1,3,5-Trinitrobenzene	----------	----------	EPA 8330 A, B	EPA 8330 A, B
1,3-Dinitrobenzene	----------	----------	EPA 8330 A, B	EPA 8330 A, B
2,4,6-Trinitrotoluene	----------	----------	EPA 8330 A, B	EPA 8330 A, B
2,4-Dinitrotoluene	----------	----------	EPA 8330 A, B	EPA 8330 A, B
2,6-Dinitrotoluene	----------	----------	EPA 8330 A, B	EPA 8330 A, B
2-Amino-4,6-dinitrotoluene	----------	----------	EPA 8330 A, B	EPA 8330 A, B
2-Nitrotoluene	----------	----------	EPA 8330 A, B	EPA 8330 A, B
3-Nitrotoluene	----------	----------	EPA 8330 A, B	EPA 8330 A, B
4-Amino-2,6-dinitrotoluene	----------	----------	EPA 8330 A, B	EPA 8330 A, B

Environmental Analyses				
Parameter/Analyte	**Potable Water**	**Nonpotable Water**	**Solid Hazardous Waste**	
			Aqueous*	**Solid***
4-Nitrotoluene	----------	----------	EPA 8330 A, B	EPA 8330 A, B
HMX (Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine)	----------	----------	EPA 8330 A, B	EPA 8330 A, B
Nitrobenzene	----------	----------	EPA 8330 A, B	EPA 8330 A, B
Nitroglycerine	----------	----------	EPA 8330 A, B	EPA 8330 A, B
Nitroguanidine	----------	----------	EPA 8330 A, B	EPA 8330 A, B
PETN (Pentaerythritol Tetranitrate)	----------	----------	EPA 8330 A, B	EPA 8330 A, B
RDX (Hexahydro-1,3,5-trinitro-1,3,5-triazine)	----------	----------	EPA 8330 A, B	EPA 8330 A, B
Tetryl (N-methyl-N,2,4,6-trinitrophenylnitramine)	----------	----------	EPA 8330 A, B	EPA 8330 A, B
Guanidine Nitrate	----------	----------	EPA 9056 A Mod.	EPA 9056 A Mod.
Nitrocellulose	----------	----------	EPA 353.2 Mod.	EPA 353.2 Mod.
8330A/8330B Prep	----------	----------	EPA 3535 A	EPA 3550 C
Hazardous Waste Characteristics				
Conductivity	----------	----------	EPA 9050 A	----------
Corrosivity	----------	----------	EPA 9045 C, D	EPA 9045 C, D
Ignitability	----------	----------	EPA 1010 EPA 1010 A	EPA 1010 EPA 1010 A
Paint Filter Liquids Test	----------	----------	----------	EPA 9095 A, B
Toxicity Characteristic Leaching Procedure	----------	----------	----------	EPA 1311
Synthetic Leachate Procedure	----------	----------	----------	EPA 1312
Bioassay*				
Ceriodaphnia Dubia Survival and Reproduction Test	----------	EPA 1002	----------	----------
Fathead Minnow Larval Survival and Growth Test	----------	EPA 1000	----------	----------
Ceriodapnia – Acute	----------	EPA 2002	----------	----------
Fathead Minnow – Acute	----------	EPA 2000	----------	----------

Air Testing		
Parameter/Analyte	**Air**	**Nonpotable Water**
1,1,1,-Trichloroethane	TO-15, TO-15 SIM	----------
1,1,2,2-Tetrachloroethane	TO-15, TO-15 SIM	----------
1,1,2-Trichloroethane	TO-15, TO-15 SIM	----------
1,1-Dichloroethane	TO-15. TO-15 SIM	----------
1,1-Dichloroethene	TO-15, TO-15 SIM	----------
1,1-Difluoroethane	TO-15	----------
1,2,3-Trimethylbenzene	TO-15	----------
1,2,4-Trichlorobenzene	TO-15	----------

Air Testing		
Parameter/Analyte	**Air**	**Nonpotable Water**
1,2,4-Trimethylbenzene	TO-15	----------
1,2-Dibromoethane	TO-15, TO-15 SIM	----------
1,2-Dichlorobenzene	TO-15	----------
1,2-Dichloroethane	TO-15	----------
1,2-Dichloropropane	TO-15, TO-15 SIM	----------
1,3,5-Trimethylbenzene	TO-15	----------
1,3-Butadiene	TO-15	----------
1,3-Dichlorobenzene	TO-15	----------
1,4-Bromofluorobenzene	TO-15, TO-15 SIM	----------
1,4-Dichlorobenzene	TO-15, TO-15 SIM	----------
1,4-Dioxane	TO-15	----------
2,2,4-Trimethylpentane	TO-15	----------
2-Chlorotoluene	TO-15	----------
2-Methylnaphthalene	TO-15	----------
4-Ethyltoluene	TO-15	----------
Acetaldehyde	TO-15	----------
Acetone	TO-15	----------
1,2-Dibromo-3-chloropropane	TO-15	----------
Acetonitrile	TO-15	----------
Acrolein	TO-15	----------
Acrylonitrile	TO-15	----------
Allyl Chloride	TO-15	----------
Benzene	TO-15, TO-15 SIM	----------
Benzyl Chloride	TO-15	----------
Bromodichloromethane	TO-15	----------
Bromoethane	TO-15	----------
Bromoform	TO-15	----------
Bromomethane	TO-15	----------
Carbon Disulfide	TO-15	----------
Carbon Tetrachloride	TO-15, TO-15 SIM	----------
Chlorobenzene	TO-15	----------
Chlorodifluoromethane	TO-15	----------
Chloroethane	TO-15, TO-15 SIM	----------
Chloroform	TO-15, TO-15 SIM	----------
Chloromethane	TO-15, TO-15 SIM	----------
cis-1,2-Dichloroethene	TO-15, TO-15 SIM	----------
cis-1,3-Dichloropropene	TO-15, TO-15 SIM	----------
Cyclohexane	TO-15	----------
Dibromochloromethane	TO-15	----------
Di-isopropyl Ether	TO-15	----------
Ethanol	TO-15	----------
Ethyl Acetate	TO-15	----------
Ethyl tert-butyl Ether	TO-15	----------
Ethylbenzene	TO-15, TO-15 SIM	----------
Freon-11 (Trichlorofluoromethane)	TO-15	----------
Freon-113 (1,1,2-Trichlorotrifluoroethane)	TO-15	----------

Air Testing		
Parameter/Analyte	**Air**	**Nonpotable Water**
Freon-114 (1,2-Dichlorotetrafluoroethane)	TO-15	----------
Freon-12 (Dichlorodifluoromethane)	TO-15	----------
Gasoline Range Organics	TO-15	----------
Hexachloro-l,3-Butadiene	TO-15	----------
Iodomethane	TO-15	
Isopropylbenzene	TO-15	----------
lsopropyl Alcohol	TO-15	----------
Methanol	TO-15	----------
Methyl Acetate	TO-15	----------
Methyl Butyl Ketone (2-Hexanone)	TO-15	----------
Methyl Cyclohexane	TO-15	----------
Methyl Ethyl Ketone (2-Butanone)	TO-15	----------
Methyl Isobutyl Ketone (4-Methyl-2-pentanone)	TO-15	----------
Methyl Methacrylate	TO-15	----------
Methyl-tert-butyl-Ether	TO-15	----------
Methylene Chloride	TO-15	----------
m-xylene	TO-15	----------
Naphthalene	TO-15, TO-15 SIM	----------
n-Butane	TO-15	----------
n-Butylbenzene	TO-15	----------
n-Decane	TO-15	----------
n-Heptane	TO-15	----------
n-Hexane	TO-15	----------
n-Nonane	TO-15	----------
n-Octane	TO-15	----------
n-Pentane	TO-15	----------
n-Propylbenzene	TO-15	----------
o-xylene	TO-15	----------
Propylene	TO-15	----------
p-xylene	TO-15	----------
p-isopropyltoluene	TO-15	----------
sec-Butylbenzene	TO-15	----------
Styrene	TO-15	----------
tert-Amyl-ethyl-ether	TO-15	----------
Tert-Amyl-methyl ether	TO-15	----------
tert-Butyl-alcohol	TO-15	----------
tert-Butylbenzene	TO-15	----------
Tetrachloroethylene	TO-15, TO-15 SIM	----------
Tetrahydrofuran	TO-15	----------
Toluene	TO-15	----------
trans-1,2-Dichloroethene	TO-15, TO-15 SIM	----------
trans-1,3-Dichloropropene	TO-15, TO-15 SIM	----------
Trichloroethylene	TO-15, TO-15 SIM	----------
Vinyl acetate	TO-15, TO-15 SIM	----------

Air Testing		
Parameter/Analyte	**Air**	**Nonpotable Water**
Vinyl bromide	TO-15	----------
Vinyl Chloride	TO-15, TO-15 SIM	----------
Xylenes (Total)	TO-15	----------
Acetylene	EPA 8015 M	RSK-175
Butane	EPA 8015 M	RSK-175
Ethane	EPA 8015 M	RSK-175
Ethene	EPA 8015 M	RSK-175
Isobutane	EPA 8015 M	RSK-175
Methane	EPA 8015 M	RSK-175
Propane	EPA 8015 M	RSK-175
Carbon Dioxide	ASTM D1946	----------
Carbon Monoxide	ASTM D1946	----------
Methane	ASTM D1946	----------
Oxygen	ASTM D1946	----------
Helium	ASTM D1946	----------

Radiochemistry		
Parameter/Analyte	**Nonpotable Water**	**Solid**
Gross Alpha	EPA 900 EPA 9310 ASTM D7283-13 (Liquid Scintillation)	EPA 900 Mod. EPA 9310 Mod. ASTM D7283-13 (Liquid Scintillation)
Gross Beta	EPA 900 EPA 9310 ASTM D7283-13 (Liquid Scintillation)	EPA 900 Mod. EPA 9310 Mod. ASTM D7283-13 (Liquid Scintillation)
Radium-228	EPA 904 EPA 9320	EPA 904 Mod. EPA 9320 Mod.
Total Strontium	EPA 905	EPA 905 Mod.
Strontium-89	EPA 905	EPA 905 Mod.
Strontium-90	EPA 905	EPA 905 Mod,
Tritium	EPA 906.0	EPA 906.0 Mod.
Carbon-14	EPA C-01	EPA C-01 Mod.
Radium-226	SM 7500-Ra B SM 7500 Ra B Mod. EPA 903 EPA 9315	SM 7500 Ra B Mod. EPA 903 EPA 9315
Total Alpha Radium	SM 7500-Ra B	SM 7500-Ra B Mod.
Radon-222	SM 7500-Rn B	
Am-241	EPA 907 Mod.	EPA 907 Mod.
Am-242/243	EPA 907 Mod.	EPA 907 Mod.
Cm-242	EPA 907 Mod.	EPA 907 Mod.
Cm-243/244	EPA 907 Mod.	EPA 907 Mod.
Cm-244	EPA 907 Mod.	EPA 907 Mod.
Cm-245/246	EPA 907 Mod.	EPA 907 Mod.
I-129	EPA 902 M	EPA 902 M
Ni-63	CHEM-TP-Ni.1 Modified	CHEM-TP-Ni.1 Modified
Np-237	EPA 907 Mod.	EPA 907 Mod.
Pb-210	ASTM D7535-09	ASTM D7535-09

Po-210	DOE HASL 300 Po-2 RC	DOE HASL 300 Po-2 RC
Pu-238	EPA 907 Mod.	EPA 907 Mod.
Pu-239	EPA 907 Mod.	EPA 907 Mod.
Pu-239/240	EPA 907 Mod.	EPA 907 Mod.
Th-227	LANL ER 200 Mod.	LANL ER 200 Mod.
Th-228	LANL ER 200 Mod.	LANL ER 200 Mod.
Th-230	LANL ER 200 Mod.	LANL ER 200 Mod.
Th-232	LANL ER 200 Mod.	LANL ER 200 Mod.
Radiochemistry		
Parameter/Analyte	**Nonpotable Water**	**Solid**
U-233/234	ASTM D3972	ASTM D3972 Mod.
U-235	ASTM D3972	ASTM D3972 Mod.
U-235/236	ASTM D3972	ASTM D3972 Mod.
U-238	ASTM D3972	ASTM D3972 Mod.
Total Uranium	ASTM D5174	ASTM D5174 Mod.
Gamma Spectrometry	EPA 901.1 HASL 300 Ga-01-R DOE 4.5.2.3	HASL 300 Ga-01-R DOE 4.5.2.3
Tc-99	TC-02-RC	TC-02-RC

In addition, in recognition of the successful completion of the A2LA evaluation process including an assessment of the laboratory's compliance with ISO IEC 17025:2017, the 2009 TNI Environmental Testing Laboratory Standard, and for the test methods applicable to Kentucky Statute KRS 224.60-130(2)(a), and for the test methods applicable to the Wyoming Storage Tank Remediation Laboratory Accreditation Program), accreditation is granted to this laboratory to perform recognized EPA methods using the following testing technologies and in the analyte categories identified below:

Kentucky UST Program		
Parameter/Analyte	**Solid Hazardous Waste**	
	Aqueous	**Solid**
Toxicity Characteristic Leaching Procedure (Metals & Organics	----------	EPA 1311
TPH (Oil & Grease)	EPA 9070A EPA 1664A EPA 1664B	EPA 9071A
Metals		
Arsenic	EPA 6010B, 6010C EPA 6020, 6020A	EPA 6010B, 6010C EPA 6020, 6020A
Barium	EPA 6010B, 6010C EPA 6020, 6020A	EPA 6010B, 6010C EPA 6020, 6020A
Cadmium	EPA 6010B, 6010C EPA 6020, 6020A	EPA 6010B, 6010C EPA 6020, 6020A
Chromium	EPA 6010B, 6010C EPA 6020, 6020A	EPA 6010B, 6010C EPA 6020, 6020A
Lead	EPA 6010B, 6010C EPA 6020, 6020A	EPA 6010B, 6010C EPA 6020, 6020A
Mercury	EPA 7470A	EPA 7471A EPA 7471B
Selenium	EPA 6010B, 6010C EPA 6020, 6020A	EPA 6010B, 6010C EPA 6020, 6020A
Silver	EPA 6010B, 6010C EPA 6020, 6020A	EPA 6010B, 6010C EPA 6020, 6020A

Organics		
Gasoline Range Organics	EPA 8015 B, C, D	EPA 8015 B, C, D
Diesel Range Organics	EPA 8015 B, C, D	EPA 8015 B, C, D
Benzene	EPA 8260 B	EPA 8260 B
Ethyl Benzene	EPA 8260 B	EPA 8260 B
Toluene	EPA 8260 B	EPA 8260 B
Xylenes	EPA 8260 B	EPA 8260 B
TPH (Fingerprint)	EPA 8015 B, C, D	EPA 8015 B, C, D

Parameter/Analyte	**Solid Hazardous Waste**	
	Aqueous	**Solid**
Volatile Organic Compounds	EPA 8260 B	EPA 8260 B
Semi-Volatile Organics	EPA 8270 C	EPA 8270 C
PAH	EPA 8270C	EPA 8270C

Wyoming STR Program		
Parameter/Analyte	**Solid Hazardous Waste**	
	Aqueous	**Solid**
Metals		
Cadmium	EPA 6010 C	EPA 6010 C
Chromium	EPA 6010 C	EPA 6010 C
Lead	EPA 6010 C	EPA 6010 C
Purgeable Organics (Volatiles)		
Benzene	EPA 8260 B	EPA 8260 B
Diisopropyl Ether	EPA 8260 B	EPA 8260 B
Ethanol	EPA 8260 B	EPA 8260 B
Ethyl Benzene	EPA 8260 B	EPA 8260 B
Ethyl-t-butyl Ether	EPA 8260 B	EPA 8260 B
Gasoline Range Organics C6-C10	EPA 8015 C EPA 8260 B	EPA 8015 C EPA 8260 B
Methyl-t-butyl ether (MTBE)	EPA 8260 B	EPA 8260 B
Naphthalene	EPA 8260 B	EPA 8260 B
Toluene	EPA 8260 B	EPA 8260 B
t-Amyl-Methyl Ether	EPA 8260 B	EPA 8260 B
t-Butyl Alcohol	EPA 8260 B	EPA 8260 B
Xylenes, Total	EPA 8260 B	EPA 8260 B
1,2-Xylene	EPA 8260 B	EPA 8260 B
1,3-Xylene	EPA 8260 B	EPA 8260 B
1,4-Xylene	EPA 8260 B	EPA 8260 B
Extractable Organics		
Diesel Range Organics C10-C32	EPA 8015 C	EPA 8015 C

THE STATE of ALASKA
GOVERNOR MIKE DUNLEAVY

Department of Environmental Conservation

DIVISION OF SPILL PREVENTION AND RESPONSE
Contaminated Sites Program
Laboratory Approval Program

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December 14, 2023

Chris Johnson
Pace Analytical National Center for Testing and Innovation
12065 Lebanon Rd
Mt Juliet, TN 37122

RE: Contaminated Sites Laboratory Approval **17-026**

Thank you for submitting a completed application to the Alaska Department of Environmental Conservation's Contaminated Sites Laboratory Approval Program (CS-LAP), on October 3, 2023. Based on your lab's National Environmental Laboratory Accreditation Program (NELAP) approval through the State of Utah Environmental Laboratory Certification Program (UT ELCP), and Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP) approval through the American Association for Laboratory Accreditation (A2LA), Pace National, located at the above address, is granted ***Approved*** status to perform the analyses listed in the attached *Scope of Approval*, for Alaska contaminated sites projects, including underground storage tanks and leaking underground storage tank sites (UST/LUST), under the July 1, 2017 amendments to 18 AAC 78. This approval is effective December 14, 2023 and expires on December 30, 2025.

Be aware that in accordance with 18 AAC 78.815(b) and 18 AAC 78.815(e), **any** changes in your lab's NELAP and/or DoD-ELAP approval status for **any** analytes in **any** methods or **any** matrices must be reported to the CS-LAP within 3 business days. This includes any suspension of any analyte(s) due to failed Performance Testing (PT) or Performance Evaluation (PE) samples. **FAILURE TO REPORT A CHANGE IN STATUS WILL RESULT IN REVOCATION OF ALL CS-LAP APPROVALS FOR ALL ANALYTES AND ALL METHODS IN ALL MATRICES FOR A PERIOD OF ONE YEAR.** Notification should be in writing sent to cs.lab.cert@alaska.gov. We recommend also contacting the CS-LAP by telephone to verify that the message was received.

If you have any questions, please contact the CS-LAP at (907) 465-5346, or by email at cs.lab.cert@alaska.gov. Labs are also highly encouraged to join the CS-LAP listserv by going to http://list.state.ak.us/mailman/listinfo/cs.lab.approval.

Respectfully,

Zuzana Culakova

Attachment: Scope of Approval

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
83-32-9	Water	Acenaphthene	625.1	A2LA
83-32-9	Soil	Acenaphthene	8310	UT ELCP
83-32-9	Water	Acenaphthene	8310	UT ELCP
83-32-9	Soil	Acenaphthene	8270C	A2LA
83-32-9	Water	Acenaphthene	8270C	A2LA
83-32-9	Soil	Acenaphthene	8270C-SIM	A2LA
83-32-9	Water	Acenaphthene	8270C-SIM	A2LA
83-32-9	Soil	Acenaphthene	8270D	A2LA
83-32-9	Water	Acenaphthene	8270D	A2LA
83-32-9	Soil	Acenaphthene	8270D-SIM	A2LA
83-32-9	Water	Acenaphthene	8270D-SIM	A2LA
83-32-9	Soil	Acenaphthene	8270E	A2LA
83-32-9	Water	Acenaphthene	8270E	A2LA
83-32-9	Soil	Acenaphthene	8270E-SIM	A2LA
83-32-9	Water	Acenaphthene	8270E-SIM	A2LA
208-96-8	Water	Acenaphthylene	625.1	A2LA
208-96-8	Soil	Acenaphthylene	8310	UT ELCP
208-96-8	Water	Acenaphthylene	8310	UT ELCP
208-96-8	Soil	Acenaphthylene	8270C	A2LA
208-96-8	Water	Acenaphthylene	8270C	A2LA
208-96-8	Soil	Acenaphthylene	8270C-SIM	A2LA
208-96-8	Water	Acenaphthylene	8270C-SIM	A2LA
208-96-8	Soil	Acenaphthylene	8270D	A2LA
208-96-8	Water	Acenaphthylene	8270D	A2LA
208-96-8	Soil	Acenaphthylene	8270D-SIM	A2LA
208-96-8	Water	Acenaphthylene	8270D-SIM	A2LA
208-96-8	Soil	Acenaphthylene	8270E	A2LA
208-96-8	Water	Acenaphthylene	8270E	A2LA
208-96-8	Soil	Acenaphthylene	8270E-SIM	A2LA
208-96-8	Water	Acenaphthylene	8270E-SIM	A2LA
67-64-1	Water	Acetone	524.2	UT ELCP
67-64-1	Water	Acetone	624.1	A2LA
67-64-1	Soil	Acetone	8260B	A2LA

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
67-64-1	Water	Acetone	8260B	A2LA
67-64-1	Soil	Acetone	8260C	A2LA
67-64-1	Water	Acetone	8260C	A2LA
67-64-1	Soil	Acetone	8260D	A2LA
67-64-1	Water	Acetone	8260D	A2LA
67-64-1	Air	Acetone	TO-15	A2LA
309-00-2	Water	Aldrin	608.3	A2LA
309-00-2	Soil	Aldrin	8081A	A2LA
309-00-2	Water	Aldrin	8081A	A2LA
309-00-2	Soil	Aldrin	8081B	A2LA
309-00-2	Water	Aldrin	8081B	A2LA
120-12-7	Water	Anthracene	625.1	A2LA
120-12-7	Soil	Anthracene	8310	UT ELCP
120-12-7	Water	Anthracene	8310	UT ELCP
120-12-7	Soil	Anthracene	8270C	A2LA
120-12-7	Water	Anthracene	8270C	A2LA
120-12-7	Soil	Anthracene	8270C-SIM	A2LA
120-12-7	Water	Anthracene	8270C-SIM	A2LA
120-12-7	Soil	Anthracene	8270D	A2LA
120-12-7	Water	Anthracene	8270D	A2LA
120-12-7	Soil	Anthracene	8270D-SIM	A2LA
120-12-7	Water	Anthracene	8270D-SIM	A2LA
120-12-7	Soil	Anthracene	8270E	A2LA
120-12-7	Water	Anthracene	8270E	A2LA
120-12-7	Soil	Anthracene	8270E-SIM	A2LA
120-12-7	Water	Anthracene	8270E-SIM	A2LA
7440-36-0	Water	Antimony (metallic)	200.7	A2LA
7440-36-0	Water	Antimony (metallic)	200.8	A2LA
7440-36-0	Soil	Antimony (metallic)	6010B	A2LA
7440-36-0	Water	Antimony (metallic)	6010B	A2LA
7440-36-0	Soil	Antimony (metallic)	6010C	A2LA
7440-36-0	Water	Antimony (metallic)	6010C	A2LA
7440-36-0	Soil	Antimony (metallic)	6010D	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
7440-36-0	Water	Antimony (metallic)	6010D	A2LA
7440-36-0	Soil	Antimony (metallic)	6020A	A2LA
7440-36-0	Water	Antimony (metallic)	6020A	A2LA
7440-36-0	Soil	Antimony (metallic)	6020B	A2LA
7440-36-0	Water	Antimony (metallic)	6020B	A2LA
7440-38-2	Water	Arsenic, Inorganic	200.7	A2LA
7440-38-2	Water	Arsenic, Inorganic	200.8	A2LA
7440-38-2	Soil	Arsenic, Inorganic	6010B	A2LA
7440-38-2	Water	Arsenic, Inorganic	6010B	A2LA
7440-38-2	Soil	Arsenic, Inorganic	6010C	A2LA
7440-38-2	Water	Arsenic, Inorganic	6010C	A2LA
7440-38-2	Soil	Arsenic, Inorganic	6010D	A2LA
7440-38-2	Water	Arsenic, Inorganic	6010D	A2LA
7440-38-2	Soil	Arsenic, Inorganic	6020A	A2LA
7440-38-2	Water	Arsenic, Inorganic	6020A	A2LA
7440-38-2	Soil	Arsenic, Inorganic	6020B	A2LA
7440-38-2	Water	Arsenic, Inorganic	6020B	A2LA
7440-39-3	Water	Barium	200.7	A2LA
7440-39-3	Water	Barium	200.8	A2LA
7440-39-3	Soil	Barium	6010B	A2LA
7440-39-3	Water	Barium	6010B	A2LA
7440-39-3	Soil	Barium	6010C	A2LA
7440-39-3	Water	Barium	6010C	A2LA
7440-39-3	Soil	Barium	6010D	A2LA
7440-39-3	Water	Barium	6010D	A2LA
7440-39-3	Soil	Barium	6020A	A2LA
7440-39-3	Water	Barium	6020A	A2LA
7440-39-3	Soil	Barium	6020B	A2LA
7440-39-3	Water	Barium	6020B	A2LA
56-55-3	Water	Benz[a]anthracene	625.1	A2LA
56-55-3	Soil	Benz[a]anthracene	8310	UT ELCP
56-55-3	Water	Benz[a]anthracene	8310	UT ELCP
56-55-3	Soil	Benz[a]anthracene	8270C	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
56-55-3	Water	Benz[a]anthracene	8270C	A2LA
56-55-3	Soil	Benz[a]anthracene	8270C-SIM	A2LA
56-55-3	Water	Benz[a]anthracene	8270C-SIM	A2LA
56-55-3	Soil	Benz[a]anthracene	8270D	A2LA
56-55-3	Water	Benz[a]anthracene	8270D	A2LA
56-55-3	Soil	Benz[a]anthracene	8270D-SIM	A2LA
56-55-3	Water	Benz[a]anthracene	8270D-SIM	A2LA
56-55-3	Soil	Benz[a]anthracene	8270E	A2LA
56-55-3	Water	Benz[a]anthracene	8270E	A2LA
56-55-3	Soil	Benz[a]anthracene	8270E-SIM	A2LA
56-55-3	Water	Benz[a]anthracene	8270E-SIM	A2LA
100-52-7	Soil	Benzaldehyde	625.1	A2LA
100-52-7	Soil	Benzaldehyde	8270C	A2LA
100-52-7	Water	Benzaldehyde	8270C	A2LA
100-52-7	Soil	Benzaldehyde	8270D	A2LA
100-52-7	Water	Benzaldehyde	8270D	A2LA
100-52-7	Soil	Benzaldehyde	8270E	A2LA
100-52-7	Water	Benzaldehyde	8270E	A2LA
71-43-2	Water	Benzene	524.2	UT ELCP
71-43-2	Water	Benzene	624.1	A2LA
71-43-2	Soil	Benzene	8021B	A2LA
71-43-2	Water	Benzene	8021B	A2LA
71-43-2	Soil	Benzene	8260B	A2LA
71-43-2	Water	Benzene	8260B	A2LA
71-43-2	Soil	Benzene	8260C	A2LA
71-43-2	Water	Benzene	8260C	A2LA
71-43-2	Soil	Benzene	8260D	A2LA
71-43-2	Water	Benzene	8260D	A2LA
71-43-2	Air	Benzene	TO-15	A2LA
50-32-8	Water	Benzo[a]pyrene	625.1	A2LA
50-32-8	Soil	Benzo[a]pyrene	8310	UT ELCP
50-32-8	Water	Benzo[a]pyrene	8310	UT ELCP
50-32-8	Soil	Benzo[a]pyrene	8270C	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
50-32-8	Water	Benzo[a]pyrene	8270C	A2LA
50-32-8	Soil	Benzo[a]pyrene	8270C-SIM	A2LA
50-32-8	Water	Benzo[a]pyrene	8270C-SIM	A2LA
50-32-8	Soil	Benzo[a]pyrene	8270D	A2LA
50-32-8	Water	Benzo[a]pyrene	8270D	A2LA
50-32-8	Soil	Benzo[a]pyrene	8270D-SIM	A2LA
50-32-8	Water	Benzo[a]pyrene	8270D-SIM	A2LA
50-32-8	Soil	Benzo[a]pyrene	8270E	A2LA
50-32-8	Water	Benzo[a]pyrene	8270E	A2LA
50-32-8	Soil	Benzo[a]pyrene	8270E-SIM	A2LA
50-32-8	Water	Benzo[a]pyrene	8270E-SIM	A2LA
205-99-2	Water	Benzo[b]fluoranthene	625.1	A2LA
205-99-2	Soil	Benzo[b]fluoranthene	8310	UT ELCP
205-99-2	Water	Benzo[b]fluoranthene	8310	UT ELCP
205-99-2	Soil	Benzo[b]fluoranthene	8270C	A2LA
205-99-2	Water	Benzo[b]fluoranthene	8270C	A2LA
205-99-2	Soil	Benzo[b]fluoranthene	8270C-SIM	A2LA
205-99-2	Water	Benzo[b]fluoranthene	8270C-SIM	A2LA
205-99-2	Soil	Benzo[b]fluoranthene	8270D	A2LA
205-99-2	Water	Benzo[b]fluoranthene	8270D	A2LA
205-99-2	Soil	Benzo[b]fluoranthene	8270D-SIM	A2LA
205-99-2	Water	Benzo[b]fluoranthene	8270D-SIM	A2LA
205-99-2	Soil	Benzo[b]fluoranthene	8270E	A2LA
205-99-2	Water	Benzo[b]fluoranthene	8270E	A2LA
205-99-2	Soil	Benzo[b]fluoranthene	8270E-SIM	A2LA
205-99-2	Water	Benzo[b]fluoranthene	8270E-SIM	A2LA
191-24-2	Water	Benzo[g,h,i]perylene	625.1	A2LA
191-24-2	Soil	Benzo[g,h,i]perylene	8310	UT ELCP
191-24-2	Water	Benzo[g,h,i]perylene	8310	UT ELCP
191-24-2	Soil	Benzo[g,h,i]perylene	8270C	A2LA
191-24-2	Water	Benzo[g,h,i]perylene	8270C	A2LA
191-24-2	Soil	Benzo[g,h,i]perylene	8270C-SIM	A2LA
191-24-2	Water	Benzo[g,h,i]perylene	8270C-SIM	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
191-24-2	Soil	Benzo[g,h,i]perylene	8270D	A2LA
191-24-2	Water	Benzo[g,h,i]perylene	8270D	A2LA
191-24-2	Soil	Benzo[g,h,i]perylene	8270D-SIM	A2LA
191-24-2	Water	Benzo[g,h,i]perylene	8270D-SIM	A2LA
191-24-2	Soil	Benzo[g,h,i]perylene	8270E	A2LA
191-24-2	Water	Benzo[g,h,i]perylene	8270E	A2LA
191-24-2	Soil	Benzo[g,h,i]perylene	8270E-SIM	A2LA
191-24-2	Water	Benzo[g,h,i]perylene	8270E-SIM	A2LA
207-08-9	Water	Benzo[k]fluoranthene	625.1	A2LA
207-08-9	Soil	Benzo[k]fluoranthene	8310	UT ELCP
207-08-9	Water	Benzo[k]fluoranthene	8310	UT ELCP
207-08-9	Soil	Benzo[k]fluoranthene	8270C	A2LA
207-08-9	Water	Benzo[k]fluoranthene	8270C	A2LA
207-08-9	Soil	Benzo[k]fluoranthene	8270C-SIM	A2LA
207-08-9	Water	Benzo[k]fluoranthene	8270C-SIM	A2LA
207-08-9	Soil	Benzo[k]fluoranthene	8270D	A2LA
207-08-9	Water	Benzo[k]fluoranthene	8270D	A2LA
207-08-9	Soil	Benzo[k]fluoranthene	8270D-SIM	A2LA
207-08-9	Water	Benzo[k]fluoranthene	8270D-SIM	A2LA
207-08-9	Soil	Benzo[k]fluoranthene	8270E	A2LA
207-08-9	Water	Benzo[k]fluoranthene	8270E	A2LA
207-08-9	Soil	Benzo[k]fluoranthene	8270E-SIM	A2LA
207-08-9	Water	Benzo[k]fluoranthene	8270E-SIM	A2LA
65-85-0	Water	Benzoic Acid	625.1	A2LA
65-85-0	Soil	Benzoic Acid	8270C	A2LA
65-85-0	Water	Benzoic Acid	8270C	A2LA
65-85-0	Soil	Benzoic Acid	8270D	A2LA
65-85-0	Water	Benzoic Acid	8270D	A2LA
65-85-0	Soil	Benzoic Acid	8270E	A2LA
65-85-0	Water	Benzoic Acid	8270E	A2LA
100-51-6	Water	Benzyl Alcohol	625.1	A2LA
100-51-6	Soil	Benzyl Alcohol	8270C	A2LA
100-51-6	Water	Benzyl Alcohol	8270C	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
100-51-6	Soil	Benzyl Alcohol	8270D	A2LA
100-51-6	Water	Benzyl Alcohol	8270D	A2LA
100-51-6	Soil	Benzyl Alcohol	8270E	A2LA
100-51-6	Water	Benzyl Alcohol	8270E	A2LA
7440-41-7	Water	Beryllium and compounds	200.7	A2LA
7440-41-7	Water	Beryllium and compounds	200.8	A2LA
7440-41-7	Soil	Beryllium and compounds	6010B	A2LA
7440-41-7	Water	Beryllium and compounds	6010B	A2LA
7440-41-7	Soil	Beryllium and compounds	6010C	A2LA
7440-41-7	Water	Beryllium and compounds	6010C	A2LA
7440-41-7	Soil	Beryllium and compounds	6010D	A2LA
7440-41-7	Water	Beryllium and compounds	6010D	A2LA
7440-41-7	Soil	Beryllium and compounds	6020A	A2LA
7440-41-7	Water	Beryllium and compounds	6020A	A2LA
7440-41-7	Soil	Beryllium and compounds	6020B	A2LA
7440-41-7	Water	Beryllium and compounds	6020B	A2LA
111-44-4	Water	Bis(2-chloroethyl)ether	625.1	A2LA
111-44-4	Soil	Bis(2-chloroethyl)ether	8270C	A2LA
111-44-4	Water	Bis(2-chloroethyl)ether	8270C	A2LA
111-44-4	Soil	Bis(2-chloroethyl)ether	8270D	A2LA
111-44-4	Water	Bis(2-chloroethyl)ether	8270D	A2LA
111-44-4	Soil	Bis(2-chloroethyl)ether	8270E	A2LA
111-44-4	Water	Bis(2-chloroethyl)ether	8270E	A2LA
117-81-7	Water	Bis(2-ethylhexyl)phthalate (DEHP)	625.1	A2LA
117-81-7	Soil	Bis(2-ethylhexyl)phthalate (DEHP)	8270C	A2LA
117-81-7	Water	Bis(2-ethylhexyl)phthalate (DEHP)	8270C	A2LA
117-81-7	Soil	Bis(2-ethylhexyl)phthalate (DEHP)	8270D	A2LA
117-81-7	Water	Bis(2-ethylhexyl)phthalate (DEHP)	8270D	A2LA
117-81-7	Soil	Bis(2-ethylhexyl)phthalate (DEHP)	8270E	A2LA
117-81-7	Water	Bis(2-ethylhexyl)phthalate (DEHP)	8270E	A2LA
108-86-1	Water	Bromobenzene	524.2	UT ELCP
108-86-1	Water	Bromobenzene	624.1	A2LA
108-86-1	Soil	Bromobenzene	8260B	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
108-86-1	Water	Bromobenzene	8260B	A2LA
108-86-1	Soil	Bromobenzene	8260C	A2LA
108-86-1	Water	Bromobenzene	8260C	A2LA
108-86-1	Soil	Bromobenzene	8260D	A2LA
108-86-1	Water	Bromobenzene	8260D	A2LA
75-27-4	Water	Bromodichloromethane	524.2	UT ELCP
75-27-4	Water	Bromodichloromethane	624.1	A2LA
75-27-4	Soil	Bromodichloromethane	8260B	A2LA
75-27-4	Water	Bromodichloromethane	8260B	A2LA
75-27-4	Soil	Bromodichloromethane	8260C	A2LA
75-27-4	Water	Bromodichloromethane	8260C	A2LA
75-27-4	Soil	Bromodichloromethane	8260D	A2LA
75-27-4	Water	Bromodichloromethane	8260D	A2LA
75-27-4	Air	Bromodichloromethane	TO-15	A2LA
75-25-2	Water	Bromoform	524.2	UT ELCP
75-25-2	Water	Bromoform	624.1	A2LA
75-25-2	Soil	Bromoform	8260B	A2LA
75-25-2	Water	Bromoform	8260B	A2LA
75-25-2	Soil	Bromoform	8260C	A2LA
75-25-2	Water	Bromoform	8260C	A2LA
75-25-2	Soil	Bromoform	8260D	A2LA
75-25-2	Water	Bromoform	8260D	A2LA
74-83-9	Water	Bromomethane	524.2	UT ELCP
74-83-9	Water	Bromomethane	624.1	A2LA
74-83-9	Soil	Bromomethane	8260B	A2LA
74-83-9	Water	Bromomethane	8260B	A2LA
74-83-9	Soil	Bromomethane	8260C	A2LA
74-83-9	Water	Bromomethane	8260C	A2LA
74-83-9	Soil	Bromomethane	8260D	A2LA
74-83-9	Water	Bromomethane	8260D	A2LA
74-83-9	Air	Bromomethane	TO-15	A2LA
106-99-0	Air	Butadiene, 1,3-	TO-15	A2LA
71-36-3	Water	Butanol, N-	624.1	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
71-36-3	Soil	Butanol, N-	8260B	A2LA
71-36-3	Water	Butanol, N-	8260B	A2LA
71-36-3	Soil	Butanol, N-	8260C	A2LA
71-36-3	Water	Butanol, N-	8260C	A2LA
71-36-3	Soil	Butanol, N-	8260D	A2LA
71-36-3	Water	Butanol, N-	8260D	A2LA
85-68-7	Soil	Butyl Benzyl Phthalate	625.1	A2LA
85-68-7	Soil	Butyl Benzyl Phthalate	8270C	A2LA
85-68-7	Water	Butyl Benzyl Phthalate	8270C	A2LA
85-68-7	Soil	Butyl Benzyl Phthalate	8270D	A2LA
85-68-7	Water	Butyl Benzyl Phthalate	8270D	A2LA
85-68-7	Soil	Butyl Benzyl Phthalate	8270E	A2LA
85-68-7	Water	Butyl Benzyl Phthalate	8270E	A2LA
104-51-8	Water	Butylbenzene, n-	524.2	UT ELCP
104-51-8	Water	Butylbenzene, n-	624.1	A2LA
104-51-8	Soil	Butylbenzene, n-	8260B	A2LA
104-51-8	Water	Butylbenzene, n-	8260B	A2LA
104-51-8	Soil	Butylbenzene, n-	8260C	A2LA
104-51-8	Water	Butylbenzene, n-	8260C	A2LA
104-51-8	Soil	Butylbenzene, n-	8260D	A2LA
104-51-8	Water	Butylbenzene, n-	8260D	A2LA
135-98-8	Water	Butylbenzene, sec-	524.2	UT ELCP
135-98-8	Water	Butylbenzene, sec-	624.1	A2LA
135-98-8	Soil	Butylbenzene, sec-	8260B	A2LA
135-98-8	Water	Butylbenzene, sec-	8260B	A2LA
135-98-8	Soil	Butylbenzene, sec-	8260C	A2LA
135-98-8	Water	Butylbenzene, sec-	8260C	A2LA
135-98-8	Soil	Butylbenzene, sec-	8260D	A2LA
135-98-8	Water	Butylbenzene, sec-	8260D	A2LA
98-06-6	Water	Butylbenzene, tert-	524.2	UT ELCP
98-06-6	Water	Butylbenzene, tert-	624.1	A2LA
98-06-6	Soil	Butylbenzene, tert-	8260B	A2LA
98-06-6	Water	Butylbenzene, tert-	8260B	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
98-06-6	Soil	Butylbenzene, tert-	8260C	A2LA
98-06-6	Water	Butylbenzene, tert-	8260C	A2LA
98-06-6	Soil	Butylbenzene, tert-	8260D	A2LA
98-06-6	Water	Butylbenzene, tert-	8260D	A2LA
7440-43-9	Water	Cadmium	200.7	A2LA
7440-43-9	Water	Cadmium	200.8	A2LA
7440-43-9	Soil	Cadmium	6010B	A2LA
7440-43-9	Water	Cadmium	6010B	A2LA
7440-43-9	Soil	Cadmium	6010C	A2LA
7440-43-9	Water	Cadmium	6010C	A2LA
7440-43-9	Soil	Cadmium	6010D	A2LA
7440-43-9	Water	Cadmium	6010D	A2LA
7440-43-9	Soil	Cadmium	6020A	A2LA
7440-43-9	Water	Cadmium	6020A	A2LA
7440-43-9	Soil	Cadmium	6020B	A2LA
7440-43-9	Water	Cadmium	6020B	A2LA
75-15-0	Water	Carbon Disulfide	524.2	UT ELCP
75-15-0	Water	Carbon Disulfide	624.1	A2LA
75-15-0	Soil	Carbon Disulfide	8260B	A2LA
75-15-0	Water	Carbon Disulfide	8260B	A2LA
75-15-0	Soil	Carbon Disulfide	8260C	A2LA
75-15-0	Water	Carbon Disulfide	8260C	A2LA
75-15-0	Soil	Carbon Disulfide	8260D	A2LA
75-15-0	Water	Carbon Disulfide	8260D	A2LA
75-15-0	Air	Carbon Disulfide	TO-15	A2LA
56-23-5	Water	Carbon Tetrachloride	524.2	UT ELCP
56-23-5	Water	Carbon Tetrachloride	624.1	A2LA
56-23-5	Soil	Carbon Tetrachloride	8260B	A2LA
56-23-5	Water	Carbon Tetrachloride	8260B	A2LA
56-23-5	Soil	Carbon Tetrachloride	8260C	A2LA
56-23-5	Water	Carbon Tetrachloride	8260C	A2LA
56-23-5	Soil	Carbon Tetrachloride	8260D	A2LA
56-23-5	Water	Carbon Tetrachloride	8260D	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
56-23-5	Air	Carbon Tetrachloride	TO-15	A2LA
5103-71-9	Water	Chlordane, α-	608.3	A2LA
5103-71-9	Soil	Chlordane, α-	8081A	A2LA
5103-71-9	Water	Chlordane, α-	8081A	A2LA
5103-71-9	Soil	Chlordane, α-	8081B	A2LA
5103-71-9	Water	Chlordane, α-	8081B	A2LA
5103-74-2	Water	Chlordane, γ-	608.3	A2LA
5103-74-2	Soil	Chlordane, γ-	8081A	A2LA
5103-74-2	Water	Chlordane, γ-	8081A	A2LA
5103-74-2	Soil	Chlordane, γ-	8081B	A2LA
5103-74-2	Water	Chlordane, γ-	8081B	A2LA
12789-03-6	Water	Chlordane, Total	608.3	A2LA
12789-03-6	Soil	Chlordane, Total	8081A	A2LA
12789-03-6	Water	Chlordane, Total	8081A	A2LA
12789-03-6	Soil	Chlordane, Total	8081B	A2LA
12789-03-6	Water	Chlordane, Total	8081B	A2LA
106-47-8	Water	Chloroaniline, p-	625.1	A2LA
106-47-8	Soil	Chloroaniline, p-	8270C	A2LA
106-47-8	Water	Chloroaniline, p-	8270C	A2LA
106-47-8	Soil	Chloroaniline, p-	8270D	A2LA
106-47-8	Water	Chloroaniline, p-	8270D	A2LA
106-47-8	Soil	Chloroaniline, p-	8270E	A2LA
106-47-8	Water	Chloroaniline, p-	8270E	A2LA
108-90-7	Water	Chlorobenzene	524.2	UT ELCP
108-90-7	Water	Chlorobenzene	624.1	A2LA
108-90-7	Soil	Chlorobenzene	8260B	A2LA
108-90-7	Water	Chlorobenzene	8260B	A2LA
108-90-7	Soil	Chlorobenzene	8260C	A2LA
108-90-7	Water	Chlorobenzene	8260C	A2LA
108-90-7	Soil	Chlorobenzene	8260D	A2LA
108-90-7	Water	Chlorobenzene	8260D	A2LA
108-90-7	Air	Chlorobenzene	TO-15	A2LA
67-66-3	Water	Chloroform	524.2	UT ELCP

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
67-66-3	Water	Chloroform	624.1	A2LA
67-66-3	Soil	Chloroform	8260B	A2LA
67-66-3	Water	Chloroform	8260B	A2LA
67-66-3	Soil	Chloroform	8260C	A2LA
67-66-3	Water	Chloroform	8260C	A2LA
67-66-3	Soil	Chloroform	8260D	A2LA
67-66-3	Water	Chloroform	8260D	A2LA
67-66-3	Air	Chloroform	TO-15	A2LA
74-87-3	Water	Chloromethane	524.2	UT ELCP
74-87-3	Water	Chloromethane	624.1	A2LA
74-87-3	Soil	Chloromethane	8260B	A2LA
74-87-3	Water	Chloromethane	8260B	A2LA
74-87-3	Soil	Chloromethane	8260C	A2LA
74-87-3	Water	Chloromethane	8260C	A2LA
74-87-3	Soil	Chloromethane	8260D	A2LA
74-87-3	Water	Chloromethane	8260D	A2LA
74-87-3	Air	Chloromethane	TO-15	A2LA
91-58-7	Water	Chloronaphthalene, Beta-	625.1	A2LA
91-58-7	Soil	Chloronaphthalene, Beta-	8270C	A2LA
91-58-7	Water	Chloronaphthalene, Beta-	8270C	A2LA
91-58-7	Soil	Chloronaphthalene, Beta-	8270D	A2LA
91-58-7	Water	Chloronaphthalene, Beta-	8270D	A2LA
91-58-7	Soil	Chloronaphthalene, Beta-	8270E	A2LA
91-58-7	Water	Chloronaphthalene, Beta-	8270E	A2LA
95-57-8	Water	Chlorophenol, 2-	625.1	A2LA
95-57-8	Soil	Chlorophenol, 2-	8270C	A2LA
95-57-8	Water	Chlorophenol, 2-	8270C	A2LA
95-57-8	Soil	Chlorophenol, 2-	8270D	A2LA
95-57-8	Water	Chlorophenol, 2-	8270D	A2LA
95-57-8	Soil	Chlorophenol, 2-	8270E	A2LA
95-57-8	Water	Chlorophenol, 2-	8270E	A2LA
7440-47-3	Water	Chromium (Total)	200.7	A2LA
7440-47-3	Water	Chromium (Total)	200.8	A2LA

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7440-47-3	Soil	Chromium (Total)	6010B	A2LA
7440-47-3	Water	Chromium (Total)	6010B	A2LA
7440-47-3	Soil	Chromium (Total)	6010C	A2LA
7440-47-3	Water	Chromium (Total)	6010C	A2LA
7440-47-3	Soil	Chromium (Total)	6010D	A2LA
7440-47-3	Water	Chromium (Total)	6010D	A2LA
7440-47-3	Soil	Chromium (Total)	6020A	A2LA
7440-47-3	Water	Chromium (Total)	6020A	A2LA
7440-47-3	Soil	Chromium (Total)	6020B	A2LA
7440-47-3	Water	Chromium (Total)	6020B	A2LA
18540-29-9	Water	Chromium (VI)	218.6	A2LA
18540-29-9	Soil	Chromium (VI)	7199	A2LA
18540-29-9	Water	Chromium (VI)	7199	A2LA
18540-29-9	Soil	Chromium (VI)	7196A	A2LA
18540-29-9	Water	Chromium (VI)	7196A	A2LA
18540-29-9	Water	Chromium (VI)	SM 3500-CR B	A2LA
218-01-9	Water	Chrysene	625.1	A2LA
218-01-9	Soil	Chrysene	8310	UT ELCP
218-01-9	Water	Chrysene	8310	UT ELCP
218-01-9	Soil	Chrysene	8270C	A2LA
218-01-9	Water	Chrysene	8270C	A2LA
218-01-9	Soil	Chrysene	8270C-SIM	A2LA
218-01-9	Water	Chrysene	8270C-SIM	A2LA
218-01-9	Soil	Chrysene	8270D	A2LA
218-01-9	Water	Chrysene	8270D	A2LA
218-01-9	Soil	Chrysene	8270D-SIM	A2LA
218-01-9	Water	Chrysene	8270D-SIM	A2LA
218-01-9	Soil	Chrysene	8270E	A2LA
218-01-9	Water	Chrysene	8270E	A2LA
218-01-9	Soil	Chrysene	8270E-SIM	A2LA
218-01-9	Water	Chrysene	8270E-SIM	A2LA
7440-50-8	Water	Copper	200.7	A2LA
7440-50-8	Water	Copper	200.8	A2LA

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7440-50-8	Soil	Copper	6010B	A2LA
7440-50-8	Water	Copper	6010B	A2LA
7440-50-8	Soil	Copper	6010C	A2LA
7440-50-8	Water	Copper	6010C	A2LA
7440-50-8	Soil	Copper	6010D	A2LA
7440-50-8	Water	Copper	6010D	A2LA
7440-50-8	Soil	Copper	6020A	A2LA
7440-50-8	Water	Copper	6020A	A2LA
7440-50-8	Soil	Copper	6020B	A2LA
7440-50-8	Water	Copper	6020B	A2LA
108-39-4	Water	Cresol, m- (3-Methylphenol)	625.1	A2LA
108-39-4	Soil	Cresol, m- (3-Methylphenol)	8270C	A2LA
108-39-4	Water	Cresol, m- (3-Methylphenol)	8270C	A2LA
108-39-4	Soil	Cresol, m- (3-Methylphenol)	8270D	A2LA
108-39-4	Water	Cresol, m- (3-Methylphenol)	8270D	A2LA
108-39-4	Soil	Cresol, m- (3-Methylphenol)	8270E	A2LA
108-39-4	Water	Cresol, m- (3-Methylphenol)	8270E	A2LA
95-48-7	Water	Cresol, o- (2-Methylphenol)	625.1	A2LA
95-48-7	Soil	Cresol, o- (2-Methylphenol)	8270C	A2LA
95-48-7	Water	Cresol, o- (2-Methylphenol)	8270C	A2LA
95-48-7	Soil	Cresol, o- (2-Methylphenol)	8270D	A2LA
95-48-7	Water	Cresol, o- (2-Methylphenol)	8270D	A2LA
95-48-7	Soil	Cresol, o- (2-Methylphenol)	8270E	A2LA
95-48-7	Water	Cresol, o- (2-Methylphenol)	8270E	A2LA
106-44-5	Water	Cresol, p- (4-Methylphenol)	625.1	A2LA
106-44-5	Soil	Cresol, p- (4-Methylphenol)	8270C	A2LA
106-44-5	Water	Cresol, p- (4-Methylphenol)	8270C	A2LA
106-44-5	Soil	Cresol, p- (4-Methylphenol)	8270D	A2LA
106-44-5	Water	Cresol, p- (4-Methylphenol)	8270D	A2LA
106-44-5	Soil	Cresol, p- (4-Methylphenol)	8270E	A2LA
106-44-5	Water	Cresol, p- (4-Methylphenol)	8270E	A2LA
98-82-8	Water	Cumene (Isopropylbenzene)	524.2	UT ELCP
98-82-8	Water	Cumene (Isopropylbenzene)	624.1	A2LA

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98-82-8	Soil	Cumene (Isopropylbenzene)	8260B	A2LA
98-82-8	Water	Cumene (Isopropylbenzene)	8260B	A2LA
98-82-8	Soil	Cumene (Isopropylbenzene)	8260C	A2LA
98-82-8	Water	Cumene (Isopropylbenzene)	8260C	A2LA
98-82-8	Soil	Cumene (Isopropylbenzene)	8260D	A2LA
98-82-8	Water	Cumene (Isopropylbenzene)	8260D	A2LA
98-82-8	Air	Cumene (isopropylbenzene)	TO-15	A2LA
57-12-5	Water	Cyanide (CN-)	335.4	A2LA
57-12-5	Soil	Cyanide (CN-)	9012B	A2LA
57-12-5	Water	Cyanide (CN-)	9012B	A2LA
57-12-5	Water	Cyanide (CN-)	SM 4500 CN B/E	A2LA
57-12-5	Water	Cyanide (CN-)	SM 4500 CN C/E	A2LA
110-82-7	Air	Cyclohexane	TO-15	A2LA
72-54-8	Water	DDD, 4,4'-	608.3	A2LA
72-54-8	Soil	DDD, 4,4'-	8081A	A2LA
72-54-8	Water	DDD, 4,4'-	8081A	A2LA
72-54-8	Soil	DDD, 4,4'-	8081B	A2LA
72-54-8	Water	DDD, 4,4'-	8081B	A2LA
72-55-9	Water	DDE, 4,4'-	608.3	A2LA
72-55-9	Soil	DDE, 4,4'-	8081A	A2LA
72-55-9	Water	DDE, 4,4'-	8081A	A2LA
72-55-9	Soil	DDE, 4,4'-	8081B	A2LA
72-55-9	Water	DDE, 4,4'-	8081B	A2LA
50-29-3	Water	DDT, 4,4'-	608.3	A2LA
50-29-3	Soil	DDT, 4,4'-	8081A	A2LA
50-29-3	Water	DDT, 4,4'-	8081A	A2LA
50-29-3	Soil	DDT, 4,4'-	8081B	A2LA
50-29-3	Water	DDT, 4,4'-	8081B	A2LA
53-70-3	Water	Dibenz[a,h]anthracene	625.1	A2LA
53-70-3	Soil	Dibenz[a,h]anthracene	8310	UT ELCP
53-70-3	Water	Dibenz[a,h]anthracene	8310	UT ELCP
53-70-3	Soil	Dibenz[a,h]anthracene	8270C	A2LA
53-70-3	Water	Dibenz[a,h]anthracene	8270C	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
53-70-3	Soil	Dibenz[a,h]anthracene	8270C-SIM	A2LA
53-70-3	Water	Dibenz[a,h]anthracene	8270C-SIM	A2LA
53-70-3	Soil	Dibenz[a,h]anthracene	8270D	A2LA
53-70-3	Water	Dibenz[a,h]anthracene	8270D	A2LA
53-70-3	Soil	Dibenz[a,h]anthracene	8270D-SIM	A2LA
53-70-3	Water	Dibenz[a,h]anthracene	8270D-SIM	A2LA
53-70-3	Soil	Dibenz[a,h]anthracene	8270E	A2LA
53-70-3	Water	Dibenz[a,h]anthracene	8270E	A2LA
53-70-3	Soil	Dibenz[a,h]anthracene	8270E-SIM	A2LA
53-70-3	Water	Dibenz[a,h]anthracene	8270E-SIM	A2LA
132-64-9	Water	Dibenzofuran	625.1	A2LA
132-64-9	Soil	Dibenzofuran	8270C	A2LA
132-64-9	Water	Dibenzofuran	8270C	A2LA
132-64-9	Soil	Dibenzofuran	8270D	A2LA
132-64-9	Water	Dibenzofuran	8270D	A2LA
132-64-9	Soil	Dibenzofuran	8270E	A2LA
132-64-9	Water	Dibenzofuran	8270E	A2LA
124-48-1	Water	Dibromochloromethane	524.2	UT ELCP
124-48-1	Water	Dibromochloromethane	624.1	A2LA
124-48-1	Soil	Dibromochloromethane	8260B	A2LA
124-48-1	Water	Dibromochloromethane	8260B	A2LA
124-48-1	Soil	Dibromochloromethane	8260C	A2LA
124-48-1	Water	Dibromochloromethane	8260C	A2LA
124-48-1	Soil	Dibromochloromethane	8260D	A2LA
124-48-1	Water	Dibromochloromethane	8260D	A2LA
124-48-1	Air	Dibromochloromethane	TO-15	A2LA
106-93-4	Air	Dibromoethane, 1,2- (Ethylene Dibromide)	TO-15	A2LA
74-95-3	Water	Dibromomethane (Methylene Bromide)	524.2	UT ELCP
74-95-3	Water	Dibromomethane (Methylene Bromide)	624.1	A2LA
74-95-3	Soil	Dibromomethane (Methylene Bromide)	8260B	A2LA
74-95-3	Water	Dibromomethane (Methylene Bromide)	8260B	A2LA
74-95-3	Soil	Dibromomethane (Methylene Bromide)	8260C	A2LA
74-95-3	Water	Dibromomethane (Methylene Bromide)	8260C	A2LA

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74-95-3	Soil	Dibromomethane (Methylene Bromide)	8260D	A2LA
74-95-3	Water	Dibromomethane (Methylene Bromide)	8260D	A2LA
84-74-2	Water	Dibutyl Phthalate	625.1	A2LA
84-74-2	Soil	Dibutyl Phthalate	8270C	A2LA
84-74-2	Water	Dibutyl Phthalate	8270C	A2LA
84-74-2	Soil	Dibutyl Phthalate	8270D	A2LA
84-74-2	Water	Dibutyl Phthalate	8270D	A2LA
84-74-2	Soil	Dibutyl Phthalate	8270E	A2LA
84-74-2	Water	Dibutyl Phthalate	8270E	A2LA
95-50-1	Water	Dichlorobenzene, 1,2-	524.2	UT ELCP
95-50-1	Water	Dichlorobenzene, 1,2-	624.1	A2LA
95-50-1	Water	Dichlorobenzene, 1,2-	625.1	A2LA
95-50-1	Soil	Dichlorobenzene, 1,2-	8260B	A2LA
95-50-1	Water	Dichlorobenzene, 1,2-	8260B	A2LA
95-50-1	Soil	Dichlorobenzene, 1,2-	8260C	A2LA
95-50-1	Water	Dichlorobenzene, 1,2-	8260C	A2LA
95-50-1	Soil	Dichlorobenzene, 1,2-	8260D	A2LA
95-50-1	Water	Dichlorobenzene, 1,2-	8260D	A2LA
95-50-1	Soil	Dichlorobenzene, 1,2-	8270C	A2LA
95-50-1	Water	Dichlorobenzene, 1,2-	8270C	A2LA
95-50-1	Soil	Dichlorobenzene, 1,2-	8270D	A2LA
95-50-1	Water	Dichlorobenzene, 1,2-	8270D	A2LA
95-50-1	Soil	Dichlorobenzene, 1,2-	8270E	A2LA
95-50-1	Water	Dichlorobenzene, 1,2-	8270E	A2LA
95-50-1	Air	Dichlorobenzene, 1,2-	TO-15	A2LA
541-73-1	Water	Dichlorobenzene, 1,3-	524.2	UT ELCP
541-73-1	Water	Dichlorobenzene, 1,3-	624.1	A2LA
541-73-1	Water	Dichlorobenzene, 1,3-	625.1	A2LA
541-73-1	Soil	Dichlorobenzene, 1,3-	8260B	A2LA
541-73-1	Water	Dichlorobenzene, 1,3-	8260B	A2LA
541-73-1	Soil	Dichlorobenzene, 1,3-	8260C	A2LA
541-73-1	Water	Dichlorobenzene, 1,3-	8260C	A2LA
541-73-1	Soil	Dichlorobenzene, 1,3-	8260D	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
541-73-1	Water	Dichlorobenzene, 1,3-	8260D	A2LA
541-73-1	Soil	Dichlorobenzene, 1,3-	8270C	A2LA
541-73-1	Water	Dichlorobenzene, 1,3-	8270C	A2LA
541-73-1	Soil	Dichlorobenzene, 1,3-	8270D	A2LA
541-73-1	Water	Dichlorobenzene, 1,3-	8270D	A2LA
541-73-1	Soil	Dichlorobenzene, 1,3-	8270E	A2LA
541-73-1	Water	Dichlorobenzene, 1,3-	8270E	A2LA
541-73-1	Air	Dichlorobenzene, 1,3-	TO-15	A2LA
106-46-7	Water	Dichlorobenzene, 1,4-	524.2	UT ELCP
106-46-7	Water	Dichlorobenzene, 1,4-	624.1	A2LA
106-46-7	Water	Dichlorobenzene, 1,4-	625.1	A2LA
106-46-7	Soil	Dichlorobenzene, 1,4-	8260B	A2LA
106-46-7	Water	Dichlorobenzene, 1,4-	8260B	A2LA
106-46-7	Soil	Dichlorobenzene, 1,4-	8260C	A2LA
106-46-7	Water	Dichlorobenzene, 1,4-	8260C	A2LA
106-46-7	Soil	Dichlorobenzene, 1,4-	8260D	A2LA
106-46-7	Water	Dichlorobenzene, 1,4-	8260D	A2LA
106-46-7	Soil	Dichlorobenzene, 1,4-	8270C	A2LA
106-46-7	Water	Dichlorobenzene, 1,4-	8270C	A2LA
106-46-7	Soil	Dichlorobenzene, 1,4-	8270D	A2LA
106-46-7	Water	Dichlorobenzene, 1,4-	8270D	A2LA
106-46-7	Soil	Dichlorobenzene, 1,4-	8270E	A2LA
106-46-7	Water	Dichlorobenzene, 1,4-	8270E	A2LA
106-46-7	Air	Dichlorobenzene, 1,4-	TO-15	A2LA
91-94-1	Water	Dichlorobenzidine, 3,3'-	625.1	A2LA
91-94-1	Soil	Dichlorobenzidine, 3,3'-	8270C	A2LA
91-94-1	Water	Dichlorobenzidine, 3,3'-	8270C	A2LA
91-94-1	Soil	Dichlorobenzidine, 3,3'-	8270D	A2LA
91-94-1	Water	Dichlorobenzidine, 3,3'-	8270D	A2LA
91-94-1	Soil	Dichlorobenzidine, 3,3'-	8270E	A2LA
91-94-1	Water	Dichlorobenzidine, 3,3'-	8270E	A2LA
75-71-8	Water	Dichlorodifluoromethane (Freon-12)	524.2	UT ELCP
75-71-8	Water	Dichlorodifluoromethane (Freon-12)	624.1	A2LA

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75-71-8	Soil	Dichlorodifluoromethane (Freon-12)	8260B	A2LA
75-71-8	Water	Dichlorodifluoromethane (Freon-12)	8260B	A2LA
75-71-8	Soil	Dichlorodifluoromethane (Freon-12)	8260C	A2LA
75-71-8	Water	Dichlorodifluoromethane (Freon-12)	8260C	A2LA
75-71-8	Soil	Dichlorodifluoromethane (Freon-12)	8260D	A2LA
75-71-8	Water	Dichlorodifluoromethane (Freon-12)	8260D	A2LA
75-71-8	Air	Dichlorodifluoromethane (Freon-12)	TO-15	A2LA
75-34-3	Water	Dichloroethane, 1,1-	524.2	UT ELCP
75-34-3	Water	Dichloroethane, 1,1-	624.1	A2LA
75-34-3	Soil	Dichloroethane, 1,1-	8260B	A2LA
75-34-3	Water	Dichloroethane, 1,1-	8260B	A2LA
75-34-3	Soil	Dichloroethane, 1,1-	8260C	A2LA
75-34-3	Water	Dichloroethane, 1,1-	8260C	A2LA
75-34-3	Soil	Dichloroethane, 1,1-	8260D	A2LA
75-34-3	Water	Dichloroethane, 1,1-	8260D	A2LA
75-34-3	Air	Dichloroethane, 1,1-	TO-15	A2LA
107-06-2	Water	Dichloroethane, 1,2-	524.2	UT ELCP
107-06-2	Water	Dichloroethane, 1,2-	624.1	A2LA
107-06-2	Soil	Dichloroethane, 1,2-	8260B	A2LA
107-06-2	Water	Dichloroethane, 1,2-	8260B	A2LA
107-06-2	Soil	Dichloroethane, 1,2-	8260C	A2LA
107-06-2	Water	Dichloroethane, 1,2-	8260C	A2LA
107-06-2	Soil	Dichloroethane, 1,2-	8260D	A2LA
107-06-2	Water	Dichloroethane, 1,2-	8260D	A2LA
107-06-2	Air	Dichloroethane, 1,2-	TO-15	A2LA
75-35-4	Water	Dichloroethylene, 1,1-	524.2	UT ELCP
75-35-4	Water	Dichloroethylene, 1,1-	624.1	A2LA
75-35-4	Soil	Dichloroethylene, 1,1-	8260B	A2LA
75-35-4	Water	Dichloroethylene, 1,1-	8260B	A2LA
75-35-4	Soil	Dichloroethylene, 1,1-	8260C	A2LA
75-35-4	Water	Dichloroethylene, 1,1-	8260C	A2LA
75-35-4	Soil	Dichloroethylene, 1,1-	8260D	A2LA
75-35-4	Water	Dichloroethylene, 1,1-	8260D	A2LA

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75-35-4	Air	Dichloroethylene, 1,1-	TO-15	A2LA
156-59-2	Water	Dichloroethylene, 1,2-cis-	524.2	UT ELCP
156-59-2	Water	Dichloroethylene, 1,2-cis-	624.1	A2LA
156-59-2	Soil	Dichloroethylene, 1,2-cis-	8260B	A2LA
156-59-2	Water	Dichloroethylene, 1,2-cis-	8260B	A2LA
156-59-2	Soil	Dichloroethylene, 1,2-cis-	8260C	A2LA
156-59-2	Water	Dichloroethylene, 1,2-cis-	8260C	A2LA
156-59-2	Soil	Dichloroethylene, 1,2-cis-	8260D	A2LA
156-59-2	Water	Dichloroethylene, 1,2-cis-	8260D	A2LA
156-59-2	Air	Dichloroethylene, 1,2-cis-	TO-15	A2LA
156-60-5	Water	Dichloroethylene, 1,2-trans-	524.2	UT ELCP
156-60-5	Water	Dichloroethylene, 1,2-trans-	624.1	A2LA
156-60-5	Soil	Dichloroethylene, 1,2-trans-	8260B	A2LA
156-60-5	Water	Dichloroethylene, 1,2-trans-	8260B	A2LA
156-60-5	Soil	Dichloroethylene, 1,2-trans-	8260C	A2LA
156-60-5	Water	Dichloroethylene, 1,2-trans-	8260C	A2LA
156-60-5	Soil	Dichloroethylene, 1,2-trans-	8260D	A2LA
156-60-5	Water	Dichloroethylene, 1,2-trans-	8260D	A2LA
156-60-5	Air	Dichloroethylene, 1,2-trans-	TO-15	A2LA
120-83-2	Water	Dichlorophenol, 2,4-	625.1	A2LA
120-83-2	Soil	Dichlorophenol, 2,4-	8270C	A2LA
120-83-2	Water	Dichlorophenol, 2,4-	8270C	A2LA
120-83-2	Soil	Dichlorophenol, 2,4-	8270D	A2LA
120-83-2	Water	Dichlorophenol, 2,4-	8270D	A2LA
120-83-2	Soil	Dichlorophenol, 2,4-	8270E	A2LA
120-83-2	Water	Dichlorophenol, 2,4-	8270E	A2LA
94-75-7	Soil	Dichlorophenoxy Acetic Acid, 2,4- (2,4-D)	8151A	A2LA
94-75-7	Water	Dichlorophenoxy Acetic Acid, 2,4- (2,4-D)	8151A	A2LA
78-87-5	Water	Dichloropropane, 1,2-	524.2	UT ELCP
78-87-5	Water	Dichloropropane, 1,2-	624.1	A2LA
78-87-5	Soil	Dichloropropane, 1,2-	8260B	A2LA
78-87-5	Water	Dichloropropane, 1,2-	8260B	A2LA
78-87-5	Soil	Dichloropropane, 1,2-	8260C	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
78-87-5	Water	Dichloropropane, 1,2-	8260C	A2LA
78-87-5	Soil	Dichloropropane, 1,2-	8260D	A2LA
78-87-5	Water	Dichloropropane, 1,2-	8260D	A2LA
78-87-5	Air	Dichloropropane, 1,2-	TO-15	A2LA
542-75-6	Water	Dichloropropene, 1,3- (cis + trans)	524.2	UT ELCP
542-75-6	Water	Dichloropropene, 1,3- (cis + trans)	624.1	A2LA
542-75-6	Soil	Dichloropropene, 1,3- (cis + trans)	8260B	A2LA
542-75-6	Water	Dichloropropene, 1,3- (cis + trans)	8260B	A2LA
542-75-6	Soil	Dichloropropene, 1,3- (cis + trans)	8260C	A2LA
542-75-6	Water	Dichloropropene, 1,3- (cis + trans)	8260C	A2LA
542-75-6	Soil	Dichloropropene, 1,3- (cis + trans)	8260D	A2LA
542-75-6	Water	Dichloropropene, 1,3- (cis + trans)	8260D	A2LA
542-75-6	Air	Dichloropropene, 1,3- (cis + trans)	TO-15	A2LA
60-57-1	Water	Dieldrin	608.3	A2LA
60-57-1	Soil	Dieldrin	8081A	A2LA
60-57-1	Water	Dieldrin	8081A	A2LA
60-57-1	Soil	Dieldrin	8081B	A2LA
60-57-1	Water	Dieldrin	8081B	A2LA
N/A	Soil	Diesel Range Organics (C10 – C25)	AK 102	A2LA
N/A	Water	Diesel Range Organics (C10 – C25)	AK 102	A2LA
84-66-2	Water	Diethyl Phthalate	625.1	A2LA
84-66-2	Soil	Diethyl Phthalate	8270C	A2LA
84-66-2	Water	Diethyl Phthalate	8270C	A2LA
84-66-2	Soil	Diethyl Phthalate	8270D	A2LA
84-66-2	Water	Diethyl Phthalate	8270D	A2LA
84-66-2	Soil	Diethyl Phthalate	8270E	A2LA
84-66-2	Water	Diethyl Phthalate	8270E	A2LA
105-67-9	Water	Dimethylphenol, 2,4-	625.1	A2LA
105-67-9	Soil	Dimethylphenol, 2,4-	8270C	A2LA
105-67-9	Water	Dimethylphenol, 2,4-	8270C	A2LA
105-67-9	Soil	Dimethylphenol, 2,4-	8270D	A2LA
105-67-9	Water	Dimethylphenol, 2,4-	8270D	A2LA
105-67-9	Soil	Dimethylphenol, 2,4-	8270E	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
105-67-9	Water	Dimethylphenol, 2,4-	8270E	A2LA
131-11-3	Water	Dimethylphthalate	625.1	A2LA
131-11-3	Soil	Dimethylphthalate	8270C	A2LA
131-11-3	Water	Dimethylphthalate	8270C	A2LA
131-11-3	Soil	Dimethylphthalate	8270D	A2LA
131-11-3	Water	Dimethylphthalate	8270D	A2LA
131-11-3	Soil	Dimethylphthalate	8270E	A2LA
131-11-3	Water	Dimethylphthalate	8270E	A2LA
99-65-0	Water	Dinitrobenzene, 1,3-	625.1	A2LA
99-65-0	Soil	Dinitrobenzene, 1,3-	8270C	A2LA
99-65-0	Water	Dinitrobenzene, 1,3-	8270C	A2LA
99-65-0	Soil	Dinitrobenzene, 1,3-	8270D	A2LA
99-65-0	Water	Dinitrobenzene, 1,3-	8270D	A2LA
99-65-0	Soil	Dinitrobenzene, 1,3-	8270E	A2LA
99-65-0	Water	Dinitrobenzene, 1,3-	8270E	A2LA
51-28-5	Water	Dinitrophenol, 2,4-	625.1	A2LA
51-28-5	Soil	Dinitrophenol, 2,4-	8270C	A2LA
51-28-5	Water	Dinitrophenol, 2,4-	8270C	A2LA
51-28-5	Soil	Dinitrophenol, 2,4-	8270D	A2LA
51-28-5	Water	Dinitrophenol, 2,4-	8270D	A2LA
51-28-5	Soil	Dinitrophenol, 2,4-	8270E	A2LA
51-28-5	Water	Dinitrophenol, 2,4-	8270E	A2LA
121-14-2	Water	Dinitrotoluene, 2,4- (2,4-DNT)	625.1	A2LA
121-14-2	Soil	Dinitrotoluene, 2,4- (2,4-DNT)	8270C	A2LA
121-14-2	Water	Dinitrotoluene, 2,4- (2,4-DNT)	8270C	A2LA
121-14-2	Soil	Dinitrotoluene, 2,4- (2,4-DNT)	8270D	A2LA
121-14-2	Water	Dinitrotoluene, 2,4- (2,4-DNT)	8270D	A2LA
121-14-2	Soil	Dinitrotoluene, 2,4- (2,4-DNT)	8270E	A2LA
121-14-2	Water	Dinitrotoluene, 2,4- (2,4-DNT)	8270E	A2LA
121-14-2	Soil	Dinitrotoluene, 2,4- (2,4-DNT)	8330A	A2LA
121-14-2	Water	Dinitrotoluene, 2,4- (2,4-DNT)	8330A	A2LA
121-14-2	Soil	Dinitrotoluene, 2,4- (2,4-DNT)	8330B	A2LA
121-14-2	Water	Dinitrotoluene, 2,4- (2,4-DNT)	8330B	A2LA

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606-20-2	Soil	Dinitrotoluene, 2,6- (2,6-DNT)	625.1	A2LA
606-20-2	Soil	Dinitrotoluene, 2,6- (2,6-DNT)	8270C	A2LA
606-20-2	Water	Dinitrotoluene, 2,6- (2,6-DNT)	8270C	A2LA
606-20-2	Soil	Dinitrotoluene, 2,6- (2,6-DNT)	8270D	A2LA
606-20-2	Water	Dinitrotoluene, 2,6- (2,6-DNT)	8270D	A2LA
606-20-2	Soil	Dinitrotoluene, 2,6- (2,6-DNT)	8270E	A2LA
606-20-2	Water	Dinitrotoluene, 2,6- (2,6-DNT)	8270E	A2LA
606-20-2	Soil	Dinitrotoluene, 2,6- (2,6-DNT)	8330A	A2LA
606-20-2	Water	Dinitrotoluene, 2,6- (2,6-DNT)	8330A	A2LA
606-20-2	Soil	Dinitrotoluene, 2,6- (2,6-DNT)	8330B	A2LA
606-20-2	Water	Dinitrotoluene, 2,6- (2,6-DNT)	8330B	A2LA
35572-78-2	Soil	Dinitrotoluene, 2-Amino-4,6-	8330A	A2LA
35572-78-2	Water	Dinitrotoluene, 2-Amino-4,6-	8330A	A2LA
35572-78-2	Soil	Dinitrotoluene, 2-Amino-4,6-	8330B	A2LA
35572-78-2	Water	Dinitrotoluene, 2-Amino-4,6-	8330B	A2LA
19406-51-0	Soil	Dinitrotoluene, 4-Amino-2,6-	8330A	A2LA
19406-51-0	Water	Dinitrotoluene, 4-Amino-2,6-	8330A	A2LA
19406-51-0	Soil	Dinitrotoluene, 4-Amino-2,6-	8330B	A2LA
19406-51-0	Water	Dinitrotoluene, 4-Amino-2,6-	8330B	A2LA
123-91-1	Water	Dioxane, 1,4-	624.1	A2LA
123-91-1	Soil	Dioxane, 1,4-	8260B	A2LA
123-91-1	Water	Dioxane, 1,4-	8260B	A2LA
123-91-1	Soil	Dioxane, 1,4-	8260B-SIM	A2LA
123-91-1	Water	Dioxane, 1,4-	8260B-SIM	A2LA
123-91-1	Soil	Dioxane, 1,4-	8260C	A2LA
123-91-1	Water	Dioxane, 1,4-	8260C	A2LA
123-91-1	Soil	Dioxane, 1,4-	8260C-SIM	A2LA
123-91-1	Water	Dioxane, 1,4-	8260C-SIM	A2LA
123-91-1	Soil	Dioxane, 1,4-	8260D	A2LA
123-91-1	Water	Dioxane, 1,4-	8260D	A2LA
123-91-1	Soil	Dioxane, 1,4-	8260D-SIM	A2LA
123-91-1	Water	Dioxane, 1,4-	8260D-SIM	A2LA
123-91-1	Air	Dioxane, 1,4-	TO-15	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
122-39-4	Water	Diphenylamine	625.1	A2LA
122-39-4	Soil	Diphenylamine	8270C	A2LA
122-39-4	Water	Diphenylamine	8270C	A2LA
122-39-4	Soil	Diphenylamine	8270D	A2LA
122-39-4	Water	Diphenylamine	8270D	A2LA
122-39-4	Soil	Diphenylamine	8270E	A2LA
122-39-4	Water	Diphenylamine	8270E	A2LA
115-29-7	Water	Endosulfan (Endosulfan I + Endosulfan II)	608.3	A2LA
115-29-7	Soil	Endosulfan (Endosulfan I + Endosulfan II)	8081A	A2LA
115-29-7	Water	Endosulfan (Endosulfan I + Endosulfan II)	8081A	A2LA
115-29-7	Soil	Endosulfan (Endosulfan I + Endosulfan II)	8081B	A2LA
115-29-7	Water	Endosulfan (Endosulfan I + Endosulfan II)	8081B	A2LA
72-20-8	Water	Endrin	608.3	A2LA
72-20-8	Soil	Endrin	8081A	A2LA
72-20-8	Water	Endrin	8081A	A2LA
72-20-8	Soil	Endrin	8081B	A2LA
72-20-8	Water	Endrin	8081B	A2LA
75-00-3	Water	Ethyl Chloride	524.2	UT ELCP
75-00-3	Water	Ethyl Chloride	624.1	A2LA
75-00-3	Soil	Ethyl Chloride	8260B	A2LA
75-00-3	Water	Ethyl Chloride	8260B	A2LA
75-00-3	Soil	Ethyl Chloride	8260C	A2LA
75-00-3	Water	Ethyl Chloride	8260C	A2LA
75-00-3	Soil	Ethyl Chloride	8260D	A2LA
75-00-3	Water	Ethyl Chloride	8260D	A2LA
75-00-3	Air	Ethyl Chloride	TO-15	A2LA
100-41-4	Water	Ethylbenzene	524.2	UT ELCP
100-41-4	Water	Ethylbenzene	602	A2LA
100-41-4	Water	Ethylbenzene	624.1	A2LA
100-41-4	Soil	Ethylbenzene	8021B	A2LA
100-41-4	Water	Ethylbenzene	8021B	A2LA
100-41-4	Soil	Ethylbenzene	8260B	A2LA
100-41-4	Water	Ethylbenzene	8260B	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
100-41-4	Soil	Ethylbenzene	8260C	A2LA
100-41-4	Water	Ethylbenzene	8260C	A2LA
100-41-4	Soil	Ethylbenzene	8260D	A2LA
100-41-4	Water	Ethylbenzene	8260D	A2LA
100-41-4	Air	Ethylbenzene	TO-15	A2LA
206-44-0	Water	Fluoranthene	625.1	A2LA
206-44-0	Soil	Fluoranthene	8310	UT ELCP
206-44-0	Water	Fluoranthene	8310	UT ELCP
206-44-0	Soil	Fluoranthene	8270C	A2LA
206-44-0	Water	Fluoranthene	8270C	A2LA
206-44-0	Soil	Fluoranthene	8270C-SIM	A2LA
206-44-0	Water	Fluoranthene	8270C-SIM	A2LA
206-44-0	Soil	Fluoranthene	8270D	A2LA
206-44-0	Water	Fluoranthene	8270D	A2LA
206-44-0	Soil	Fluoranthene	8270D-SIM	A2LA
206-44-0	Water	Fluoranthene	8270D-SIM	A2LA
206-44-0	Soil	Fluoranthene	8270E	A2LA
206-44-0	Water	Fluoranthene	8270E	A2LA
206-44-0	Soil	Fluoranthene	8270E-SIM	A2LA
206-44-0	Water	Fluoranthene	8270E-SIM	A2LA
86-73-7	Water	Fluorene	625.1	A2LA
86-73-7	Soil	Fluorene	8310	UT ELCP
86-73-7	Water	Fluorene	8310	UT ELCP
86-73-7	Soil	Fluorene	8270C	A2LA
86-73-7	Water	Fluorene	8270C	A2LA
86-73-7	Soil	Fluorene	8270C-SIM	A2LA
86-73-7	Water	Fluorene	8270C-SIM	A2LA
86-73-7	Soil	Fluorene	8270D	A2LA
86-73-7	Water	Fluorene	8270D	A2LA
86-73-7	Soil	Fluorene	8270D-SIM	A2LA
86-73-7	Water	Fluorene	8270D-SIM	A2LA
86-73-7	Soil	Fluorene	8270E	A2LA
86-73-7	Water	Fluorene	8270E	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
86-73-7	Soil	Fluorene	8270E-SIM	A2LA
86-73-7	Water	Fluorene	8270E-SIM	A2LA
N/A	Soil	Gasoline Range Organics (C6 – C10)	AK 101	A2LA
N/A	Water	Gasoline Range Organics (C6 – C10)	AK 101	A2LA
76-44-8	Water	Heptachlor	608.3	A2LA
76-44-8	Soil	Heptachlor	8081A	A2LA
76-44-8	Water	Heptachlor	8081A	A2LA
76-44-8	Soil	Heptachlor	8081B	A2LA
76-44-8	Water	Heptachlor	8081B	A2LA
1024-57-3	Water	Heptachlor Epoxide	608.3	A2LA
1024-57-3	Soil	Heptachlor Epoxide	8081A	A2LA
1024-57-3	Water	Heptachlor Epoxide	8081A	A2LA
1024-57-3	Soil	Heptachlor Epoxide	8081B	A2LA
1024-57-3	Water	Heptachlor Epoxide	8081B	A2LA
118-74-1	Water	Hexachlorobenzene	625.1	A2LA
118-74-1	Soil	Hexachlorobenzene	8270C	A2LA
118-74-1	Water	Hexachlorobenzene	8270C	A2LA
118-74-1	Soil	Hexachlorobenzene	8270D	A2LA
118-74-1	Water	Hexachlorobenzene	8270D	A2LA
118-74-1	Soil	Hexachlorobenzene	8270E	A2LA
118-74-1	Water	Hexachlorobenzene	8270E	A2LA
87-68-3	Water	Hexachlorobutadiene	524.2	UT ELCP
87-68-3	Water	Hexachlorobutadiene	624.1	A2LA
87-68-3	Water	Hexachlorobutadiene	625.1	A2LA
87-68-3	Soil	Hexachlorobutadiene	8260B	A2LA
87-68-3	Water	Hexachlorobutadiene	8260B	A2LA
87-68-3	Soil	Hexachlorobutadiene	8260C	A2LA
87-68-3	Water	Hexachlorobutadiene	8260C	A2LA
87-68-3	Soil	Hexachlorobutadiene	8260D	A2LA
87-68-3	Water	Hexachlorobutadiene	8260D	A2LA
87-68-3	Soil	Hexachlorobutadiene	8270C	A2LA
87-68-3	Water	Hexachlorobutadiene	8270C	A2LA
87-68-3	Soil	Hexachlorobutadiene	8270D	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
87-68-3	Water	Hexachlorobutadiene	8270D	A2LA
87-68-3	Soil	Hexachlorobutadiene	8270E	A2LA
87-68-3	Water	Hexachlorobutadiene	8270E	A2LA
87-68-3	Air	Hexachlorobutadiene	TO-15	A2LA
319-84-6	Water	Hexachlorocyclohexane, Alpha- (α-BHC)	608.3	A2LA
319-84-6	Soil	Hexachlorocyclohexane, Alpha- (α-BHC)	8081B	A2LA
319-84-6	Water	Hexachlorocyclohexane, Alpha- (α-BHC)	8081B	A2LA
319-85-7	Water	Hexachlorocyclohexane, Beta- (β-BHC)	608.3	A2LA
319-85-7	Soil	Hexachlorocyclohexane, Beta- (β-BHC)	8081A	A2LA
319-85-7	Water	Hexachlorocyclohexane, Beta- (β-BHC)	8081A	A2LA
319-85-7	Soil	Hexachlorocyclohexane, Beta- (β-BHC)	8081B	A2LA
319-85-7	Water	Hexachlorocyclohexane, Beta- (β-BHC)	8081B	A2LA
319-86-8	Water	Hexachlorocyclohexane, Delta- (δ-BHC)	608.3	A2LA
319-86-8	Soil	Hexachlorocyclohexane, Delta- (δ-BHC)	8081A	A2LA
319-86-8	Water	Hexachlorocyclohexane, Delta- (δ-BHC)	8081A	A2LA
319-86-8	Soil	Hexachlorocyclohexane, Delta- (δ-BHC)	8081B	A2LA
319-86-8	Water	Hexachlorocyclohexane, Delta- (δ-BHC)	8081B	A2LA
58-89-9	Water	Hexachlorocyclohexane, Gamma- (Lindane)	608.3	A2LA
58-89-9	Soil	Hexachlorocyclohexane, Gamma- (Lindane)	8081A	A2LA
58-89-9	Water	Hexachlorocyclohexane, Gamma- (Lindane)	8081A	A2LA
58-89-9	Soil	Hexachlorocyclohexane, Gamma- (Lindane)	8081B	A2LA
58-89-9	Water	Hexachlorocyclohexane, Gamma- (Lindane)	8081B	A2LA
77-47-4	Water	Hexachlorocyclopentadiene	625.1	A2LA
77-47-4	Soil	Hexachlorocyclopentadiene	8270C	A2LA
77-47-4	Water	Hexachlorocyclopentadiene	8270C	A2LA
77-47-4	Soil	Hexachlorocyclopentadiene	8270D	A2LA
77-47-4	Water	Hexachlorocyclopentadiene	8270D	A2LA
77-47-4	Soil	Hexachlorocyclopentadiene	8270E	A2LA
77-47-4	Water	Hexachlorocyclopentadiene	8270E	A2LA
67-72-1	Water	Hexachloroethane	625.1	A2LA
67-72-1	Soil	Hexachloroethane	8270C	A2LA
67-72-1	Water	Hexachloroethane	8270C	A2LA
67-72-1	Soil	Hexachloroethane	8270D	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
67-72-1	Water	Hexachloroethane	8270D	A2LA
67-72-1	Soil	Hexachloroethane	8270E	A2LA
67-72-1	Water	Hexachloroethane	8270E	A2LA
121-82-4	Soil	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	8330A	A2LA
121-82-4	Water	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	8330A	A2LA
121-82-4	Soil	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	8330B	A2LA
121-82-4	Water	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	8330B	A2LA
110-54-3	Soil	Hexane, N-	8260B	A2LA
110-54-3	Water	Hexane, N-	8260B	A2LA
110-54-3	Soil	Hexane, N-	8260C	A2LA
110-54-3	Water	Hexane, N-	8260C	A2LA
110-54-3	Soil	Hexane, N-	8260D	A2LA
110-54-3	Water	Hexane, N-	8260D	A2LA
110-54-3	Air	Hexane, N-	TO-15	A2LA
591-78-6	Water	Hexanone, 2-	524.2	UT ELCP
591-78-6	Water	Hexanone, 2-	624.1	A2LA
591-78-6	Soil	Hexanone, 2-	8260B	A2LA
591-78-6	Water	Hexanone, 2-	8260B	A2LA
591-78-6	Soil	Hexanone, 2-	8260C	A2LA
591-78-6	Water	Hexanone, 2-	8260C	A2LA
591-78-6	Soil	Hexanone, 2-	8260D	A2LA
591-78-6	Water	Hexanone, 2-	8260D	A2LA
193-39-5	Water	Indeno[1,2,3-cd]pyrene	625.1	A2LA
193-39-5	Soil	Indeno[1,2,3-cd]pyrene	8310	UT ELCP
193-39-5	Water	Indeno[1,2,3-cd]pyrene	8310	UT ELCP
193-39-5	Soil	Indeno[1,2,3-cd]pyrene	8270C	A2LA
193-39-5	Water	Indeno[1,2,3-cd]pyrene	8270C	A2LA
193-39-5	Soil	Indeno[1,2,3-cd]pyrene	8270C-SIM	A2LA
193-39-5	Water	Indeno[1,2,3-cd]pyrene	8270C-SIM	A2LA
193-39-5	Soil	Indeno[1,2,3-cd]pyrene	8270D	A2LA
193-39-5	Water	Indeno[1,2,3-cd]pyrene	8270D	A2LA
193-39-5	Soil	Indeno[1,2,3-cd]pyrene	8270D-SIM	A2LA
193-39-5	Water	Indeno[1,2,3-cd]pyrene	8270D-SIM	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
193-39-5	Soil	Indeno[1,2,3-cd]pyrene	8270E	A2LA
193-39-5	Water	Indeno[1,2,3-cd]pyrene	8270E	A2LA
193-39-5	Soil	Indeno[1,2,3-cd]pyrene	8270E-SIM	A2LA
193-39-5	Water	Indeno[1,2,3-cd]pyrene	8270E-SIM	A2LA
78-59-1	Water	Isophorone	625.1	A2LA
78-59-1	Soil	Isophorone	8270C	A2LA
78-59-1	Water	Isophorone	8270C	A2LA
78-59-1	Soil	Isophorone	8270D	A2LA
78-59-1	Water	Isophorone	8270D	A2LA
78-59-1	Soil	Isophorone	8270E	A2LA
78-59-1	Water	Isophorone	8270E	A2LA
67-63-0	Water	Isopropanol	624.1	A2LA
67-63-0	Soil	Isopropanol	8260B	A2LA
67-63-0	Water	Isopropanol	8260B	A2LA
67-63-0	Soil	Isopropanol	8260C	A2LA
67-63-0	Water	Isopropanol	8260C	A2LA
67-63-0	Soil	Isopropanol	8260D	A2LA
67-63-0	Water	Isopropanol	8260D	A2LA
7439-92-1	Water	Lead, Total	200.7	A2LA
7439-92-1	Water	Lead, Total	200.8	A2LA
7439-92-1	Soil	Lead, Total	6010B	A2LA
7439-92-1	Water	Lead, Total	6010B	A2LA
7439-92-1	Soil	Lead, Total	6010C	A2LA
7439-92-1	Water	Lead, Total	6010C	A2LA
7439-92-1	Soil	Lead, Total	6010D	A2LA
7439-92-1	Water	Lead, Total	6010D	A2LA
7439-92-1	Soil	Lead, Total	6020A	A2LA
7439-92-1	Water	Lead, Total	6020A	A2LA
7439-92-1	Soil	Lead, Total	6020B	A2LA
7439-92-1	Water	Lead, Total	6020B	A2LA
7439-96-5	Water	Manganese	200.7	A2LA
7439-96-5	Water	Manganese	200.8	A2LA
7439-96-5	Soil	Manganese	6010B	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
7439-96-5	Water	Manganese	6010B	A2LA
7439-96-5	Soil	Manganese	6010C	A2LA
7439-96-5	Water	Manganese	6010C	A2LA
7439-96-5	Soil	Manganese	6010D	A2LA
7439-96-5	Water	Manganese	6010D	A2LA
7439-96-5	Soil	Manganese	6020A	A2LA
7439-96-5	Water	Manganese	6020A	A2LA
7439-96-5	Soil	Manganese	6020B	A2LA
7439-96-5	Water	Manganese	6020B	A2LA
7439-97-6	Water	Mercury (elemental)	245.1	A2LA
7439-97-6	Water	Mercury (elemental)	7470A	A2LA
72-43-5	Water	Methoxychlor	608.3	A2LA
72-43-5	Soil	Methoxychlor	8081A	A2LA
72-43-5	Water	Methoxychlor	8081A	A2LA
72-43-5	Soil	Methoxychlor	8081B	A2LA
72-43-5	Water	Methoxychlor	8081B	A2LA
78-93-3	Water	Methyl Ethyl Ketone (2-Butanone)	524.2	UT ELCP
78-93-3	Water	Methyl Ethyl Ketone (2-Butanone)	624.1	A2LA
78-93-3	Soil	Methyl Ethyl Ketone (2-Butanone)	8260B	A2LA
78-93-3	Water	Methyl Ethyl Ketone (2-Butanone)	8260B	A2LA
78-93-3	Soil	Methyl Ethyl Ketone (2-Butanone)	8260C	A2LA
78-93-3	Water	Methyl Ethyl Ketone (2-Butanone)	8260C	A2LA
78-93-3	Soil	Methyl Ethyl Ketone (2-Butanone)	8260D	A2LA
78-93-3	Water	Methyl Ethyl Ketone (2-Butanone)	8260D	A2LA
78-93-3	Air	Methyl Ethyl Ketone (2-Butanone)	TO-15	A2LA
108-10-1	Water	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	524.2	UT ELCP
108-10-1	Water	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	624.1	A2LA
108-10-1	Soil	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	8260B	A2LA
108-10-1	Water	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	8260B	A2LA
108-10-1	Soil	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	8260C	A2LA
108-10-1	Water	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	8260C	A2LA
108-10-1	Soil	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	8260D	A2LA
108-10-1	Water	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	8260D	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
108-10-1	Air	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	TO-15	A2LA
1634-04-4	Water	Methyl tert-Butyl Ether (MTBE)	524.2	UT ELCP
1634-04-4	Water	Methyl tert-Butyl Ether (MTBE)	624.1	A2LA
1634-04-4	Soil	Methyl tert-Butyl Ether (MTBE)	8021B	A2LA
1634-04-4	Water	Methyl tert-Butyl Ether (MTBE)	8021B	A2LA
1634-04-4	Soil	Methyl tert-Butyl Ether (MTBE)	8260B	A2LA
1634-04-4	Water	Methyl tert-Butyl Ether (MTBE)	8260B	A2LA
1634-04-4	Soil	Methyl tert-Butyl Ether (MTBE)	8260C	A2LA
1634-04-4	Water	Methyl tert-Butyl Ether (MTBE)	8260C	A2LA
1634-04-4	Soil	Methyl tert-Butyl Ether (MTBE)	8260D	A2LA
1634-04-4	Water	Methyl tert-Butyl Ether (MTBE)	8260D	A2LA
1634-04-4	Air	Methyl tert-Butyl Ether (MTBE)	TO-15	A2LA
75-09-2	Water	Methylene Chloride	524.2	UT ELCP
75-09-2	Water	Methylene Chloride	624.1	A2LA
75-09-2	Soil	Methylene Chloride	8260B	A2LA
75-09-2	Water	Methylene Chloride	8260B	A2LA
75-09-2	Soil	Methylene Chloride	8260C	A2LA
75-09-2	Water	Methylene Chloride	8260C	A2LA
75-09-2	Soil	Methylene Chloride	8260D	A2LA
75-09-2	Water	Methylene Chloride	8260D	A2LA
75-09-2	Air	Methylene Chloride	TO-15	A2LA
90-12-0	Water	Methylnaphthalene, 1-	625.1	A2LA
90-12-0	Soil	Methylnaphthalene, 1-	8270C	A2LA
90-12-0	Water	Methylnaphthalene, 1-	8270C	A2LA
90-12-0	Soil	Methylnaphthalene, 1-	8270C-SIM	A2LA
90-12-0	Water	Methylnaphthalene, 1-	8270C-SIM	A2LA
90-12-0	Soil	Methylnaphthalene, 1-	8270D	A2LA
90-12-0	Water	Methylnaphthalene, 1-	8270D	A2LA
90-12-0	Soil	Methylnaphthalene, 1-	8270D-SIM	A2LA
90-12-0	Water	Methylnaphthalene, 1-	8270D-SIM	A2LA
90-12-0	Soil	Methylnaphthalene, 1-	8270E	A2LA
90-12-0	Water	Methylnaphthalene, 1-	8270E	A2LA
90-12-0	Soil	Methylnaphthalene, 1-	8270E-SIM	A2LA

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90-12-0	Water	Methylnaphthalene, 1-	8270E-SIM	A2LA
91-57-6	Water	Methylnaphthalene, 2-	625.1	A2LA
91-57-6	Soil	Methylnaphthalene, 2-	8270C	A2LA
91-57-6	Water	Methylnaphthalene, 2-	8270C	A2LA
91-57-6	Soil	Methylnaphthalene, 2-	8270C-SIM	A2LA
91-57-6	Water	Methylnaphthalene, 2-	8270C-SIM	A2LA
91-57-6	Soil	Methylnaphthalene, 2-	8270D	A2LA
91-57-6	Water	Methylnaphthalene, 2-	8270D	A2LA
91-57-6	Soil	Methylnaphthalene, 2-	8270D-SIM	A2LA
91-57-6	Water	Methylnaphthalene, 2-	8270D-SIM	A2LA
91-57-6	Soil	Methylnaphthalene, 2-	8270E	A2LA
91-57-6	Water	Methylnaphthalene, 2-	8270E	A2LA
91-57-6	Soil	Methylnaphthalene, 2-	8270E-SIM	A2LA
91-57-6	Water	Methylnaphthalene, 2-	8270E-SIM	A2LA
91-20-3	Water	Naphthalene	524.2	UT ELCP
91-20-3	Water	Naphthalene	624.1	A2LA
91-20-3	Water	Naphthalene	625.1	A2LA
91-20-3	Water	Naphthalene	8310	UT ELCP
91-20-3	Soil	Naphthalene	8260B	A2LA
91-20-3	Water	Naphthalene	8260B	A2LA
91-20-3	Soil	Naphthalene	8260C	A2LA
91-20-3	Water	Naphthalene	8260C	A2LA
91-20-3	Soil	Naphthalene	8260D	A2LA
91-20-3	Water	Naphthalene	8260D	A2LA
91-20-3	Soil	Naphthalene	8270C	A2LA
91-20-3	Water	Naphthalene	8270C	A2LA
91-20-3	Soil	Naphthalene	8270C-SIM	A2LA
91-20-3	Water	Naphthalene	8270C-SIM	A2LA
91-20-3	Soil	Naphthalene	8270D	A2LA
91-20-3	Water	Naphthalene	8270D	A2LA
91-20-3	Soil	Naphthalene	8270D-SIM	A2LA
91-20-3	Water	Naphthalene	8270D-SIM	A2LA
91-20-3	Soil	Naphthalene	8270E	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
91-20-3	Water	Naphthalene	8270E	A2LA
91-20-3	Soil	Naphthalene	8270E-SIM	A2LA
91-20-3	Water	Naphthalene	8270E-SIM	A2LA
91-20-3	Air	Naphthalene	TO-15	A2LA
7440-02-0	Water	Nickel, Total	200.7	A2LA
7440-02-0	Water	Nickel, Total	200.8	A2LA
7440-02-0	Soil	Nickel, Total	6010B	A2LA
7440-02-0	Water	Nickel, Total	6010B	A2LA
7440-02-0	Soil	Nickel, Total	6010C	A2LA
7440-02-0	Water	Nickel, Total	6010C	A2LA
7440-02-0	Soil	Nickel, Total	6010D	A2LA
7440-02-0	Water	Nickel, Total	6010D	A2LA
7440-02-0	Soil	Nickel, Total	6020A	A2LA
7440-02-0	Water	Nickel, Total	6020A	A2LA
7440-02-0	Soil	Nickel, Total	6020B	A2LA
7440-02-0	Water	Nickel, Total	6020B	A2LA
98-95-3	Water	Nitrobenzene	625.1	A2LA
98-95-3	Soil	Nitrobenzene	8270C	A2LA
98-95-3	Water	Nitrobenzene	8270C	A2LA
98-95-3	Soil	Nitrobenzene	8270D	A2LA
98-95-3	Water	Nitrobenzene	8270D	A2LA
98-95-3	Soil	Nitrobenzene	8270E	A2LA
98-95-3	Water	Nitrobenzene	8270E	A2LA
98-95-3	Soil	Nitrobenzene	8330A	A2LA
98-95-3	Water	Nitrobenzene	8330A	A2LA
98-95-3	Soil	Nitrobenzene	8330B	A2LA
98-95-3	Water	Nitrobenzene	8330B	A2LA
55-63-0	Soil	Nitroglycerin	8330A	A2LA
55-63-0	Water	Nitroglycerin	8330A	A2LA
55-63-0	Soil	Nitroglycerin	8330B	A2LA
55-63-0	Water	Nitroglycerin	8330B	A2LA
62-75-9	Water	Nitrosodimethylamine, N-	625.1	A2LA
62-75-9	Soil	Nitrosodimethylamine, N-	8270C	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
62-75-9	Water	Nitrosodimethylamine, N-	8270C	A2LA
62-75-9	Soil	Nitrosodimethylamine, N-	8270D	A2LA
62-75-9	Water	Nitrosodimethylamine, N-	8270D	A2LA
62-75-9	Soil	Nitrosodimethylamine, N-	8270E	A2LA
62-75-9	Water	Nitrosodimethylamine, N-	8270E	A2LA
621-64-7	Water	Nitroso-di-N-propylamine, N-	625.1	A2LA
621-64-7	Soil	Nitroso-di-N-propylamine, N-	8270C	A2LA
621-64-7	Water	Nitroso-di-N-propylamine, N-	8270C	A2LA
621-64-7	Soil	Nitroso-di-N-propylamine, N-	8270D	A2LA
621-64-7	Water	Nitroso-di-N-propylamine, N-	8270D	A2LA
621-64-7	Soil	Nitroso-di-N-propylamine, N-	8270E	A2LA
621-64-7	Water	Nitroso-di-N-propylamine, N-	8270E	A2LA
86-30-6	Water	Nitrosodiphenylamine, N-	625.1	A2LA
86-30-6	Soil	Nitrosodiphenylamine, N-	8270C	A2LA
86-30-6	Water	Nitrosodiphenylamine, N-	8270C	A2LA
86-30-6	Soil	Nitrosodiphenylamine, N-	8270D	A2LA
86-30-6	Water	Nitrosodiphenylamine, N-	8270D	A2LA
86-30-6	Soil	Nitrosodiphenylamine, N-	8270E	A2LA
86-30-6	Water	Nitrosodiphenylamine, N-	8270E	A2LA
99-08-1	Soil	Nitrotoluene, m-	8330A	A2LA
99-08-1	Water	Nitrotoluene, m-	8330A	A2LA
99-08-1	Soil	Nitrotoluene, m-	8330B	A2LA
99-08-1	Water	Nitrotoluene, m-	8330B	A2LA
88-72-2	Soil	Nitrotoluene, o-	8330A	A2LA
88-72-2	Water	Nitrotoluene, o-	8330A	A2LA
88-72-2	Soil	Nitrotoluene, o-	8330B	A2LA
88-72-2	Water	Nitrotoluene, o-	8330B	A2LA
99-99-0	Soil	Nitrotoluene, p-	8330A	A2LA
99-99-0	Water	Nitrotoluene, p-	8330A	A2LA
99-99-0	Soil	Nitrotoluene, p-	8330B	A2LA
99-99-0	Water	Nitrotoluene, p-	8330B	A2LA
2691-41-0	Soil	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	8330A	A2LA
2691-41-0	Water	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	8330A	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
2691-41-0	Soil	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	8330B	A2LA
2691-41-0	Water	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	8330B	A2LA
117-84-0	Water	Octyl Phthalate, di-N-	625.1	A2LA
117-84-0	Soil	Octyl Phthalate, di-N-	8270C	A2LA
117-84-0	Water	Octyl Phthalate, di-N-	8270C	A2LA
117-84-0	Soil	Octyl Phthalate, di-N-	8270D	A2LA
117-84-0	Water	Octyl Phthalate, di-N-	8270D	A2LA
117-84-0	Soil	Octyl Phthalate, di-N-	8270E	A2LA
117-84-0	Water	Octyl Phthalate, di-N-	8270E	A2LA
12674-11-2	Water	PCB - Aroclor-1016	608.3	A2LA
12674-11-2	Soil	PCB - Aroclor-1016	8082	A2LA
12674-11-2	Water	PCB - Aroclor-1016	8082	A2LA
12674-11-2	Soil	PCB - Aroclor-1016	8082A	A2LA
12674-11-2	Water	PCB - Aroclor-1016	8082A	A2LA
11104-28-2	Water	PCB - Aroclor-1221	608.3	A2LA
11104-28-2	Soil	PCB - Aroclor-1221	8082	A2LA
11104-28-2	Water	PCB - Aroclor-1221	8082	A2LA
11104-28-2	Soil	PCB - Aroclor-1221	8082A	A2LA
11104-28-2	Water	PCB - Aroclor-1221	8082A	A2LA
11141-16-5	Water	PCB - Aroclor-1232	608.3	A2LA
11141-16-5	Soil	PCB - Aroclor-1232	8082	A2LA
11141-16-5	Water	PCB - Aroclor-1232	8082	A2LA
11141-16-5	Soil	PCB - Aroclor-1232	8082A	A2LA
11141-16-5	Water	PCB - Aroclor-1232	8082A	A2LA
53469-21-9	Water	PCB - Aroclor-1242	608.3	A2LA
53469-21-9	Soil	PCB - Aroclor-1242	8082	A2LA
53469-21-9	Water	PCB - Aroclor-1242	8082	A2LA
53469-21-9	Soil	PCB - Aroclor-1242	8082A	A2LA
53469-21-9	Water	PCB - Aroclor-1242	8082A	A2LA
12672-29-6	Water	PCB - Aroclor-1248	608.3	A2LA
12672-29-6	Soil	PCB - Aroclor-1248	8082	A2LA
12672-29-6	Water	PCB - Aroclor-1248	8082	A2LA
12672-29-6	Soil	PCB - Aroclor-1248	8082A	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
12672-29-6	Water	PCB - Aroclor-1248	8082A	A2LA
11097-69-1	Water	PCB - Aroclor-1254	608.3	A2LA
11097-69-1	Soil	PCB - Aroclor-1254	8082	A2LA
11097-69-1	Water	PCB - Aroclor-1254	8082	A2LA
11097-69-1	Soil	PCB - Aroclor-1254	8082A	A2LA
11097-69-1	Water	PCB - Aroclor-1254	8082A	A2LA
11096-82-5	Water	PCB - Aroclor-1260	608.3	A2LA
11096-82-5	Soil	PCB - Aroclor-1260	8082	A2LA
11096-82-5	Water	PCB - Aroclor-1260	8082	A2LA
11096-82-5	Soil	PCB - Aroclor-1260	8082A	A2LA
11096-82-5	Water	PCB - Aroclor-1260	8082A	A2LA
37324-23-5	Water	PCB - Aroclor-1262	608.3	A2LA
37324-23-5	Soil	PCB - Aroclor-1262	8082	A2LA
37324-23-5	Water	PCB - Aroclor-1262	8082	A2LA
37324-23-5	Soil	PCB - Aroclor-1262	8082A	A2LA
37324-23-5	Water	PCB - Aroclor-1262	8082A	A2LA
11100-14-4	Water	PCB - Aroclor-1268	608.3	A2LA
11100-14-4	Soil	PCB - Aroclor-1268	8082	A2LA
11100-14-4	Water	PCB - Aroclor-1268	8082	A2LA
11100-14-4	Soil	PCB - Aroclor-1268	8082A	A2LA
11100-14-4	Water	PCB - Aroclor-1268	8082A	A2LA
87-86-5	Water	Pentachlorophenol	625.1	A2LA
87-86-5	Soil	Pentachlorophenol	8270C	A2LA
87-86-5	Water	Pentachlorophenol	8270C	A2LA
87-86-5	Soil	Pentachlorophenol	8270D	A2LA
87-86-5	Water	Pentachlorophenol	8270D	A2LA
87-86-5	Soil	Pentachlorophenol	8270E	A2LA
87-86-5	Water	Pentachlorophenol	8270E	A2LA
78-11-5	Soil	Pentaerythritol tetranitrate (PETN)	8330A	A2LA
78-11-5	Water	Pentaerythritol tetranitrate (PETN)	8330A	A2LA
78-11-5	Soil	Pentaerythritol tetranitrate (PETN)	8330B	A2LA
78-11-5	Water	Pentaerythritol tetranitrate (PETN)	8330B	A2LA
85-01-8	Water	Phenanthrene	625.1	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
85-01-8	Soil	Phenanthrene	8310	UT ELCP
85-01-8	Water	Phenanthrene	8310	UT ELCP
85-01-8	Soil	Phenanthrene	8270C	A2LA
85-01-8	Water	Phenanthrene	8270C	A2LA
85-01-8	Soil	Phenanthrene	8270C-SIM	A2LA
85-01-8	Water	Phenanthrene	8270C-SIM	A2LA
85-01-8	Soil	Phenanthrene	8270D	A2LA
85-01-8	Water	Phenanthrene	8270D	A2LA
85-01-8	Soil	Phenanthrene	8270D-SIM	A2LA
85-01-8	Water	Phenanthrene	8270D-SIM	A2LA
85-01-8	Soil	Phenanthrene	8270E	A2LA
85-01-8	Water	Phenanthrene	8270E	A2LA
85-01-8	Soil	Phenanthrene	8270E-SIM	A2LA
85-01-8	Water	Phenanthrene	8270E-SIM	A2LA
108-95-2	Water	Phenol	625.1	A2LA
108-95-2	Soil	Phenol	8270C	A2LA
108-95-2	Water	Phenol	8270C	A2LA
108-95-2	Soil	Phenol	8270D	A2LA
108-95-2	Water	Phenol	8270D	A2LA
108-95-2	Soil	Phenol	8270E	A2LA
108-95-2	Water	Phenol	8270E	A2LA
103-65-1	Water	Propyl benzene	524.2	UT ELCP
103-65-1	Water	Propyl benzene	624.1	A2LA
103-65-1	Soil	Propyl benzene	8260B	A2LA
103-65-1	Water	Propyl benzene	8260B	A2LA
103-65-1	Soil	Propyl benzene	8260C	A2LA
103-65-1	Water	Propyl benzene	8260C	A2LA
103-65-1	Soil	Propyl benzene	8260D	A2LA
103-65-1	Water	Propyl benzene	8260D	A2LA
129-00-0	Water	Pyrene	625.1	A2LA
129-00-0	Soil	Pyrene	8310	UT ELCP
129-00-0	Water	Pyrene	8310	UT ELCP
129-00-0	Soil	Pyrene	8270C	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
129-00-0	Water	Pyrene	8270C	A2LA
129-00-0	Soil	Pyrene	8270C-SIM	A2LA
129-00-0	Water	Pyrene	8270C-SIM	A2LA
129-00-0	Soil	Pyrene	8270D	A2LA
129-00-0	Water	Pyrene	8270D	A2LA
129-00-0	Soil	Pyrene	8270D-SIM	A2LA
129-00-0	Water	Pyrene	8270D-SIM	A2LA
129-00-0	Soil	Pyrene	8270E	A2LA
129-00-0	Water	Pyrene	8270E	A2LA
129-00-0	Soil	Pyrene	8270E-SIM	A2LA
129-00-0	Water	Pyrene	8270E-SIM	A2LA
N/A	Soil	Residual Range Organics (C25 – C36)	AK 103	A2LA
N/A	Water	Residual Range Organics (C25 – C36)	AK 103	A2LA
7782-49-2	Water	Selenium	200.7	A2LA
7782-49-2	Water	Selenium	200.8	A2LA
7782-49-2	Soil	Selenium	6010B	A2LA
7782-49-2	Water	Selenium	6010B	A2LA
7782-49-2	Soil	Selenium	6010C	A2LA
7782-49-2	Water	Selenium	6010C	A2LA
7782-49-2	Soil	Selenium	6010D	A2LA
7782-49-2	Water	Selenium	6010D	A2LA
7782-49-2	Soil	Selenium	6020A	A2LA
7782-49-2	Water	Selenium	6020A	A2LA
7782-49-2	Soil	Selenium	6020B	A2LA
7782-49-2	Water	Selenium	6020B	A2LA
7440-22-4	Water	Silver	200.7	A2LA
7440-22-4	Water	Silver	200.8	A2LA
7440-22-4	Soil	Silver	6010B	A2LA
7440-22-4	Water	Silver	6010B	A2LA
7440-22-4	Soil	Silver	6010C	A2LA
7440-22-4	Water	Silver	6010C	A2LA
7440-22-4	Soil	Silver	6010D	A2LA
7440-22-4	Water	Silver	6010D	A2LA

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
7440-22-4	Soil	Silver	6020A	A2LA
7440-22-4	Water	Silver	6020A	A2LA
7440-22-4	Soil	Silver	6020B	A2LA
7440-22-4	Water	Silver	6020B	A2LA
7440-24-6	Water	Strontium	200.7	A2LA
7440-24-6	Water	Strontium	200.8	A2LA
7440-24-6	Soil	Strontium	6010B	A2LA
7440-24-6	Water	Strontium	6010B	A2LA
7440-24-6	Soil	Strontium	6010C	A2LA
7440-24-6	Water	Strontium	6010C	A2LA
7440-24-6	Soil	Strontium	6010D	A2LA
7440-24-6	Water	Strontium	6010D	A2LA
7440-24-6	Soil	Strontium	6020A	A2LA
7440-24-6	Water	Strontium	6020A	A2LA
7440-24-6	Soil	Strontium	6020B	A2LA
7440-24-6	Water	Strontium	6020B	A2LA
100-42-5	Water	Styrene	524.2	UT ELCP
100-42-5	Water	Styrene	624.1	A2LA
100-42-5	Soil	Styrene	8260B	A2LA
100-42-5	Water	Styrene	8260B	A2LA
100-42-5	Soil	Styrene	8260C	A2LA
100-42-5	Water	Styrene	8260C	A2LA
100-42-5	Soil	Styrene	8260D	A2LA
100-42-5	Water	Styrene	8260D	A2LA
100-42-5	Air	Styrene	TO-15	A2LA
630-20-6	Water	Tetrachloroethane, 1,1,1,2-	524.2	UT ELCP
630-20-6	Water	Tetrachloroethane, 1,1,1,2-	624.1	A2LA
630-20-6	Soil	Tetrachloroethane, 1,1,1,2-	8260B	A2LA
630-20-6	Water	Tetrachloroethane, 1,1,1,2-	8260B	A2LA
630-20-6	Soil	Tetrachloroethane, 1,1,1,2-	8260C	A2LA
630-20-6	Water	Tetrachloroethane, 1,1,1,2-	8260C	A2LA
630-20-6	Soil	Tetrachloroethane, 1,1,1,2-	8260D	A2LA
630-20-6	Water	Tetrachloroethane, 1,1,1,2-	8260D	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
79-34-5	Water	Tetrachloroethane, 1,1,2,2-	524.2	UT ELCP
79-34-5	Water	Tetrachloroethane, 1,1,2,2-	624.1	A2LA
79-34-5	Soil	Tetrachloroethane, 1,1,2,2-	8260B	A2LA
79-34-5	Water	Tetrachloroethane, 1,1,2,2-	8260B	A2LA
79-34-5	Soil	Tetrachloroethane, 1,1,2,2-	8260C	A2LA
79-34-5	Water	Tetrachloroethane, 1,1,2,2-	8260C	A2LA
79-34-5	Soil	Tetrachloroethane, 1,1,2,2-	8260D	A2LA
79-34-5	Water	Tetrachloroethane, 1,1,2,2-	8260D	A2LA
79-34-5	Air	Tetrachloroethane, 1,1,2,2-	TO-15	A2LA
127-18-4	Water	Tetrachloroethylene	524.2	UT ELCP
127-18-4	Water	Tetrachloroethylene	624.1	A2LA
127-18-4	Soil	Tetrachloroethylene	8260B	A2LA
127-18-4	Water	Tetrachloroethylene	8260B	A2LA
127-18-4	Soil	Tetrachloroethylene	8260C	A2LA
127-18-4	Water	Tetrachloroethylene	8260C	A2LA
127-18-4	Soil	Tetrachloroethylene	8260D	A2LA
127-18-4	Water	Tetrachloroethylene	8260D	A2LA
479-45-8	Soil	Tetryl (Trinitrophenylmethylnitramine)	8330A	A2LA
479-45-8	Water	Tetryl (Trinitrophenylmethylnitramine)	8330A	A2LA
479-45-8	Soil	Tetryl (Trinitrophenylmethylnitramine)	8330B	A2LA
479-45-8	Water	Tetryl (Trinitrophenylmethylnitramine)	8330B	A2LA
7440-28-0	Water	Thallium, Total	200.7	A2LA
7440-28-0	Water	Thallium, Total	200.8	A2LA
7440-28-0	Soil	Thallium, Total	6010B	A2LA
7440-28-0	Water	Thallium, Total	6010B	A2LA
7440-28-0	Soil	Thallium, Total	6010C	A2LA
7440-28-0	Water	Thallium, Total	6010C	A2LA
7440-28-0	Soil	Thallium, Total	6010D	A2LA
7440-28-0	Water	Thallium, Total	6010D	A2LA
7440-28-0	Soil	Thallium, Total	6020A	A2LA
7440-28-0	Water	Thallium, Total	6020A	A2LA
7440-28-0	Soil	Thallium, Total	6020B	A2LA
7440-28-0	Water	Thallium, Total	6020B	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
108-88-3	Water	Toluene	524.2	UT ELCP
108-88-3	Water	Toluene	602	A2LA
108-88-3	Water	Toluene	624.1	A2LA
108-88-3	Soil	Toluene	8021B	A2LA
108-88-3	Water	Toluene	8021B	A2LA
108-88-3	Soil	Toluene	8260B	A2LA
108-88-3	Water	Toluene	8260B	A2LA
108-88-3	Soil	Toluene	8260C	A2LA
108-88-3	Water	Toluene	8260C	A2LA
108-88-3	Soil	Toluene	8260D	A2LA
108-88-3	Water	Toluene	8260D	A2LA
108-88-3	Air	Toluene	TO-15	A2LA
8001-35-2	Water	Toxaphene	608.3	A2LA
8001-35-2	Soil	Toxaphene	8081A	A2LA
8001-35-2	Water	Toxaphene	8081A	A2LA
8001-35-2	Soil	Toxaphene	8081B	A2LA
8001-35-2	Water	Toxaphene	8081B	A2LA
76-13-1	Water	Trichloro-1,2,2-trifluoroethane, 1,1,2- (Freon 113)	624.1	A2LA
76-13-1	Soil	Trichloro-1,2,2-trifluoroethane, 1,1,2- (Freon 113)	8260B	A2LA
76-13-1	Water	Trichloro-1,2,2-trifluoroethane, 1,1,2- (Freon 113)	8260B	A2LA
76-13-1	Soil	Trichloro-1,2,2-trifluoroethane, 1,1,2- (Freon 113)	8260C	A2LA
76-13-1	Water	Trichloro-1,2,2-trifluoroethane, 1,1,2- (Freon 113)	8260C	A2LA
76-13-1	Soil	Trichloro-1,2,2-trifluoroethane, 1,1,2- (Freon 113)	8260D	A2LA
76-13-1	Water	Trichloro-1,2,2-trifluoroethane, 1,1,2- (Freon 113)	8260D	A2LA
87-61-6	Water	Trichlorobenzene, 1,2,3-	524.2	UT ELCP
87-61-6	Water	Trichlorobenzene, 1,2,3-	624.1	A2LA
87-61-6	Soil	Trichlorobenzene, 1,2,3-	8260B	A2LA
87-61-6	Water	Trichlorobenzene, 1,2,3-	8260B	A2LA
87-61-6	Soil	Trichlorobenzene, 1,2,3-	8260C	A2LA
87-61-6	Water	Trichlorobenzene, 1,2,3-	8260C	A2LA
87-61-6	Soil	Trichlorobenzene, 1,2,3-	8260D	A2LA
87-61-6	Water	Trichlorobenzene, 1,2,3-	8260D	A2LA
120-82-1	Water	Trichlorobenzene, 1,2,4-	524.2	UT ELCP

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
120-82-1	Water	Trichlorobenzene, 1,2,4-	624.1	A2LA
120-82-1	Soil	Trichlorobenzene, 1,2,4-	8260B	A2LA
120-82-1	Water	Trichlorobenzene, 1,2,4-	8260B	A2LA
120-82-1	Soil	Trichlorobenzene, 1,2,4-	8260C	A2LA
120-82-1	Water	Trichlorobenzene, 1,2,4-	8260C	A2LA
120-82-1	Soil	Trichlorobenzene, 1,2,4-	8260D	A2LA
120-82-1	Water	Trichlorobenzene, 1,2,4-	8260D	A2LA
120-82-1	Air	Trichlorobenzene, 1,2,4-	TO-15	A2LA
71-55-6	Water	Trichloroethane, 1,1,1-	524.2	UT ELCP
71-55-6	Water	Trichloroethane, 1,1,1-	624.1	A2LA
71-55-6	Soil	Trichloroethane, 1,1,1-	8260B	A2LA
71-55-6	Water	Trichloroethane, 1,1,1-	8260B	A2LA
71-55-6	Soil	Trichloroethane, 1,1,1-	8260C	A2LA
71-55-6	Water	Trichloroethane, 1,1,1-	8260C	A2LA
71-55-6	Soil	Trichloroethane, 1,1,1-	8260D	A2LA
71-55-6	Water	Trichloroethane, 1,1,1-	8260D	A2LA
71-55-6	Air	Trichloroethane, 1,1,1-	TO-15	A2LA
79-00-5	Water	Trichloroethane, 1,1,2-	524.2	UT ELCP
79-00-5	Water	Trichloroethane, 1,1,2-	624.1	A2LA
79-00-5	Soil	Trichloroethane, 1,1,2-	8260B	A2LA
79-00-5	Water	Trichloroethane, 1,1,2-	8260B	A2LA
79-00-5	Soil	Trichloroethane, 1,1,2-	8260C	A2LA
79-00-5	Water	Trichloroethane, 1,1,2-	8260C	A2LA
79-00-5	Soil	Trichloroethane, 1,1,2-	8260D	A2LA
79-00-5	Water	Trichloroethane, 1,1,2-	8260D	A2LA
79-00-5	Air	Trichloroethane, 1,1,2-	TO-15	A2LA
79-01-6	Water	Trichloroethylene	524.2	UT ELCP
79-01-6	Water	Trichloroethylene	624.1	A2LA
79-01-6	Soil	Trichloroethylene	8260B	A2LA
79-01-6	Water	Trichloroethylene	8260B	A2LA
79-01-6	Soil	Trichloroethylene	8260C	A2LA
79-01-6	Water	Trichloroethylene	8260C	A2LA
79-01-6	Soil	Trichloroethylene	8260D	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
79-01-6	Water	Trichloroethylene	8260D	A2LA
79-01-6	Air	Trichloroethylene	TO-15	A2LA
75-69-4	Water	Trichlorofluoromethane	524.2	UT ELCP
75-69-4	Water	Trichlorofluoromethane	624.1	A2LA
75-69-4	Soil	Trichlorofluoromethane	8260B	A2LA
75-69-4	Water	Trichlorofluoromethane	8260B	A2LA
75-69-4	Soil	Trichlorofluoromethane	8260C	A2LA
75-69-4	Water	Trichlorofluoromethane	8260C	A2LA
75-69-4	Soil	Trichlorofluoromethane	8260D	A2LA
75-69-4	Water	Trichlorofluoromethane	8260D	A2LA
95-95-4	Water	Trichlorophenol, 2,4,5-	625.1	A2LA
95-95-4	Soil	Trichlorophenol, 2,4,5-	8270C	A2LA
95-95-4	Water	Trichlorophenol, 2,4,5-	8270C	A2LA
95-95-4	Soil	Trichlorophenol, 2,4,5-	8270D	A2LA
95-95-4	Water	Trichlorophenol, 2,4,5-	8270D	A2LA
95-95-4	Soil	Trichlorophenol, 2,4,5-	8270E	A2LA
95-95-4	Water	Trichlorophenol, 2,4,5-	8270E	A2LA
88-06-2	Water	Trichlorophenol, 2,4,6-	625.1	A2LA
88-06-2	Soil	Trichlorophenol, 2,4,6-	8270C	A2LA
88-06-2	Water	Trichlorophenol, 2,4,6-	8270C	A2LA
88-06-2	Soil	Trichlorophenol, 2,4,6-	8270D	A2LA
88-06-2	Water	Trichlorophenol, 2,4,6-	8270D	A2LA
88-06-2	Soil	Trichlorophenol, 2,4,6-	8270E	A2LA
88-06-2	Water	Trichlorophenol, 2,4,6-	8270E	A2LA
93-76-5	Soil	Trichlorophenoxyacetic Acid, 2,4,5- (2,4,5-T)	8151A	A2LA
93-76-5	Water	Trichlorophenoxyacetic Acid, 2,4,5- (2,4,5-T)	8151A	A2LA
93-72-1	Soil	Trichlorophenoxypropionic acid, 2,4,5- (2,4,5-TP)	8151A	A2LA
93-72-1	Water	Trichlorophenoxypropionic acid, 2,4,5- (2,4,5-TP)	8151A	A2LA
96-18-4	Water	Trichloropropane, 1,2,3-	524.2	UT ELCP
96-18-4	Water	Trichloropropane, 1,2,3-	624.1	A2LA
96-18-4	Soil	Trichloropropane, 1,2,3-	8260B	A2LA
96-18-4	Water	Trichloropropane, 1,2,3-	8260B	A2LA
96-18-4	Soil	Trichloropropane, 1,2,3-	8260C	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
96-18-4	Water	Trichloropropane, 1,2,3-	8260C	A2LA
96-18-4	Soil	Trichloropropane, 1,2,3-	8260D	A2LA
96-18-4	Water	Trichloropropane, 1,2,3-	8260D	A2LA
95-63-6	Water	Trimethylbenzene, 1,2,4-	524.2	UT ELCP
95-63-6	Water	Trimethylbenzene, 1,2,4-	624.1	A2LA
95-63-6	Soil	Trimethylbenzene, 1,2,4-	8260B	A2LA
95-63-6	Water	Trimethylbenzene, 1,2,4-	8260B	A2LA
95-63-6	Soil	Trimethylbenzene, 1,2,4-	8260C	A2LA
95-63-6	Water	Trimethylbenzene, 1,2,4-	8260C	A2LA
95-63-6	Soil	Trimethylbenzene, 1,2,4-	8260D	A2LA
95-63-6	Water	Trimethylbenzene, 1,2,4-	8260D	A2LA
95-63-6	Air	Trimethylbenzene, 1,2,4-	TO-15	A2LA
108-67-8	Water	Trimethylbenzene, 1,3,5-	524.2	UT ELCP
108-67-8	Water	Trimethylbenzene, 1,3,5-	624.1	A2LA
108-67-8	Soil	Trimethylbenzene, 1,3,5-	8260B	A2LA
108-67-8	Water	Trimethylbenzene, 1,3,5-	8260B	A2LA
108-67-8	Soil	Trimethylbenzene, 1,3,5-	8260C	A2LA
108-67-8	Water	Trimethylbenzene, 1,3,5-	8260C	A2LA
108-67-8	Soil	Trimethylbenzene, 1,3,5-	8260D	A2LA
108-67-8	Water	Trimethylbenzene, 1,3,5-	8260D	A2LA
108-67-8	Air	Trimethylbenzene, 1,3,5-	TO-15	A2LA
99-35-4	Water	Trinitrobenzene, 1,3,5- (1,3,5-TNB)	625.1	A2LA
99-35-4	Soil	Trinitrobenzene, 1,3,5- (1,3,5-TNB)	8270C	A2LA
99-35-4	Water	Trinitrobenzene, 1,3,5- (1,3,5-TNB)	8270C	A2LA
99-35-4	Soil	Trinitrobenzene, 1,3,5- (1,3,5-TNB)	8270D	A2LA
99-35-4	Water	Trinitrobenzene, 1,3,5- (1,3,5-TNB)	8270D	A2LA
99-35-4	Soil	Trinitrobenzene, 1,3,5- (1,3,5-TNB)	8270E	A2LA
99-35-4	Water	Trinitrobenzene, 1,3,5- (1,3,5-TNB)	8270E	A2LA
99-35-4	Soil	Trinitrobenzene, 1,3,5- (1,3,5-TNB)	8330A	A2LA
99-35-4	Water	Trinitrobenzene, 1,3,5- (1,3,5-TNB)	8330A	A2LA
99-35-4	Soil	Trinitrobenzene, 1,3,5- (1,3,5-TNB)	8330B	A2LA
99-35-4	Water	Trinitrobenzene, 1,3,5- (1,3,5-TNB)	8330B	A2LA
118-96-7	Soil	Trinitrotoluene, 2,4,6-	8330A	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
118-96-7	Water	Trinitrotoluene, 2,4,6-	8330A	A2LA
118-96-7	Soil	Trinitrotoluene, 2,4,6-	8330B	A2LA
118-96-7	Water	Trinitrotoluene, 2,4,6-	8330B	A2LA
7440-62-2	Water	Vanadium, Total	200.7	A2LA
7440-62-2	Water	Vanadium, Total	200.8	A2LA
7440-62-2	Soil	Vanadium, Total	6010B	A2LA
7440-62-2	Water	Vanadium, Total	6010B	A2LA
7440-62-2	Soil	Vanadium, Total	6010C	A2LA
7440-62-2	Water	Vanadium, Total	6010C	A2LA
7440-62-2	Soil	Vanadium, Total	6010D	A2LA
7440-62-2	Water	Vanadium, Total	6010D	A2LA
7440-62-2	Soil	Vanadium, Total	6020A	A2LA
7440-62-2	Water	Vanadium, Total	6020A	A2LA
7440-62-2	Soil	Vanadium, Total	6020B	A2LA
7440-62-2	Water	Vanadium, Total	6020B	A2LA
108-05-4	Water	Vinyl Acetate	624.1	A2LA
108-05-4	Soil	Vinyl Acetate	8260B	A2LA
108-05-4	Water	Vinyl Acetate	8260B	A2LA
108-05-4	Soil	Vinyl Acetate	8260C	A2LA
108-05-4	Water	Vinyl Acetate	8260C	A2LA
108-05-4	Soil	Vinyl Acetate	8260D	A2LA
108-05-4	Water	Vinyl Acetate	8260D	A2LA
108-05-4	Air	Vinyl Acetate	TO-15	A2LA
75-01-4	Water	Vinyl Chloride	524.2	UT ELCP
75-01-4	Water	Vinyl Chloride	624.1	A2LA
75-01-4	Soil	Vinyl Chloride	8260B	A2LA
75-01-4	Water	Vinyl Chloride	8260B	A2LA
75-01-4	Soil	Vinyl Chloride	8260C	A2LA
75-01-4	Water	Vinyl Chloride	8260C	A2LA
75-01-4	Soil	Vinyl Chloride	8260D	A2LA
75-01-4	Water	Vinyl Chloride	8260D	A2LA
75-01-4	Air	Vinyl Chloride	TO-15	A2LA
108-38-3	Water	Xylene, m-	624.1	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
108-38-3	Soil	Xylene, m-	8260B	A2LA
108-38-3	Water	Xylene, m-	8260B	A2LA
108-38-3	Soil	Xylene, m-	8260C	A2LA
108-38-3	Water	Xylene, m-	8260C	A2LA
108-38-3	Soil	Xylene, m-	8260D	A2LA
108-38-3	Water	Xylene, m-	8260D	A2LA
108-38-3	Air	Xylene, m-	TO-15	A2LA
95-47-6	Water	Xylene, o-	624.1	A2LA
95-47-6	Soil	Xylene, o-	8260B	A2LA
95-47-6	Water	Xylene, o-	8260B	A2LA
95-47-6	Soil	Xylene, o-	8260C	A2LA
95-47-6	Water	Xylene, o-	8260C	A2LA
95-47-6	Soil	Xylene, o-	8260D	A2LA
95-47-6	Water	Xylene, o-	8260D	A2LA
95-47-6	Air	Xylene, o-	TO-15	A2LA
106-42-3	Water	Xylene, p-	624.1	A2LA
106-42-3	Soil	Xylene, p-	8260B	A2LA
106-42-3	Water	Xylene, p-	8260B	A2LA
106-42-3	Soil	Xylene, p-	8260C	A2LA
106-42-3	Water	Xylene, p-	8260C	A2LA
106-42-3	Soil	Xylene, p-	8260D	A2LA
106-42-3	Water	Xylene, p-	8260D	A2LA
106-42-3	Air	Xylene, p-	TO-15	A2LA
1330-20-7	Water	Xylene, Total	524.2	UT ELCP
1330-20-7	Water	Xylene, Total	602	A2LA
1330-20-7	Water	Xylene, Total	624.1	A2LA
1330-20-7	Soil	Xylene, Total	8021B	A2LA
1330-20-7	Water	Xylene, Total	8021B	A2LA
1330-20-7	Soil	Xylene, Total	8260B	A2LA
1330-20-7	Water	Xylene, Total	8260B	A2LA
1330-20-7	Soil	Xylene, Total	8260C	A2LA
1330-20-7	Water	Xylene, Total	8260C	A2LA
1330-20-7	Soil	Xylene, Total	8260D	A2LA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation Body
1330-20-7	Water	Xylene, Total	8260D	A2LA
1330-20-7	Air	Xylene, Total	TO-15	A2LA
7440-66-6	Water	Zinc, Total	200.7	A2LA
7440-66-6	Water	Zinc, Total	200.8	A2LA
7440-66-6	Soil	Zinc, Total	6010B	A2LA
7440-66-6	Water	Zinc, Total	6010B	A2LA
7440-66-6	Soil	Zinc, Total	6010C	A2LA
7440-66-6	Water	Zinc, Total	6010C	A2LA
7440-66-6	Soil	Zinc, Total	6010D	A2LA
7440-66-6	Water	Zinc, Total	6010D	A2LA
7440-66-6	Soil	Zinc, Total	6020A	A2LA
7440-66-6	Water	Zinc, Total	6020A	A2LA
7440-66-6	Soil	Zinc, Total	6020B	A2LA
7440-66-6	Water	Zinc, Total	6020B	A2LA

PERRY JOHNSON LABORATORY ACCREDITATION, INC.

Certificate of Accreditation

Perry Johnson Laboratory Accreditation, Inc.
has assessed the Organization of:

Sterling Labs
509 N. 3rd Avenue, Des Plaines, IL 60016

(Hereinafter called the Organization) and hereby declares that Organization has met the requirements of ISO/IEC 17025:2017 General Requirements for the competence of Testing and Calibration Laboratories and the United States Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP) requirements identified within the DoD/DOE Quality Systems Manual (DoD/DOE QSM) Version 5.4 October 2021 and is accredited in accordance with the:

United States Department of Defense
Environmental Laboratory Accreditation Program
(DoD-ELAP)

This accreditation demonstrates the technical competence for the defined scope and the operation of a laboratory quality management system
(as outlined by the joint ISO-ILAC-IAF Communiqué dated April 2017):

Environmental Testing
(As detailed in the supplement)

Accreditation claims for such activities shall only be made from the addresses referenced within this certificate. This Accreditation is granted subject to the system rules governing the Accreditation referred to above, and the Organization hereby covenants with the Accreditation Body's duty to observe and comply with the said rules.

Initial Accreditation Date:	*Issue Date:*	*Expiration Date*
January 13, 2013	January 02, 2024	January 02, 2026

For PJLA

Tracy Szerszen
President

Accreditation No:	*Certificate No:*
75537	L24-1

Perry Johnson Laboratory Accreditation, Inc. (PJLA)
755 W. Big Beaver, Suite 1325
Troy, Michigan 48084

The validity of this certificate is maintained through ongoing assessments based on a continuous accreditation cycle. The validity of this certificate should be confirmed through the PJLA website: **www.pjlabs.com**

Certificate of Accreditation: Supplement

Sterling Labs
509 N. 3rd Avenue, Des Plaines, IL 60016
Contact Name: Sabina Stankevicius Phone: 847-324-3334

Accreditation is granted to the facility to perform the following testing:

	Code
General Chemistry	
EPA 1010 by Pensky Martin	10234818
Solid	
Ignitability	1780
EPA 1664B by Gravimetry	10261617
Aqueous	
n-Hexane Extractable Material (HEM) Oil & Grease (O&G)	1803
EPA 350.1 by Segmented Flow Analysis (SFA) Analyzer	10063204
Aqueous	
Ammonia (as N)	1515
EPA 420.1 by Colorimetry	10079400
Aqueous	
Phenolics (Total Recoverable)	1905
EPA 9014 by Colorimetry	10193803
Aqueous	
Cyanide (Total)	1645
Solid	
Cyanide (Total)	1645
EPA 9030 by Titrimetry	10195605
Aqueous	
Sulfide	2005
Solid	
Sulfide	2005
EPA 9034 by Titrimetry	10196006
Aqueous	
Sulfide	2005
Solid	
Sulfide	2005
EPA 9040C by Ion Selective Electrode (ISE)	10244403
Aqueous	
pH	1900
EPA 9045C by Ion Selective Electrode (ISE)	10198400
Solid	
pH (Corrosivity)	1625
EPA 9060A by TOC Analyzer	10244801
Aqueous	
Total Organic Carbon (TOC)	2040

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	Code
General Chemistry	
EPA 9065 by Colorimetry	10200405
Solid	
Phenolics (Total Recoverable)	1905
EPA 9095 by Physical Property	10204009
Aqueous	
Paint Filter Liquids Test	1434
Solid	
Paint Filter Liquids Test	1434
HACH 8000 by Colorimetry	60003001
Aqueous	
Chemical Oxygen Demand (COD)	1565
SM 2320B (2011) by Titrimetry	20045436
Aqueous	
Alkalinity (as CaCO3)	1505
SM 2340B (2011) by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP/AES)	20048684
Aqueous	
Hardness (as CaCO3, by Calculation)	1550
Total Hardness (CaCO3)	1750
SM 2540B (2011) by Gravimetry	20048684
Aqueous	
Solids (Total, TS)	1950
SM 2540C (2011) by Gravimetry	20050424
Aqueous	
Solids (Total Dissolved, TDS)	1955
SM 2540D (2011) by Gravimetry	20051018
Aqueous	
Solids (Total Suspended, TSS, Non-Filterable Residue)	1960
SM 4500 CN C (2011) by Titrimetry	20095458
Aqueous	
Cyanide (Total)	1645
Solid	
Cyanide (Total)	1645
SM 4500 CN E (2011) by Colorimetry	20096213
Aqueous	
Cyanide (Total)	1645
SM 4500 CN G (2011) by Colorimetry	20097012
Aqueous	
Cyanide (Amenable to Chlorination)	1510

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	Code
General Chemistry	
SM 4500 H+B (2011) by Ion Selective Electrode (ISE)	20105037
Aqueous	
pH	1900
Solid	
pH	1900
SM 4500 NH3 B (2011) by Ion Selective Electrode (ISE)	20106621
Aqueous	
Total Kjeldahl Nitrogen (TKN)	1795
SM 4500 NH3 C (2011) by Ion Selective Electrode (ISE)	20105822
Aqueous	
Ammonia (as N)	1515
SM 4500 NO2 B (2011) by Colorimetry	20112838
Aqueous	
Nitrite (as N)	1840
SM 4500 NO3 E (2011) by Ion Selective Electrode (ISE)	20114618
Aqueous	
Nitrate + Nitrite (as N)	1820
SM 4500 P E (2011) by Colorimetry	20124010
Aqueous	
Phosphorous (Total)	1910
SM 4500 P F (2011) by Colorimetry	20124816
Aqueous	
Orthophosphate (as P)	1870
SM 4500 S D (2011) by Colorimetry	20125626
Aqueous	
Sulfide	2005
SM 4500 S F (2011) by Titrimetry	20126414
Aqueous	
Sulfide	2005
SM 4500 SiO2 D (2011) by Discrete Analyzer	20129037
Aqueous	
Silica (as SiO2)	1990
SM 4500 SiO2 E (2011) by Discrete Analyzer	20129639
Aqueous	
Silica (as SiO2)	1990
SM 5210B (2011) by 5-Day BOD Test	20135017
Aqueous	
Biochemical Oxygen Demand (BOD)	1530

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	Code
General Chemistry	
SM 5210B (2011) by Ultraviolet-Visible (UV/VIS) Spectrophotometry	20135017
Aqueous	
Carbonaceous Biochemical Oxygen Demand (CBOD)	1555
SM 5310C (2011) by TOC Analyzer (Chemical Oxidation/IR)	20137615
Aqueous	
Total Organic Carbon (TOC)	2040
Inorganic	
EPA 200.7 Rev 4.4 by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP/AES)	10013806
Aqueous	
Aluminum	1000
Antimony	1005
Arsenic	1010
Barium	1015
Beryllium	1020
Boron	1025
Cadmium	1030
Calcium	1035
Chromium	1040
Cobalt	1050
Copper	1055
Iron	1070
Lead	1075
Magnesium	1085
Manganese	1090
Molybdenum	1100
Nickel	1105
Phosphorous (Total, as P)	1910
Potassium	1125
Selenium	1140
Silver	1150
Sodium	1155
Strontium	1160
Thallium	1165
Tin	1175
Titanium	1180
Vanadium	1185
Zinc	1190

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Accreditation is granted to the facility to perform the following testing:

	Code
Inorganic	
EPA 200.8 Rev 5.4 by Inductively Coupled Plasma Mass Spectrometry (ICP/MS)	10014605
Aqueous	
Aluminum	1000
Antimony	1005
Arsenic	1010
Barium	1015
Beryllium	1020
Boron	1025
Cadmium	1030
Calcium	1035
Chromium	1040
Cobalt	1050
Copper	1055
Iron	1070
Lead	1075
Magnesium	1085
Manganese	1090
Molybdenum	1100
Nickel	1105
Phosphorous (Total, as P)	1910
Potassium	1125
Selenium	1140
Silver	1150
Sodium	1155
Thallium	1165
Tin	1175
Titanium	1180
Vanadium	1185
Zinc	1190
EPA 245.1 Rev 3.0 by Cold Vapor Atomic Absorption Spectrophotometry (CVAAS)	10036609
Aqueous	
Mercury	1095
EPA 300.0 by Ion Chromatography (IC)	10053200
Aqueous	
Bromide	1540
Chloride	1575
Fluoride	1730
Nitrate (as N)	1810

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	Code
Inorganic	
EPA 300.0 by Ion Chromatography (IC)	10053200
Aqueous	
Nitrate + Nitrite (as N)	1820
Nitrite (as N)	1840
Orthophosphate (as P)	1870
Sulfate	2000
EPA 6010D by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP/AES)	10155916
Aqueous	
Aluminum	1000
Antimony	1005
Arsenic	1010
Barium	1015
Beryllium	1020
Boron	1025
Cadmium	1030
Calcium	1035
Chromium	1040
Cobalt	1050
Copper	1055
Iron	1070
Lead	1075
Magnesium	1085
Manganese	1090
Molybdenum	1100
Nickel	1105
Phosphorous (Total)	1910
Phosphorus	1909
Potassium	1125
Selenium	1140
Silver	1150
Sodium	1155
Strontium	1160
Thallium	1165
Tin	1175
Titanium	1180
Vanadium	1185
Zinc	1190

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	Code
Inorganic	
EPA 6010D by Inductively Coupled Plasma Atomic Emission Spectrometry (ICP/AES)	10155916
Solid	
Aluminum	1000
Antimony	1005
Arsenic	1010
Barium	1015
Beryllium	1020
Boron	1025
Cadmium	1030
Calcium	1035
Chromium	1040
Cobalt	1050
Copper	1055
Iron	1070
Lead	1075
Magnesium	1085
Manganese	1090
Molybdenum	1100
Nickel	1105
Phosphorous (Total)	1910
Phosphorus	1909
Potassium	1125
Selenium	1140
Silver	1150
Sodium	1155
Strontium	1160
Thallium	1165
Tin	1175
Titanium	1180
Vanadium	1185
Zinc	1190
EPA 6020B by Inductively Coupled Plasma Mass Spectrometry (ICP/MS)	10156420
Aqueous	
Aluminum	1000
Antimony	1005
Arsenic	1010
Barium	1015
Beryllium	1020

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Accreditation is granted to the facility to perform the following testing:

	Code
Inorganic	
EPA 6020B by Inductively Coupled Plasma Mass Spectrometry (ICP/MS)	10156420
Aqueous	
Boron	1025
Cadmium	1030
Calcium	1035
Chromium	1040
Cobalt	1050
Copper	1055
Iron	1070
Lead	1075
Magnesium	1085
Manganese	1090
Molybdenum	1100
Nickel	1105
Phosphorus	1909
Potassium	1125
Selenium	1140
Silver	1150
Sodium	1155
Thallium	1165
Tin	1175
Titanium	1180
Vanadium	1185
Zinc	1190
Solid	
Aluminum	1000
Antimony	1005
Arsenic	1010
Barium	1015
Beryllium	1020
Boron	1025
Cadmium	1030
Calcium	1035
Chromium	1040
Cobalt	1050
Copper	1055
Iron	1070
Lead	1075

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	Code
Inorganic	
EPA 6020B by Inductively Coupled Plasma Mass Spectrometry (ICP/MS)	10156420
Solid	
Magnesium	1085
Manganese	1090
Molybdenum	1100
Nickel	1105
Phosphorus	1909
Potassium	1125
Selenium	1140
Silver	1150
Sodium	1155
Thallium	1165
Tin	1175
Titanium	1180
Vanadium	1185
Zinc	1190
EPA 7196A by Colorimetry	10162400
Aqueous	
Hexavalent Chromium (Cr VI)	1045
Solid	
Hexavalent Chromium (Cr VI)	1045
EPA 7470A by Cold Vapor Atomic Absorption Spectrophotometry (CVAAS)	10165807
Aqueous	
Mercury	1095
EPA 7471B by Cold Vapor Atomic Absorption Spectrophotometry (CVAAS)	10166402
Solid	
Mercury	1095
EPA 9056A by Ion Chromatography (IC)	10199607
Aqueous	
Nitrite (as N)	1840
Solid	
Bromide	1540
Chloride	1575
Fluoride	1730
Nitrate (as N)	1810
Orthophosphate (as P)	1870
Sulfate	2000

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	Code
Inorganic	
SM 3500 Cr D (2011) by Colorimetry	20066255
Aqueous	
Hexavalent Chromium (Cr VI)	1045
Solid	
Hexavalent Chromium (Cr VI)	1045
Organic	
AK-101 (GRO) by Gas Chromatography Flame Ionization Detection (GC/FID)	90015002
Aqueous	
Total Petroleum Hydrocarbons Gasoline Range Organics (TPH GRO)	9408
Solid	
Total Petroleum Hydrocarbons Gasoline Range Organics (TPH GRO)	9408
AK-102 (DRO) by Gas Chromatography Flame Ionization Detection (GC/FID)	90015206
Aqueous	
Total Petroleum Hydrocarbons Diesel Range Organics (TPH DRO)	9369
Solid	
Total Petroleum Hydrocarbons Diesel Range Organics (TPH DRO)	9369
AK-103 (RRO) by Gas Chromatography Flame Ionization Detection (GC/FID)	90015400
Aqueous	
Residual Range Organics (RRO)	9506
Solid	
Residual Range Organics (RRO)	9506
Draft EPA Method 1633 by Liquid Chromatography Tandem Mass Spectrometry (LC/MS/MS)	10123441
Aqueous	
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	9490
1H, 1H, 2H, 2H-Perfluorodecanesulfonic Acid (8:2 Fluorotelomersulfonic Acid, 8:2FTS)	6948
1H, 1H, 2H, 2H-Perfluorohexanesulfonic Acid (4:2 Fluorotelomersulfonic Acid, 4:2FTS)	6946
1H, 1H, 2H, 2H-Perfluorooctanesulfonic Acid (6:2 Fluorotelomersulfonic Acid, 6:2FTS)	6947
2H,2H,3H,3H-Perfluorodecanoic Acid (7:3 FTCA, 3-Perfluoroheptyl Propanoic Acid)	9340
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3 FTCA)	9338
4,4,5,5,6,6,6-Heptafluorohexanoi Acid (3:3 FTCA, 3-Perfluoropropyl Propanoic Acid)	9353
4,8-dioxa-3H-perfluorononanoic acid (ADONA)	6951
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)	6952
Hexafluoropropylene oxide dimer acid (HFPO-DA)	9460
N-ethylperfluorooctanesulfonamide (EtFOSA)	9395
N-ethylperfluorooctanesulfonamidoacetic acid (EtFOSAA)	4847
N-ethylperfluorooctanesulfonamidoethanol (EtFOSE)	9431
N-methylperfluorooctanesulfonamide (MeFOSA)	9433
N-methylperfluorooctanesulfonamidoacetic acid (MeFOSAA)	4846

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	Code
Organic	
Draft EPA Method 1633 by Liquid Chromatography Tandem Mass Spectrometry (LC/MS/MS)	10123441
Aqueous	
N-methylperfluorooctanesulfonamidoethanol (MeFOSE)	6949
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	6956
Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA)	6957
Perfluoro-3-methoxypropanoic acid (PFMPA)	6965
Perfluoro-4-methoxybutanoic acid (PFMBA)	6966
Perfluorobutanesulfonic acid (PFBS)	6918
Perfluorobutanoic acid (PFBA)	6915
Perfluorodecanesulfonic acid (PFDS)	6920
Perfluorodecanoic acid (PFDA)	6905
Perfluorododecanesulfonic acid (PFDoS)	6923
Perfluorododecanoic acid (PFDoA)	6903
Perfluoroheptanesulfonic acid (PFHpS)	9470
Perfluoroheptanoic acid (PFHpA)	6908
Perfluorohexanesulfonic acid (PFHxS)	6927
Perfluorohexanoic acid (PFHxA)	6913
Perfluorononanesulfonic acid (PFNS)	6929
Perfluorononanoic acid (PFNA)	6906
Perfluorooctanesulfonamide (PFOSA)	6917
Perfluorooctanesulfonic acid (PFOS)	6931
Perfluorooctanoic acid (PFOA)	6912
Perfluoropentanesulfonic acid (PFPeS)	6934
Perfluoropentanoic acid (PFPeA)	6914
Perfluorotetradecanoic acid (PFTeDA)	6902
Perfluorotridecanoic acid (PFTrDA)	9563
Perfluoroundecanoic acid (PFUnA)	6904
Solid	
11-Chloroeicosafluoro-3-Oxaundecane-1-Sulfonic Acid (11Cl-PF3OUdS)	9490
1H, 1H, 2H, 2H-Perfluorodecanesulfonic Acid (8:2 Fluorotelomersulfonic Acid, 8:2FTS)	6948
1H, 1H, 2H, 2H-Perfluorohexanesulfonic Acid (4:2 Fluorotelomersulfonic Acid, 4:2FTS)	6946
1H, 1H, 2H, 2H-Perfluorooctanesulfonic Acid (6:2 Fluorotelomersulfonic Acid, 6:2FTS)	6947
2H,2H,3H,3H-Perfluorodecanoic Acid (7:3 FTCA, 3-Perfluoroheptyl Propanoic Acid)	9340
2H,2H,3H,3H-Perfluorooctanoic Acid (5:3 FTCA)	9338
4,4,5,5,6,6,6-Heptafluorohexanoi Acid (3:3 FTCA, 3-Perfluoropropyl Propanoic Acid)	9353
4,8-dioxa-3H-perfluorononanoic acid (ADONA)	6951
9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)	6952
Hexafluoropropylene oxide dimer acid (HFPO-DA)	9460

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	Code
Organic	
Draft EPA Method 1633 by Liquid Chromatography Tandem Mass Spectrometry (LC/MS/MS)	10123441
Solid	
N-ethylperfluorooctanesulfonamide (EtFOSA)	9395
N-ethylperfluorooctanesulfonamidoacetic acid (EtFOSAA)	4847
N-ethylperfluorooctanesulfonamidoethanol (EtFOSE)	9431
N-methylperfluorooctanesulfonamide (MeFOSA)	9433
N-methylperfluorooctanesulfonamidoacetic acid (MeFOSAA)	4846
N-methylperfluorooctanesulfonamidoethanol (MeFOSE)	6949
Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	6956
Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA)	6957
Perfluoro-3-methoxypropanoic acid (PFMPA)	6965
Perfluoro-4-methoxybutanoic acid (PFMBA)	6966
Perfluorobutanesulfonic acid (PFBS)	6918
Perfluorobutanoic acid (PFBA)	6915
Perfluorodecanesulfonic acid (PFDS)	6920
Perfluorodecanoic acid (PFDA)	6905
Perfluorododecanesulfonic acid (PFDoS)	6923
Perfluorododecanoic acid (PFDoA)	6903
Perfluoroheptanesulfonic acid (PFHpS)	9470
Perfluoroheptanoic acid (PFHpA)	6908
Perfluorohexanesulfonic acid (PFHxS)	6927
Perfluorohexanoic acid (PFHxA)	6913
Perfluorononanesulfonic acid (PFNS)	6929
Perfluorononanoic acid (PFNA)	6906
Perfluorooctanesulfonamide (PFOSA)	6917
Perfluorooctanesulfonic acid (PFOS)	6931
Perfluorooctanoic acid (PFOA)	6912
Perfluoropentanesulfonic acid (PFPeS)	6934
Perfluoropentanoic acid (PFPeA)	6914
Perfluorotetradecanoic acid (PFTeDA)	6902
Perfluorotridecanoic acid (PFTrDA)	9563
Perfluoroundecanoic acid (PFUnA)	6904
EPA 608.3 by Gas Chromatography Electron Capture Detector (GC/ECD)	10296614
Aqueous	
4,4'-DDD	7355
4,4'-DDE	7360
4,4'-DDT	7365
Aldrin	7025

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Organic	
EPA 608.3 by Gas Chromatography Electron Capture Detector (GC/ECD)	10296614
Aqueous	
alpha-BHC (a-BHC, alpha-Hexachlorocyclohexane)	7110
alpha-Chlordane (cis-Chlordane)	7240
Aroclor 1016	8880
Aroclor 1221	8885
Aroclor 1232	8890
Aroclor 1242	8895
Aroclor 1248	8900
Aroclor 1254	8905
Aroclor 1260	8910
Aroclor 1262	8912
Aroclor 1268	8913
beta-BHC (b-BHC, beta-Hexachlorocyclohexane)	7115
Chlordane (Technical)	7250
delta-BHC (d-BHC)	7105
Dieldrin	7470
Endosulfan I	7510
Endosulfan II	7515
Endosulfan Sulfate	7520
Endrin	7540
Endrin Aldehyde	7530
Endrin Ketone	7535
gamma-BHC (?-BHC, Lindane)	7120
gamma-Chlordane	7245
Heptachlor	7685
Heptachlor Epoxide	7690
Methoxychlor	7810
Toxaphene (Chlorinated Camphene)	8250
EPA 624.1 by Gas Chromatography Mass Spectrometry (GC/MS)	10298121
Aqueous	
1,1,1-Trichloroethane	5160
1,1,2,2-Tetrachloroethane	5110
1,1,2-Trichloroethane	5165
1,1-Dichloroethane	4630
1,1-Dichloroethylene	4640
1,2-Dichlorobenzene	4610
1,2-Dichloroethane (Ethylene Dichloride, EDC)	4635

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	Code
Organic	
EPA 624.1 by Gas Chromatography Mass Spectrometry (GC/MS)	10298121
Aqueous	
1,2-Dichloropropane	4655
1,3-Dichlorobenzene (1,3-DCB)	4615
1,4-Dichlorobenzene	4620
2-Chloroethyl Vinyl Ether (2-CEVE)	4500
Acrolein (Propenal)	4325
Acrylonitrile	4340
Benzene	4375
Bromodichloromethane	4395
Bromoform	4400
Carbon Tetrachloride	4455
Chlorobenzene	4475
Chlorodibromomethane (Dibromochloromethane)	4575
Chloroethane (Ethyl Chloride)	4485
Chloroform	4505
cis-1,2-Dichloroethylene	4645
cis-1,3-Dichloropropene	4680
Ethylbenzene	4765
Methyl Bromide (Bromomethane)	4950
Methyl Chloride (Chloromethane)	4960
Methyl tert Butyl Ether (MTBE)	5000
Methylene Chloride (Dichloromethane)	4975
Tetrachloroethylene (Perchloroethylene, PCE)	5115
Toluene	5140
trans-1,2-Dichloroethylene	4700
trans-1,3-Dichloropropylene	4685
Trichloroethene (TCE, Trichloroethylene)	5170
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	5175
Vinyl Chloride (Chloroethene)	5235
Xylenes (Total)	5260
EPA 625.1 by Gas Chromatography Mass Spectrometry (GC/MS)	10300024
Aqueous	
1,2,4-Trichlorobenzene	5155
1,2-Dichlorobenzene	4610
1,3-Dichlorobenzene (1,3-DCB)	4615
1,4-Dichlorobenzene	4620
2,2'-Oxybis(1-Chloropropane)	4659

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	Code
Organic	
EPA 625.1 by Gas Chromatography Mass Spectrometry (GC/MS)	10300024
Aqueous	
2,4,5-Trichlorophenol	6835
2,4,6-Trichlorophenol	6840
2,4-Dichlorophenol	6000
2,4-Dimethylphenol	6130
2,4-Dinitrophenol	6175
2,4-Dinitrotoluene (2,4-DNT)	6185
2,6-Dinitrotoluene (2,6-DNT)	6190
2-Chloronaphthalene	5795
2-Chlorophenol	5800
2-Methyl-4,6-Dinitrophenol (4,6-Dinitro-2-Methylphenol)	6360
2-Nitrophenol	6490
3,3´-Dichlorobenzidine	5945
4-Bromophenyl Phenyl Ether (BDE-3)	5660
4-Chloro-3-Methylphenol	5700
4-Chlorophenyl Phenylether	5825
4-Nitrophenol	6500
Acenaphthene	5500
Acenaphthylene	5505
Anthracene	5555
Benzidine	5595
Benzo(a)Anthracene	5575
Benzo(a)Pyrene	5580
Benzo(b)Fluoranthene	5585
Benzo(g,h,i)Perylene	5590
Benzo(k)Fluoranthene	5600
bis(2-Chloroethoxy)Methane	5760
bis(2-Chloroethyl)Ether	5765
Butyl Benzyl Phthalate	5670
Chrysene	5855
Dibenz(a,h)Anthracene	5895
Diethyl Phthalate	6070
Dimethyl Phthalate	6135
di-n-Butyl Phthalate	5925
di-n-Octyl Phthalate	6200
Fluoranthene	6265
Fluorene	6270

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Sterling Labs
509 N. 3rd Avenue, Des Plaines, IL 60016
Contact Name: Sabina Stankevicius Phone: 847-324-3334

Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA 625.1 by Gas Chromatography Mass Spectrometry (GC/MS)	10300024
Aqueous	
Hexachlorobenzene	6275
Hexachlorobutadiene	4835
Hexachlorocyclopentadiene	6285
Hexachloroethane	4840
Indeno(1,2,3,cd)Pyrene	6315
Isophorone	6320
Naphthalene	5005
Nitrobenzene	5015
n-Nitrosodimethylamine	6530
n-Nitrosodi-n-Propylamine	6545
n-Nitrosodiphenylamine	6535
Pentachlorophenol (PCP)	6605
Phenanthrene	6615
Phenol	6625
Pyrene	6665
EPA 8011 by Gas Chromatography Electron Capture Detector (GC/ECD)	10173009
Aqueous	
1,2,3-Trichloropropane (TCP)	5180
1,2-Dibromo-3-Chloropropane (DBCP)	4570
1,2-Dibromoethane (EDB, Ethylene Dibromide)	4585
Solid	
1,2,3-Trichloropropane (TCP)	5180
1,2-Dibromo-3-Chloropropane (DBCP)	4570
1,2-Dibromoethane (EDB, Ethylene Dibromide)	4585
EPA 8015D by Gas Chromatography Flame Ionization Detection (GC/FID)	10305609
Aqueous	
Ethylene Glycol	4785
Methanol	4930
Total Petroleum Hydrocarbons Diesel Range Organics (TPH DRO)	9369
Total Petroleum Hydrocarbons Gasoline Range Organics (TPH GRO)	9408
Solid	
Ethylene Glycol	4785
Methanol	4930
Total Petroleum Hydrocarbons Diesel Range Organics (TPH DRO)	9369
Total Petroleum Hydrocarbons Gasoline Range Organics (TPH GRO)	9408

Sterling Labs
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Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA 8081B by Gas Chromatography Electron Capture Detector (GC/ECD)	10178833
Aqueous	
2,4'-DDD	8580
2,4'-DDE	8585
2,4'-DDT	8590
4,4'-DDD	7355
4,4'-DDE	7360
4,4'-DDT	7365
Aldrin	7025
alpha-BHC (a-BHC, alpha-Hexachlorocyclohexane)	7110
alpha-Chlordane (cis-Chlordane)	7240
beta-BHC (b-BHC, beta-Hexachlorocyclohexane)	7115
Chlordane (Technical)	7250
cis-Nonachlor	7925
delta-BHC (d-BHC)	7105
Dieldrin	7470
Endosulfan I	7510
Endosulfan II	7515
Endosulfan Sulfate	7520
Endrin	7540
Endrin Aldehyde	7530
Endrin Ketone	7535
gamma-BHC (?-BHC, Lindane)	7120
gamma-Chlordane	7245
Heptachlor	7685
Heptachlor Epoxide	7690
Methoxychlor	7810
Oxychlordane	3890
Toxaphene (Chlorinated Camphene)	8250
trans-Nonachlor	7910
Solid	
2,4'-DDD	8580
2,4'-DDE	8585
2,4'-DDT	8590
4,4'-DDD	7355
4,4'-DDE	7360
4,4'-DDT	7365
Aldrin	7025

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Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA 8081B by Gas Chromatography Electron Capture Detector (GC/ECD)	10178833
Solid	
alpha-BHC (a-BHC, alpha-Hexachlorocyclohexane)	7110
alpha-Chlordane (cis-Chlordane)	7240
beta-BHC (b-BHC, beta-Hexachlorocyclohexane)	7115
Chlordane (Technical)	7250
cis-Nonachlor	7925
delta-BHC (d-BHC)	7105
Dieldrin	7470
Endosulfan I	7510
Endosulfan II	7515
Endosulfan Sulfate	7520
Endrin	7540
Endrin Aldehyde	7530
Endrin Ketone	7535
gamma-BHC (?-BHC, Lindane)	7120
gamma-Chlordane	7245
Heptachlor	7685
Heptachlor Epoxide	7690
Methoxychlor	7810
Oxychlordane	3890
Toxaphene (Chlorinated Camphene)	8250
trans-Nonachlor	7910
EPA 8082A by Gas Chromatography Electron Capture Detector (GC/ECD)	10179201
Aqueous	
Aroclor 1016	8880
Aroclor 1221	8885
Aroclor 1232	8890
Aroclor 1242	8895
Aroclor 1248	8900
Aroclor 1254	8905
Aroclor 1260	8910
Aroclor 1262	8912
Aroclor 1268	8913
Solid	
Aroclor 1016	8880
Aroclor 1221	8885
Aroclor 1232	8890

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Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA 8082A by Gas Chromatography Electron Capture Detector (GC/ECD)	10179201
Solid	
Aroclor 1242	8895
Aroclor 1248	8900
Aroclor 1254	8905
Aroclor 1260	8910
Aroclor 1262	8912
Aroclor 1268	8913
EPA 8260B SIM by Gas Chromatography Mass Spectrometry (GC/MS) Selective Ion Monitoring (SIM)	10184904
Aqueous	
1,4-Dioxane (1,4-Diethyleneoxide, p-Dioxane)	4735
Solid	
1,1,1,2-Tetrachloroethane	5105
1,1,1-Trichloroethane	5160
1,1,2,2-Tetrachloroethane	5110
1,1,2-Trichloroethane	5165
1,1-Dichloroethane	4630
1,1-Dichloroethene	4640
1,2-Dibromo-3-Chloropropane (DBCP)	4570
1,2-Dibromoethane (EDB, Ethylene Dibromide)	4585
1,2-Dichlorobenzene	4610
1,2-Dichloroethane (Ethylene Dichloride, EDC)	4635
1,2-Dichloroethene (Total, cis & trans)	4705
1,3-Dichlorobenzene (1,3-DCB)	4615
1,3-Dichloropropene (Total, cis & trans)	4675
1,4-Dichlorobenzene	4620
1-Butanol (n-Butanol)	9321
2-Hexanone (Methyl Butyl Ketone, MBK)	4860
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone (MIBK), Hexone)	4995
Benzene	4375
Bromodichloromethane	4395
Bromoform	4400
Carbon Tetrachloride	4455
Chlorodibromomethane (Dibromochloromethane)	4575
Chloroform	4505
cis-1,2-Dichloroethylene	4645
Dibromomethane (Methylene Bromide)	4595
Ethyl Ether	NC

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Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA 8260B SIM by Gas Chromatography Mass Spectrometry (GC/MS) Selective Ion Monitoring (SIM)	10184904
Solid	
Hexachlorobutadiene	4835
Methyl Bromide (Bromomethane)	4950
Naphthalene	5005
Tetrachloroethylene (Perchloroethylene, PCE)	5115
trans-1,2-Dichloroethylene	4700
trans-1,3-Dichloropropylene	4685
Trichloroethene (TCE, Trichloroethylene)	5170
Vinyl Chloride (Chloroethene)	5235
EPA 8260D by Gas Chromatography Mass Spectrometry (GC/MS)	10307127
Aqueous	
1,1,1,2-Tetrachloroethane	5105
1,1,1-Trichloroethane	5160
1,1,2,2-Tetrachloroethane	5110
1,1,2-Trichloroethane	5165
1,1-Dichloroethane	4630
1,1-Dichloroethylene	4640
1,1-Dichloropropene	4670
1,2,3-Trichlorobenzene	5150
1,2,3-Trichloropropane (TCP)	5180
1,2,4-Trichlorobenzene	5155
1,2,4-Trimethylbenzene	5210
1,2-Dibromo-3-Chloropropane (DBCP)	4570
1,2-Dibromoethane (EDB, Ethylene Dibromide)	4585
1,2-Dichlorobenzene	4610
1,2-Dichloroethane (Ethylene Dichloride, EDC)	4635
1,2-Dichloroethene (Total, cis & trans)	4705
1,2-Dichloropropane	4655
1,3,5-Trimethylbenzene	5215
1,3-Dichlorobenzene (1,3-DCB)	4615
1,3-Dichloropropane	4660
1,4-Dichlorobenzene	4620
1,4-Dioxane (1,4-Diethyleneoxide, p-Dioxane)	4735
2,2-Dichloropropane	4665
2-Butanone (Methyl Ethyl Ketone, MEK)	4410
2-Chloroethyl Vinyl Ether (2-CEVE)	4500
2-Chlorotoluene	4535

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Sterling Labs
509 N. 3rd Avenue, Des Plaines, IL 60016
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Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA 8260D by Gas Chromatography Mass Spectrometry (GC/MS)	10307127
Aqueous	
2-Hexanone (Methyl Butyl Ketone, MBK)	4860
4-Chlorotoluene (p-Chlorotoluene)	4540
4-Isopropyltoluene (p-Isopropyltoluene, p-Cymene)	4910
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone (MIBK), Hexone)	4995
Acetone	4315
Acetonitrile	4320
Acrolein (Propenal)	4325
Acrylonitrile	4340
Benzene	4375
Bromobenzene	4385
Bromochloromethane	4390
Bromodichloromethane	4395
Bromoform	4400
Carbon Disulfide	4450
Carbon Tetrachloride	4455
Chlorobenzene	4475
Chlorodibromomethane (Dibromochloromethane)	4575
Chloroethane (Ethyl Chloride)	4485
Chloroform	4505
cis-1,2-Dichloroethylene	4645
cis-1,3-Dichloropropene	4680
Cyclohexane	4555
Dibromomethane (Methylene Bromide)	4595
Dichlorodifluoromethane (Freon 12)	4625
Diethyl Ether	4725
Ethyl Methacrylate	4810
Ethylbenzene	4765
Hexachlorobutadiene	4835
Isobutanol (2-Methyl-1-Propanol, Isobutyl OH)	4875
Isopropyl Alcohol (IPA, 2-Propanol, Isopropanol)	4895
Isopropylbenzene (Cumene)	4900
m,p-Xylene	5240
Methyl Bromide (Bromomethane)	4950
Methyl Chloride (Chloromethane)	4960
Methyl Methacrylate	4990
Methyl tert Butyl Ether (MTBE)	5000

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	Code
Organic	
EPA 8260D by Gas Chromatography Mass Spectrometry (GC/MS)	10307127
Aqueous	
Methylene Chloride (Dichloromethane)	4975
Naphthalene	5005
n-Butylbenzene	4435
n-Propanol (1-Propanol)	5055
n-Propylbenzene (1-phenylpropane)	5090
o-Xylene (1,2-Xylene)	5250
sec-Butylbenzene	4440
Styrene	5100
tert-Butylbenzene	4445
Tetrachloroethylene (Perchloroethylene, PCE)	5115
Tetrahydrofuran (THF)	5120
Toluene	5140
trans-1,2-Dichloroethylene	4700
trans-1,3-Dichloropropylene	4685
Trichloroethene (TCE, Trichloroethylene)	5170
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	5175
Vinyl Acetate	5225
Vinyl Chloride (Chloroethene)	5235
Xylenes (Total)	5260
Solid	
1,1,1,2-Tetrachloroethane	5105
1,1,1-Trichloroethane	5160
1,1,2,2-Tetrachloroethane	5110
1,1,2-Trichloroethane	5165
1,1-Dichloroethane	4630
1,1-Dichloroethylene	4640
1,1-Dichloropropene	4670
1,2,3-Trichlorobenzene	5150
1,2,3-Trichloropropane (TCP)	5180
1,2,4-Trichlorobenzene	5155
1,2,4-Trimethylbenzene	5210
1,2-Dibromo-3-Chloropropane (DBCP)	4570
1,2-Dibromoethane (EDB, Ethylene Dibromide)	4585
1,2-Dichlorobenzene	4610
1,2-Dichloroethane (Ethylene Dichloride, EDC)	4635
1,2-Dichloroethene (Total, cis & trans)	4705

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Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA 8260D by Gas Chromatography Mass Spectrometry (GC/MS)	10307127
Solid	
1,2-Dichloropropane	4655
1,3,5-Trimethylbenzene	5215
1,3-Dichlorobenzene (1,3-DCB)	4615
1,3-Dichloropropane	4660
1,4-Dichlorobenzene	4620
1,4-Dioxane (1,4-Diethyleneoxide, p-Dioxane)	4735
2,2-Dichloropropane	4665
2-Butanone (Methyl Ethyl Ketone, MEK)	4410
2-Chloroethyl Vinyl Ether (2-CEVE)	4500
2-Chlorotoluene	4535
2-Hexanone (Methyl Butyl Ketone, MBK)	4860
4-Chlorotoluene (p-Chlorotoluene)	4540
4-Isopropyltoluene (p-Isopropyltoluene, p-Cymene)	4910
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone (MIBK), Hexone)	4995
Acetone	4315
Acetonitrile	4320
Acrolein (Propenal)	4325
Acrylonitrile	4340
Benzene	4375
Bromobenzene	4385
Bromochloromethane	4390
Bromodichloromethane	4395
Bromoform	4400
Carbon Disulfide	4450
Carbon Tetrachloride	4455
Chlorobenzene	4475
Chlorodibromomethane (Dibromochloromethane)	4575
Chloroethane (Ethyl Chloride)	4485
Chloroform	4505
cis-1,2-Dichloroethylene	4645
cis-1,3-Dichloropropene	4680
Cyclohexane	4555
Dibromomethane (Methylene Bromide)	4595
Dichlorodifluoromethane (Freon 12)	4625
Ethyl Methacrylate	4810
Ethylbenzene	4765

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Sterling Labs
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Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA 8260D by Gas Chromatography Mass Spectrometry (GC/MS)	10307127
Solid	
Isobutanol (2-Methyl-1-Propanol, Isobutyl OH)	4875
Isopropyl Alcohol (IPA, 2-Propanol, Isopropanol)	4895
Isopropylbenzene (Cumene)	4900
m,p-Xylene	5240
Methyl Bromide (Bromomethane)	4950
Methyl Chloride (Chloromethane)	4960
Methyl Methacrylate	4990
Methyl tert Butyl Ether (MTBE)	5000
Methylene Chloride (Dichloromethane)	4975
Naphthalene	5005
n-Butylbenzene	4435
n-Propanol (1-Propanol)	5055
n-Propylbenzene (1-phenylpropane)	5090
o-Xylene (1,2-Xylene)	5250
sec-Butylbenzene	4440
Styrene	5100
tert-Butylbenzene	4445
Tetrachloroethylene (Perchloroethylene, PCE)	5115
Tetrahydrofuran (THF)	5120
Toluene	5140
trans-1,2-Dichloroethylene	4700
trans-1,3-Dichloropropylene	4685
Trichloroethene (TCE, Trichloroethylene)	5170
Trichlorofluoromethane (Fluorotrichloromethane, Freon 11)	5175
Vinyl Acetate	5225
Vinyl Chloride (Chloroethene)	5235
Xylenes (Total)	5260
EPA 8260D SIM by Gas Chromatography Mass Spectrometry (GC/MS) Selective Ion Monitoring (SIM)	10307138
Solid	
1,1,1,2-Tetrachloroethane	5105
1,1,1-Trichloroethane	5160
1,1,2,2-Tetrachloroethane	5110
1,1,2-Trichloroethane	5165
1,1-Dichloroethane	4630
1,1-Dichloroethene	4640
1,2-Dibromo-3-Chloropropane (DBCP)	4570

Sterling Labs
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Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA 8260D SIM by Gas Chromatography Mass Spectrometry (GC/MS) Selective Ion Monitoring (SIM)	10307138
Solid	
1,2-Dibromoethane (EDB, Ethylene Dibromide)	4585
1,2-Dichlorobenzene	4610
1,2-Dichloroethane (Ethylene Dichloride, EDC)	4635
1,2-Dichloroethene (Total, cis & trans)	4705
1,3-Dichlorobenzene (1,3-DCB)	4615
1,3-Dichloropropene (Total, cis & trans)	4675
1,4-Dichlorobenzene	4620
1-Butanol (n-Butanol)	9321
2-Hexanone (Methyl Butyl Ketone, MBK)	4860
4-Methyl-2-Pentanone (Methyl Isobutyl Ketone (MIBK), Hexone)	4995
Benzene	4375
Bromodichloromethane	4395
Bromoform	4400
Carbon Tetrachloride	4455
Chlorodibromomethane (Dibromochloromethane)	4575
Chloroform	4505
cis-1,2-Dichloroethylene	4645
Dibromomethane (Methylene Bromide)	4595
Ethyl Ether	NC
Hexachlorobutadiene	4835
Methyl Bromide (Bromomethane)	4950
Naphthalene	5005
Tetrachloroethylene (Perchloroethylene, PCE)	5115
trans-1,2-Dichloroethylene	4700
trans-1,3-Dichloropropylene	4685
Trichloroethene (TCE, Trichloroethylene)	5170
Vinyl Chloride (Chloroethene)	5235
EPA 8270D SIM by Gas Chromatography Mass Spectrometry (GC/MS) Selective Ion Monitoring (SIM)	10242509
Aqueous	
1,4-Dioxane (1,4-Diethyleneoxide, p-Dioxane)	4735
1-Methylnaphthalene	6380
2-Methylnaphthalene	6385
Acenaphthene	5500
Acenaphthylene	5505
Anthracene	5555
Benzo(a)Anthracene	5575

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	Code
Organic	
EPA 8270D SIM by Gas Chromatography Mass Spectrometry (GC/MS) Selective Ion Monitoring (SIM)	10242509
Aqueous	
Benzo(a)Pyrene	5580
Benzo(b)Fluoranthene	5585
Benzo(g,h,i)Perylene	5590
Benzo(k)Fluoranthene	5600
bis(2-Ethylhexy)Phthalate (DEHP, as di(2-ethylhexyl) phthalate)	6065
Chrysene	5855
Dibenz(a,h)Anthracene	5895
Fluoranthene	6265
Fluorene	6270
Indeno(1,2,3,cd)Pyrene	6315
Naphthalene	5005
Phenanthrene	6615
Pyrene	6665
Solid	
1,4-Dioxane (1,4-Diethyleneoxide, p-Dioxane)	4735
1-Methylnaphthalene	6380
2-Methylnaphthalene	6385
Acenaphthene	5500
Acenaphthylene	5505
Anthracene	5555
Benzo(a)Anthracene	5575
Benzo(a)Pyrene	5580
Benzo(b)Fluoranthene	5585
Benzo(g,h,i)Perylene	5590
Benzo(k)Fluoranthene	5600
bis(2-Ethylhexy)Phthalate (DEHP, as di(2-ethylhexyl) phthalate)	6065
Chrysene	5855
Dibenz(a,h)Anthracene	5895
Fluoranthene	6265
Fluorene	6270
Indeno(1,2,3,cd)Pyrene	6315
Naphthalene	5005
Phenanthrene	6615
Pyrene	6665

Sterling Labs
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Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA 8270E by Gas Chromatography Mass Spectrometry (GC/MS)	10242543
Aqueous	
1,2,4-Trichlorobenzene	5155
1,2-Dichlorobenzene	4610
1,2-Dinitrobenzene (1,2-DNB)	6155
1,2-Diphenylhydrazine (as Azobenzene)	6220
1,3-Dichlorobenzene (1,3-DCB)	4615
1,4-Dichlorobenzene	4620
1,4-Dinitrobenzene (1,4-DNB)	6165
1-Methylnaphthalene	6380
2,2'-Oxybis(1-Chloropropane)	4659
2,3,4,6- Tetrachlorophenol	6735
2,4,5-Trichlorophenol	6835
2,4,6-Trichlorophenol	6840
2,4-Dichlorophenol	6000
2,4-Dimethylphenol	6130
2,4-Dinitrophenol	6175
2,4-Dinitrotoluene (2,4-DNT)	6185
2,6-Dichlorophenol	6005
2,6-Dinitrotoluene (2,6-DNT)	6190
2-Chloronaphthalene	5795
2-Chlorophenol	5800
2-Methyl-4,6-Dinitrophenol (4,6-Dinitro-2-Methylphenol)	6360
2-Methylnaphthalene	6385
2-Methylphenol (o-Cresol)	6400
2-Nitroaniline	6460
2-Nitrophenol	6490
3,3´-Dichlorobenzidine	5945
3-Nitroaniline	6465
4-Bromophenyl Phenyl Ether (BDE-3)	5660
4-Chloro-3-Methylphenol	5700
4-Chloroaniline	5745
4-Chlorophenyl Phenylether	5825
4-Methylphenol (p-Cresol, as 3,4-Methylphenol)	6410
4-Nitroaniline	6470
4-Nitrophenol	6500
Acenaphthene	5500
Acenaphthylene	5505

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Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA 8270E by Gas Chromatography Mass Spectrometry (GC/MS)	10242543
Aqueous	
Alachlor	7005
Aniline	5545
Anthracene	5555
Benzidine	5595
Benzo(a)Anthracene	5575
Benzo(a)Pyrene	5580
Benzo(b)Fluoranthene	5585
Benzo(g,h,i)Perylene	5590
Benzo(k)Fluoranthene	5600
Benzoic Acid	5610
Benzyl Alcohol	5630
bis(2-Chloroethoxy)Methane	5760
bis(2-Chloroethyl)Ether	5765
bis(2-Ethylhexy)Phthalate (DEHP, as di(2-ethylhexyl) phthalate)	6065
Butyl Benzyl Phthalate	5670
Carbazole	5680
Chrysene	5855
Cresols (Total)	5862
Dibenz(a,h)Anthracene	5895
Dibenzofuran	5905
Diethyl Phthalate	6070
Dimethyl Phthalate	6135
di-n-Butyl Phthalate	5925
di-n-Octyl Phthalate	6200
Fluoranthene	6265
Fluorene	6270
Hexachlorobenzene	6275
Hexachlorobutadiene	4835
Hexachlorocyclopentadiene	6285
Hexachloroethane	4840
Indeno(1,2,3,cd)Pyrene	6315
Isophorone	6320
Naphthalene	5005
Nitrobenzene	5015
n-Nitrosodimethylamine	6530
n-Nitrosodi-n-Propylamine	6545

Certificate of Accreditation: Supplement

Sterling Labs
509 N. 3rd Avenue, Des Plaines, IL 60016
Contact Name: Sabina Stankevicius Phone: 847-324-3334

Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA 8270E by Gas Chromatography Mass Spectrometry (GC/MS)	10242543
Aqueous	
n-Nitrosodiphenylamine	6535
n-Nitrosopyrrolidine	6565
Pentachlorophenol (PCP)	6605
Phenanthrene	6615
Phenol	6625
Phorate	7985
Pyrene	6665
Pyridine	5095
Solid	
1,2,4-Trichlorobenzene	5155
1,2-Dichlorobenzene	4610
1,2-Dinitrobenzene (1,2-DNB)	6155
1,2-Diphenylhydrazine (as Azobenzene)	6220
1,3-Dichlorobenzene (1,3-DCB)	4615
1,4-Dichlorobenzene	4620
1,4-Dinitrobenzene (1,4-DNB)	6165
1-Methylnaphthalene	6380
2,2'-Oxybis(1-Chloropropane)	4659
2,3,4,6- Tetrachlorophenol	6735
2,4,5-Trichlorophenol	6835
2,4,6-Trichlorophenol	6840
2,4-Dichlorophenol	6000
2,4-Dimethylphenol	6130
2,4-Dinitrophenol	6175
2,4-Dinitrotoluene (2,4-DNT)	6185
2,6-Dichlorophenol	6005
2,6-Dinitrotoluene (2,6-DNT)	6190
2-Chloronaphthalene	5795
2-Chlorophenol	5800
2-Methyl-4,6-Dinitrophenol (4,6-Dinitro-2-Methylphenol)	6360
2-Methylnaphthalene	6385
2-Methylphenol (o-Cresol)	6400
2-Nitroaniline	6460
2-Nitrophenol	6490
3,3´-Dichlorobenzidine	5945
3-Nitroaniline	6465

Certificate of Accreditation: Supplement

Sterling Labs
509 N. 3rd Avenue, Des Plaines, IL 60016
Contact Name: Sabina Stankevicius Phone: 847-324-3334

Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA 8270E by Gas Chromatography Mass Spectrometry (GC/MS)	10242543
Solid	
4-Bromophenyl Phenyl Ether (BDE-3)	5660
4-Chloro-3-Methylphenol	5700
4-Chloroaniline	5745
4-Chlorophenyl Phenylether	5825
4-Methylphenol (p-Cresol, as 3,4-Methylphenol)	6410
4-Nitroaniline	6470
4-Nitrophenol	6500
Acenaphthene	5500
Acenaphthylene	5505
Alachlor	7005
Aniline	5545
Anthracene	5555
Benzidine	5595
Benzo(a)Anthracene	5575
Benzo(a)Pyrene	5580
Benzo(b)Fluoranthene	5585
Benzo(g,h,i)Perylene	5590
Benzo(k)Fluoranthene	5600
Benzoic Acid	5610
Benzyl Alcohol	5630
bis(2-Chloroethoxy)Methane	5760
bis(2-Chloroethyl)Ether	5765
bis(2-Ethylhexy)Phthalate (DEHP, as di(2-ethylhexyl) phthalate)	6065
Butyl Benzyl Phthalate	5670
Carbazole	5680
Chrysene	5855
Cresols (Total)	5862
Dibenz(a,h)Anthracene	5895
Dibenzofuran	5905
Diethyl Phthalate	6070
Dimethyl Phthalate	6135
di-n-Butyl Phthalate	5925
di-n-Octyl Phthalate	6200
Fluoranthene	6265
Fluorene	6270
Hexachlorobenzene	6275

Certificate of Accreditation: Supplement

Sterling Labs
509 N. 3rd Avenue, Des Plaines, IL 60016
Contact Name: Sabina Stankevicius Phone: 847-324-3334

Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA 8270E by Gas Chromatography Mass Spectrometry (GC/MS)	10242543
Solid	
Hexachlorobutadiene	4835
Hexachlorocyclopentadiene	6285
Hexachloroethane	4840
Indeno(1,2,3,cd)Pyrene	6315
Isophorone	6320
Naphthalene	5005
Nitrobenzene	5015
n-Nitrosodimethylamine	6530
n-Nitrosodi-n-Propylamine	6545
n-Nitrosodiphenylamine	6535
n-Nitrosopyrrolidine	6565
Pentachlorophenol (PCP)	6605
Phenanthrene	6615
Phenol	6625
Phorate	7985
Pyrene	6665
Pyridine	5095
EPA 8270E SIM by Gas Chromatography Mass Spectrometry (GC/MS) Selective Ion Monitoring (SIM)	10242565
Aqueous	
1,4-Dioxane (1,4-Diethyleneoxide, p-Dioxane)	4735
1-Methylnaphthalene	6380
2-Methylnaphthalene	6385
Acenaphthene	5500
Acenaphthylene	5505
Anthracene	5555
Benzo(a)Anthracene	5575
Benzo(a)Pyrene	5580
Benzo(b)Fluoranthene	5585
Benzo(g,h,i)Perylene	5590
Benzo(k)Fluoranthene	5600
bis(2-Ethylhexy)Phthalate (DEHP, as di(2-ethylhexyl) phthalate)	6065
Chrysene	5855
Dibenz(a,h)Anthracene	5895
Fluoranthene	6265
Fluorene	6270
Indeno(1,2,3,cd)Pyrene	6315

Certificate of Accreditation: Supplement

Sterling Labs
509 N. 3rd Avenue, Des Plaines, IL 60016
Contact Name: Sabina Stankevicius Phone: 847-324-3334

Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA 8270E SIM by Gas Chromatography Mass Spectrometry (GC/MS) Selective Ion Monitoring (SIM)	10242565
Aqueous	
Naphthalene	5005
Phenanthrene	6615
Pyrene	6665
Solid	
1,4-Dioxane (1,4-Diethyleneoxide, p-Dioxane)	4735
1-Methylnaphthalene	6380
2-Methylnaphthalene	6385
Acenaphthene	5500
Acenaphthylene	5505
Anthracene	5555
Benzo(a)Anthracene	5575
Benzo(a)Pyrene	5580
Benzo(b)Fluoranthene	5585
Benzo(g,h,i)Perylene	5590
Benzo(k)Fluoranthene	5600
bis(2-Ethylhexy)Phthalate (DEHP, as di(2-ethylhexyl) phthalate)	6065
Chrysene	5855
Dibenz(a,h)Anthracene	5895
Fluoranthene	6265
Fluorene	6270
Indeno(1,2,3,cd)Pyrene	6315
Naphthalene	5005
Phenanthrene	6615
Pyrene	6665
EPA 8321B by High Performance Liquid Chromatography (HPLC)	10189205
Aqueous	
2,4,5-T	8655
2,4-DB	8560
2,4-Dichlorophenoxyacetic Acid (2,4-D)	8545
Dalapon	8555
Dicamba	8595
Dichloroprop (2,4-DP)	8605
Dinoseb (2-sec-Butyl-4,6-Dinitrophenol, DNBP)	8620
MCPA	7775
MCPP	7780
Silvex (2,4,5-TP)	8650

Certificate of Accreditation: Supplement

Sterling Labs
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Contact Name: Sabina Stankevicius Phone: 847-324-3334

Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA 8321B by High Performance Liquid Chromatography (HPLC)	10189205
Solid	
2,4,5-T	8655
2,4-DB	8560
2,4-Dichlorophenoxyacetic Acid (2,4-D)	8545
Dalapon	8555
Dicamba	8595
Dichloroprop (2,4-DP)	8605
Dinoseb (2-sec-Butyl-4,6-Dinitrophenol, DNBP)	8620
MCPA	7775
MCPP	7780
Silvex (2,4,5-TP)	8650
EPA 8330B by High Performance Liquid Chromatography (HPLC)	10308006
Aqueous	
1,3,5-Trinitrobenzene (1,3,5-TNB)	6885
1,3,5-Trinitroso-1,3,5-hexahydrotriazine (TNX)	6887
1,3-Dinitrobenzene (1,3-DNB)	6160
2,4,6-Trinitrotoluene (2,4,6-TNT)	9651
2,4-Dinitrotoluene (2,4-DNT)	6185
2,6-Dinitrotoluene (2,6-DNT)	6190
2-Amino-4,6-Dinitrotoluene (2-Am-DNT)	9303
2-Nitrotoluene (2-NT)	9507
3,5-Dinitroaniline	6150
3-Nitrotoluene (3-NT)	9510
4-Amino-2,6-Dinitrotoluene (4-Am-DNT)	9306
4-Nitrotoluene (4-NT)	9513
Hexahydro-1,3-Dinitroso-5-Nitro-1,3,5-Triazine (DNX)	9416
Hexahydro-1-Nitroso-3,5-Dinitro-1,3,5-Triazine (MNX)	9418
HMX (Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine)	9522
Nitrobenzene	5015
Nitroglycerin	6485
Nitroguanidine (NQ)	6462
Pentaerythritoltetranitrate (PETN)	9558
RDX (Hexahydro-1,3,5-Trinitro-1,3,5-Triazine)	9432
Tetryl (Methyl-2,4,6-Trinitrophenylnitramine)	6415
Solid	
1,3,5-Trinitrobenzene (1,3,5-TNB)	6885
1,3,5-Trinitroso-1,3,5-hexahydrotriazine (TNX)	6887

Certificate of Accreditation: Supplement

Sterling Labs
509 N. 3rd Avenue, Des Plaines, IL 60016
Contact Name: Sabina Stankevicius Phone: 847-324-3334

Accreditation is granted to the facility to perform the following testing:

	Code
Organic	
EPA 8330B by High Performance Liquid Chromatography (HPLC)	10308006
Solid	
1,3-Dinitrobenzene (1,3-DNB)	6160
2,4,6-Trinitrotoluene (2,4,6-TNT)	9651
2,4-Dinitrotoluene (2,4-DNT)	6185
2,6-Dinitrotoluene (2,6-DNT)	6190
2-Amino-4,6-Dinitrotoluene (2-Am-DNT)	9303
2-Nitrotoluene (2-NT)	9507
3,5-Dinitroaniline	6150
3-Nitrotoluene (3-NT)	9510
4-Amino-2,6-Dinitrotoluene (4-Am-DNT)	9306
4-Nitrotoluene (4-NT)	9513
Hexahydro-1,3-Dinitroso-5-Nitro-1,3,5-Triazine (DNX)	9416
Hexahydro-1-Nitroso-3,5-Dinitro-1,3,5-Triazine (MNX)	9418
HMX (Octahydro-1,3,5,7-Tetranitro-1,3,5,7-Tetrazocine)	9522
Nitrobenzene	5015
Nitroglycerin	6485
Nitroguanidine (NQ)	6462
Pentaerythritoltetranitrate (PETN)	9558
RDX (Hexahydro-1,3,5-Trinitro-1,3,5-Triazine)	9432
Tetryl (Methyl-2,4,6-Trinitrophenylnitramine)	6415
WI DRO by Gas Chromatography Flame Ionization Detection (GC/FID)	90019457
Aqueous	
WI Diesel Range Organics (DRO)	9369
Solid	
WI Diesel Range Organics (DRO)	9369
WI GRO by Gas Chromatography Flame Ionization Detection (GC/FID)	90019468
Aqueous	
WI Gasoline Range Organics (GRO)	9408
Solid	
WI Gasoline Range Organics (GRO)	9408

Certificate of Accreditation: Supplement

Sterling Labs
509 N. 3rd Avenue, Des Plaines, IL 60016
Contact Name: Sabina Stankevicius Phone: 847-324-3334

Accreditation is granted to the facility to perform the following testing:

		Code
Preparation		
Aqueous		
EPA 1311	Toxicity Characteristic Leaching Procedure (TCLP)	
EPA 1312	Synthetic Precipitation Leaching Procedure (SPLP)	
EPA 3015A	Acid Digestion for Metals (Microwave)	
EPA 3510C	Separatory Funnel Liquid-Liquid Extraction	
EPA 3535A	Solid-Phase Extraction (SPE)	
EPA 3620C	Florisil Cleanup	
EPA 3660B	Sulfur Cleanup	
EPA 3665A	Sulfuric Acid Cleanup	
EPA 5030B	Purge-and-Trap for Volatile Organics in Aqueous Samples	
EPA 5050	Bomb Digestion (Total Chlorine)	
Solid		
EPA 1311	Toxicity Characteristic Leaching Procedure (TCLP)	
EPA 1312	Synthetic Precipitation Leaching Procedure (SPLP)	
EPA 3050B	Acid Digestion for Metals	
EPA 3051	Acid Digestion for Metals	
EPA 3540C	Soxhlet Extraction (Non-Automated)	
EPA 3546	Microwave Extraction (Organics)	
EPA 3550C	Ultrasonic Extraction	
EPA 3620C	Florisil Cleanup	
EPA 3660B	Sulfur Cleanup	
EPA 3665A	Sulfuric Acid Cleanup	
EPA 5035A	Purge-and-Trap and Extraction For Volatile Organics (Closed-System)	
EPA 5050	Bomb Digestion (Total Chlorine)	

Footnotes:
> Method codes are typically based on The NELAC Institute (TNI) Laboratory Accreditation Management System (LAMS) and are used to compare to the laboratory reported Performance Test (PT) results. Although the method code may not represent the specific method version, it is the method code used to represent the method/technology used to report PTs. (NC = No Code)

THE STATE of ALASKA
GOVERNOR MIKE DUNLEAVY

Department of Environmental Conservation

DIVISION OF SPILL PREVENTION AND RESPONSE
Contaminated Sites Program
Laboratory Approval Program

PO Box 111800
Juneau, Alaska 99811-1800
CS Chemist: 907.465.5346
cs.lab.cert@alaska.gov

March 29, 2024

Nathan Fey
Sterling Labs
509 N. 3rd Avenue
Des Plaines, IL 60016

RE: Contaminated Sites Laboratory Approval **17-011**

Thank you for submitting a completed application to the Alaska Department of Environmental Conservation's Contaminated Sites Laboratory Approval Program (CS-LAP), on March 25, 2024. Based on your lab's National Environmental Laboratory Accreditation Program (NELAP) approval through the Illinois Environmental Protection Agency Environmental Laboratory Accreditation Program (IL ELAP), and Department of Defense Environmental Laboratory Accreditation Program (DoD-ELAP) approval through Perry Johnson Laboratory Accreditation, Inc. (PJLA), Sterling Labs, located at the above address, is granted ***Approved*** status to perform the analyses listed in the attached *Scope of Approval*, for Alaska contaminated sites projects, including underground storage tanks and leaking underground storage tank sites (UST/LUST), under the July 1, 2017 amendments to 18 AAC 78. This approval is effective March 29, 2024 and expires on February 2, 2026.

Be aware that in accordance with 18 AAC 78.815(b) and 18 AAC 78.815(e), **any** changes in your lab's NELAP and/or DoD-ELAP approval status for **any** analytes in **any** methods or **any** matrices must be reported to the CS-LAP within 3 business days. This includes any suspension of any analyte(s) due to failed Performance Testing (PT) or Performance Evaluation (PE) samples. **FAILURE TO REPORT A CHANGE IN STATUS WILL RESULT IN REVOCATION OF ALL CS-LAP APPROVALS FOR ALL ANALYTES AND ALL METHODS IN ALL MATRICES FOR A PERIOD OF ONE YEAR.** Notification should be in writing sent to cs.lab.cert@alaska.gov. We recommend also contacting the CS-LAP by telephone to verify that the message was received.

If you have any questions, please contact the CS-LAP at (907) 465-5346, or by email at cs.lab.cert@alaska.gov. Labs are also highly encouraged to join the CS-LAP listserv by going to http://list.state.ak.us/mailman/listinfo/cs.lab.approval.

Respectfully,

Zuzana Culakova

Attachment: Scope of Approval

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation body
763051-92-9	Soil	11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	Draft 1633	PJLA
763051-92-9	Water	11-chloroeicosafluoro-3-oxaundecane-1-sulfonic acid (11Cl-PF3OUdS)	Draft 1633	PJLA
812-70-4	Soil	2H, 2H, 3H, 3H-Perfluorodecanoic acid (7:3 FTCA)	Draft 1633	PJLA
812-70-4	Water	2H, 2H, 3H, 3H-Perfluorodecanoic acid (7:3 FTCA)	Draft 1633	PJLA
914637-49-3	Soil	2H, 2H, 3H, 3H-Perfluorooctanoic acid (5:3 FTCA)	Draft 1633	PJLA
914637-49-3	Water	2H, 2H, 3H, 3H-Perfluorooctanoic acid (5:3 FTCA)	Draft 1633	PJLA
356-02-5	Soil	4,4,5,5,6,6-Heptafluorohexanoic acid (3:3 FTCA)	Draft 1633	PJLA
356-02-5	Water	4,4,5,5,6,6-Heptafluorohexanoic acid (3:3 FTCA)	Draft 1633	PJLA
919005-14-4	Soil	4,8-dioxa-3H-perfluorononanoic acid (ADONA)	Draft 1633	PJLA
919005-14-4	Water	4,8-dioxa-3H-perfluorononanoic acid (ADONA)	Draft 1633	PJLA
757124-72-4	Soil	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	Draft 1633	PJLA
757124-72-4	Water	4:2 Fluorotelomer sulfonic acid (4:2 FTS)	Draft 1633	PJLA
27619-97-2	Soil	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	Draft 1633	PJLA
27619-97-2	Water	6:2 Fluorotelomer sulfonic acid (6:2 FTS)	Draft 1633	PJLA
39108-34-4	Soil	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	Draft 1633	PJLA
39108-34-4	Water	8:2 Fluorotelomer sulfonic acid (8:2 FTS)	Draft 1633	PJLA
756426-58-1	Soil	9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)	Draft 1633	PJLA
756426-58-1	Water	9-chlorohexadecafluoro-3-oxanone-1-sulfonic acid (9Cl-PF3ONS)	Draft 1633	PJLA
83-32-9	Water	Acenaphthene	625.1	PJLA
83-32-9	Soil	Acenaphthene	8270D-SIM	PJLA
83-32-9	Water	Acenaphthene	8270D-SIM	PJLA
83-32-9	Soil	Acenaphthene	8270E	PJLA
83-32-9	Water	Acenaphthene	8270E	PJLA
83-32-9	Soil	Acenaphthene	8270E-SIM	PJLA
83-32-9	Water	Acenaphthene	8270E-SIM	PJLA
208-96-8	Water	Acenaphthylene	625.1	PJLA
208-96-8	Soil	Acenaphthylene	8270D-SIM	PJLA
208-96-8	Water	Acenaphthylene	8270D-SIM	PJLA
208-96-8	Soil	Acenaphthylene	8270E	PJLA

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation body
208-96-8	Water	Acenaphthylene	8270E	PJLA
208-96-8	Soil	Acenaphthylene	8270E-SIM	PJLA
208-96-8	Water	Acenaphthylene	8270E-SIM	PJLA
67-64-1	Soil	Acetone	8260D	PJLA
67-64-1	Water	Acetone	8260D	PJLA
309-00-2	Water	Aldrin	608.3	PJLA
309-00-2	Soil	Aldrin	8081B	PJLA
309-00-2	Water	Aldrin	8081B	PJLA
120-12-7	Water	Anthracene	625.1	PJLA
120-12-7	Soil	Anthracene	8270D-SIM	PJLA
120-12-7	Water	Anthracene	8270D-SIM	PJLA
120-12-7	Soil	Anthracene	8270E	PJLA
120-12-7	Water	Anthracene	8270E	PJLA
120-12-7	Soil	Anthracene	8270E-SIM	PJLA
120-12-7	Water	Anthracene	8270E-SIM	PJLA
7440-36-0	Water	Antimony (metallic)	200.7	PJLA
7440-36-0	Water	Antimony (metallic)	200.8	PJLA
7440-36-0	Soil	Antimony (metallic)	6010D	PJLA
7440-36-0	Water	Antimony (metallic)	6010D	PJLA
7440-36-0	Soil	Antimony (metallic)	6020B	PJLA
7440-36-0	Water	Antimony (metallic)	6020B	PJLA
7440-38-2	Water	Arsenic, Inorganic	200.7	PJLA
7440-38-2	Water	Arsenic, Inorganic	200.8	PJLA
7440-38-2	Soil	Arsenic, Inorganic	6010D	PJLA
7440-38-2	Water	Arsenic, Inorganic	6010D	PJLA
7440-38-2	Soil	Arsenic, Inorganic	6020B	PJLA
7440-38-2	Water	Arsenic, Inorganic	6020B	PJLA
7440-39-3	Water	Barium	200.7	PJLA
7440-39-3	Water	Barium	200.8	PJLA
7440-39-3	Soil	Barium	6010D	PJLA
7440-39-3	Water	Barium	6010D	PJLA
7440-39-3	Soil	Barium	6020B	PJLA
7440-39-3	Water	Barium	6020B	PJLA

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation body
56-55-3	Water	Benz[a]anthracene	625.1	PJLA
56-55-3	Soil	Benz[a]anthracene	8270D-SIM	PJLA
56-55-3	Water	Benz[a]anthracene	8270D-SIM	PJLA
56-55-3	Soil	Benz[a]anthracene	8270E	PJLA
56-55-3	Water	Benz[a]anthracene	8270E	PJLA
56-55-3	Soil	Benz[a]anthracene	8270E-SIM	PJLA
56-55-3	Water	Benz[a]anthracene	8270E-SIM	PJLA
71-43-2	Water	Benzene	624.1	PJLA
71-43-2	Soil	Benzene	8260B-SIM	PJLA
71-43-2	Soil	Benzene	8260D	PJLA
71-43-2	Water	Benzene	8260D	PJLA
71-43-2	Soil	Benzene	8260D-SIM	PJLA
50-32-8	Water	Benzo[a]pyrene	625.1	PJLA
50-32-8	Soil	Benzo[a]pyrene	8270D-SIM	PJLA
50-32-8	Water	Benzo[a]pyrene	8270D-SIM	PJLA
50-32-8	Soil	Benzo[a]pyrene	8270E	PJLA
50-32-8	Water	Benzo[a]pyrene	8270E	PJLA
50-32-8	Soil	Benzo[a]pyrene	8270E-SIM	PJLA
50-32-8	Water	Benzo[a]pyrene	8270E-SIM	PJLA
205-99-2	Water	Benzo[b]fluoranthene	625.1	PJLA
205-99-2	Soil	Benzo[b]fluoranthene	8270D-SIM	PJLA
205-99-2	Water	Benzo[b]fluoranthene	8270D-SIM	PJLA
205-99-2	Soil	Benzo[b]fluoranthene	8270E	PJLA
205-99-2	Water	Benzo[b]fluoranthene	8270E	PJLA
205-99-2	Soil	Benzo[b]fluoranthene	8270E-SIM	PJLA
205-99-2	Water	Benzo[b]fluoranthene	8270E-SIM	PJLA
191-24-2	Water	Benzo[g,h,i]perylene	625.1	PJLA
191-24-2	Soil	Benzo[g,h,i]perylene	8270D-SIM	PJLA
191-24-2	Water	Benzo[g,h,i]perylene	8270D-SIM	PJLA
191-24-2	Soil	Benzo[g,h,i]perylene	8270E	PJLA
191-24-2	Water	Benzo[g,h,i]perylene	8270E	PJLA
191-24-2	Soil	Benzo[g,h,i]perylene	8270E-SIM	PJLA
191-24-2	Water	Benzo[g,h,i]perylene	8270E-SIM	PJLA

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation body
207-08-9	Water	Benzo[k]fluoranthene	625.1	PJLA
207-08-9	Soil	Benzo[k]fluoranthene	8270D-SIM	PJLA
207-08-9	Water	Benzo[k]fluoranthene	8270D-SIM	PJLA
207-08-9	Soil	Benzo[k]fluoranthene	8270E	PJLA
207-08-9	Water	Benzo[k]fluoranthene	8270E	PJLA
207-08-9	Soil	Benzo[k]fluoranthene	8270E-SIM	PJLA
207-08-9	Water	Benzo[k]fluoranthene	8270E-SIM	PJLA
65-85-0	Soil	Benzoic Acid	8270E	PJLA
65-85-0	Water	Benzoic Acid	8270E	PJLA
100-51-6	Soil	Benzyl Alcohol	8270E	PJLA
100-51-6	Water	Benzyl Alcohol	8270E	PJLA
7440-41-7	Water	Beryllium and compounds	200.7	PJLA
7440-41-7	Water	Beryllium and compounds	200.8	PJLA
7440-41-7	Soil	Beryllium and compounds	6010D	PJLA
7440-41-7	Water	Beryllium and compounds	6010D	PJLA
7440-41-7	Soil	Beryllium and compounds	6020B	PJLA
7440-41-7	Water	Beryllium and compounds	6020B	PJLA
111-44-4	Water	Bis(2-chloroethyl)ether	625.1	PJLA
111-44-4	Soil	Bis(2-chloroethyl)ether	8270E	PJLA
111-44-4	Water	Bis(2-chloroethyl)ether	8270E	PJLA
117-81-7	Soil	Bis(2-ethylhexyl)phthalate (DEHP)	8270D-SIM	PJLA
117-81-7	Water	Bis(2-ethylhexyl)phthalate (DEHP)	8270D-SIM	PJLA
117-81-7	Soil	Bis(2-ethylhexyl)phthalate (DEHP)	8270E	PJLA
117-81-7	Water	Bis(2-ethylhexyl)phthalate (DEHP)	8270E	PJLA
117-81-7	Soil	Bis(2-ethylhexyl)phthalate (DEHP)	8270E-SIM	PJLA
117-81-7	Water	Bis(2-ethylhexyl)phthalate (DEHP)	8270E-SIM	PJLA
108-86-1	Soil	Bromobenzene	8260D	PJLA
108-86-1	Water	Bromobenzene	8260D	PJLA
75-27-4	Water	Bromodichloromethane	624.1	PJLA
75-27-4	Soil	Bromodichloromethane	8260B-SIM	PJLA
75-27-4	Soil	Bromodichloromethane	8260D	PJLA
75-27-4	Water	Bromodichloromethane	8260D	PJLA
75-27-4	Soil	Bromodichloromethane	8260D-SIM	PJLA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation body
75-25-2	Water	Bromoform	624.1	PJLA
75-25-2	Soil	Bromoform	8260B-SIM	PJLA
75-25-2	Soil	Bromoform	8260D	PJLA
75-25-2	Water	Bromoform	8260D	PJLA
75-25-2	Soil	Bromoform	8260D-SIM	PJLA
74-83-9	Water	Bromomethane	624.1	PJLA
74-83-9	Soil	Bromomethane	8260B-SIM	PJLA
74-83-9	Soil	Bromomethane	8260D	PJLA
74-83-9	Water	Bromomethane	8260D	PJLA
74-83-9	Soil	Bromomethane	8260D-SIM	PJLA
85-68-7	Water	Butyl Benzyl Phthalate	625.1	PJLA
85-68-7	Soil	Butyl Benzyl Phthalate	8270E	PJLA
85-68-7	Water	Butyl Benzyl Phthalate	8270E	PJLA
104-51-8	Soil	Butylbenzene, n-	8260D	PJLA
104-51-8	Water	Butylbenzene, n-	8260D	PJLA
135-98-8	Soil	Butylbenzene, sec-	8260D	PJLA
135-98-8	Water	Butylbenzene, sec-	8260D	PJLA
98-06-6	Soil	Butylbenzene, tert-	8260D	PJLA
98-06-6	Water	Butylbenzene, tert-	8260D	PJLA
7440-43-9	Water	Cadmium	200.7	PJLA
7440-43-9	Water	Cadmium	200.8	PJLA
7440-43-9	Soil	Cadmium	6010D	PJLA
7440-43-9	Water	Cadmium	6010D	PJLA
7440-43-9	Soil	Cadmium	6020B	PJLA
7440-43-9	Water	Cadmium	6020B	PJLA
56-23-5	Water	Carbon Tetrachloride	624.1	PJLA
56-23-5	Soil	Carbon Tetrachloride	8260B-SIM	PJLA
56-23-5	Soil	Carbon Tetrachloride	8260D	PJLA
56-23-5	Water	Carbon Tetrachloride	8260D	PJLA
56-23-5	Soil	Carbon Tetrachloride	8260D-SIM	PJLA
5103-71-9	Water	Chlordane, a-	608.3	PJLA
5103-71-9	Soil	Chlordane, a-	8081B	PJLA
5103-71-9	Water	Chlordane, a-	8081B	PJLA

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5103-74-2	Water	Chlordane, g-	608.3	PJLA
5103-74-2	Soil	Chlordane, g-	8081B	PJLA
5103-74-2	Water	Chlordane, g-	8081B	PJLA
12789-03-6	Water	Chlordane, Total	608.3	PJLA
12789-03-6	Soil	Chlordane, Total	8081B	PJLA
12789-03-6	Water	Chlordane, Total	8081B	PJLA
106-47-8	Soil	Chloroaniline, p-	8270E	PJLA
106-47-8	Water	Chloroaniline, p-	8270E	PJLA
108-90-7	Water	Chlorobenzene	624.1	PJLA
108-90-7	Soil	Chlorobenzene	8260D	PJLA
108-90-7	Water	Chlorobenzene	8260D	PJLA
67-66-3	Water	Chloroform	624.1	PJLA
67-66-3	Soil	Chloroform	8260B-SIM	PJLA
67-66-3	Soil	Chloroform	8260D	PJLA
67-66-3	Water	Chloroform	8260D	PJLA
67-66-3	Soil	Chloroform	8260D-SIM	PJLA
74-87-3	Water	Chloromethane	624.1	PJLA
74-87-3	Soil	Chloromethane	8260D	PJLA
74-87-3	Water	Chloromethane	8260D	PJLA
95-57-8	Water	Chlorophenol, 2-	625.1	PJLA
95-57-8	Soil	Chlorophenol, 2-	8270E	PJLA
95-57-8	Water	Chlorophenol, 2-	8270E	PJLA
7440-47-3	Water	Chromium (Total)	200.7	PJLA
7440-47-3	Water	Chromium (Total)	200.8	PJLA
7440-47-3	Soil	Chromium (Total)	6010D	PJLA
7440-47-3	Water	Chromium (Total)	6010D	PJLA
7440-47-3	Soil	Chromium (Total)	6020B	PJLA
7440-47-3	Water	Chromium (Total)	6020B	PJLA
18540-29-9	Soil	Chromium (VI)	7196A	PJLA
218-01-9	Water	Chrysene	625.1	PJLA
218-01-9	Soil	Chrysene	8270D-SIM	PJLA
218-01-9	Water	Chrysene	8270D-SIM	PJLA
218-01-9	Soil	Chrysene	8270E	PJLA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation body
218-01-9	Water	Chrysene	8270E	PJLA
218-01-9	Soil	Chrysene	8270E-SIM	PJLA
218-01-9	Water	Chrysene	8270E-SIM	PJLA
7440-50-8	Water	Copper	200.7	PJLA
7440-50-8	Water	Copper	200.8	PJLA
7440-50-8	Soil	Copper	6010D	PJLA
7440-50-8	Water	Copper	6010D	PJLA
7440-50-8	Soil	Copper	6020B	PJLA
7440-50-8	Water	Copper	6020B	PJLA
108-39-4	Soil	Cresol, m- (3-Methylphenol)	8270E	IL ELAP
108-39-4	Water	Cresol, m- (3-Methylphenol)	8270E	IL ELAP
N/A	Soil	Cresol, m- (3-Methylphenol) + Cresol, p- (4-Methylphenol)	8270E	PJLA
N/A	Water	Cresol, m- (3-Methylphenol) + Cresol, p- (4-Methylphenol)	8270E	PJLA
95-48-7	Soil	Cresol, o- (2-Methylphenol)	8270E	PJLA
95-48-7	Water	Cresol, o- (2-Methylphenol)	8270E	PJLA
106-44-5	Soil	Cresol, p- (4-Methylphenol)	8270E	IL ELAP
106-44-5	Water	Cresol, p- (4-Methylphenol)	8270E	IL ELAP
98-82-8	Soil	Cumene (Isopropylbenzene)	8260D	PJLA
98-82-8	Water	Cumene (Isopropylbenzene)	8260D	PJLA
57-12-5	Soil	Cyanide (CN-)	9010/9014	PJLA
57-12-5	Water	Cyanide (CN-)	9010/9014	PJLA
57-12-5	Water	Cyanide (CN-)	SM 4500 CN-E	PJLA
110-82-7	Soil	Cyclohexane	8260D	PJLA
110-82-7	Water	Cyclohexane	8260D	PJLA
72-54-8	Water	DDD, 4,4'-	608.3	PJLA
72-54-8	Soil	DDD, 4,4'-	8081B	PJLA
72-54-8	Water	DDD, 4,4'-	8081B	PJLA
72-55-9	Water	DDE, 4,4'-	608.3	PJLA
72-55-9	Soil	DDE, 4,4'-	8081B	PJLA
72-55-9	Water	DDE, 4,4'-	8081B	PJLA
50-29-3	Water	DDT, 4,4'-	608.3	PJLA
50-29-3	Soil	DDT, 4,4'-	8081B	PJLA
50-29-3	Water	DDT, 4,4'-	8081B	PJLA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation body
53-70-3	Water	Dibenz[a,h]anthracene	625.1	PJLA
53-70-3	Soil	Dibenz[a,h]anthracene	8270D-SIM	PJLA
53-70-3	Water	Dibenz[a,h]anthracene	8270D-SIM	PJLA
53-70-3	Soil	Dibenz[a,h]anthracene	8270E	PJLA
53-70-3	Water	Dibenz[a,h]anthracene	8270E	PJLA
53-70-3	Soil	Dibenz[a,h]anthracene	8270E-SIM	PJLA
53-70-3	Water	Dibenz[a,h]anthracene	8270E-SIM	PJLA
132-64-9	Soil	Dibenzofuran	8270E	PJLA
132-64-9	Water	Dibenzofuran	8270E	PJLA
124-48-1	Water	Dibromochloromethane	624.1	PJLA
124-48-1	Soil	Dibromochloromethane	8260B-SIM	PJLA
124-48-1	Soil	Dibromochloromethane	8260D	PJLA
124-48-1	Water	Dibromochloromethane	8260D	PJLA
124-48-1	Soil	Dibromochloromethane	8260D-SIM	PJLA
106-93-4	Soil	Dibromoethane, 1,2- (Ethylene Dibromide)	8011	PJLA
106-93-4	Water	Dibromoethane, 1,2- (Ethylene Dibromide)	8011	PJLA
106-93-4	Soil	Dibromoethane, 1,2- (Ethylene Dibromide)	8260B-SIM	PJLA
106-93-4	Soil	Dibromoethane, 1,2- (Ethylene Dibromide)	8260D	PJLA
106-93-4	Water	Dibromoethane, 1,2- (Ethylene Dibromide)	8260D	PJLA
106-93-4	Soil	Dibromoethane, 1,2- (Ethylene Dibromide)	8260D-SIM	PJLA
74-95-3	Soil	Dibromomethane (Methylene Bromide)	8260B-SIM	PJLA
74-95-3	Soil	Dibromomethane (Methylene Bromide)	8260D	PJLA
74-95-3	Water	Dibromomethane (Methylene Bromide)	8260D	PJLA
74-95-3	Soil	Dibromomethane (Methylene Bromide)	8260D-SIM	PJLA
84-74-2	Soil	Dibutyl Phthalate	8270E	PJLA
84-74-2	Water	Dibutyl Phthalate	8270E	PJLA
95-50-1	Water	Dichlorobenzene, 1,2-	624.1	PJLA
95-50-1	Water	Dichlorobenzene, 1,2-	625.1	PJLA
95-50-1	Soil	Dichlorobenzene, 1,2-	8260D	PJLA
95-50-1	Water	Dichlorobenzene, 1,2-	8260D	PJLA
95-50-1	Soil	Dichlorobenzene, 1,2-	8270E	PJLA
95-50-1	Water	Dichlorobenzene, 1,2-	8270E	PJLA
541-73-1	Water	Dichlorobenzene, 1,3-	624.1	PJLA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation body
541-73-1	Water	Dichlorobenzene, 1,3-	625.1	PJLA
541-73-1	Soil	Dichlorobenzene, 1,3-	8260D	PJLA
541-73-1	Water	Dichlorobenzene, 1,3-	8260D	PJLA
541-73-1	Soil	Dichlorobenzene, 1,3-	8270E	PJLA
541-73-1	Water	Dichlorobenzene, 1,3-	8270E	PJLA
106-46-7	Water	Dichlorobenzene, 1,4-	624.1	PJLA
106-46-7	Water	Dichlorobenzene, 1,4-	625.1	PJLA
106-46-7	Soil	Dichlorobenzene, 1,4-	8260B-SIM	PJLA
106-46-7	Soil	Dichlorobenzene, 1,4-	8260D	PJLA
106-46-7	Water	Dichlorobenzene, 1,4-	8260D	PJLA
106-46-7	Soil	Dichlorobenzene, 1,4-	8260D-SIM	PJLA
106-46-7	Soil	Dichlorobenzene, 1,4-	8270E	PJLA
106-46-7	Water	Dichlorobenzene, 1,4-	8270E	PJLA
91-94-1	Water	Dichlorobenzidine, 3,3'-	625.1	PJLA
91-94-1	Soil	Dichlorobenzidine, 3,3'-	8270E	PJLA
91-94-1	Water	Dichlorobenzidine, 3,3'-	8270E	PJLA
75-71-8	Soil	Dichlorodifluoromethane (Freon-12)	8260D	PJLA
75-71-8	Water	Dichlorodifluoromethane (Freon-12)	8260D	PJLA
75-34-3	Water	Dichloroethane, 1,1-	624.1	PJLA
75-34-3	Soil	Dichloroethane, 1,1-	8260D	PJLA
75-34-3	Water	Dichloroethane, 1,1-	8260D	PJLA
107-06-2	Water	Dichloroethane, 1,2-	624.1	PJLA
107-06-2	Soil	Dichloroethane, 1,2-	8260B-SIM	PJLA
107-06-2	Soil	Dichloroethane, 1,2-	8260D	PJLA
107-06-2	Water	Dichloroethane, 1,2-	8260D	PJLA
107-06-2	Soil	Dichloroethane, 1,2-	8260D-SIM	PJLA
75-35-4	Water	Dichloroethylene, 1,1-	624.1	PJLA
75-35-4	Soil	Dichloroethylene, 1,1-	8260B-SIM	PJLA
75-35-4	Soil	Dichloroethylene, 1,1-	8260D	PJLA
75-35-4	Water	Dichloroethylene, 1,1-	8260D	PJLA
75-35-4	Soil	Dichloroethylene, 1,1-	8260D-SIM	PJLA
156-59-2	Water	Dichloroethylene, 1,2-cis-	624.1	PJLA
156-59-2	Soil	Dichloroethylene, 1,2-cis-	8260B-SIM	PJLA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation body
156-59-2	Soil	Dichloroethylene, 1,2-cis-	8260D	PJLA
156-59-2	Water	Dichloroethylene, 1,2-cis-	8260D	PJLA
156-59-2	Soil	Dichloroethylene, 1,2-cis-	8260D-SIM	PJLA
156-60-5	Water	Dichloroethylene, 1,2-trans-	624.1	PJLA
156-60-5	Soil	Dichloroethylene, 1,2-trans-	8260B-SIM	PJLA
156-60-5	Soil	Dichloroethylene, 1,2-trans-	8260D	PJLA
156-60-5	Water	Dichloroethylene, 1,2-trans-	8260D	PJLA
156-60-5	Soil	Dichloroethylene, 1,2-trans-	8260D-SIM	PJLA
120-83-2	Water	Dichlorophenol, 2,4-	625.1	PJLA
120-83-2	Soil	Dichlorophenol, 2,4-	8270E	PJLA
120-83-2	Water	Dichlorophenol, 2,4-	8270E	PJLA
78-87-5	Water	Dichloropropane, 1,2-	624.1	PJLA
78-87-5	Soil	Dichloropropane, 1,2-	8260D	PJLA
78-87-5	Water	Dichloropropane, 1,2-	8260D	PJLA
542-75-6	Soil	Dichloropropene, 1,3- (cis + trans)	8260D	PJLA
542-75-6	Water	Dichloropropene, 1,3- (cis + trans)	8260D	PJLA
10061-01-5	Water	Dichloropropene, cis-1,3-	624.1	PJLA
10061-01-5	Soil	Dichloropropene, cis-1,3-	8260D	PJLA
10061-01-5	Water	Dichloropropene, cis-1,3-	8260D	PJLA
10061-02-6	Water	Dichloropropene, trans-1,3-	624.1	PJLA
10061-02-6	Soil	Dichloropropene, trans-1,3-	8260B-SIM	PJLA
10061-02-6	Soil	Dichloropropene, trans-1,3-	8260D	PJLA
10061-02-6	Water	Dichloropropene, trans-1,3-	8260D	PJLA
10061-02-6	Soil	Dichloropropene, trans-1,3-	8260D-SIM	PJLA
60-57-1	Water	Dieldrin	608.3	PJLA
60-57-1	Soil	Dieldrin	8081B	PJLA
60-57-1	Water	Dieldrin	8081B	PJLA
N/A	Soil	Diesel Range Organics (C10 – C25)	AK 102	PJLA
N/A	Water	Diesel Range Organics (C10 – C25)	AK 102	PJLA
84-66-2	Water	Diethyl Phthalate	625.1	PJLA
84-66-2	Soil	Diethyl Phthalate	8270E	PJLA
84-66-2	Water	Diethyl Phthalate	8270E	PJLA
105-67-9	Water	Dimethylphenol, 2,4-	625.1	PJLA

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CAS Number	Matrix	Hazardous Substance	Method	Accreditation body
105-67-9	Soil	Dimethylphenol, 2,4-	8270E	PJLA
105-67-9	Water	Dimethylphenol, 2,4-	8270E	PJLA
131-11-3	Water	Dimethylphthalate	625.1	PJLA
131-11-3	Soil	Dimethylphthalate	8270E	PJLA
131-11-3	Water	Dimethylphthalate	8270E	PJLA
99-65-0	Soil	Dinitrobenzene, 1,3-	8330B	PJLA
99-65-0	Water	Dinitrobenzene, 1,3-	8330B	PJLA
51-28-5	Water	Dinitrophenol, 2,4-	625.1	PJLA
51-28-5	Soil	Dinitrophenol, 2,4-	8270E	PJLA
51-28-5	Water	Dinitrophenol, 2,4-	8270E	PJLA
121-14-2	Water	Dinitrotoluene, 2,4- (2,4-DNT)	625.1	PJLA
121-14-2	Soil	Dinitrotoluene, 2,4- (2,4-DNT)	8270E	PJLA
121-14-2	Water	Dinitrotoluene, 2,4- (2,4-DNT)	8270E	PJLA
121-14-2	Soil	Dinitrotoluene, 2,4- (2,4-DNT)	8330B	PJLA
121-14-2	Water	Dinitrotoluene, 2,4- (2,4-DNT)	8330B	PJLA
606-20-2	Water	Dinitrotoluene, 2,6- (2,6-DNT)	625.1	PJLA
606-20-2	Soil	Dinitrotoluene, 2,6- (2,6-DNT)	8270E	PJLA
606-20-2	Water	Dinitrotoluene, 2,6- (2,6-DNT)	8270E	PJLA
606-20-2	Soil	Dinitrotoluene, 2,6- (2,6-DNT)	8330B	PJLA
606-20-2	Water	Dinitrotoluene, 2,6- (2,6-DNT)	8330B	PJLA
35572-78-2	Soil	Dinitrotoluene, 2-Amino-4,6-	8330B	PJLA
35572-78-2	Water	Dinitrotoluene, 2-Amino-4,6-	8330B	PJLA
19406-51-0	Soil	Dinitrotoluene, 4-Amino-2,6-	8330B	PJLA
19406-51-0	Water	Dinitrotoluene, 4-Amino-2,6-	8330B	PJLA
123-91-1	Soil	Dioxane, 1,4-	8260D	PJLA
123-91-1	Water	Dioxane, 1,4-	8260D	PJLA
123-91-1	Soil	Dioxane, 1,4-	8270D-SIM	PJLA
123-91-1	Water	Dioxane, 1,4-	8270D-SIM	PJLA
123-91-1	Soil	Dioxane, 1,4-	8270E-SIM	PJLA
123-91-1	Water	Dioxane, 1,4-	8270E-SIM	PJLA
959-98-8	Water	Endosulfan I	608.3	PJLA
959-98-8	Soil	Endosulfan I	8081B	PJLA
959-98-8	Water	Endosulfan I	8081B	PJLA

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33213-65-9	Water	Endosulfan II	608.3	PJLA
33213-65-9	Soil	Endosulfan II	8081B	PJLA
33213-65-9	Water	Endosulfan II	8081B	PJLA
1031-07-8	Water	Endosulfan sulfate	608.3	PJLA
1031-07-8	Soil	Endosulfan sulfate	8081B	PJLA
1031-07-8	Water	Endosulfan sulfate	8081B	PJLA
72-20-8	Water	Endrin	608.3	PJLA
72-20-8	Soil	Endrin	8081B	PJLA
72-20-8	Water	Endrin	8081B	PJLA
75-00-3	Soil	Ethyl Chloride	8260D	PJLA
75-00-3	Water	Ethyl Chloride	8260D	PJLA
100-41-4	Water	Ethylbenzene	624.1	PJLA
100-41-4	Soil	Ethylbenzene	8260D	PJLA
100-41-4	Water	Ethylbenzene	8260D	PJLA
107-21-1	Soil	Ethylene Glycol	8015B	PJLA
107-21-1	Water	Ethylene Glycol	8015B	PJLA
206-44-0	Water	Fluoranthene	625.1	PJLA
206-44-0	Soil	Fluoranthene	8270D-SIM	PJLA
206-44-0	Water	Fluoranthene	8270D-SIM	PJLA
206-44-0	Soil	Fluoranthene	8270E	PJLA
206-44-0	Water	Fluoranthene	8270E	PJLA
206-44-0	Soil	Fluoranthene	8270E-SIM	PJLA
206-44-0	Water	Fluoranthene	8270E-SIM	PJLA
86-73-7	Water	Fluorene	625.1	PJLA
86-73-7	Soil	Fluorene	8270D-SIM	PJLA
86-73-7	Water	Fluorene	8270D-SIM	PJLA
86-73-7	Soil	Fluorene	8270E	PJLA
86-73-7	Water	Fluorene	8270E	PJLA
86-73-7	Soil	Fluorene	8270E-SIM	PJLA
86-73-7	Water	Fluorene	8270E-SIM	PJLA
N/A	Soil	Gasoline Range Organics (C6 – C10)	AK 101	PJLA
N/A	Water	Gasoline Range Organics (C6 – C10)	AK 101	PJLA
76-44-8	Water	Heptachlor	608.3	PJLA

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76-44-8	Soil	Heptachlor	8081B	PJLA
76-44-8	Water	Heptachlor	8081B	PJLA
1024-57-3	Water	Heptachlor Epoxide	608.3	PJLA
1024-57-3	Soil	Heptachlor Epoxide	8081B	PJLA
1024-57-3	Water	Heptachlor Epoxide	8081B	PJLA
118-74-1	Water	Hexachlorobenzene	625.1	PJLA
118-74-1	Soil	Hexachlorobenzene	8270E	PJLA
118-74-1	Water	Hexachlorobenzene	8270E	PJLA
87-68-3	Water	Hexachlorobutadiene	625.1	PJLA
87-68-3	Soil	Hexachlorobutadiene	8260B-SIM	PJLA
87-68-3	Water	Hexachlorobutadiene	8260D	PJLA
87-68-3	Soil	Hexachlorobutadiene	8260D-SIM	PJLA
87-68-3	Soil	Hexachlorobutadiene	8270E	PJLA
87-68-3	Water	Hexachlorobutadiene	8270E	PJLA
319-84-6	Water	Hexachlorocyclohexane, Alpha- (a-BHC)	608.3	PJLA
319-84-6	Soil	Hexachlorocyclohexane, Alpha- (a-BHC)	8081B	PJLA
319-84-6	Water	Hexachlorocyclohexane, Alpha- (a-BHC)	8081B	PJLA
319-85-7	Water	Hexachlorocyclohexane, Beta- (b-BHC)	608.3	PJLA
319-85-7	Soil	Hexachlorocyclohexane, Beta- (b-BHC)	8081B	PJLA
319-85-7	Water	Hexachlorocyclohexane, Beta- (b-BHC)	8081B	PJLA
319-86-8	Water	Hexachlorocyclohexane, Delta- (d-BHC)	608.3	PJLA
319-86-8	Soil	Hexachlorocyclohexane, Delta- (d-BHC)	8081B	PJLA
319-86-8	Water	Hexachlorocyclohexane, Delta- (d-BHC)	8081B	PJLA
58-89-9	Water	Hexachlorocyclohexane, Gamma- (Lindane)	608.3	PJLA
58-89-9	Soil	Hexachlorocyclohexane, Gamma- (Lindane)	8081B	PJLA
58-89-9	Water	Hexachlorocyclohexane, Gamma- (Lindane)	8081B	PJLA
77-47-4	Water	Hexachlorocyclopentadiene	625.1	PJLA
77-47-4	Soil	Hexachlorocyclopentadiene	8270E	PJLA
77-47-4	Water	Hexachlorocyclopentadiene	8270E	PJLA
67-72-1	Water	Hexachloroethane	625.1	PJLA
67-72-1	Soil	Hexachloroethane	8270E	PJLA
67-72-1	Water	Hexachloroethane	8270E	PJLA
13252-13-6	Soil	Hexafluoropropylene oxide dimer acid (HFPO-DA)	Draft 1633	PJLA

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13252-13-6	Water	Hexafluoropropylene oxide dimer acid (HFPO-DA)	Draft 1633	PJLA
121-82-4	Soil	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	8330B	PJLA
121-82-4	Water	Hexahydro-1,3,5-trinitro-1,3,5-triazine (RDX)	8330B	PJLA
591-78-6	Soil	Hexanone, 2-	8260B-SIM	PJLA
591-78-6	Soil	Hexanone, 2-	8260D	PJLA
591-78-6	Water	Hexanone, 2-	8260D	PJLA
591-78-6	Soil	Hexanone, 2-	8260D-SIM	PJLA
193-39-5	Water	Indeno[1,2,3-cd]pyrene	625.1	PJLA
193-39-5	Soil	Indeno[1,2,3-cd]pyrene	8270D-SIM	PJLA
193-39-5	Water	Indeno[1,2,3-cd]pyrene	8270D-SIM	PJLA
193-39-5	Soil	Indeno[1,2,3-cd]pyrene	8270E	PJLA
193-39-5	Water	Indeno[1,2,3-cd]pyrene	8270E	PJLA
193-39-5	Soil	Indeno[1,2,3-cd]pyrene	8270E-SIM	PJLA
193-39-5	Water	Indeno[1,2,3-cd]pyrene	8270E-SIM	PJLA
78-59-1	Water	Isophorone	625.1	PJLA
78-59-1	Soil	Isophorone	8270E	PJLA
78-59-1	Water	Isophorone	8270E	PJLA
67-63-0	Soil	Isopropanol	8260D	PJLA
67-63-0	Water	Isopropanol	8260D	PJLA
7439-92-1	Water	Lead, Total	200.7	PJLA
7439-92-1	Water	Lead, Total	200.8	PJLA
7439-92-1	Soil	Lead, Total	6010D	PJLA
7439-92-1	Water	Lead, Total	6010D	PJLA
7439-92-1	Soil	Lead, Total	6020B	PJLA
7439-92-1	Water	Lead, Total	6020B	PJLA
7439-96-5	Water	Manganese	200.7	PJLA
7439-96-5	Water	Manganese	200.8	PJLA
7439-96-5	Soil	Manganese	6010D	PJLA
7439-96-5	Water	Manganese	6010D	PJLA
7439-96-5	Soil	Manganese	6020B	PJLA
7439-96-5	Water	Manganese	6020B	PJLA
7439-97-6	Water	Mercury (elemental)	245.1	PJLA
7439-97-6	Water	Mercury (elemental)	7470A	PJLA

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7439-97-6	Soil	Mercury (elemental)	7471B	PJLA
67-56-1	Soil	Methanol	8015B	PJLA
67-56-1	Water	Methanol	8015B	PJLA
72-43-5	Water	Methoxychlor	608.3	PJLA
72-43-5	Soil	Methoxychlor	8081B	PJLA
72-43-5	Water	Methoxychlor	8081B	PJLA
78-93-3	Soil	Methyl Ethyl Ketone (2-Butanone)	8260D	PJLA
78-93-3	Water	Methyl Ethyl Ketone (2-Butanone)	8260D	PJLA
108-10-1	Soil	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	8260D	PJLA
108-10-1	Water	Methyl Isobutyl Ketone (4-methyl-2-pentanone)	8260D	PJLA
1634-04-4	Water	Methyl tert-Butyl Ether (MTBE)	624.1	PJLA
1634-04-4	Soil	Methyl tert-Butyl Ether (MTBE)	8260D	PJLA
1634-04-4	Water	Methyl tert-Butyl Ether (MTBE)	8260D	PJLA
75-09-2	Water	Methylene Chloride	624.1	PJLA
75-09-2	Soil	Methylene Chloride	8260D	PJLA
75-09-2	Water	Methylene Chloride	8260D	PJLA
90-12-0	Soil	Methylnaphthalene, 1-	8270D-SIM	PJLA
90-12-0	Water	Methylnaphthalene, 1-	8270D-SIM	PJLA
90-12-0	Soil	Methylnaphthalene, 1-	8270E	PJLA
90-12-0	Water	Methylnaphthalene, 1-	8270E	PJLA
90-12-0	Soil	Methylnaphthalene, 1-	8270E-SIM	PJLA
90-12-0	Water	Methylnaphthalene, 1-	8270E-SIM	PJLA
91-57-6	Soil	Methylnaphthalene, 2-	8270D-SIM	PJLA
91-57-6	Water	Methylnaphthalene, 2-	8270D-SIM	PJLA
91-57-6	Soil	Methylnaphthalene, 2-	8270E	PJLA
91-57-6	Water	Methylnaphthalene, 2-	8270E	PJLA
91-57-6	Soil	Methylnaphthalene, 2-	8270E-SIM	PJLA
91-57-6	Water	Methylnaphthalene, 2-	8270E-SIM	PJLA
91-20-3	Water	Naphthalene	625.1	PJLA
91-20-3	Soil	Naphthalene	8260B-SIM	PJLA
91-20-3	Soil	Naphthalene	8260D	PJLA
91-20-3	Water	Naphthalene	8260D	PJLA
91-20-3	Soil	Naphthalene	8260D-SIM	PJLA

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91-20-3	Soil	Naphthalene	8270D-SIM	PJLA
91-20-3	Water	Naphthalene	8270D-SIM	PJLA
91-20-3	Soil	Naphthalene	8270E	PJLA
91-20-3	Water	Naphthalene	8270E	PJLA
91-20-3	Soil	Naphthalene	8270E-SIM	PJLA
91-20-3	Water	Naphthalene	8270E-SIM	PJLA
4151-50-2	Soil	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	Draft 1633	PJLA
4151-50-2	Water	N-Ethyl perfluorooctane sulfonamide (EtFOSA)	Draft 1633	PJLA
1691-99-2	Soil	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	Draft 1633	PJLA
1691-99-2	Water	N-Ethyl perfluorooctane sulfonamidoethanol (EtFOSE)	Draft 1633	PJLA
2991-50-6	Soil	N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	Draft 1633	PJLA
2991-50-6	Water	N-ethyl perfluorooctanesulfonamidoacetic acid (NEtFOSAA)	Draft 1633	PJLA
7440-02-0	Water	Nickel, Total	200.7	PJLA
7440-02-0	Water	Nickel, Total	200.8	PJLA
7440-02-0	Soil	Nickel, Total	6010D	PJLA
7440-02-0	Water	Nickel, Total	6010D	PJLA
7440-02-0	Soil	Nickel, Total	6020B	PJLA
7440-02-0	Water	Nickel, Total	6020B	PJLA
98-95-3	Water	Nitrobenzene	625.1	PJLA
98-95-3	Soil	Nitrobenzene	8270E	PJLA
98-95-3	Water	Nitrobenzene	8270E	PJLA
98-95-3	Soil	Nitrobenzene	8330B	PJLA
98-95-3	Water	Nitrobenzene	8330B	PJLA
55-63-0	Soil	Nitroglycerin	8330B	PJLA
55-63-0	Water	Nitroglycerin	8330B	PJLA
62-75-9	Soil	Nitrosodimethylamine, N-	8270E	PJLA
62-75-9	Water	Nitrosodimethylamine, N-	8270E	PJLA
621-64-7	Water	Nitroso-di-N-propylamine, N-	625.1	PJLA
621-64-7	Soil	Nitroso-di-N-propylamine, N-	8270E	PJLA
621-64-7	Water	Nitroso-di-N-propylamine, N-	8270E	PJLA
86-30-6	Water	Nitrosodiphenylamine, N-	625.1	PJLA
86-30-6	Soil	Nitrosodiphenylamine, N-	8270E	PJLA
86-30-6	Water	Nitrosodiphenylamine, N-	8270E	PJLA

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99-08-1	Soil	Nitrotoluene, m-	8330B	PJLA
99-08-1	Water	Nitrotoluene, m-	8330B	PJLA
88-72-2	Soil	Nitrotoluene, o-	8330B	PJLA
88-72-2	Water	Nitrotoluene, o-	8330B	PJLA
99-99-0	Soil	Nitrotoluene, p-	8330B	PJLA
99-99-0	Water	Nitrotoluene, p-	8330B	PJLA
31506-32-8	Soil	N-Methyl perfluorooctane sulfonamide (MeFOSA)	Draft 1633	PJLA
31506-32-8	Water	N-Methyl perfluorooctane sulfonamide (MeFOSA)	Draft 1633	PJLA
24448-09-7	Soil	N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	Draft 1633	PJLA
24448-09-7	Water	N-Methyl perfluorooctane sulfonamidoethanol (MeFOSE)	Draft 1633	PJLA
2355-31-9	Soil	N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	Draft 1633	PJLA
2355-31-9	Water	N-methyl perfluorooctanesulfonamidoacetic acid (NMeFOSAA)	Draft 1633	PJLA
151772-58-6	Soil	Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	Draft 1633	PJLA
151772-58-6	Water	Nonafluoro-3,6-dioxaheptanoic acid (NFDHA)	Draft 1633	PJLA
2691-41-0	Soil	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	8330B	PJLA
2691-41-0	Water	Octahydro-1,3,5,7-tetranitro-1,3,5,7-tetrazocine (HMX)	8330B	PJLA
12674-11-2	Water	PCB - Aroclor-1016	608.3	PJLA
12674-11-2	Soil	PCB - Aroclor-1016	8082A	PJLA
12674-11-2	Water	PCB - Aroclor-1016	8082A	PJLA
11104-28-2	Water	PCB - Aroclor-1221	608.3	PJLA
11104-28-2	Soil	PCB - Aroclor-1221	8082A	PJLA
11104-28-2	Water	PCB - Aroclor-1221	8082A	PJLA
11141-16-5	Water	PCB - Aroclor-1232	608.3	PJLA
11141-16-5	Soil	PCB - Aroclor-1232	8082A	PJLA
11141-16-5	Water	PCB - Aroclor-1232	8082A	PJLA
53469-21-9	Water	PCB - Aroclor-1242	608.3	PJLA
53469-21-9	Soil	PCB - Aroclor-1242	8082A	PJLA
53469-21-9	Water	PCB - Aroclor-1242	8082A	PJLA
12672-29-6	Water	PCB - Aroclor-1248	608.3	PJLA
12672-29-6	Soil	PCB - Aroclor-1248	8082A	PJLA
12672-29-6	Water	PCB - Aroclor-1248	8082A	PJLA

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11097-69-1	Water	PCB - Aroclor-1254	608.3	PJLA
11097-69-1	Soil	PCB - Aroclor-1254	8082A	PJLA
11097-69-1	Water	PCB - Aroclor-1254	8082A	PJLA
11096-82-5	Water	PCB - Aroclor-1260	608.3	PJLA
11096-82-5	Soil	PCB - Aroclor-1260	8082A	PJLA
11096-82-5	Water	PCB - Aroclor-1260	8082A	PJLA
37324-23-5	Water	PCB - Aroclor-1262	608.3	PJLA
37324-23-5	Soil	PCB - Aroclor-1262	8082A	PJLA
37324-23-5	Water	PCB - Aroclor-1262	8082A	PJLA
11100-14-4	Water	PCB - Aroclor-1268	608.3	PJLA
11100-14-4	Soil	PCB - Aroclor-1268	8082A	PJLA
11100-14-4	Water	PCB - Aroclor-1268	8082A	PJLA
87-86-5	Water	Pentachlorophenol	625.1	PJLA
87-86-5	Soil	Pentachlorophenol	8270E	PJLA
87-86-5	Water	Pentachlorophenol	8270E	PJLA
78-11-5	Soil	Pentaerythritol tetranitrate (PETN)	8330B	PJLA
78-11-5	Water	Pentaerythritol tetranitrate (PETN)	8330B	PJLA
113507-82-7	Soil	Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA)	Draft 1633	PJLA
113507-82-7	Water	Perfluoro(2-ethoxyethane)sulfonic acid (PFEESA)	Draft 1633	PJLA
377-73-1	Soil	Perfluoro-3-methoxypropanoic acid (PFMPA)	Draft 1633	PJLA
377-73-1	Water	Perfluoro-3-methoxypropanoic acid (PFMPA)	Draft 1633	PJLA
863090-89-5	Soil	Perfluoro-4-methoxybutanoic acid (PFMBA)	Draft 1633	PJLA
863090-89-5	Water	Perfluoro-4-methoxybutanoic acid (PFMBA)	Draft 1633	PJLA
375-73-5	Soil	Perfluorobutanesulfonic acid (PFBS)	Draft 1633	PJLA
375-73-5	Water	Perfluorobutanesulfonic acid (PFBS)	Draft 1633	PJLA
375-22-4	Soil	Perfluorobutanoic acid (PFBA)	Draft 1633	PJLA
375-22-4	Water	Perfluorobutanoic acid (PFBA)	Draft 1633	PJLA
335-77-3	Soil	Perfluorodecane sulfonic acid (PFDS)	Draft 1633	PJLA
335-77-3	Water	Perfluorodecane sulfonic acid (PFDS)	Draft 1633	PJLA
335-76-2	Soil	Perfluorodecanoic acid (PFDA)	Draft 1633	PJLA
335-76-2	Water	Perfluorodecanoic acid (PFDA)	Draft 1633	PJLA
79780-39-5	Soil	Perfluorododecane sulfonic acid (PFDoS)	Draft 1633	PJLA
79780-39-5	Water	Perfluorododecane sulfonic acid (PFDoS)	Draft 1633	PJLA

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307-55-1	Soil	Perfluorododecanoic acid (PFDoA)	Draft 1633	PJLA
307-55-1	Water	Perfluorododecanoic acid (PFDoA)	Draft 1633	PJLA
375-92-8	Soil	Perfluoroheptane sulfonic acid (PFHpS)	Draft 1633	PJLA
375-92-8	Water	Perfluoroheptane sulfonic acid (PFHpS)	Draft 1633	PJLA
375-85-9	Soil	Perfluoroheptanoic acid (PFHpA)	Draft 1633	PJLA
375-85-9	Water	Perfluoroheptanoic acid (PFHpA)	Draft 1633	PJLA
355-46-4	Soil	Perfluorohexanesulfonic acid (PFHxS)	Draft 1633	PJLA
355-46-4	Water	Perfluorohexanesulfonic acid (PFHxS)	Draft 1633	PJLA
307-24-4	Soil	Perfluorohexanoic acid (PFHxA)	Draft 1633	PJLA
307-24-4	Water	Perfluorohexanoic acid (PFHxA)	Draft 1633	PJLA
68259-12-1	Soil	Perfluorononanesulfonic acid (PFNS)	Draft 1633	PJLA
68259-12-1	Water	Perfluorononanesulfonic acid (PFNS)	Draft 1633	PJLA
375-95-1	Soil	Perfluorononanoic acid (PFNA)	Draft 1633	PJLA
375-95-1	Water	Perfluorononanoic acid (PFNA)	Draft 1633	PJLA
754-91-6	Soil	Perfluorooctanesulfonamide (PFOSA)	Draft 1633	PJLA
754-91-6	Water	Perfluorooctanesulfonamide (PFOSA)	Draft 1633	PJLA
1763-23-1	Soil	Perfluorooctanesulfonic acid (PFOS)	Draft 1633	PJLA
1763-23-1	Water	Perfluorooctanesulfonic acid (PFOS)	Draft 1633	PJLA
335-67-1	Soil	Perfluorooctanoic acid (PFOA)	Draft 1633	PJLA
335-67-1	Water	Perfluorooctanoic acid (PFOA)	Draft 1633	PJLA
2706-91-4	Soil	Perfluoropentanesulfonic acid (PFPeS)	Draft 1633	PJLA
2706-91-4	Water	Perfluoropentanesulfonic acid (PFPeS)	Draft 1633	PJLA
2706-90-3	Soil	Perfluoropentanoic acid (PFPeA)	Draft 1633	PJLA
2706-90-3	Water	Perfluoropentanoic acid (PFPeA)	Draft 1633	PJLA
376-06-7	Soil	Perfluorotetradecanoic acid (PFTA)	Draft 1633	PJLA
376-06-7	Water	Perfluorotetradecanoic acid (PFTA)	Draft 1633	PJLA
72629-94-8	Soil	Perfluorotridecanoic acid (PFTrDA)	Draft 1633	PJLA
72629-94-8	Water	Perfluorotridecanoic acid (PFTrDA)	Draft 1633	PJLA
2058-94-8	Soil	Perfluoroundecanoic acid (PFUnA)	Draft 1633	PJLA
2058-94-8	Water	Perfluoroundecanoic acid (PFUnA)	Draft 1633	PJLA
85-01-8	Water	Phenanthrene	625.1	PJLA
85-01-8	Soil	Phenanthrene	8270D-SIM	PJLA
85-01-8	Water	Phenanthrene	8270D-SIM	PJLA

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85-01-8	Soil	Phenanthrene	8270E	PJLA
85-01-8	Water	Phenanthrene	8270E	PJLA
85-01-8	Soil	Phenanthrene	8270E-SIM	PJLA
85-01-8	Water	Phenanthrene	8270E-SIM	PJLA
108-95-2	Water	Phenol	625.1	PJLA
108-95-2	Soil	Phenol	8270E	PJLA
108-95-2	Water	Phenol	8270E	PJLA
103-65-1	Soil	Propyl benzene	8260D	PJLA
103-65-1	Water	Propyl benzene	8260D	PJLA
129-00-0	Water	Pyrene	625.1	PJLA
129-00-0	Soil	Pyrene	8270D-SIM	PJLA
129-00-0	Water	Pyrene	8270D-SIM	PJLA
129-00-0	Soil	Pyrene	8270E	PJLA
129-00-0	Water	Pyrene	8270E	PJLA
129-00-0	Soil	Pyrene	8270E-SIM	PJLA
129-00-0	Water	Pyrene	8270E-SIM	PJLA
N/A	Soil	Residual Range Organics (C25 – C36)	AK 103	PJLA
N/A	Water	Residual Range Organics (C25 – C36)	AK 103	PJLA
7782-49-2	Water	Selenium	200.7	PJLA
7782-49-2	Water	Selenium	200.8	PJLA
7782-49-2	Soil	Selenium	6010D	PJLA
7782-49-2	Water	Selenium	6010D	PJLA
7782-49-2	Soil	Selenium	6020B	PJLA
7782-49-2	Water	Selenium	6020B	PJLA
7440-22-4	Water	Silver	200.7	PJLA
7440-22-4	Water	Silver	200.8	PJLA
7440-22-4	Soil	Silver	6010D	PJLA
7440-22-4	Water	Silver	6010D	PJLA
7440-22-4	Soil	Silver	6020B	PJLA
7440-22-4	Water	Silver	6020B	PJLA
7440-24-6	Water	Strontium	200.7	PJLA
7440-24-6	Soil	Strontium	6010D	PJLA
7440-24-6	Water	Strontium	6010D	PJLA

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100-42-5	Soil	Styrene	8260D	PJLA
100-42-5	Water	Styrene	8260D	PJLA
630-20-6	Soil	Tetrachloroethane, 1,1,1,2-	8260B-SIM	PJLA
630-20-6	Soil	Tetrachloroethane, 1,1,1,2-	8260D	PJLA
630-20-6	Water	Tetrachloroethane, 1,1,1,2-	8260D	PJLA
630-20-6	Soil	Tetrachloroethane, 1,1,1,2-	8260D-SIM	PJLA
79-34-5	Water	Tetrachloroethane, 1,1,2,2-	624.1	PJLA
79-34-5	Soil	Tetrachloroethane, 1,1,2,2-	8260B-SIM	PJLA
79-34-5	Soil	Tetrachloroethane, 1,1,2,2-	8260D	PJLA
79-34-5	Water	Tetrachloroethane, 1,1,2,2-	8260D	PJLA
79-34-5	Soil	Tetrachloroethane, 1,1,2,2-	8260D-SIM	PJLA
127-18-4	Water	Tetrachloroethylene	624.1	PJLA
127-18-4	Soil	Tetrachloroethylene	8260B-SIM	PJLA
127-18-4	Soil	Tetrachloroethylene	8260D	PJLA
127-18-4	Water	Tetrachloroethylene	8260D	PJLA
127-18-4	Soil	Tetrachloroethylene	8260D-SIM	PJLA
479-45-8	Soil	Tetryl (Trinitrophenylmethylnitramine)	8330B	PJLA
479-45-8	Water	Tetryl (Trinitrophenylmethylnitramine)	8330B	PJLA
7440-28-0	Water	Thallium, Total	200.7	PJLA
7440-28-0	Water	Thallium, Total	200.8	PJLA
7440-28-0	Soil	Thallium, Total	6010D	PJLA
7440-28-0	Water	Thallium, Total	6010D	PJLA
7440-28-0	Soil	Thallium, Total	6020B	PJLA
7440-28-0	Water	Thallium, Total	6020B	PJLA
108-88-3	Water	Toluene	624.1	PJLA
108-88-3	Soil	Toluene	8260D	PJLA
108-88-3	Water	Toluene	8260D	PJLA
N/A	Water	Total Organic Carbon	9060A	PJLA
8001-35-2	Water	Toxaphene	608.3	PJLA
8001-35-2	Soil	Toxaphene	8081B	PJLA
8001-35-2	Water	Toxaphene	8081B	PJLA
87-61-6	Soil	Trichlorobenzene, 1,2,3-	8260D	PJLA
87-61-6	Water	Trichlorobenzene, 1,2,3-	8260D	PJLA

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation body
120-82-1	Water	Trichlorobenzene, 1,2,4-	625.1	PJLA
120-82-1	Soil	Trichlorobenzene, 1,2,4-	8260D	PJLA
120-82-1	Water	Trichlorobenzene, 1,2,4-	8260D	PJLA
120-82-1	Soil	Trichlorobenzene, 1,2,4-	8270E	PJLA
120-82-1	Water	Trichlorobenzene, 1,2,4-	8270E	PJLA
71-55-6	Water	Trichloroethane, 1,1,1-	624.1	PJLA
71-55-6	Soil	Trichloroethane, 1,1,1-	8260D	PJLA
71-55-6	Water	Trichloroethane, 1,1,1-	8260D	PJLA
79-00-5	Water	Trichloroethane, 1,1,2-	624.1	PJLA
79-00-5	Soil	Trichloroethane, 1,1,2-	8260B-SIM	PJLA
79-00-5	Soil	Trichloroethane, 1,1,2-	8260D	PJLA
79-00-5	Water	Trichloroethane, 1,1,2-	8260D	PJLA
79-00-5	Soil	Trichloroethane, 1,1,2-	8260D-SIM	PJLA
79-01-6	Water	Trichloroethylene	624.1	PJLA
79-01-6	Soil	Trichloroethylene	8260B-SIM	PJLA
79-01-6	Soil	Trichloroethylene	8260D	PJLA
79-01-6	Water	Trichloroethylene	8260D	PJLA
79-01-6	Soil	Trichloroethylene	8260D-SIM	PJLA
75-69-4	Water	Trichlorofluoromethane	624.1	PJLA
75-69-4	Soil	Trichlorofluoromethane	8260D	PJLA
75-69-4	Water	Trichlorofluoromethane	8260D	PJLA
95-95-4	Water	Trichlorophenol, 2,4,5-	625.1	PJLA
95-95-4	Soil	Trichlorophenol, 2,4,5-	8270E	PJLA
95-95-4	Water	Trichlorophenol, 2,4,5-	8270E	PJLA
88-06-2	Water	Trichlorophenol, 2,4,6-	625.1	PJLA
88-06-2	Soil	Trichlorophenol, 2,4,6-	8270E	PJLA
88-06-2	Water	Trichlorophenol, 2,4,6-	8270E	PJLA
96-18-4	Soil	Trichloropropane, 1,2,3-	8011	PJLA
96-18-4	Water	Trichloropropane, 1,2,3-	8011	PJLA
96-18-4	Soil	Trichloropropane, 1,2,3-	8260D	PJLA
96-18-4	Water	Trichloropropane, 1,2,3-	8260D	PJLA
95-63-6	Soil	Trimethylbenzene, 1,2,4-	8260D	PJLA
95-63-6	Water	Trimethylbenzene, 1,2,4-	8260D	PJLA

Scope of Approval

CAS Number	Matrix	Hazardous Substance	Method	Accreditation body
108-67-8	Soil	Trimethylbenzene, 1,3,5-	8260D	PJLA
108-67-8	Water	Trimethylbenzene, 1,3,5-	8260D	PJLA
99-35-4	Soil	Trinitrobenzene, 1,3,5- (1,3,5-TNB)	8330B	PJLA
99-35-4	Water	Trinitrobenzene, 1,3,5- (1,3,5-TNB)	8330B	PJLA
118-96-7	Soil	Trinitrotoluene, 2,4,6-	8330B	PJLA
118-96-7	Water	Trinitrotoluene, 2,4,6-	8330B	PJLA
7440-62-2	Water	Vanadium, Total	200.7	PJLA
7440-62-2	Water	Vanadium, Total	200.8	PJLA
7440-62-2	Soil	Vanadium, Total	6010D	PJLA
7440-62-2	Water	Vanadium, Total	6010D	PJLA
7440-62-2	Soil	Vanadium, Total	6020B	PJLA
7440-62-2	Water	Vanadium, Total	6020B	PJLA
108-05-4	Soil	Vinyl Acetate	8260D	PJLA
108-05-4	Water	Vinyl Acetate	8260D	PJLA
75-01-4	Water	Vinyl Chloride	624.1	PJLA
75-01-4	Soil	Vinyl Chloride	8260B-SIM	PJLA
75-01-4	Soil	Vinyl Chloride	8260D	PJLA
75-01-4	Water	Vinyl Chloride	8260D	PJLA
75-01-4	Soil	Vinyl Chloride	8260D-SIM	PJLA
179601-23-1	Soil	Xylene, m+p-	8260D	PJLA
179601-23-1	Water	Xylene, m+p-	8260D	PJLA
95-47-6	Soil	Xylene, o-	8260D	PJLA
95-47-6	Water	Xylene, o-	8260D	PJLA
1330-20-7	Water	Xylene, Total	624.1	PJLA
1330-20-7	Soil	Xylene, Total	8260D	PJLA
1330-20-7	Water	Xylene, Total	8260D	PJLA
7440-66-6	Water	Zinc, Total	200.7	PJLA
7440-66-6	Water	Zinc, Total	200.8	PJLA
7440-66-6	Soil	Zinc, Total	6010D	PJLA
7440-66-6	Soil	Zinc, Total	6020B	PJLA
7440-66-6	Water	Zinc, Total	6020B	PJLA

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APPENDIX G
GAC BREAKTHROUGH CALCULATIONS

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Appendix G - GAC Breakthrough Calculations

#1 Carbon Usage Rate

CUR = (Co-Ce)F/(x/m)C0
CUR = Carbon Usage Rate (g/day)
Co = Initial concentration (mg/L)
Ce = desired effluent concentration (mg/L)
F = Volumetric flow rate of contaminated liquid treated/day (L/day)

2-gallon per minute rate = 7.57 L/min

1 gram = 0.00220462 lb

F = Qt
Q=flow rate, t = time

F = 7.57 L/min * 60 min/hr * 3 hr/day
1362.6 L/ day

	Concentration in influent	Concentration in Effluent	Freundlich Constant	Intensity Factor	Carbon Usage Rate	
Contaminant	**Co (mg/L)**	**Ce (mg/L)**	**Kf (mg/g)(L/mg)**	**1/n**	**CUR (g/day)**	**CUR (lb/day)**
PFOS	0.00027	0.000004	25.9	1.123	142.4061515	0.31395145

#2 Empty Bed Contact Time

EBCT = V/Q=LA/Q
V = bulk volume of GAC in contactor
A = Cross-sectional bed area
L = bed depth
Q = volumetric flow rate

V= 2.01 cubic feet (volume of a 15-gallon drum)
Q = 0.2673612 cubic feet/min (based on a 2 gallon/min flow rate)

7.517919578

EBCT (minutes) 7.517919578 @ 2gal/min flow rate

#3 Carbon Required for EBCT 7.5179 minutes

Carbon Required for EBCT = EBCT*Q*GAC density (g/L)

Carbon Required for EBCT = (7.518 min) * (7.57 L/min)*(450 g/L
25610.067 grams
56.46046591 pounds

#4 Total Carbon Required

V = ((CUR * days)*SF)/bulk density
V = volume of adsorber
CUR = carbon usage rate g/day
Bulk Density of Carbon (g/L)
SF = Safety Factor (1.2)

Bituminous GAC

Density 0.50 g/cm^3 or 30 lb/ft^3
1 liter = 0.0353147 ft^3

Total Purge Water with Safety Factor 1400
Days to Treat Total Purge Water 1
*Assumed 8 hour work day

	Concentration in influent	Concentration in Effluent	Freundlich Constant	Intensity Factor	Carbon Usage Rate		Volume of Total Carbon Required for Total Purge Water		
Contaminant	**Co (mg/L)**	**Ce (mg/L)**	**Kf (mg/g)(L/mg)**	**1/n**	**CUR (g/day)**	**CUR (lb/day)**	**Volume GAC (L)**	**Conversion (ft^3)**	**Pounds of GAC**
PFOS	0.00027	0.000004	25.9	1.123	142.4061515	0.31395145	0.379749737	0.013410748	0.402322442

#5 Number of 55-Gal GAC Drums

Number of Drums = Total Pounds of GAC/Pounds per Container
0.007314953 Drums needed
Only 1 container is required based on our calculations

15-Gal GAC Drum = 55 pounds

#6 Breakthrough

q = Kf * Ce^1/n

	Concentration in influent	Concentration in Effluent	Freundlich Constant	Intensity Factor	Breakthrough	Breakthrough	Conversion	Breakthrough	Conversion	Breakthrough
Contaminant	**Co (mg/L)**	**Ce (mg/L)**	**Kf (mg/g)(L/mg)**	**1/n**	**mg/g**	**L/g**	**L/gal**	**Gal/g**	**g/lb**	**gal/lb**
PFOS	0.00027	0.000004	25.9	1.123	2.24602E-05	5.615043731	3.785	1.483499004	453.592	672.9032804

Total of 55 lbs per GAC drum
Total Gallons to Breakthrough (no safety measure)
141309.6889

Safety Factor 50%

70655 gallons of PFOS-contaminated water to breakthrough

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APPENDIX H
PAST PFAS SCREENING RESULTS

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APPENDIX H – PAST PFAS SCREENING RESULTS

This attachment presents the previous PFAS soil and groundwater results in tabulated form compared to the current EPA November 2023 RSLs (EPA 2023) as stated on the DoD PFAS 101 webpage *Regional Screening Levels Used in DoD Cleanups* (https://www.acq.osd.mil/eie/eer/ecc/pfas/pfas101/rsl.html) (DoD 2024). Hexafluoropropylene oxide-dimer acid (HFPO-DA or GenX) was not previously analyzed for and is not suspected to be present at the former Haines Fuel Terminal because HFPO-DA was not in commercial use until 2009, after the terminal had ceased operation. EPA has published RSLs for lithium bis[(trifluoromethyl)sulfonyl]azanide (TFSI) and perfluoropropanoic acid (PFPrA); however, there are no current EPA-approved analytical methods for these analytes. Therefore, there is no previous data for these analytes and they will not be analyzed during this RI. Refer to Tables H-1 and H-2 for soil results and Table H-3 for groundwater results. All non-detect results are reported with LOD.

ANALYTE ACRONYMS

The following analyte acronyms are used in the tables; analytes in **bold** have DoD-approved RSLs.

- 8:2 FTS 1H,1H, 2H, 2H-Perfluorodecane sulfonic acid
- 6:2 FTS 1H,1H, 2H, 2H-Perfluorooctane sulfonic acid
- NEtFOSAA N-ethyl perfluorooctanesulfonamidoacetic acid
- NMeFOSAA N-methyl perfluorooctanesulfonamidoacetic acid
- **PFBS** **Perfluorobutanesulfonic acid**
- **PFHxS** **Perfluorohexanesulfonic acid**
- **PFBA** **Perfluorobutanoic acid**
- PFDA Perfluorodecanoic acid
- PFDoA Perfluorododecanoic acid
- PFHpA Perfluoroheptanoic acid
- **PFHxA** **Perfluorohexanoic acid**
- **PFNA** **Perfluorononanoic acid**
- **PFOA** **Perfluorooctanoic acid**
- PFPeA Perfluoropentanoic acid
- PFTeDA Perfluorotetradecanoic acid
- PFTrDA Perfluorotridecanoic acid
- PFUnA Perfluoroundecanoic acid
- **PFOS** **Perfluorooctanesulfonic acid**

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Table H-1 Previous Soil PFAS Results for the Former Administrative Area and Former Fuel Terminal Dock Area

	AREA	FORMER ADMINISTRATIVE AREA								FORMER FUEL TERMINAL DOCK AREA			
	LOCATION	Firehouse Office, Shop, and Garage Building 1212			Hose Cart Building 1209	Fire Pump Building 1208		Fire Pump Building 1203		Marine Dock Fire Hose Building 1236		Dockmaster Building 1234	
	SAMPLE ID	HFT-B1212-1-SO-061322	HFT-FD-2-SO-061322	HFT-B1212-2-SO-061122	HFT-B1209-1-SO-061322	HFT-B1208-1-SO-061322	HFT-B1208-2-SO-061322	HFT-B1203-1-SO-061322	HFT-B1203-2-SO-061322	HFT-B1236-1-SO-061122	HFT-B1236-2-SO-061122	HFT-B1234-1-SO-061122	HFT-B1234-2-SO-061122
ANALYTE	**CURRENT DOD-APPROVED RSL (MG/KG)[1]**	**RESULT (mg/kg)**	**RESULT (mg/kg)**	**RESULT (mg/kg)**	**RESULT (mg/kg)**	**RESULT (mg/kg)**	**RESULT (mg/kg)**	**RESULT (mg/kg)**	**RESULT (mg/kg)**	**RESULT (mg/kg)**	**RESULT (mg/kg)**	**RESULT (mg/kg)**	**RESULT (mg/kg)**
8:2 FTS	NE	ND 0.00090 U	ND 0.0010 U	ND 0.0023 U	ND 0.0010 U	ND 0.00095 U	ND 0.0011 U	ND 0.00090 U	ND 0.00090 U	ND 0.0010 U	ND 0.0010 U	ND 0.0010 U	ND 0.00095 U
6:2 FTS	NE	ND 0.00090 U	ND 0.0010 U	ND 0.0023 U	ND 0.0010 U	ND 0.00095 U	ND 0.0011 U	ND 0.00090 U	ND 0.00090 U	ND 0.0010 U	ND 0.0010 U	ND 0.0010 U	ND 0.00095 U
NEtFOSAA	NE	ND 0.00090 U	ND 0.0010 U	ND 0.0023 U	ND 0.0010 U	ND 0.00095 U	ND 0.0011 U	ND 0.00090 U	ND 0.00090 U	ND 0.0010 U	ND 0.0010 U	ND 0.0010 U	ND 0.00095 U
NMeFOSAA	NE	ND 0.00090 U	ND 0.0010 U	ND 0.0023 U	ND 0.0010 U	ND 0.00095 U	ND 0.0011 U	ND 0.00090 U	ND 0.00090 U	ND 0.0010 U	ND 0.0010 U	ND 0.0010 U	ND 0.00095 U
PFBS	1.9	ND 0.00045 U	ND 0.00050U	ND 0.0012 U	ND 0.00049 U	ND 0.00048 U	ND 0.00050 U	ND 0.00046 U	ND 0.00046 U	ND 0.00050 U	ND 0.00049 U	ND 0.00050 U	ND 0.00048 U
PFHxS	0.13	ND 0.00045 U	ND 0.00050U	ND 0.0012 U	ND 0.00049 U	ND 0.00048 U	ND 0.00050 U	ND 0.00046 U	ND 0.00046 U	ND 0.00050 U	ND 0.00049 U	ND 0.00050 U	ND 0.00048 U
PFBA	7.8	ND 0.00045 U	ND 0.00050U	ND 0.0012 U	ND 0.00049 U	ND 0.00048 U	ND 0.00050 U	ND 0.00046 U	ND 0.00046 U	ND 0.00050 U	ND 0.00049 U	ND 0.00050 U	ND 0.00048 U
PFDA	NE	ND 0.00045 U	ND 0.00050U	ND 0.0012 U	ND 0.00049 U	ND 0.00048 U	ND 0.00050 U	ND 0.00046 U	ND 0.00046 U	ND 0.00050 U	ND 0.00049 U	ND 0.00050 U	ND 0.00048 U
PFDoA	NE	ND 0.00045 U	ND 0.00050U	ND 0.0012 U	ND 0.00049 U	ND 0.00048 U	ND 0.00050 U	ND 0.00046 U	ND 0.00046 U	ND 0.00050 U	ND 0.00049 U	ND 0.00050 U	ND 0.00048 U
PFHpA	NE	ND 0.00045 U	ND 0.00050U	ND 0.0012 U	ND 0.00049 U	ND 0.00048 U	ND 0.00050 U	ND 0.00046 U	ND 0.00046 U	ND 0.00050 U	ND 0.00049 U	ND 0.00050 U	ND 0.00048 U
PFHxA	3.2	ND 0.00045 U	ND 0.00050U	ND 0.0012 U	ND 0.00049 U	ND 0.00048 U	ND 0.00050 U	ND 0.00046 U	ND 0.00046 U	ND 0.00050 U	ND 0.00049 U	ND 0.00050 U	ND 0.00048 U
PFNA	0.019	ND 0.00045 U	ND 0.00050U	ND 0.0012 U	ND 0.00049 U	ND 0.00048 U	ND 0.00050 U	ND 0.00046 U	ND 0.00046 U	ND 0.00050 U	ND 0.00049 U	ND 0.00050 U	ND 0.00048 U
PFOA	0.019	ND 0.00045 U	ND 0.00050U	ND 0.0012 U	ND 0.00049 U	ND 0.00048 U	ND 0.00050 U	ND 0.00046 U	ND 0.00046 U	ND 0.00050 U	ND 0.00049 U	ND 0.00050 U	ND 0.00048 U
PFPeA	NE	ND 0.00045 U	ND 0.00050U	ND 0.0012 U	ND 0.00049 U	ND 0.00048 U	ND 0.00050 U	ND 0.00046 U	ND 0.00046 U	ND 0.00050 U	ND 0.00049 U	ND 0.00050 U	ND 0.00048 U
PFTeDA	NE	ND 0.00045 U	ND 0.00050U	ND 0.0012 U	ND 0.00049 U	ND 0.00048 U	ND 0.00050 U	ND 0.00046 U	ND 0.00046 U	ND 0.00050 U	ND 0.00049 U	ND 0.00050 U	ND 0.00048 U
PFTrDA	NE	ND 0.00045 U	ND 0.00050U	ND 0.0012 U	ND 0.00049 U	ND 0.00048 U	ND 0.00050 U	ND 0.00046 U	ND 0.00046 U	ND 0.00050 U	ND 0.00049 U	ND 0.00050 U	ND 0.00048 U
PFUnA	NE	ND 0.00045 U	ND 0.00050U	ND 0.0012 U	ND 0.00049 U	ND 0.00048 U	ND 0.00050 U	ND 0.00046 U	ND 0.00046 U	ND 0.00050 U	ND 0.00049 U	ND 0.00050 U	ND 0.00048 U
PFOS	0.013	ND 0.00045 U	ND 0.00050U	ND 0.0012 U	ND 0.00049 U	ND 0.00048 U	ND 0.00050 U	ND 0.00046 U	**0.00055 J**	ND 0.00050 U	ND 0.00049 U	ND 0.00050 U	**0.00056 J**

Notes

For definitions, refer to the Acronyms and Abbreviations section of the Work Plan and the analyte list included with this attachment.

Bold text denotes a positive detection at a concentration less than the EPA RSL (EPA 2023) (target risk=1×10^{-6} and HQ=0.1).

J = The analyte was positively identified; however the associated numerical value is an estimated concentration only.

ND = non-detect

U = The analyte was analyzed for but was not detected above the limit of quantitation.

[1] DoD PFAS 101 webpage *Regional Screening Levels Used in DoD Cleanups* (https://www.acq.osd.mil/eie/eer/ecc/pfas/pfas101/rsl.html) (DoD 2024).

Table H-2 Previous Soil PFAS Results for the Former Tank Farm Area

	AREA	FROMER TANK FARM AREA										
	LOCATION	Fire Foam Building 1231				Fire Foam Building 1231/Tank Farm Fire Foam System						
	SAMPLE ID	15HFTB231SB01S001	15HFTB231SB01S201	15HFTB231SB02S001	16HFTB231SB03S001	HFT-TFFFS-1-SO-061022	HFT-FD-1-SO-061022	HFT-TFFFS-2-SO-061022	HFT-TFFFS-3-SO-061022	HFT-TFFFS-4-SO-061022	HFT-TFFFS-5-SO-061022	HFT-TFFFS-6-SO-061022
ANALYTE	**CURRENT DOD-APPROVED RSL (mg/kg)[1]**	**RESULT (mg/kg)**	**RESULT (mg/kg)**	**RESULT (mg/kg)**	**RESULT (mg/kg)**	**RESULT (mg/kg)**	**RESULT (mg/kg)**	**RESULT (mg/kg)**	**RESULT (mg/kg)**	**RESULT (mg/kg)**	**RESULT (mg/kg)**	**RESULT (mg/kg)**
8:2 FTS	NE	N/A	N/A	N/A	N/A	ND 0.0012 U	ND 0.0012 U	ND 0.00095 U	ND 0.0012 U	ND 0.0010 U	ND 0.0010 U	ND 0.0012 U
6:2 FTS	NE	N/A	N/A	N/A	N/A	ND 0.0012 UJ	ND 0.0012 U	ND 0.00095 U	ND 0.0012 U	ND 0.0010 U	ND 0.0010 U	ND 0.0012 U
NEtFOSAA	NE	N/A	N/A	N/A	N/A	ND 0.0012 U	ND 0.0012 U	ND 0.00095 U	ND 0.0012 U	ND 0.0010 U	ND 0.0010 U	ND 0.0012 U
NMeFOSAA	NE	N/A	N/A	N/A	N/A	ND 0.0012 U	ND 0.0012 U	ND 0.00095 U	ND 0.0012 U	ND 0.0010 U	ND 0.0010 U	ND 0.0012 U
PFBS	1.9	N/A	N/A	N/A	N/A	ND 0.00055 U	ND 0.00055 U	ND 0.00048 U	ND 0.00055 U	ND 0.00050 U	ND 0.00050 U	ND 0.00055 U
PFHxS	0.13	N/A	N/A	N/A	N/A	ND 0.00055 U	ND 0.00055 U	ND 0.00048 U	ND 0.00055 U	ND 0.00050 U	ND 0.00050 U	ND 0.00055 U
PFBA	7.8	N/A	N/A	N/A	N/A	ND 0.00055 U	ND 0.00055 U	ND 0.00048 U	ND 0.00055 U	ND 0.00050 U	ND 0.00050 U	ND 0.00055 U
PFDA	NE	N/A	N/A	N/A	N/A	ND 0.00055 U	ND 0.00055 U	ND 0.00048 U	ND 0.00055 U	ND 0.00050 U	ND 0.00050 U	ND 0.00055 U
PFDoA	NE	N/A	N/A	N/A	N/A	ND 0.00055 U	ND 0.00055 U	ND 0.00048 U	ND 0.00055 U	ND 0.00050 U	ND 0.00050 U	ND 0.00055 U
PFHpA	NE	N/A	N/A	N/A	N/A	ND 0.00055 UJ	ND 0.00055 U	ND 0.00048 U	ND 0.00055 U	ND 0.00050 U	ND 0.00050 U	ND 0.00055 U
PFHxA	3.2	N/A	N/A	N/A	N/A	ND 0.00055 U	ND 0.00055 U	ND 0.00048 U	ND 0.00055 U	ND 0.00050 U	ND 0.00050 U	ND 0.00055 U
PFNA	0.019	N/A	N/A	N/A	N/A	ND 0.00055 U	ND 0.00055 U	ND 0.00048 U	ND 0.00055 U	ND 0.00050 U	ND 0.00050 U	ND 0.00055 U
PFOA	0.019	ND 0.00034 QL	ND 0.00037 QL	ND 0.00039	ND 0.00055	ND 0.00055 U	ND 0.00055 U	ND 0.00048 U	ND 0.00055 U	ND 0.00050 U	ND 0.00050 U	ND 0.00055 U
PFPeA	NE	N/A	N/A	N/A	N/A	ND 0.00055 U	ND 0.00055 U	ND 0.00048 U	ND 0.00055 U	ND 0.00050 U	ND 0.00050 U	ND 0.00055 U
PFTeDA	NE	N/A	N/A	N/A	N/A	ND 0.00055 U	ND 0.00055 U	ND 0.00048 U	ND 0.00055 U	ND 0.00050 U	ND 0.00050 U	ND 0.00055 U
PFTrDA	NE	N/A	N/A	N/A	N/A	ND 0.00055 U	ND 0.00055 U	ND 0.00048 U	ND 0.00055 U	ND 0.00050 U	ND 0.00050 U	ND 0.00055 U
PFUnA	NE	N/A	N/A	N/A	N/A	ND 0.00055 U	ND 0.00055 U	ND 0.00048 U	ND 0.00055 U	ND 0.00050 U	ND 0.00050 U	ND 0.00055 U
PFOS	0.013	ND 0.00033 QL	ND 0.00036 QL	**0.0055 QL**	**0.0029**	**0.00083 J**	**0.0010 J**	**0.00055 J**	ND 0.00055 U	ND 0.00050 U	**0.0010**	ND 0.00055 U

Notes
For definitions, refer to the Acronyms and Abbreviations section of the Work Plan and the analyte list included with this attachment.
Bold text denotes a positive detection at a concentration less than the EPA RSL (EPA 2023) (target risk=1×10^{-6} and HQ=0.1).
J = The analyte was positively identified; however the associated numerical value is an estimated concentration only.
N/A = analytes not sampled for
ND = non-detect
QL = result considered a low estimate due to QC failure.
U = The analyte was analyzed for but was not detected above the limit of quantitation.
[1] DoD PFAS 101 webpage *Regional Screening Levels Used in DoD Cleanups* (https://www.acq.osd.mil/eie/eer/ecc/pfas/pfas101/rsl.html) (DoD 2024).

Table A-3 Previous PFAS Groundwater Results for the HFT Site

	AREA	FORMER ADMINISTRATIVE AREA					FORMER TANK FARM AREA						FORMER FUEL TERMINAL DOCK AREA
	LOCATION	Firehouse Office, Shop, and Garage Building 1212	Firehouse Office, Shop, and Garage Building 1212 & Fire Pump Building 1208	Hose Cart Building 1209 & Fire Pump Building 1208	Fire Hose Building 1203		Fire Foam Building 1231/Tank Farm Fire Foam System						Marine Dock Fire Hose Building 1236 & Dockmaster Building 1234
	MONITORING WELL	AP-148	AP-009	AP-006	AP-146	AP-114	AP-534	AP-533	AP-515	AP-207	AP-137	AP-137	AP-153
	SAMPLE ID	HFT-AP-148-061122	HFT-AP-009-061222	HFT-AP-006-061222	HFT-AP-146-061222	HFT-AP-114-061222	HFT-AP-534-061122	HFT-AP-533-061222	HFT-AP-515-061222	HFT-AP-207-061122	HFT-AP-137-061122	HFT-FD-1-GW-061122	HFT-AP-153-061322
ANALYTE	**CURRENT DOD-APPROVED RSL (ng/L)[1]**	**RESULT (ng/L)**	**RESULT (ng/L)**	**RESULT (ng/L)**	**RESULT (ng/L)**	**RESULT (ng/L)**	**RESULT (ng/L)**	**RESULT (ng/L)**	**RESULT (ng/L)**	**RESULT (ng/L)**	**RESULT (ng/L)**	**RESULT (ng/L)**	**RESULT (ng/L)**
8:2 FTS	NE	ND 4.4 U	ND 9.5 UJ-	ND 4.9 UJ	ND 4.5 U	R	ND 4.1 U	ND 6.5 UJ-	ND 4.2 U	ND 11 UJ-	ND 4.5 U	ND 4.2 U	ND 4.7 U
6:2 FTS	NE	ND 4.4 U	ND 9.5 UJ-	ND 4.9 UJ	**5.5 J**	**23 J-**	ND 4.1 U	ND 6.5 UJ-	ND 4.2 U	ND 11 UJ-	ND 4.5 U	ND 4.2 U	ND 4.7 U
NEtFOSAA	NE	ND 4.4 U	ND 9.5 UJ-	ND 4.9 UJ	ND 4.5 U	R	ND 4.1 U	ND 6.5 UJ-	ND 4.2 U	ND 11 UJ-	ND 4.5 U	ND 4.2 U	ND 4.7 U
NMeFOSAA	NE	ND 4.4 U	ND 9.5 UJ-	ND 4.9 UJ	ND 4.5 U	ND 17 UJ-	ND 4.1 U	ND 3.3 UJ-	ND 4.2 U	ND 11 UJ-	ND 4.5 U	ND 4.2 U	ND 4.7 U
PFBS	600	ND 2.2 U	ND 4.7 UJ-	ND 2.5 UJ	ND 2.2 U	ND 8.5 UJ-	ND 2.1 U	ND 3.3 UJ-	ND 2.1 U	ND 5.0 UJ-	ND 2.2 U	ND 2.1 U	ND 2.3 U
PFHxS	39	**45**	**9.7 J-**	ND 2.5 UJ	ND 2.2 U	**16 J-**	ND 2.1 U	ND 3.3 UJ-	ND 2.1 U	**7.1 J-**	**3.0 J**	**3.1 J**	ND 2.3 U
PFBA	1800	ND 2.2 U	ND 4.7 UJ-	ND 2.5 UJ	ND 2.2 U	ND 8.5 UJ-	ND 2.1 U	ND 3.3 UJ-	ND 2.1 U	ND 5.0 UJ-	ND 2.2 U	ND 2.1 U	ND 2.3 U
PFDA	NE	ND 2.2 U	ND 4.7 UJ-	ND 2.5 UJ	ND 2.2 U	ND 8.5 UJ-	ND 2.1 U	ND 3.3 UJ-	ND 2.1 U	ND 5.0 UJ-	ND 2.2 U	ND 2.1 U	ND 2.3 U
PFDoA	NE	ND 2.2 U	ND 4.7 UJ-	ND 2.5 UJ	ND 2.2 U	R	ND 2.1 U	ND 3.3 UJ-	ND 2.1 U	ND 5.0 UJ-	ND 2.2 U	ND 2.1 U	ND 2.3 U
PFHpA	NE	ND 2.2 U	ND 4.7 UJ-	ND 2.5 UJ	ND 2.2 U	ND 8.5 UJ-	ND 2.1 U	ND 3.3 UJ-	ND 2.1 U	ND 5.0 UJ-	ND 2.2 U	ND 2.1 U	ND 2.3 U
PFHxA	990	ND 2.2 U	ND 4.7 UJ-	ND 2.5 UJ	ND 2.2 U	ND 8.5 UJ-	ND 2.1 U	ND 3.3 UJ-	ND 2.1 U	ND 5.0 UJ-	ND 2.2 U	ND 2.1 U	ND 2.3 U
PFNA	5.9	ND 2.2 U	ND 4.7 UJ-	ND 2.5 UJ	ND 2.2 U	ND 8.5 UJ-	ND 2.1 U	ND 3.3 UJ-	ND 2.1 U	ND 5.0 UJ-	ND 2.2 U	ND 2.1 U	ND 2.3 U
PFOA	6.0	ND 2.2 U	ND 4.7 UJ-	ND 2.5 UJ	ND 2.2 U	ND 8.5 UJ-	ND 2.1 U	ND 3.3 UJ-	ND 2.1 U	ND 5.0 UJ-	ND 2.2 U	ND 2.1 U	ND 2.3 U
PFPeA	NE	ND 2.2 U	ND 4.7 UJ-	ND 2.5 UJ	ND 2.2 U	ND 8.5 UJ-	ND 2.1 U	ND 3.3 UJ-	ND 2.1 U	ND 5.0 UJ-	ND 2.2 U	ND 2.1 U	ND 2.3 U
PFTeDA	NE	ND 2.2 U	ND 4.7 UJ-	ND 2.5 UJ	ND 2.2 U	R	ND 2.1 U	ND 3.3 UJ-	ND 2.1 U	ND 5.0 UJ-	ND 2.2 U	ND 2.1 U	ND 2.3 U
PFTrDA	NE	ND 2.2 U	ND 4.7 UJ-	ND 2.5 UJ	ND 2.2 U	R	ND 2.1 U	ND 3.3 UJ-	ND 2.1 U	ND 5.0 UJ-	ND 2.2 U	ND 2.1 U	ND 2.3 U
PFUnA	NE	ND 2.2 U	ND 4.7 UJ-	ND 2.5 UJ	ND 2.2 U	ND 8.5 UJ-	ND 2.1 U	ND 3.3 UJ-	ND 2.1 U	ND 5.0 UJ-	ND 2.2 U	ND 2.1 U	ND 2.3 U
PFOS	4.0	**270**	**43 J-**	ND 2.5 UJ	ND 2.2 U	**87 J-**	ND 2.1 U	ND 3.3 UJ-	**2.9 J**	ND 5.0 UJ-	ND 2.2 U	ND 2.1 U	ND 2.3 U

Notes

For definitions, refer to the Acronyms and Abbreviations section of the Work Plan and the analyte list included with this attachment.

Bold text denotes a positive detection at a concentration less than the EPA RSL (EPA 2023) (target risk=1×10^{-6} and HQ=0.1).

Bold text denotes a positive detection at a concentration greater than the EPA RSL (EPA 2023) (target risk=1×10^{-6} and HQ=0.1).

Orange shaded box denotes LOD above OSD RSL.

J = The analyte was positively identified; however the associated numerical value is an estimated concentration only.

ND = non-detect

R = The sample results were affected by serious deficiencies and the result was rejected.

U = The analyte was analyzed for but was not detected above the limit of quantitation.

UJ = The analyte was analyzed for but not detected. The limit of quantitation is approximate and may be inaccurate or imprecise.

[1] DoD PFAS 101 webpage *Regional Screening Levels Used in DoD Cleanups* (https://www.acq.osd.mil/eie/eer/ecc/pfas/pfas101/rsl.html) (DoD 2024).

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APPENDIX I
RESPONSE TO COMMENTS

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THE STATE of ALASKA
GOVERNOR MIKE DUNLEAVY

Department of Environmental Conservation

DIVISION OF SPILL PREVENTION AND RESPONSE
Contaminated Sites Program

Post Office Box 1542
Haines, Alaska 99827
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dec.alaska.gov

File No. 1508.38.002

June 28, 2024

Via Electronic Mail Only
Mr. Peter Baker
1060 Gaffney Road, #4500
Fort Wainwright, AK 99703-4500

Re: *Draft-Final PFAS Remedial Investigation Work Plan*
Haines Fuel Terminal, Haines, Alaska

Dear Mr. Baker:

The Alaska Department of Environmental Conservation (DEC) has received and reviewed the *Draft-Final PFAS Remedial Investigation Work Plan* for the Haines Fuel Terminal, prepared by Brice Environmental Services Corporation, and dated June 2024. This red line/strikeout version of the work plan satisfactorily resolves all of DEC's comments on the previous version with the exception of Ted Wu's comment #3. Comment #3 addresses the identification of appropriate screening values for the surface water seep samples in the case that any per- and poly-fluoroalkyl substances (PFAS) are detected.

I recognize that your contractor is preparing to conduct field activities beginning July 8th and we believe that resolution of Comment #3 is not critical in relation to the timing of the field activities. Therefore, I hereby approve this work plan in accordance with 18 Alaska Administrative Code (AAC) 75.335(d), with the provision that Comment #3 is resolved to our satisfaction prior to the end of the summer.

If you have any questions regarding this site, please contact me at 907.766.3184, or annemarie.palmieri@alaska.gov.

Sincerely,

Anne Marie Palmieri
Environmental Program Manager

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REVIEW COMMENTS			
PROJECT: Haines Fuel Terminal			**DOCUMENT:** Draft PFAS RI Work Plan
DATE: 4/30/24			**REVIEWER:** Anne Marie Palmieri **PHONE:** (907) 766-3184
Item No.	**Location (page, par., sen.)**	**Comment**	**Response**
1.	Section 1.3 & Worksheet 15	PFAS toxicity values are changing frequently. Please use the most current screening levels from the EPA RSL for the PSLs and most current toxicity values for the risk assessment. Suggested revision to the work plan is inclusion of a sentence stating that the most current values at the time of the development of the report will be used. June 2024: Accepted.	Accepted. A sentence has been incorporated that identifies that updates to the EPA RSLs that occur prior to reporting will be incorporated into the PSLs and toxicity levels as appropriate and with DoD approval. Any differences from this work plan will be summarized as part of the report.
2.	Section 1.3, para 5	The alternative cleanup levels approved in 2001 were rescinded in December 2016 and, thus, should not be used. Please let me know if you need a copy of the 2016 letter. June 2024: Accepted.	Accepted. This paragraph has been removed.
3.	Section 2.2.4	Although the perched aquifers at the site are not likely sources of drinking water due to low yield, this exposure pathway needs to be retained unless the Army determines that an institutional control prohibiting that use can be placed on the site. June 2024: Accepted.	Acknowledged. This section is intended to describe the disposition and use of groundwater in the area. Groundwater is being assessed as an exposure pathway and is retained.
4.	Section 3.1.16	Please add a sentence that the 2001 ACLs were subsequently rescinded and the default 18 AAC 75.341, Tables B1 and B2, most stringent exposure pathway values were used as screening values in the 2020 Remedial Investigation. June 2024: Accepted.	Accepted. Included that alternative cleanup levels were subsequently rescinded in December 2016 by ADEC, as a result cleanup levels default to the most stringent exposure pathway values from 18 AAC 75.341 Tables B1 and B2 for soil and groundwater cleanup levels identified in 18 AAC 75.345 Table C.
5.	Section 3.1.17	The RI was completed in 2020, not 2017. Suggest change in dates and include a sentence about approval in 2020. June 2024: Accepted.	Accepted. The timeline of 2015-2017 is intended to reflect the active field efforts. To keep in line with the formatting of this section, the dates have not been changed. A sentence has been included to identify the approval of the RI report in 2020.

REVIEW COMMENTS			
PROJECT: Haines Fuel Terminal			**DOCUMENT:** Draft PFAS RI Work Plan
DATE: 4/30/24			**REVIEWER:** Anne Marie Palmieri **PHONE:** (907) 766-3184
Item No.	**Location (page, par., sen.)**	**Comment**	**Response**
6.	Section 3.3 and Appendix A	Human Health CSM: The future residential use scenario needs to be retained unless the Army proposes to remove this scenario and determines that an institutional control prohibiting that use can be placed on the site. Note: the CSM in the draft risk assessment includes the future residential scenario. It's unclear why two different CSMs were created. June 2024: Accepted.	Response. The CSM was completed based on current information, that residential development is prohibited throughout most of the site based on zoning restrictions. This currently means that future residential development is not reasonably anticipated. The Baseline Risk Assessment will assess a hypothetical residential land use scenario along with the more reasonably anticipated land use scenario assessed by the CSM. The Baseline Risk Assessment will be used to inform management decisions for the range of possible outcomes between the most realistic human receptors (future industrial workers) and most sensitive receptors (hypothetical future child residents). Future CSMs will be revised as needed to reflect reasonably anticipated land use receptors.
7.	Section 4.3.4 and throughout	Please note that the EPA Method 1633 has now been finalized. It will take some time for labs to gain ELAP or NELAP approval and DEC approval. If labs have gained approval by Mobilization 2, the final method should be used rather than the draft method. Include a sentence to this effect in the appropriate sections. June 2024: Accepted.	Accepted. A statement has been included globally that Method 1633 was finalized in January 2024; the final version of the method will be used if the selected laboratory receives method accreditation. It was confirmed that both Pace and the backup laboratory are currently performing the draft method. Brice will remain in contact with the laboratories and notify USACE if and when the laboratory begins performing the final method.
8.	Section 4.4.1	DEC requests that permanent wells are installed south of Lutak Road rather than temporary wells. It is acknowledged that there may be some overarching rationale for temporary wells due to ADOT&PF concerns. June 2024: Accepted.	Response. Due to the potential concerns related to storm/tidal impacts and ADOT&PF these wells will be installed as temporary wells as described in the Work Plan during Mobilization 1. The decision to complete these wells as permanent wells or decommission them will be made prior to Mobilization 2 after assessing the concerns related to storm/tidal impacts and ADOT&PF, and after reviewing the Mobilization 1 data. Recommendations for these monitoring wells will be provided in the Work Plan Addendum. Section 4.4.3 will be maintained in the event Mobilization 2 efforts result in the installation of temporary monitoring wells.

REVIEW COMMENTS			
PROJECT: Haines Fuel Terminal			**DOCUMENT:** Draft PFAS RI Work Plan
DATE: 4/30/24			**REVIEWER:** Anne Marie Palmieri **PHONE:** (907) 766-3184
Item No.	**Location (page, par., sen.)**	**Comment**	**Response**
9.	Section 4.4.2	The wells inside the fence line are proposed to be completed as flush mounts. Given the high grasses and plants, I suggest that the wells have an above ground casing for ease of future locating. June 2024: Accepted.	Accepted. Wells within the fence line will be completed as stick-up monitoring wells.
10	Section 4.5	As the surface water and sediment sample locations are going to be determined in the field, I would like the opportunity to be on site and participate in those discussions as well as observe the sample collection. June 2024: Accepted. Per my 6/18/24 email, I am available during the projected sampling period for the 7/8 9:30am low tide cycle.	Response. ADEC will be kept apprised of the field schedule and estimated timeframe for collecting the surface seep and sediment samples. Due to the limited timeframe to complete this work it may be necessary to proceed without ADEC onsite if ADEC is unavailable during the tidal window. Photo documentation will be collected, and the process will be detailed in the report. June 2024 Response: Understood, the field team will coordinate to meet onsite on 7/8/24.

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DATE: 4/30/24			**REVIEWER:** Anne Marie Palmieri **PHONE:** (907) 766-3184
Item No.	**Location (page, par., sen.)**	**Comment**	**Response**
11	Section 4.10.2	The IDW water should be sampled and determined to meet the appropriate PSLs prior to discharge. The DEC Field Sampling Guidance references GAC breakthrough calculations for petroleum, not for PFAS. If the analytical results for mobilization 1 show that the post-GAC treated water meets the PSLs, then DEC will be amenable to discharging IDW without sampling during the mobilization 2 activities. June 2024: DEC determines appropriate handling of IDW on a site specific basis; decisions made on one site cannot be applied to another site. For the purposes of this workplan, DEC will allow the discharge of post-treatment IDW to be discharged onsite, without sampling with the following stipulations: • The 15-gallon GAC treatment system contains either new or newly refreshed (e.g., previously unused) GAC; • IDW is processed through the treatment system at a slow rate to allow for a sufficient residence time for the GAC to fully absorb any PFAS present; • The water from the Former Administration Area is discharged near AP-148 (the well with this highest known concentration and furthest away from surface water) in a manner that allows the water to infiltrate the ground fully and does not run across the ground surface; • The water from the Former Tank Farm Area is discharged near AP-137 (the location furthest away from surface water) in a manner that allows the water to infiltrate the ground fully and does not run across the ground surface; and • A sample of post-treatment IDW is collected prior to discharge at the Former Administration Area.	Response. GAC is a proven method for removing PFAS from water, including drinking water and the calculations in Appendix G consider PFAS specific parameters when calculating breakthrough. In addition, a conservative safety factor of 50% was built into these calculations. During Mobilization 1, we estimated a conservative maximum volume of purge and decontamination water of 1,400 gallons (60 gallons of water generated per monitoring well sampled), which is only 2% of the calculated volume of water that could be treated with the 15-gallon GAC system. This level of conservatism has been proposed to avoid storing wastewater onsite between mobilizations and eliminates the need to transport 20+ 55-gallon drums to and from Haines. The calculations in Appendix G follow the Freundlich method, which was chosen for the following reasons: 1. It is the most used model to describe the adsorption characteristics of the activated carbon used in water and wastewater treatment. 2. As ADEC does not have any PFAS IDW water treatment guidance, the available federal guidance documents were used. The Freundlich method is described throughout the U.S. Army Corps of Engineers (USACE) *Adsorption Design Guide* and is supported by U.S. Environmental Protection Agency (EPA) documentation and testing. Per the *Adsorption Design Guide* the EPA listed Freundlich constants may be used for an order-of-magnitude carbon usage estimate or for determining the feasibility of GAC adsorption. 3. The Freundlich method was the method chosen for determining the carbon system sizing for individual home drinking water systems for residents impacted by PFAS in the Moose Creek, Alaska area (Final Moose Creek Water Treatment Work Plan Eielson Air Force Base, Alaska). Given ADEC's level of concern for PFAS this method

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DATE: 4/30/24			**REVIEWER:** Anne Marie Palmieri **PHONE:** (907) 766-3184
Item No.	**Location (page, par., sen.)**	**Comment**	**Response**
			was identified as having preference based on State of Alaska approval. Based on a review of available Work Plans, ADEC has accepted that GAC can treat PFAS-contaminated IDW water. For example: • Per the Gustavus Airport PFAS Site Characterization Work Plan, regarding GAC treatment the IDW section states that, "*Development and purge water from temporary well points and monitoring wells will be treated with GAC and disposed of to the ground surface.*" • Per the AVAGS Hill Phase III Remedial Investigation Work Plan the Waste Handling section states, "*Decontamination/purge water may be treated onsite using a granular activated carbon filter drum prior to discharge onsite*". The Work Plan will be updated to include the collection of a post-GAC treatment water sample, which will be collected at the conclusion of the water treatment activities at the end of Mobilization 1. The Work Plan will also state that the post-GAC treated water will be discharged next to monitoring well AP-148 where the highest levels of PFAS contamination have been detected in groundwater. June 2024 Response: Agreed. The Work Plan has been updated to specify these stipulations. Per the email dated 6/19/24 from ADEC, it is acceptable to discharge the IDW water from the former Tank Farm Area near well AP-148 where that GAC system will be staged.
12	Figures 6 & 7	The May 2024 EPA RSLs are anticipated to be lower than the proposed PSLs. DEC suggests that the Army consider the placement of sample locations using those values. June 2024: Accepted.	Accepted. It is not anticipated that the updated May 2024 EPA RSLs will result in changes to the mobilization 1 efforts and proposed locations. However, once DoD approves the use of the May 2024 EPA RSLs, the existing PFAS data will be rescreened to determine if potential data gaps arise.

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PROJECT: Haines Fuel Terminal			**DOCUMENT:** Draft PFAS RI Work Plan
DATE: 4/30/24			**REVIEWER:** Anne Marie Palmieri **PHONE:** (907) 766-3184
Item No.	**Location (page, par., sen.)**	**Comment**	**Response**
13	Table 14-1	The scheduled dates for mobilization 2 are 11/23 – 12/5. I recommend that the schedule is moved up if possible. In years past at that time of year, snow depth would have caused access issues. June 2024: Accepted.	Response. Mobilization 2 is dependent on the turnaround of sample results from the laboratory, review, and approval of additional boring and monitoring well locations (Work Plan Addendum). It may not be feasible to adjust the mobilization date earlier. Conditions can be assessed as mobilization 2 efforts near and if necessary, can be adjusted to Spring 2025, with concurrence from USACE and the Army.
14	Worksheet 19/30	This worksheet shows Pace-TN's accreditation credentials as expired. They are currently approved and the current approvals are included in Appendix F. The date on the worksheet needs to be updated. June 2024: Accepted.	Accepted. Date has been corrected. Note that in general certificates are set to expire during the performance of work. Updated certificates will be obtained from the laboratories as they become available. In the rare event that the laboratory does not receive updated certificates USACE will be immediately notified, and a backup laboratory will be utilized.
15	App. B, Section 2.4.2, para 2	Sentence 1 states, "Groundwater at the HFT is not currently, previously, nor reasonably anticipated to be a future drinking water source…and drinking water is acquired from a readily available surface water source". As there aren't current users of HFT, I suggest that this is revised to read, "…water could be acquired…". June 2024: Accepted.	Accepted. The first sentence of the second paragraph of Section 2.4.2 of Appendix B will be revised to: "Groundwater at the HFT is not currently, previously, nor reasonably anticipated to be a future source of drinking water since it occurs in discontinuous lenses with poor transmissivity and storativity, and drinking water could be acquired from a readily available surface water source."
16	App. B. Section 2.4.2, para 2	Suggest removing "current" occupants as the HFT currently does not have any residents or workers present. The Alaska State Ferry Terminal is located north of the HFT on a non-adjacent parcel. June 2024: Accepted.	Accepted. The second sentence of the second paragraph of Section 2.4.2 of Appendix B will be revised as follows to remove the reference to 'future' occupants: "For these reasons, future occupants are unlikely to install, utilize, and maintain drinking water wells in favor of alternate, readily available surface water."

REVIEW COMMENTS			
PROJECT: Haines Fuel Terminal			**DOCUMENT:** Draft PFAS RI Work Plan
DATE: 4/30/24			**REVIEWER:** Anne Marie Palmieri **PHONE:** (907) 766-3184
Item No.	**Location (page, par., sen.)**	**Comment**	**Response**
17	App. B, Section 5.2	Ecoscoping of the Tanani Bay marine environment should be conducted. June 2024: DEC would like to discuss the Army's next steps if PFAS is detected in the seeps.	Response. Please note that there is currently no confirmation that the seeps between the Administrative Area and Tanani Bay provide potential migration pathways for PFAS contamination into the marine environment. However, if the PFAS RI determines that one or more PFAS compounds are present in the seeps at detectable concentrations, the Ecoscoping Form will be updated accordingly, and the surface water exposure pathway will be identified as needed. June 2024 Response: The U.S. Army requests provisional approval of the Work Plan pending this discussion.
18	App. B, Section 6.0, para 5	See comments 15 and 16 for editorial suggestions. June 2024: Accepted.	Accepted. Text in the fifth paragraph of Section 6.0 of Appendix B will be revised as suggested in Comments 15 and 16 to: "Groundwater at the HFT is not currently, previously, nor reasonably anticipated to be a future source of drinking water since it occurs in discontinuous lenses with poor transmissivity and storativity, and drinking water could be acquired from a readily available surface water source. For these reasons, future occupants are unlikely to install, utilize, and maintain drinking water wells in favor of alternate, readily available surface water. Uncertainties associated with the inclusion of the groundwater pathway will be described in the HHERA report."
19		---end---	
20			

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PROJECT: Haines Fuel Terminal

REVIEW COMMENTS **DOCUMENT: PFAS Remedial Investigation Work Plan Haines, Alaska April 2024**

Alaska Department of Environmental Conservation	**DATE: 04/29/24** **REVIEWER: ADEC Wu, Ted** **PHONE: 907-451-4869**	**Action taken on comment by: Brice Environmental Corporation and Stantec Consulting Services Inc.**

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
1.	General	Precursors at AFFF sites have been shown to account for a large percentage of targeted terminal PFAS concentrations after oxidation of samples. Understanding the factors affecting the long-term transformation of precursors is important in predicting PFAS plume development and characterization, and risk necessary for site management. Analytical method with total oxidizable precursors (TOP) can provide useful information into level of target PFAS with and without TOP assay, thus worth considering in addressing some of the uncertainties associated with transformation.	Response	Acknowledged. For the remedial investigation (RI) phase, the incorporation of TOP would not provide added benefit. Generally, this analysis is better implemented to support pilot studies/remedial actions to determine overall destruction and transformation of PFAS and fluorine mass balance. In addition, TOP do not have regional screening levels (RSLs) that can be used to evaluate actionable human health risk.	Acknowledged no change required in the report as the information is captured in the comment table. Clarification on the usability response provided. TOP assay would give updated target PFAS concentrations some of which do contain regional screening levels (RSLs) that can be used to evaluate actionable human health risk. June 2024 Response: Acknowledged.
2.	Pg 1-3 Sec. 1.3	Given the routine updates occurring with PFAS, some language should be included for incorporating updates that may have occurred prior to the time of report writing for comparison of data set to the PSL and toxicity values used in the assessment. EPA RSL updates are occurring in May 2024 and on a biannual cycle.	A	Accepted. Language will be included for the incorporation of updates that may occur prior to reporting for comparison of data set to the PSL and toxicity values used in the assessment.	A

Alaska Department of Environmental Conservation	DATE: 04/29/24 REVIEWER: ADEC Wu, Ted PHONE: 907-451-4869	Action taken on comment by: Brice Environmental Corporation and Stantec Consulting Services Inc.

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
		The DoD memo does state, "in anticipation of changes and additions to RSLs, DoD will maintain future updates or additions to existing PFAS-related RSLs on its PFAS website at: https://www.acq.osd.mil/eie/eer/ecc/pfas/tf/policies.html instead of updating this memo".			
3.	Pg 1-3 Sec. 1.3	Surface water body discussion is not included in the regulatory framework but seeps discharging into the marine surface water body are being collected. Please provide information on how the data is being evaluated. At a minimum screening value should be compared with the sampling effort. The following report below presents ecological screening values that have been developed to support screening-level ecological risk assessments at U.S. Air Force, Navy, Army, and other U.S. Department of Defense sites where per- and polyfluorinated alkyl substances have been detected in soils and surface waters.	Partial Acceptance	Accepted. Surface seep sampling and sediment sampling have been included in the section. The goal of this sampling is for the identification of the presence or absence of PFAS as it relates to the groundwater to surface water pathway. Acknowledged. Due to sampling being limited to the surface seeps, sampling is evaluating the potential groundwater to surface water pathway. Incorporation of screening levels from the Derivation of PFAS Ecological Screening Values do not fit with the goal of the sampling to be conducted.	DEC was providing relevant screening values for marine surface water screening values for the next step if there are detections with the results. DEC would like to discuss what the Army's next steps will be to evaluate the pathway if there are PFAS detections in the seep water. June 2024 Response: Understood. U.S. Army requests provisional approval of the Work Plan pending discussion regarding the next steps if PFAS is detected in the seep water. August 2024 Response:

Alaska Department of Environmental Conservation	DATE: 04/29/24 REVIEWER: ADEC Wu, Ted PHONE: 907-451-4869	Action taken on comment by: Brice Environmental Corporation and Stantec Consulting Services Inc.

Item No.	Drawing Sheet No., Spec. Para.	COMMENTS	REVIEW CONFERENCE A - comment accepted W - comment withdrawn (if neither, explain)	CONTRACTOR RESPONSE	RESPONSE ACCEPTANCE (A-AGREE) (D-DISAGREE)
		-Derivation of PFAS Ecological Screening Values M. Grippo, J. Hayse, I. Hlohowskyj, and K. Picel Environmental Science Division Argonne National Laboratory Sept 2021			Per the meeting held on 28 August 2024 between U.S. Army, USACE, ADEC, and USACE Contractors the next steps regarding the groundwater to surface water pathway will be addressed in the Risk Assessment Report through a qualitative comparison of the seep water sample results to the Grippo et al freshwater and marine surface water Ecological Screening Values (ESVs). Meeting minutes from that meeting are included in this Appendix.
4.	**Draft Risk Assessment Work Plan**				
5.	Pg 1 sec 1.1	"The PFAS RI risk assessment will also include an evaluation of cumulative risks from potential human and ecological exposures to PFAS and non-PFAS compounds." Please provide more descriptive information on the process and presentation for the proposed report for	A	Accepted. Please note Section 4.4.2 of Appendix B specifies "In addition, risks estimated for potential exposure to PFAS COPCs will be summed with risks presented for non-PFAS COPCs in the RI Report (Bristol and North Wind 2020)."	A

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		the non-PFAS compounds as "evaluation" can entail several paths.		For clarity, the sentence referenced in Section 1.1 of Appendix B has been revised to: "The PFAS RI risk assessment will also evaluate potential cumulative risks from PFAS and non-PFAS compounds (Section 4.4.2)."	
6.	Pg 11 sec. 4.1	Please also note that pfas constituents with detection but no reliable screening value will also be qualitatively evaluated in the PFAS HHRA.	A	Accepted. The following text has been added after the first sentence of the last paragraph of Section 4.1: "If a human health screening level is not available for a detected constituent, the constituent will be identified as a COPC and qualitatively evaluated in the PFAS HHRA." In addition, the following sentence has been deleted from the first paragraph of Section 4.1: "PFAS constituents that exceed screening levels will be carried through the HHRA process."	A
7.	Pg 11 sec. 4.1	Please include table 2.1 from Risk Assessment Guidance for Superfund (RAGS): Volume I - Human Health Evaluation Manual (Part D, Standardized	Response	Acknowledged. Data summary and COPC screening tables that include information similar to the information included in Table 2.1	A

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		Planning, Reporting and Review of Superfund Risk Assessments) for documentation on the COPC process for transparency. See link @ https://semspub.epa.gov/src/document/HQ/175137 Table proves a summary of the information used in the COPC selection for the reader in a central location. The information is also useful in the future for any five-year review process.		from RAGS Part D will be included in the HHERA Report for each exposure area and medium evaluated.	

TABLE 2.1
OCCURRENCE, DISTRIBUTION, AND SELECTION OF CHEMICALS OF POTENTIAL CONCERN
Site Name

Scenario Timeframe:
Medium:
Exposure Medium:

Exposure Point	CAS Number	Chemical	Minimum Concentration (Qualifier) (1)	Maximum Concentration (Qualifier) (1)	Units	Location of Maximum Concentration	Detection Frequency	Range of Detection Limits	Concentration Used for Screening (2)	Background Value (3)	Screening Toxicity Value (NC) (4)	Potential ARAR/TBC Value	Potential ARAR/TBC Source	COPC Flag (Y/N)	Rationale for Selection or Deletion (5)

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8.	Pg 11 sec. 4.2	"There are no perennial surface waterbodies present at the site. Although groundwater seeps are present, the seeps are intermittent/seasonal and/or of low flow (Bristol and North Wind 2020)." The statement is not reflective of the site information from figure 1 as Tanani Bay is a permanent (e.g., perennial) and adjacent to the site. Please ensure statement is reflective of the site information. Samples are being collected for the seeps discharging into the bay and can be compared with relevant screening values. The following sources do contain limited PFAS (PFOS and PFOA) for marine surface water. -Derivation of PFAS Ecological Screening Values M. Grippo, J. Hayse, I. Hlohowskyj, and K. Picel Environmental Science Division Argonne National Laboratory Sept 2021	A	Accepted. The first sentence of Section 4.2.1.1 has been revised to: "There are no perennial surface waterbodies present within the HFT." Please refer to response to Comment 3 above.	A

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9.	Pg. 12 sec. 11.	"Typical activities include berry picking, harvesting of seaweed, harvesting of clams and mussels, fishing, harvesting of crabs, as well as duck and moose hunting. However, upland terrestrial game species that are potentially used for subsistence purposes are expected to find more desirable habitat in areas surrounding the site (Bristol and North Wind 2020)." The statement only provides information for upland terrestrial game species for the moose consumption pathway. Supporting information for the other resource pathways being off ramp is not documented for the decision making. Please include documentation on the reasoning for the other resource for exclusion. Would the "current and future adult and adolescent recreational users" include some of these resources in the exposure assessment pathways that still would be protective under the future industrial assumptions? Comment also applies to the CSM 4-1.	A	Accepted. The end of the first paragraph of Section 4.2.1.2 has been revised as follows: "However, there is currently no confirmation that the seeps between the Administrative Area and Tanani Bay provide potential migration pathways for PFAS contamination into the marine environment, it is unlikely that contamination from the HFT PFAS RI AOPIs extends beyond the fenced area of the HFT where individuals have been observed conducting subsistence harvesting (Attachment A-1 of the PFAS RI Work Plan), and upland terrestrial game species that are potentially used for subsistence purposes are expected to find more desirable habitat in areas surrounding the site (Bristol and North Wind 2020)." In regard to the potential for recreational exposures to off-site aquatic resources, please refer to	A

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				our responses to Comments 3 and 13.	
10.	Pg 22	In the ecoscoping documentation it would be worth including soil benchmarks in "5. Toxicity benchmark levels" from Derivation of PFAS Ecological Screening Values M. Grippo, J. Hayse, I. Hlohowskyj, and K. Picel Environmental Science Division Argonne National Laboratory Sept 2021. None of the current soil samples exceed. Values are provided in Table 3-7	Response	Acknowledged. Please note the Ecoscoping Form was not filled in for scoping factors 4 or 5 (contaminant quantity and toxicity determination), because the off-ramp was taken during scoping factor 3 (habitat), which is consistent with the RI and Ecoscoping Guidance (ADEC 2014).	Prior scoping forms from report "Former Haines Fuel Terminal RI June 2020" did not off ramp on habitat for any sites on HFT with summary information captured in Table 17.2-1. Ecoscoping form included the following: "Birds observed at the overall HFT site include bald eagles, crows, ravens, magpies, gray jays, Steller's Jays, and other passerines. There is sufficient habitat throughout and adjacent to the HFT to support bird presence, although more attractive and well-developed habitat is located off site. Bald eagles are piscivorous and unlikely to obtain significant resources from terrestrial sources, but other observed bird species may potentially utilize terrestrial food resources

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		TABLE 3-6 Summary of Results and Data Gaps fo			(invertebrates and plants) at the HFT and in association with the AP-104 Containment Source Area. While seasonal movement of birds between nesting habitats during breeding and nonbreeding seasons and because birds and other wildlife typically respond to seasonal changes in diet due to forage/prey availability such that overall exposure to contaminants within the AP-104 Containment Source Area is likely limited. Nonetheless, birds as well as small to moderate range mammalian receptors are likely present in the area." The report also noted that there were a lack of PFOS and PFOA ecological screening value for the soil as data gap. Thus, it would seem appropriate to provide at this point.

	Soil ESVs (mg/kg)			
PFAS	Terrestrial Plants	Terrestrial Invertebrates	Terrestrial Mammals	Terrestrial Birds
PFBA	—[d]	—	2.98	—
PFHxA	—	—	6.20	—
PFOA	79.5	22.4	3.84	—
PFNA	—	10	0.0242	—
PFDA	—	—	0.0677	—
PFBS	—	100	0.817	15.8
PFHxS	—	10	0.0028	—
PFOS	40.2	48.1	0.0087	0.0386

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					June 2024 Response: Clarification. The Ecoscoping Form included in this Work Plan is specific to the former Administrative Area. Table 17.2-1 from the previous RI Report and the associated Ecoscoping Forms off ramped the four sites located in the former Administrative Area at Step 3: Habitat.
11.	Attachment 1 - Ecoscoping Form	Some discussion regarding the marine water body pathway should be provided in the comment write up.	Response	Acknowledged. Please note that there is currently no confirmation that the seeps between the Administrative Area and Tanani Bay provide potential migration pathways for PFAS contamination into the marine environment. However, if the PFAS RI determines that one or more PFAS compounds are present in the seeps at detectable concentrations, the Ecoscoping Form will be updated accordingly, and the surface water exposure pathway will be identified as needed.	A

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12.	Table H-1	The "currently DoD approved RSL" used for comparison in soil media doesn't incorporate EPA protection of groundwater or ADEC migration to groundwater cleanup value. It is not clear how fate and transport concern from the soil leaching are being evaluated in the RI without the comparison. Please elaborate in the work plan.	Understood	Understood. The currently available soil data does not suggest that continued migration of contaminants from soil to groundwater is occurring. The only exceedance of the current ADEC Method Two migration to groundwater cleanup levels was PFOS detected in sample 15HFTB231SB02S001 at 0.0055 mg/kg and PFOS was not detected in the adjacent (downgradient) monitoring well AP-137. It may be possible that due to the age of the release, high precipitation, and inorganic nature of the soil that a source in soil may no longer be present. The U.S. Army recognizes that the recently released May 2024 EPA RSLs for protection of groundwater could be used to evaluate this pathway; however, the DoD PFAS Task Force is in the process of reviewing these updated RSLs and has not yet provided approval of	A

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				their use. Additional revisions to the RSLs are expected prior to reporting (November 2024). As a result, a multiple-lines-of-evidence approach to evaluating the migration to groundwater pathway has been added to the UFP-QAPP (see WS #11).	
13.	Attachment A-1 Conceptual Site Models	CSM are not static and can evolve with time given more data. The attached CSM in A-1 is different than Figure 4.1 in the risk assessment. Why and how the CSMs are different based on the information needs to be discussed within the section.	Partial Acceptance	The CSM included in Attachment A-1 was completed as part of the planning efforts for the RI. The purpose of the CSM included in the Risk Assessment Work Plan (Figure 4-1) is to identify potentially complete human exposure pathways and specify which pathways will be quantitatively evaluated in the PFAS HHRA. As noted in the response to Comment 6 from Anne Marie Palmieri, the PFAS HHRA will assess a hypothetical future residential land use scenario along with the more reasonably anticipated future land use scenario assessed by the CSM (future industrial worker scenario), and will	The comment is accepted based on the response that proposed RI data will be evaluated. The comment was just pointing out the inconsistency between the two CSMs provided in the work plan. June 2024 Response: Understood.

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				be used to inform management decisions for the range of possible outcomes between the most realistic human receptors (future industrial workers) and most sensitive receptors (hypothetical future child residents). In addition, surface water and sediment pathways are shown as incomplete on Figure 4-1 because the seeps are intermittent/seasonal and/or of low flow and there is currently no confirmation that PFAS are present in the seeps. For clarity, the first sentence of Section 4.2.1 has been revised to: "The CSM includes the identification of chemical sources and contaminated environmental media, potentially exposed populations under current and future exposure scenarios, and potentially complete exposure pathways between contaminated media and human receptors based on current site knowledge. The CSM included in the PFAS HHRA will be updated,	

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				as needed, based on the results of the PFAS RI.”.	
		----- End of Comments ----			

PFAS Remedial Investigation Seep Water Results Screening Meeting
Haines Fuel Terminal, Haines, Alaska
Meeting Minutes
28 August 2024, 12:30 to 1:15 PM AK ST

Microsoft Teams

1. Attendees

ADEC	**U.S. Army**
Anne Marie Palmieri, ADEC PM	Peter Baker, DPW PM
	Melissa Shippey, DPW Alternate PM
U.S. Army Corps of Engineers	**Brice Environmental**
Guy Warren, USACE PM	Greg Rutkowski, Brice PM
Richard Bernhardt, USACE Risk Assessor	**Stantec Consulting Services**
	Bruce Narloch, Stantec Principal Toxicologist

Other Project Team members (not present)

U.S. Army
Sam Klein, AEC Representative
ADEC
Ted Wu, ADEC Risk Assessor

2. **Purpose**

a. The purpose of the meeting was to resolve the ADEC Risk Assessor's comment #3 on the Work Plan regarding the next steps to be taken if PFAS is detected in the seep samples collected along Tanani Beach. The decision was made to postpone further discussion of this topic until the seep sample results were available.

b. ADEC provided provisional approval of the Work Plan on 28 June 2024 to allow the initial sampling activities to commence.

c. Attachment 1 below provides the discussion topics that were used to guide the meeting.

3. Discussion

a. Greg provided a review of the ADEC comment and summarized the preliminary seep sample results as compared to the EPA RSLs for residential drinking water and the marine surface water Ecological Screening Values (ESV) from the *Derivation of PFAS Ecological Screening Values* (Grippo et al 2021).

b. Both Rick and Anne Marie pointed out that the comparison of the intertidal seep surface water sample results to EPA RSLs for a residential drinking water source is not appropriate because brackish seep water could not be used as a residential drinking water source. The group agreed that the comparison does not represent a realistic exposure scenario but was helpful in guiding the discussion of how the available screening levels should be used.

c. Anne Marie stated that there is no perfect screening level that can be used for the media sampled (fresh surface water entering a marine water body). However, the results could be used to complete a qualitative analysis of the overall pathway. She recommended that the surface water seep results be qualitatively compared to both the Grippo et al Table ES-3 Freshwater and Marine Surface Water ESVs. The surface water seep results for PFHxS and PFOS are orders of magnitude less than the ESVs, which could be used to demonstrate the lack of potential risk to ecological receptors.

d. Bruce stated that this could be qualitatively summarized in the Risk Assessment Report. Bruce also asked about using surrogate toxicity since a Marine Surface Water ESV for PFHxS is not included in Grippo et al. Rick stated that could be considered since the toxicity of the surrogate was more stringent than PFHxS for other media.

e. The group agreed that, although neither the Freshwater or Marine ESVs were the perfect screening level for freshwater surface seeps along a marine shoreline, the PFHxS and PFOS concentrations were low enough that a qualitative analysis was sufficient to show the lack of human or ecological risk.

f. The group agreed that the comment-response form would be updated to describe this meeting and that these meeting minutes would also be included in Appendix I of the Work Plan.

ATTACHMENT 1

Haines PFAS Remedial Investigation – Marine Surface Water Screening Levels Summary

Original Comment from Ted Wu (ADEC Risk Assessor):

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3.	Pg 1-3 Sec. 1.3	Surface water body discussion is not included in the regulatory framework but seeps discharging into the marine surface water body are being collected. Please provide information on how the data is being evaluated. At a minimum screening value should be compared with the sampling effort. The following report below presents ecological screening values that have been developed to support screening-level ecological risk assessments at U.S. Air Force, Navy, Army, and other U.S. Department of Defense sites where per- and polyfluorinated alkyl substances have been detected in soils and surface waters. -Derivation of PFAS Ecological Screening Values M. Grippo, J. Hayse, I. Hlohowskyj, and K. Picel Environmental Science Division Argonne National Laboratory Sept 2021	Partial Acceptance	Accepted. Surface seep sampling and sediment sampling have been included in the section. The goal of this sampling is for the identification of the presence or absence of PFAS as it relates to the groundwater to surface water pathway. Acknowledged. Due to sampling being limited to the surface seeps, sampling is evaluating the potential groundwater to surface water pathway. Incorporation of screening levels from the Derivation of PFAS Ecological Screening Values do not fit with the goal of the sampling to be conducted.	DEC was providing relevant screening values for marine surface water screening values for the next step if there are detections with the results. DEC would like to discuss what the Army's next steps will be to evaluate the pathway if there are PFAS detections in the seep water. June 2024 Response: Understood. U.S. Army requests provisional approval of the Work Plan pending discussion regarding the next steps if PFAS is detected in the seep water.

2024 Haines Seep Sample Results – Preliminary
Detections

Sample ID	Analyte	GW Screening Level (ng/L) (November 2023 RSLs)	GW Screening Level (ng/L) (May 2024 RSLs)	Surface Water Ecological Screening Value (ESV) (ng/L)	Result (ng/L)
24HFT-SW-TBS-01	PFHxS	39	39	-	0.40
24HFT-SW-TBS-02	PFHxS	39	39	-	0.31
24HFT-SW-TBS-02	PFOS	4.0	0.2	3,960	2.0
24HFT-SW-TBS-02A	PFHxS	39	39	-	0.30
24HFT-SW-TBS-02A	PFOS	4.0	0.2	3,960	2.5
24HFT-SW-TBS-03	PFHxS	39	39	-	0.50
24HFT-SW-TBS-03	PFOS	4.0	0.2	3,960	1.8

RED	Exceeds the surface water Ecological Screening Value (ESV) from Grippo et al.
ORANGE	Exceeds the screening levels specified in the Work Plan (November 2023 RSLs).
YELLOW	Exceeds the current EPA RSLs (May 2024). Note, however, that RSLs assume human consumption of this brackish water and are being used semi-quantitatively.

Marine Surface Water Screening Levels from the Grippo et al Document

PFAS	Surface Water Ecological Screening Value (ESV) (ng/L)[a] Marine Aquatic Life[b]
PFOA	6,120
PFOS	3,960

Notes:

[a] - The surface-water values can only be used when the water column is relatively quiescent and sediments at the site are relatively undisturbed: the derived ESVs do not consider the antagonistic, additive, or synergistic effects of other PFAS or other aquatic contaminants in combination with individual PFAS chemicals.

[b] - Chronic ESV values; PFOA and PFOS are Tier I ESVs; the remaining are Tier II ESVs.

Locations presented on the figure below correspond to the following:

- 24HFT-SW-TBS-01 = SE01_WS01
- 24HFT-SW-TBS-02/A = SE02_WS02
- 24HFT-SW-TBS-03 = SE03_WS03



The Grippo et al document screening levels are the preferred source for initial fresh and marine surface water screening levels; however, those screening levels are not directly applicable to the seep water. In summary, only PFHxS and PFOS were detected in the seep surface water samples. The seep sample results are three orders of magnitude less than the Grippo et al freshwater and marine surface water ecological screening levels; therefore, U.S. Army proposed no further investigation of the groundwater to surface water pathway.

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