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DRAFT

EXPLORATION PHASE - SAMPLING AND ANALYSIS PLAN

Yakutat Airport Water Line Extension

YAKUTAT, ALASKA

SHANNON & WILSON

August 2024

Shannon & Wilson No: 112494

Submitted To: RESPEC
2700 Gambell Street, Suite 500
Anchorage, AK 99503
Attn: Karen Brady, P.E.

Subject: DRAFT EXPLORATION PHASE - SAMPLING AND ANALYSIS PLAN, YAKUTAT AIRPORT WATER LINE EXTENSION, YAKUTAT, ALASKA

Shannon & Wilson prepared this Sampling and Analysis Plan (SAP) as a consultant to RESPEC Company, LLC. Our scope of services was detailed in our proposal for this project dated March 21, 2024. This SAP presents our approach for environmental support services during geotechnical explorations, which will guide our recommendations for soil handling during construction. This plan was prepared by the undersigned.

We appreciate the opportunity to be of service to you on this project. If you have questions concerning this report, or if we may be of further service, please contact us.

Sincerely,

SHANNON & WILSON

Ashley Jaramillo,
Sr. Chemist

Russell Hepner, EIT
Sr. Professional I

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ACRONYMS

AAC	Alaska Administrative Code
bgs	below ground surface
CBY	City and Borough of Yakutat
COC	chain-of-custody
COPC	contaminant of potential concern
°C	degrees Celsius
DEC	Alaska Department of Environmental Conservation
DRO	diesel range organics
EPA	U.S. Environmental Protection Agency
ESA	Environmental Site Assessment
Eurofins	Eurofins Environment Testing
FUDS	Formerly Used Defense Sites
GeoTek	GeoTek Alaska, Inc.
GRO	gasoline range organics
MCL	Maximum Contaminant Level
mg/kg	milligrams per kilogram
MPT	Modified Penetration Test
NAPL	non-aqueous phase liquid
PAH	polycyclic aromatic hydrocarbon
PCB	polychlorinated biphenyl
PFAS	per- and polyfluoroalkyl substances
PID	photoionization detector
PM	project manager
ppm	parts per million
QA	quality assurance
QC	quality control
QEP	Qualified Environmental Professional
RRO	residual range organics
SAP	Sampling and Analysis Plan
SDS	safety data sheet
SGS	SGS North America, Inc.
SPT	Standard Penetration Test
SSHP	site safety and health plan
S&W	Shannon & Wilson, Inc.
VOC	volatile organic compound

1 INTRODUCTION

This Sampling and Analysis Plan (SAP) describes our proposed approach for pre-construction environmental sampling during a planned geotechnical investigation. The results of this sampling will guide our recommendations for soil handling during construction for the City and Borough of Yakutat (CBY) Airport water extension project in Yakutat, Alaska (Figure 1). The water line alignment and proposed boring locations are presented in Figure 2.

Our services will be performed in general accordance with our proposal dated March 21, 2024, and authorized under the subconsultant agreement dated May 9, 2024. This SAP has been prepared by Shannon & Wilson, Inc. (S&W) personnel who are Qualified Environmental Professionals (QEPs) as defined in Title 18 Chapter 75 of the Alaska Administrative Code (AAC).

1.1 Project Description

We understand that the CBY plans to expand their existing water line approximately 4.5 miles from the City of Yakutat to the Yakutat Airport. Some private water supply wells at the airport have been found to contain per- and polyfluoroalkyl substances (PFAS) in exceedance of Alaska Department of Environmental Conservation (DEC) drinking water action levels and are no longer in-use for drinking water. In addition, in April 2024 the U.S. Environmental Protection Agency (EPA) promulgated maximum contaminant levels (MCLs) for several PFAS compounds that are more stringent than the current DEC drinking water action levels. As of this writing DEC has not yet changed their drinking water action level to match EPA's new MCLs; however, it is likely that DEC will align with EPA's PFAS MCLs in the future. We understand geotechnical explorations for the water line construction will occur in summer 2024 and design will occur in 2024/2025.

1.2 Project Boundaries

The project area is an approximately 4.5-mile-long alignment in the right-of-way along the north side of Airport Road between the City of Yakutat and the airport (Figure 2). The northwest end of the alignment splits at Coast Guard Road to separately meet Mallott Avenue and Ophir Creek Road and the southeast end of the alignment leaves Airport Road to follow Endicott Way to Airport Access Road. In addition, the CBY plans to develop three parcels comprising approximately six acres near the intersection of Coast Guard Road and Airport Road for construction of a water storage tank and pump house. The water line will be buried up to six feet below the ground surface along the alignment. The CBY parcels will be cleared of vegetation and we assume some excavation will occur for the building foundation. Up to 30 geotechnical borings are planned along the water line route.

The project alignment may intersect contaminated soil and groundwater from DEC "active" contaminated sites. The DEC contaminated sites with potential to affect the project area are depicted in Figure 3 and summarized in Section 1.3.

1.3 Contaminants of Potential Concern and Cleanup Levels

We reviewed the DEC Contaminated Sites Database and identified two active contaminated sites that have potential to affect the project area (Figure 3):

- *DOT&PF Yakutat Airport Sitewide PFAS (DEC Hazard ID 27090, File Number 1530.38.022):*

  Historic use of aqueous film forming foam at various locations at the Yakutat Airport has caused PFAS groundwater contamination in some water supply wells in the immediate vicinity of the airport. The extent of PFAS groundwater contamination or PFAS in soil near the airport is unknown. PFAS is mobile in groundwater and could be distributed downgradient from the airport to the project area.

- *DOT&PF Yakutat Airport Multiple Sites (DEC Hazard ID 25640, File Number 1530.38.018):*

  Petroleum-contaminated soil has been discovered on state-owned property at the airport with no apparent source, which prompted a 2012 Phase I Environmental Site Assessment (Phase I ESA) of 60 parcels at the Yakutat Airport. The Phase I ESA found that petroleum-impacted soil and groundwater at the airport may be widespread. The airport was a former Air Force Base during World War II and four formerly used defense sites (FUDS) are located within the airport boundary. In addition, there are many aboveground storage tanks, drums, floor drains with unknown discharge locations, a waste lagoon, and septic systems with unknown discharge destinations. The wide range of potential sources, documented and undocumented, presents a risk that the project may encounter previously unknown contamination.

Other nearby active contaminated sites are less likely to impact the project area but are included for completeness:

- *FAA Yakutat Bldg 607 (DEC Hazard ID 2377, File Number 1530.38.007):*

  Petroleum and polychlorinated biphenyl (PCB) contamination from known and unknown releases is present at the FAA Building 607 near the Yakutat Airport. In 2010, a remedial action by Bethel Services Inc. excavated approximately 774 cubic yards of petroleum and PCB-contaminated soil from the former Building 607 location. During excavation they encountered areas with non-aqueous phase liquid (NAPL) fuel and/or oil on the groundwater table. They used sorbent booms to remove approximately 350 pounds of NAPL from groundwater entering the area of soil excavation; however, they observed that NAPL appeared to extend outside of the excavation area. The NAPL may be contaminated with PCBs. Diesel-contaminated soil remains in areas of the site. The petroleum and NAPL contamination is unlikely to migrate the distance from the source to the project area; however, the project area may be hydrologically downgradient from the FAA Bldg 607 site.

- *DOT&PF Yakutat Former Shop Building (DEC Hazard ID 25483, File Number 1530.38.017):*

  During site characterization for the FAA Bldg 607 site, diesel-contaminated soil was encountered on the north side of the lot on the Alaska Department of Transportation and Public Facilities (DOT&PF) Yakutat former shop building property. It was determined that the area of contamination was related to the DOT&PF former shop building. The petroleum contamination is unlikely to migrate due to distance from the area of contamination to the project area; however, the project may be downgradient from the DOT&PF former shop building.

- *NOAA NWS Former Employee Housing (DEC Hazard ID 27902, File Number 1530.38.024):*

  A hazardous building materials survey for a residential six-plex in 2009 found lead in paint samples. In 2019, a limited site investigation to evaluate whether soil surrounding the building had been contaminated by the lead in paint found lead contamination around the building drip line at about six inches below ground surface up to 10,100 milligrams per kilogram (mg/kg). The residential six-plex and adjacent concrete walkways and utilities are planned to be demolished. The lead contamination is likely limited to shallow surface soil adjacent to the building where paint may have weathered off the building.

- *NOAA Yakutat Office (DEC Hazard ID 2972, File Number 1530.38.006):*

  The site was used for launching weather balloons and had a single building with a 675-gallon diesel fuel underground storage tank (UST). The diesel was used to heat the building and to power a hydrogen gas generator until the UST was decommissioned in 1998. Soil samples were collected around the UST and were found to exceed DEC cleanup levels for diesel range organics (DRO). Some soil was subsequently excavated from around the UST but later soil borings found that DRO contamination remained in the area. Three monitoring wells were installed at the soil boring locations; DRO and BTEX (benzene, toluene, ethylbenzene, and xylenes) were detected in groundwater less than DEC cleanup levels.

- *Yakutat AFB State Disposal Site No.3 (DEC Hazard ID 26914, File Number 1530.38.011):*

  A former World War II-era motor repair shop, oil sheds, and utility building were constructed at this location. The area was used as a disposal site for military debris. The area was later used by the Federal Aviation Administration and DOT&PF as a shop area. DEC observed tar and visually contaminated surface soil in the vicinity of this location during a site visit in 2018.

Based on the above information, the contaminants of potential concern (COPCs) for the water line extension project include the following:

- Gasoline range organics (GRO)
- DRO
- Residual range organics (RRO)
- VOCs
- Polycyclic aromatic hydrocarbons (PAHs)
- PFAS
- Lead
- PCBs (in NAPL-only)

To evaluate soil analytical data, we will compare the sample results to the most stringent values between the DEC cleanup levels in 18 AAC 75.341 Table B1 and B2 Method Two (Migration to Groundwater or Over 40 Inch Zone Human Health). The most stringent value of the DEC cleanup levels will be used as the project action limit for a given analyte. Table 1 summarizes the DEC regulatory limits for the site soil COPCs.

1.4 Environmental Scope of Services

S&W's scope of environmental services includes:

- Preparing this project-specific SAP.
- Consulting with DEC and finalizing the SAP.
- Field-screening and sampling soil during exploration activities. We assume eight soil borings will be sampled for PFAS and up to eight soil borings will be sampled for other site COPCs; however, if field screening and visual observations indicate potential contamination in more than eight borings we will be prepared to sample additional borings.
- Quality control field and analytical laboratory testing of soils.
- Preparing a summary report of the results of chemical analyses.

This project does not include an environmental site assessment, overall site characterization, nor delineation of contamination.

2 PROJECT TEAM

Ashley Jaramillo (Fairbanks office) will serve as the Project Manager (PM) and Environmental Lead, Russell Hepner (Anchorage office) will serve as the Geotechnical Lead, and Kyle Brennan (Anchorage office) will serve as the Principal-in-Charge. S&W's project team also includes other State of Alaska QEPs and/or Qualified Samplers from our

Anchorage and Fairbanks offices to support the field and reporting tasks required to achieve the project objectives. Russell Hepner will act as the S&W project safety officer responsible for maintaining safe work practices for S&W personnel. The Site Safety and Health Plan (SSHP) is included in Appendix A and the Safety Data Sheets (SDS) of potential chemical exposure hazards are presented in Appendix B.

The project team and their associated responsibilities are summarized in Exhibit 2-1.

Exhibit 2-1: Project Team

Affiliation	Responsibility	Involvement	Representative	Contact Number
City and Borough of Yakutat	Project Administrator	City Manager	Jon Erikson	(907) 784-3323 x103
RESPEC Companies, LLC	Project Manager	Client	Karen Brady	(907) 452-1414
DEC Contaminated Sites	SAP Approval; Regulatory Oversight	Regulatory Agency	To Be Determined	To Be Determined
Shannon & Wilson, Inc.	Contracting	Principal-in-Charge	Kyle Brennan	(907) 433-3219
	Project Management	Project Manager	Ashley Jaramillo	907-251-7534
	Environmental Management	Environmental Lead	Ashley Jaramillo	907-251-7534
	Geotechnical Management	Geotechnical Lead	Russell Hepner	(907) 433-3243
Discovery Drilling, Inc.	Drilling Services	Drilling Subcontractor	DJ Wardwell	(907) 344-6431
SGS North America, Inc.	Analytical Reporting	Laboratory Analysis	Jen Dawkins or Justin Nelson	(907) 474-8656 or (907) 562-2343
Eurofins Environment Testing	Analytical Reporting	Laboratory Analysis - PFAS	David Alltucker	(916) 374-4383

3 FIELD SAMPLING PLAN

S&W field representatives will implement the SAP as described herein. We will conduct the field portion of this project in accordance with 18 AAC 75 and our SAP. We will document our field activities with field notes and photographs. We have included copies of our field forms in Appendix C.

We will subcontract with Discovery Drilling, Inc. to advance up to 30 borings along the proposed water line alignment to collect site-specific geotechnical and baseline environmental information (Figures 4 through 6). The borings will generally be advanced to 15 feet below the ground surface (bgs). Two borings will be advanced on either side of the two Ophir Creek crossings and one boring will be advanced at the pump house location to

30 feet bgs. We will provide one geotechnical/environmental staff QEP during the drilling process who will visually classify soil recovered in the field and prepare a descriptive log of encountered soil conditions. Following drilling, borings will be backfilled with soil cuttings and/or bentonite chips (hydrated) to two feet bgs and completed with material to match the original surface condition.

3.1 Drilling Methodology

The borings will be advanced using hollow stem auger drilling methods. Standard penetration test (SPT) or modified penetration test (MPT) samples will be collected by driving a split-barrel sampler into soils at the base of the drill stem using an automatic hammer with a 30-inch free fall. SPT samples are collected by driving a two-inch outside diameter sampler with a 140-pount automatic hammer, and MPT samples are collected by driving a three-inch outside diameter using a 340-pound automatic hammer. The split-spoon sampler will be advanced at 2.5-foot intervals to a depth of 10 feet or until groundwater is encountered, whichever is deeper, and then at 5-foot intervals to the bottom of the boring. Soil samples will be observed in the field and described on field logs using the Unified Soil Classification System, then placed in moisture-tight containers for transport to our soil laboratory for soil index property testing.

3.2 Field Screening Procedures

S&W's geotechnical/environmental representative will be present during the explorations to field screen soil for volatile compounds. We will collect field-screening samples from each soil boring at 2.5-foot intervals to a depth of 10 feet bgs or until groundwater is encountered, whichever is deeper, and then at 5-foot intervals until boring is complete. We will field screen soils using a handheld photoionization detector (PID). The PID is capable of detecting some volatile organic compounds but is not able to detect PFAS or other non-volatile organic compounds. Currently, there are no field-screening methods for PFAS analytes.

We will field-screen for volatile contamination using the heated headspace methodology, per the DEC 2022 *Field Sampling Guidance*. The instrument used for field-screening will be a hand-held Rae Systems, Inc. MiniRae 3000 or equivalent PID. The PID measures total volatile compounds present in vapors as a semi-quantitative indication of volatile hydrocarbons. The MiniRae provides a three-second response time up to 15,000 parts per million (ppm). We will calibrate the PID daily, or more often as needed, to a 100-ppm isobutylene standard according to the manufacturer's instructions. S&W's field representatives are trained and experienced in the calibration, operation, routine maintenance, and troubleshooting of the PID, as well as interpreting PID results.

We will retrieve headspace samples using a clean, stainless-steel spoon from freshly uncovered soil and place the soil in a clean, sealable plastic bag, filling it one-third to one-half full and quickly sealing it closed. We will maintain the headspace samples in our custody and screen the samples within one hour of collection.

We will allow the headspace to develop in the bag by warming it to at least 40 degrees Fahrenheit for 10 minutes to one hour, shaking the bag for 15 seconds at the beginning and end of the period to assist volatilization. We will open the bag enough to allow insertion of the PID probe about one-half the headspace depth, taking care to avoid uptake of water droplets and soil particles. We will record the maximum PID reading obtained, noting any erratic meter response or conditions of elevated headspace moisture. PID results will be presented with boring logs.

If we encounter previously unidentified contamination during drilling, DEC's Preparation, Prevention, and Response Program will be notified in accordance with 18 AAC 75.300.

3.3 Soil Sampling Procedures

S&W's QEP will determine analytical sample locations based on field-screening results and field observations. We will collect and handle analytical samples in accordance with the DEC *Field Sampling Guidance* and this project-specific SAP. We will collect quality control (QC) samples as described in Section 4.

Samples will be collected for PFAS analysis from eight borings along Airport Access Road (Figure 3). The PFAS sample location will be from the groundwater interface, anticipated to be approximately three feet below ground surface. We will collect samples for other COPCs (GRO, DRO, RRO, VOCs, and PAHs) only if field-screening results exceed 10 ppm or visual or olfactory observations indicate the potential for contamination. Samples will be collected for PCBs only if NAPL is observed in the boring. We assume that one analytical sample per boring with suspected contamination, from the interval with the highest field screening result, will be sufficient.

Field personnel will wear a new pair of disposable nitrile gloves during sample collection and handling to prevent cross-contamination. Samples will be collected using a new stainless-steel spoon or similar tool, after which the soil will be quickly placed into new, laboratory-supplied jars appropriate for the analysis to be performed. After collection the samples will be placed into a designated sample cooler maintained between 0 degrees Celsius (°C) and 6 °C with ice substitute.

3.4 Special Considerations for PFAS Sampling

Because PFAS is found in numerous everyday items, special precautions will be taken during sampling activities. S&W's Reference Document (RD-B74 Final 1.1) for PFAS sampling has been included in Appendix D.

3.5 Decontamination Procedures

All non-disposable sampling equipment introduced into or contacting soil at the site will be decontaminated prior to reuse. We will decontaminate all non-disposable sampling equipment using a four-part process as follows:

- A thorough wash with Alconox detergent
- Potable water rinse
- Distilled water rinse
- PFAS-free water rinse

We will discharge the decontamination rinse water to the ground surface in vegetated areas near the boring locations, at a distance of greater than 100 feet from drinking water wells and surface water.

3.6 Laboratory Analysis

Based on the COPCs for the project, we will submit the soil samples for analysis of the following:

- GRO by AK101
- DRO by AK102
- RRO by AK103
- VOCs by SW8260
- PAHs by SW8270-SIM
- Lead by SW6020
- PCBs by SW8082
- PFAS by EPA Method 537(M)

All sample analyses will be requested with a standard turnaround time, approximately four weeks for PFAS and two weeks for other analyses. Analytical results will be compared to the DEC regulatory limits listed in Table 1.

3.7 Sample Preservation and Holding Times

Prior to field-sampling efforts, S&W will request sample containers from SGS North America, Inc. (SGS) and Eurofins Environment Testing (Eurofins). Sample containers, preservation requirements, and holding times for selected soil analyses are shown in Exhibit 3-1. Samples for GRO, DRO, RRO, VOC, PCB, and PAH analyses will be submitted to the SGS laboratory in Anchorage, Alaska. Samples for PFAS analysis will be submitted to the Eurofins laboratory in Sacramento, California. Both laboratories are DEC-certified laboratories for the requested analyses. The project-specific detection limits are included Table 1.

Exhibit 3-1: Soil Sample Storage, Preservation, and Holding Time Requirements

Analyte	Method	Container	Preservation	Holding Time
PFAS	537(M)	4-ounce polycarbonate jar	0 °C to 6 °C	14 days to extraction
GRO	AK101	4-ounce pre-weighed amber glass jar	MeOH+BFB; 0 °C to 6 °C	28 days to extraction
DRO	AK102	4-ounce amber glass jar	0 °C to 6 °C	14 days to extraction 40 from extraction to analysis
RRO	AK103	4-ounce amber glass jar	0 °C to 6 °C	14 days to extraction 40 from extraction to analysis
VOCs	SW8260	4-ounce pre-weighed amber glass jar	MeOH+BFB; 0 °C to 6 °C	14 days to extraction
PCBs	SW8082	4-ounce amber glass jar	0 °C to 6 °C	14 days to extraction 40 from extraction to analysis
PAHs	SW8270-SIM	4-ounce amber glass jar	4-ounce pre-weighed amber jar	14 days to extraction 40 from extraction to analysis
Lead	SW6020	4-ounce amber glass jar	0 °C to 6 °C	14 days to extraction 40 from extraction to analysis

BFB = 4-Bromofluorobenzene, °C = degrees Celsius, DRO = diesel range organics, GRO = gasoline range organics, MeOH = methanol, RRO = residual range organics, PAH = polycyclic aromatic hydrocarbon, PCB = polychlorinated biphenyl; PFAS = per- and polyfluoroalkyl substances; VOC = volatile organic compound

3.8 Sample Custody, Storage, and Shipping

Prior to the delivery to the laboratory, soil samples will be in the custody of S&W. During field activities, the field representative will store the samples in a cooler with adequate quantities of ice substitute to maintain samples between 0° C and 6° C.

The field representative will complete chain-of-custody (COC) records to document sample possession from the point of collection to the time of receipt by the laboratory's sample-control center. S&W will keep a copy of the COC record to allow sample accountability between field and laboratory.

S&W will hand-deliver or ship samples to the analytical laboratory with sufficient time to allow the laboratory to extract the sample within the holding time requirements of the test method. The field representative will pack the samples in a hard-plastic cooler with bubble wrap and enough ice substitute to maintain sample temperature between 0° C and 6° C during travel. The field representative will pack a temperature blank with the samples in each cooler, carefully tape the cooler shut, and affix dated and signed custody seals across the front of the hinged cooler lid.

3.9 Soil Containerization, Storage, and Disposal

The drilling subcontractor will return excess soil to the borehole, including from borings sampled for PFAS and petroleum COPCs. Contaminated soil will be returned to approximately the same depth from where it came, in accordance with DEC's September 2018 *Managing Petroleum-Contaminated Soil, Water, or Free Product during Public Utility and Right-of-Way Construction and Maintenance Projects Technical Memorandum*. Our rationale for this is that the water line installation will re-excavate soil in the boring areas, and if contaminated soil needs to be dealt with it will be disposed of in bulk at that time. Due to Yakutat's remote location, it is not financially practicable to contain and dispose of cuttings from individually sampled soil borings.

3.10 Field Notes

S&W staff will document field activities, procedures, and observations in the Field Activities Daily Log presented in Appendix C. The field representative will sign and date each page on the log. The field representative will write entries in the log in waterproof ink, including at minimum:

- Name of person performing field screening.
- Names and affiliations of pertinent field contacts.
- Date and time(s) of sampling.
- Date, time, and location of tests.
- A summary of test results.
- GPS coordinates for locations of boreholes.
- Field observations and comments.
- Unusual/unexpected problems, including observations of leaks, releases, signs of soil contamination, or other unusual items.
- Site photograph notes and sketches.
- Deviations from the work plan.

- PID identification and calibration data.
- Weather conditions.

3.11 Submittals and Schedule

We will include a summary of analytical soil results and disposal recommendations for the soil cuttings in an environmental letter report within two weeks following the receipt of the final laboratory report.

4 QUALITY ASSURANCE PROJECT PLAN

Quality assurance (QA) and QC are important components of an environmental site investigation. QA is the integrated program for measuring the reliability of data. QC is the routine use of specific procedures set forth to meet defined standards for sampling and analysis. This QA/QC plan describes specific procedures to be followed so the sampling, documentation, and laboratory data are effective and do not detract from the quality and reliability of the results.

4.1 Data Quality Objectives

The QA objective for measurement data is to verify environmental monitoring data are of known and acceptable quality. Due to the heterogeneous nature of soils, exact duplication of soil sample analytical results is not a practicable goal. In addition, matrix interference in soil samples can adversely affect comparability of duplicate laboratory results. For analytical data, the objective is to meet acceptable QA standards of precision, accuracy, representativeness, comparability, and completeness. These terms are defined below:

- Precision is a measure of mutual agreement among replicate or duplicate measurements of the same analyte. The laboratory objective for precision is to equal or exceed the precision demonstrated for similar samples and shall be within the established control limits for the methods as published by the EPA. Precision will be measured as the relative percent difference between project and duplicate samples.
- Accuracy is a measure of bias in a measurement system. Accuracy will be expressed as the percent recovery of an analyte from a surrogate or matrix spike sample, or a standard reference material. The laboratory objective for accuracy is to equal or exceed accuracy demonstrated for these analytical methods on similar samples and shall be within the established control limits for the methods as published by the EPA.
- Representativeness is a quality characteristic attributable to the type and number of samples to be taken to represent the medium/environment (e.g., soil or water). Sample

locations will be selected in the field to be representative of the soil at that location, within the constraints of sample location guidelines in the regulations.

- Comparability is a qualitative parameter expressing the confidence with which one data set can be compared to another. The sampling method employed, methods used for the transfer of samples to the analytical laboratory, and analytical techniques implemented at the laboratory shall be performed in a uniform manner.
- Completeness is a measure of the number of valid measurements obtained in relation to the total number of measurements planned. The objective of completeness is to generate an adequate database to successfully achieve the goals of the investigation.

According to the manufacturer's information, the measurement accuracy of the MiniRae PID is ±10 percent of a reading or ±2 ppm, whichever is greater, between 0 and 2,000 ppm. The accuracy is ±20 percent of a reading above 2,000 ppm. The precision is one percent of calibration (calibrated with 100 ppm isobutylene).

4.2 Field Instrument Use and Calibration

Equipment and instrument calibration assure accurate and reliable measurements are obtained. The field representative will calibrate the PID daily, or more often as necessary, with a 100-ppm isobutylene standard and adjust it to operate within the manufacturer's specifications. The field representative will record calibration results and instrument maintenance and error messages in the field notebook and the designated PID logbook kept with the instrument. The field representative will clean the detector lamp and replace the inlet filter regularly, in accordance with the manufacturer's instructions or as required.

4.3 Field QC Samples

In addition to the primary project samples, S&W's representative will collect and submit QA/QC samples including field duplicate samples for laboratory analysis. S&W's representative will collect field duplicate samples at a minimum of 10-percent of samples submitted for laboratory analysis. If possible, the field representative will collect soil duplicate samples from locations suspected to be contaminated, as calculation of duplicate precision is not possible for samples with contaminants below detection limits. The field representative will assign a separate sample number to duplicates and submit them "blind" to the laboratory. We will use duplicate sample results to test comparability of analytical data.

A laboratory-provided trip blank will accompany every cooler with volatile samples. This QC sample will be used to assess potential laboratory cross contamination between samples during collection and transit.

Analytical samples will be collected with non-reusable sampling equipment. We will not perform decontamination of disposable sampling equipment; therefore, we do not need to collect equipment-rinse blank samples.

4.4 Laboratory QC Samples

The analytical laboratory will perform QC measurements to determine the precision and accuracy of each analytical method, including initial and continuing calibration checks, analysis of method blanks, analysis of spiked samples, duplicate analyses, and evaluation of surrogate recoveries. Surrogate or isotope dilution analyte recovery data will be presented with the results of all applicable samples.

4.5 Laboratory Data Deliverables

S&W will request standard DEC Level II Data Deliverables from the analytical laboratory for transmittal with the summary report. Analytical results will be reported down to the laboratory limit of detection. We will also include our own internal QA assessment and submit a copy of the completed DEC laboratory data review checklist.

4.6 Data Reduction, Evaluation, and Reporting

Data evaluation procedures will include QA checks to verify holding times have been met, duplicate samples have been collected, and that other QA parameters have been performed. We will complete a DEC Laboratory Data Review Checklist as part of our data review process.

Laboratory tests will be validated by the laboratory supervisor or other responsible party and include evaluation for precision and accuracy of the data set. The laboratory QC officer or other responsible party will review and sign analytical data before its release. Laboratory deliverables will comprise Level II laboratory reports and electronic data packages to be submitted to S&W. The individual laboratory reports will be included with our summary report; the data will be summarized in tables for convenient reference. Analytical data generated by the laboratory will be checked for precision, accuracy, and completeness. We will prepare a draft and final report presenting the results of our field activities, as well as our recommendations based on the analytical data and field observations.

5 INVESTIGATION-DERIVED WASTE

Investigation-derived waste will consist of disposable sampling equipment (nitrile gloves, paper towels, sorbent pads, plastic bags, etc.) which will be disposed of at the Yakutat landfill as inert solid waste. Soil cuttings generated during drilling will be used to backfill the borings. Decontamination rinse water will be disposed of to the ground surface near the soil boring locations and at least 100 feet from drinking water wells and surface water.

6 REFERENCES

Alaska Department of Environmental Conservation, October 2023, *Title 18 Alaska Administrative Code Part 75: Oil and Other Hazardous Substances Pollution Control*, available: https://dec.alaska.gov/spar/regulations.

Alaska Department of Environmental Conservation, January 2022, *Field Sampling Guidance*, available: https://dec.alaska.gov/spar/csp/guidance-forms/.

Alaska Department of Environmental Conservation, Division of Spill Prevention and Response Contaminated Sites Database, available: https://dec.alaska.gov/spar/csp/.

Alaska Department of Environmental Conservation, September 2018, *Managing Petroleum-Contaminated Soil, Water, or Free Product during Public Utility and Right-of-Way Construction and Maintenance Projects*.

Table 1 - Soil Contaminants of Potential Concern

Analytical Method	Analyte	CAS Number	DEC Limit[1] (mg/kg)	LOD[2] (mg/kg)
AK101	Gasoline Range Organics	GRO	260	1.25
AK102	Diesel Range Organics	DRO	230	10
AK103	Residual Range Organics	RRO	9,700	50
SW8260 (VOC)	1,1,1,2-Tetrachloroethane	630-20-6	0.022	0.01
	1,1,1-Trichloroethane	71-55-6	32	0.0125
	1,1,2,2-Tetrachloroethane	79-34-5	0.0030	0.001
	1,1,2-Trichloroethane	79-00-5	0.0014	0.0005
	1,1-Dichloroethane	75-34-3	0.092	0.0125
	1,1-Dichloroethene	75-35-4	1.2	0.0125
	1,1-Dichloropropene	563-58-6	NS	0.0125
	1,2,3-Trichlorobenzene	87-61-6	0.15	0.05
	1,2,3-Trichloropropane	96-18-4	0.000031	**0.001**
	1,2,4-Trichlorobenzene	120-82-1	0.082	0.0125
	1,2,4-Trimethylbenzene	95-63-6	0.61	0.05
	1,2-Dibromo-3-chloropropane	96-12-8	NS	**0.05**
	1,2-Dibromoethane	106-93-4	0.00024	**0.00075**
	1,2-Dichlorobenzene	95-50-1	2.4	0.0125
	1,2-Dichloroethane	107-06-2	0.0055	0.001
	1,2-Dichloropropane	78-87-5	0.030	0.005
	1,3,5-Trimethylbenzene	108-67-8	0.66	0.0125
	1,3-Dichlorobenzene	541-73-1	2.3	0.0125
	1,3-Dichloropropane	142-28-9	NS	0.005
	1,4-Dichlorobenzene	106-46-7	0.037	0.0125
	2,2-Dichloropropane	594-20-7	NS	0.0125
	2-Butanone (MEK)	78-93-3	15	0.125
	2-Chlorotoluene	95-49-8	NS	0.0125
	2-Hexanone	591-78-6	0.11	0.06
	4-Chlorotoluene	106-43-4	NS	0.01
	4-Isopropyltoluene	99-87-6	NS	0.04
	4-Methyl-2-pentanone (MIBK)	108-10-1	18	0.125
	Acetone	67-64-1	38	0.125
	Benzene	71-43-2	0.022	0.00625
	Bromobenzene	108-86-1	0.36	0.0125
	Bromochloromethane	74-97-5	NS	0.0125
	Bromodichloromethane	75-27-4	0.0043	0.001
	Bromoform	75-25-2	0.10	0.0125
	Bromomethane	74-83-9	0.024	0.01
	Carbon disulfide	75-15-0	2.9	0.05
	Carbon tetrachloride	56-23-5	0.021	0.00625

Table 1 - Soil Contaminants of Potential Concern

Analytical Method	Analyte	CAS Number	DEC Limit[1] (mg/kg)	LOD[2] (mg/kg)
SW8260 (VOC)	Chlorobenzene	108-90-7	0.46	0.0125
	Chloroethane	75-00-3	72	0.1
	Chloroform	67-66-3	0.0071	0.003
	Chloromethane	74-87-3	0.61	0.0125
	cis-1,2-Dichloroethene	156-59-2	0.12	0.0125
	cis-1,3-Dichloropropene[3]	10061-01-5	0.018	0.00625
	Dibromochloromethane	124-48-1	0.0027	0.0025
	Dibromomethane	74-95-3	0.025	0.0125
	Dichlorodifluoromethane	75-71-8	3.9	0.05
	Ethylbenzene	100-41-4	0.13	0.0125
	Freon-113	76-13-1	0.020	**0.05**
	Hexachlorobutadiene	87-68-3	5.6	0.01
	Isopropylbenzene (Cumene)	98-82-8	0.33	0.0125
	Methylene chloride	1634-04-4	0.40	0.05
	Methyl-t-butyl ether	91-20-3	0.038	**0.05**
	Naphthalene	91-20-3	23	0.0125
	n-Butylbenzene	104-51-8	9.1	0.0125
	n-Propylbenzene	103-65-1	1.5	0.0125
	o-Xylene	95-47-6	1.5	0.0125
	P & M -Xylene	P & M -Xylene	42	0.025
	sec-Butylbenzene	135-98-8	10	0.0125
	Styrene	100-42-5	11	0.0125
	tert-Butylbenzene	127-18-4	0.19	0.0125
	Tetrachloroethene	127-18-4	6.7	0.00625
	Toluene	108-88-3	1.3	0.0125
	trans-1,2-Dichloroethene	156-60-5	0.018	0.0125
	trans-1,3-Dichloropropene[3]	10061-02-6	0.011	0.00625
	Trichloroethene	75-69-4	41	0.005
	Trichlorofluoromethane	76-13-1	310	0.025
	Vinyl acetate	108-05-4	1.1	0.05
	Vinyl chloride	75-01-4	0.00080	0.0004
	Xylenes (total)	1330-20-7	1.5	0.0375
SW8270-SIM (PAH)	1-Methylnaphthalene	90-12-0	0.41	0.0125
	2-Methylnaphthalene	91-57-6	1.3	0.0125
	Acenaphthene	83-32-9	37	0.0125
	Acenaphthylene	208-96-8	18	0.0125
	Anthracene	120-12-7	390	0.0125
	Benzo(a)anthracene	56-55-3	0.70	0.0125
	Benzo[a]pyrene[4]	50-32-8	1.2	0.0125

Table 1 - Soil Contaminants of Potential Concern

Analytical Method	Analyte	CAS Number	DEC Limit[1] (mg/kg)	LOD[2] (mg/kg)
SW8270-SIM (PAH)	Benzo[b]fluoranthene[4]	205-99-2	12	0.0125
	Benzo[g,h,i]perylene[4]	191-24-2	1,900	0.0125
	Benzo[k]fluoranthene[4]	207-08-9	120	0.0125
	Chrysene	218-01-9	600	0.0125
	Dibenzo[a,h]anthracene[4]	53-70-3	1.2	0.0125
	Fluoranthene	206-44-0	590	0.0125
	Fluorene	86-73-7	36	0.0125
	Indeno[1,2,3-c,d] pyrene[4]	193-39-5	12	0.0125
	Naphthalene	91-20-3	0.038	0.01
	Phenanthrene	85-01-8	39	0.0125
	Pyrene	129-00-0	87	0.0125
SW8082 (PCBs)	Aroclor-1016[4]	12674-11-2	1.0	0.025
	Aroclor-1221[4]	11104-28-2		0.050
	Aroclor-1232[4]	11141-16-5		0.025
	Aroclor-1242[4]	53469-21-9		0.025
	Aroclor-1248[4]	12672-29-6		0.025
	Aroclor-1254[4]	11097-69-1		0.025
	Aroclor-1260[4]	11096-82-5		0.025
SW6020 (Metals)	Lead	7439-92-1	400	0.100
EPA Modified 537.1 (PFAS)	Perfluorohexanoic acid (PFHxA)	307-24-4	NS	0.0002
	Perfluoroheptanoic acid (PFHpA)	375-85-9	NS	0.0002
	Perfluorooctanoic acid (PFOA)	335-67-1	0.0017	0.0002
	Perfluorononanoic acid (PFNA)	375-95-1	NS	0.0002
	Perfluorodecanoic acid (PFDA)	335-76-2	NS	0.0002
	Perfluoroundecanoic acid (PFUnA)	2058-94-8	NS	0.0002
	Perfluorododecanoic acid (PFDoA)	307-55-1	NS	0.0002
	Perfluorotridecanoic acid (PFTriA)	72629-94-8	NS	0.0002
	Perfluorotetradecanoic acid (PFTeA)	376-06-7	NS	0.0002
	Perfluorobutanesulfonic acid (PFBS)	375-73-5	NS	0.0002
	Perfluorohexanesulfonic acid (PFHxS)	355-46-4	NS	0.0002
	Perfluorooctanesulfonic acid (PFOS)	1763-23-1	0.0030	0.0002
	N-methylperfluorooctanesulfonamidoacetic acid (NMeFOSAA)	2355-31-9	NS	0.0002
	N-ethylperfluorooctanesulfonamidoacetic acid (NEtFOSAA)	2991-50-6	NS	0.0002
	9-Chlorohexadecafluoro-3-oxanonane-1-sulfonic acid	756426-58-1	NS	0.0002
	Hexafluoropropylene Oxide Dimer Acid (HFPO-DA)	13252-13-6	NS	0.0002
	11-Chloroeicosafluoro-3-oxaundecane-1-sulfonic acid	763051-92-9	NS	0.0002
	4,8-Dioxa-3H-perfluorononanoic acid (ADONA)	919005-14-4	NS	0.0002

Table 1 - Soil Contaminants of Potential Concern

NOTES:

1 DEC Soil-Cleanup Levels are from 18 AAC 75.341 (updated October 2023) Table B1. Migration to Groundwater and Table B2. Method Two - Over 40 Inch Zone (Migration to Groundwater) unless otherwise specified.

2 Laboratory limits from SGS North America, Inc. for GRO, DRO, RRO, VOCs, PCB, and PAH analyses. Laboratory limits from Eurofins Environmental Testing America – Sacramento for PFAS analyses.

3 Regulatory limit for 1,3-dichloropropene was used for both cis-1,3-dichloropropene and trans-1,3-dichloropropene.

4 DEC Soil-Cleanup Levels are from 18 AAC 75.341 (updated October 2023) Table B1 Method Two - Over 40 Inch Zone – Human Health Value.

BOLD LOD exceeds DEC regulatory limit.

DEC = Alaska Department of Environmental Conservation; CAS = Chemical Abstract Service Registry Number; LOD = limit of detection; mg/kg = milligram per kilogram; NS = not specified; PAH = polycyclic aromatic hydrocarbon; PCB = polychlorinated biphenyl; PFAS = per- and polyfluoroalkyl substances; VOC = volatile organic compound

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Imagery: https://services.arcgisonline.com/ArcGIS/rest/services/World_Imagery/MapServer

VICINITY MAP

Figure 1

SHANNON & WILSON

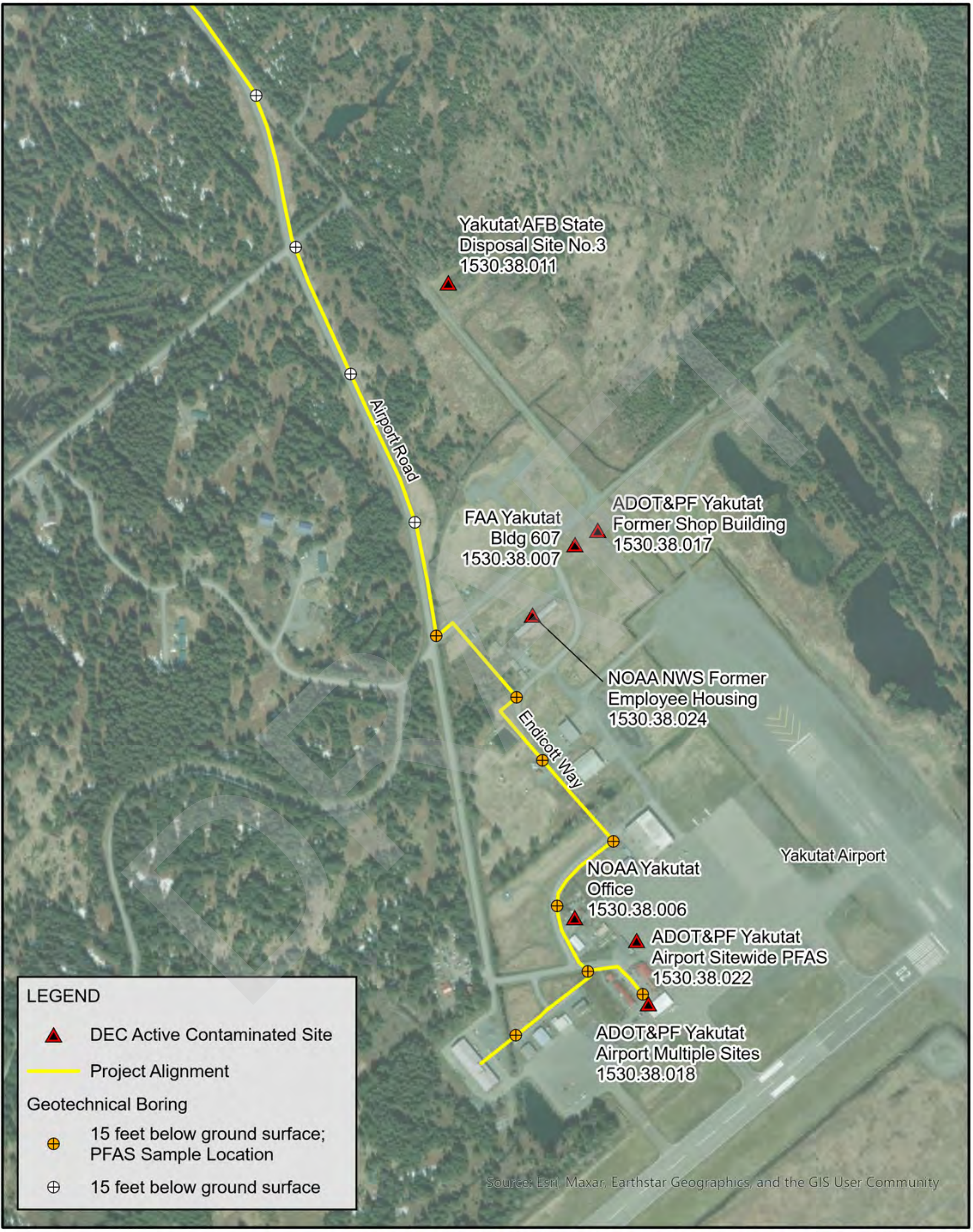
Yakutat Airport Water Line Extension
Yakutat, Alaska

112494

PROJECT ALIGNMENT & GEOTECHNICAL BORING LOCATIONS

Figure 2

112494



Imagery: https://services.arcgisonline.com/ArcGIS/rest/services/World_Imagery/MapServer

CONTAMINATED SITES AND PFAS SAMPLE LOCATIONS

Figure 3

NOTES:
1. DEC = Alaska Department of Environmental Conservation
2. Only "Active" DEC Contaminated Sites likely to impact the project area are depicted. Contaminated site locations are provided by DEC Contaminated Sites Database. Other DEC Contaminated Sites, not depicted, are present in the vicinity.

112474

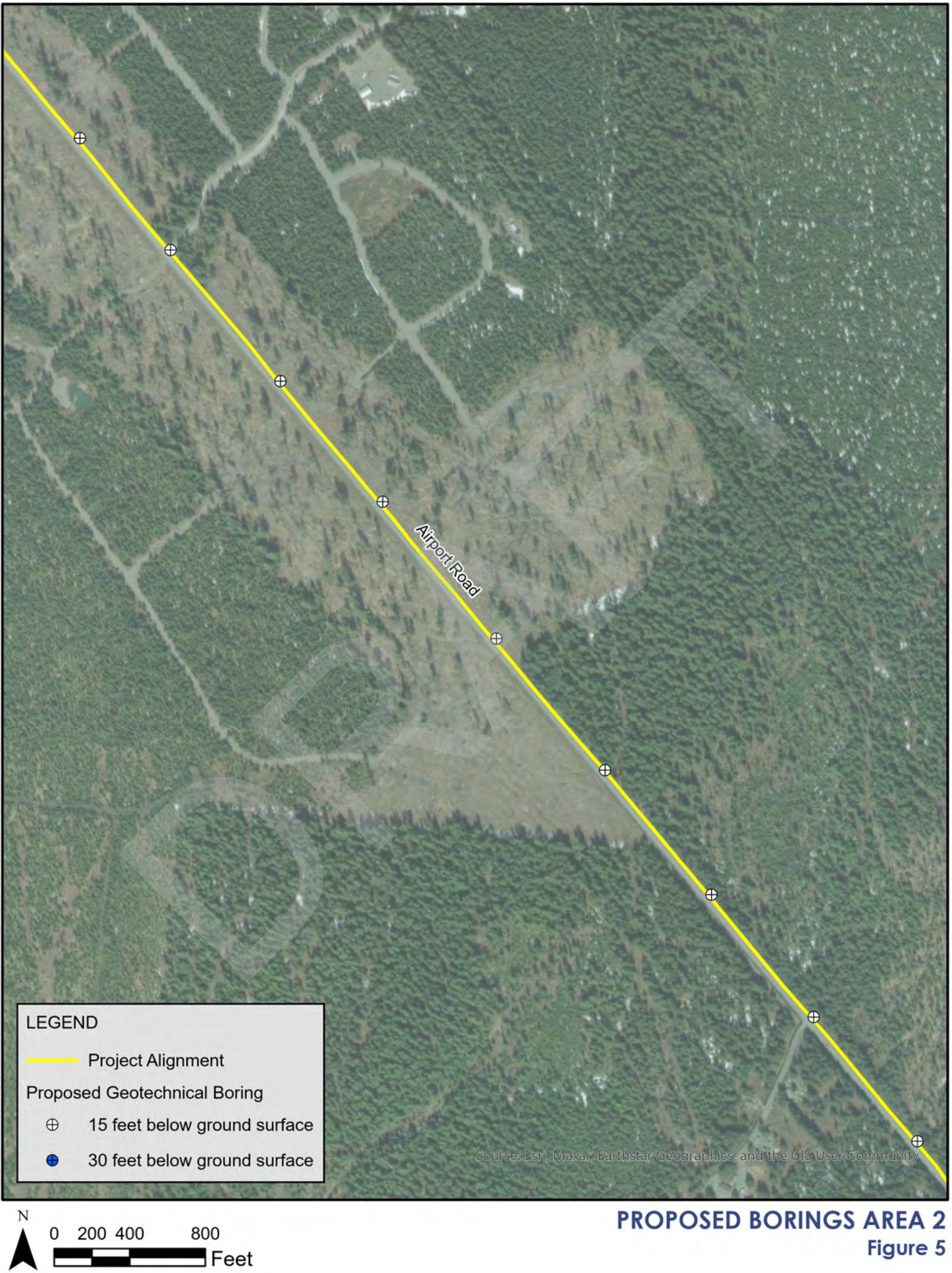
Source: Esri, Maxar, Earthstar Geographics, and the GIS User Community

Imagery: https://services.arcgisonline.com/ArcGIS/rest/services/World_Imagery/MapServer

PROPOSED BORINGS AREA 1

Figure 4

112474



Imagery: https://services.arcgisonline.com/ArcGIS/rest/services/World_Imagery/MapServer

PROPOSED BORINGS AREA 2

Figure 5

112474

Imagery: https://services.arcgisonline.com/ArcGIS/rest/services/World_Imagery/MapServer

PROPOSED BORINGS AREA 3

Figure 6

APPENDIX A: SITE SAFETY AND HEALTH PLAN

Appendix A

Site Safety and Health Plan

SITE SAFETY AND HEALTH PLAN

A.1 APPLICABILITY AND PURPOSE

S&W prepared this SSHP for field-screening and analytical soil sampling activities at the City and Borough of Yakutat (CBY) Airport water extension project site in Yakutat, Alaska. The purpose of this SSHP is to protect the health and safety of field personnel from physical and chemical hazards associated with work at this site.

The provisions of this plan apply to S&W personnel who will potentially be exposed to safety and/or health hazards during this investigation. S&W employees are covered under our Corporate Safety and Health Program. General safety and health requirements described in that program will be met. Each S&W employee on the site will complete the personal acknowledgement form provided at the end of this SSHP, documenting they have read and understand this SSHP and agree to abide by its requirements. A copy of this SSHP will be kept on site throughout the duration of sampling operations.

A.2 SITE HAZARD ANALYSIS

There are two categories of hazards that may occur during the field work: potential chemical exposure hazards and physical hazards associated with field-screening, sampling and construction activities. These hazards are discussed below.

A.2.1 Chemical-Exposure Hazards

Contaminated soil and water may be present on the project site and encountered during field activities. Health and safety information is provided in the following paragraphs.

Petroleum Hydrocarbons

Petroleum hydrocarbons (diesel and gasoline fuel) are expected to be encountered in onsite soils during the project. Health and safety information for petroleum hydrocarbons is provided in the following paragraphs, and in the SDS in Appendix B.

The most likely petroleum hydrocarbons to be encountered are constituents of gasoline and diesel fuel. S&W personnel will use appropriate personal protective equipment (PPE) to limit dermal contact, ingestion and inhalation exposures. The selection, use, and maintenance of respiratory protective equipment shall meet the requirements of established procedures and recognized consensus standards and comply with the requirements set forth in 29 CFR 1910.134.

Diesel has a flashpoint of 110 to 120 degrees Fahrenheit and a vapor density greater than 1. The lower explosive limit is approximately 1 percent, with an upper explosive limit of approximately 6 percent. Diesel can cause irritation of the skin. Inhalation of high concentrations of diesel vapors causes headaches and stupor. Diesel fuel may also contain small quantities of volatile organic compounds including benzene.

The most toxic component in gasoline is benzene, which is added to gasoline at a rate of up to 5 percent to increase octane levels in unleaded gasoline.

Benzene

Benzene (and related compounds such as ethylbenzene and xylene isomers) has a characteristic "sweet" aroma. All are central nervous system depressants. Benzene is generally considered one of the most dangerous petroleum volatile organic compounds due to its carcinogenic properties, relatively high volatility, and transport mobility. Benzene has been linked with some types of cancer (specifically, leukemia) when workers have been exposed to a high (300 ppm to 600 ppm) concentration for long periods of time (15 or more years). The Occupational Safety and Health Administration (OSHA) permissible exposure limit (PEL) for benzene is 1 ppm as an eight-hour time-weighted average (TWA), with a short-term exposure limit of 5 ppm as averaged over any 15-minute period (29 CFR Part 1910.1028). The recommended exposure limit set by the National Institute for Occupational Safety and Health (NIOSH) is 0.1 ppm for an eight-hour TWA or 1 ppm for a 15-minute ceiling.

Benzene-contaminated soil may be present at the site and encountered during excavation activities. We do not anticipate the OSHA PEL will be exceeded in the breathing space of field personnel. S&W personnel will implement skin-contact protection (use of disposable nitrile gloves) as appropriate. The SDS for benzene is in Appendix B.

Isobutylene

The isobutylene calibration gas is used for calibration of the hand-held field screening instrument. Care must be taken to avoid puncturing the compressed gas and keeping the compressed gas away from potential heat sources. The SDS for the isobutylene calibration gas is provided in Appendix B.

Methanol

Methanol can cause damage to eyes and central nervous system if ingested or inhaled, and may be fatal if swallowed. Sampling personnel will avoid exposure by keeping the sample jar away from the face and avoid breathing the vapors. The SDS for the methanol soil-sample extractant is provided in Appendix B.

PFAS

Certain PFAS compounds are known to be carcinogenic over long periods of exposure. Contamination in the soil and water in the project area may be encountered. S&W personnel will implement skin protection when they are to contact potentially contaminated soil or water. Field personnel will wear work gloves or nitrile gloves as needed, and Level D personal protective equipment. The SDS for the PFAS is provided in Appendix B.

A.2.2 Physical Hazards

Physical hazards associated with sampling include: equipment-related injuries, such as being struck by equipment; lifting, slipping, tripping, and falling; insects and animals; temperature stress; and risk of fire. The best means of protection against accidents related to physical hazards are careful control of equipment activities in the planned work area and use of experienced and safety- and health-trained field personnel

A.2.3 Heavy Equipment

Our scope necessitates the use of a drill rig and we may also be working in close proximity to passing trucks and equipment. Personnel will exercise caution when working around heavy equipment and maintain a safe distance from moving equipment. Eye contact will be made with the operator prior to entering the work area, and personnel within the work area will remain within sight of the operator at all times. Personnel will wear high visibility clothing (safety vest) while working near heavy equipment.

A.2.4 Slips, Trips, and Falls

The most common hazards on an investigation site are slips, trips, and falls. These hazards will be reduced through the following practices:

- Personnel will stay alert to their surroundings.
- Work areas and access ways will be kept free of materials, supplies, and obstructions at all times.
- Tools and other materials will be located so as not to cause tripping or other hazards.
- Personnel should be aware of potential tripping hazards associated with vegetation, debris, and uneven ground.
- Personnel should be aware of limitations imposed by work clothing and PPE.

The project site may be inherently hazardous due to the potential presence of rain, snow or ice, which can alter the character of the ground surface. The risk for slips, trips, and falls by site representatives is increased due to wet and frozen surfaces; therefore, field representatives will use caution when walking at the site.

A.2.5 Insects and Animals

During the summer months in Alaska, mosquitoes and other insects are common in areas predominantly covered with vegetation. Wearing PPE should be sufficient to protect site workers. Animals such as moose and bears are also commonly seen in Alaska. If a large animal approaches the site, workers should keep their distance or seek shelter in their vehicles. We will stay alert for animals and always have a vehicle in close proximity to field personnel. Food can attract animals and should be kept in closed vehicles.

A.2.6 Temperature Stress

Cold stress/injury due to hypothermia, as well as heat stress, will be guarded against by wearing appropriate clothing, having adequate shelter available, scheduling rest periods, and self-monitoring physical and mental conditions.

A.2.7 Noise Hazards

Noise is a physical hazard associated with working near heavy equipment and aircraft. Hearing protection will be used near operating heavy equipment and when active aircraft activities are occurring. Disposable earplugs will be used by representatives to reduce noise levels. An F-35 Lightning II produces 115 dB of noise. Exposer to the site workers may vary depending on the proximity to the jets. Disposable earplugs will have the capacity to reduce noise by at least 30 decibels (dB), and below the OSHA PEL (eight-hour TWA) of 85 dB. Earmuffs may reduce noise by approximately 30 dB. A combination of earmuffs and earplugs may reduce noise by approximately 35 dB. A combination of both earmuffs and earplugs may be required, based on the proximity to operating jets.

A.2.8 Lifting Hazards

Moving sample coolers or other heavy objects presents a lifting hazard. Personnel will use proper lifting techniques and obtain assistance when lifting objects weighing more than 40 pounds.

A.2.9 Fire Hazards

Fire hazards are a concern when working in areas with flammable contaminants or substances. Methanol (methyl alcohol) used for the preservation of volatile soil samples is considered flammable. Therefore, no open flames, including cigarettes, will be allowed within the work area. The SDS for methanol is provided in Appendix B.

A.2.10 Other Hazards

Underground utilities may be present at the site. Field personnel will verify that locates have performed prior to drilling activities.

A.3 PERSONNEL RESPONSIBILITIES, TRAININGS, AND MEDICAL SURVEILLANCE

A.3.1 Assignment of Responsibilities

S&W personnel are responsible for understanding and complying with the requirements of this SSHP. Following is a list of responsibilities of all S&W personnel working on the site:

- Review and follow this SSHP.
- Attend and participate in safety meetings.
- Take appropriate action as described in this SSHP regarding accidents, fires, or other emergency situations.
- Take reasonable precautions to prevent injury to themselves and their fellow personnel.
- Perform only those tasks they believe they can do safely, and immediately report any accidents or unsafe conditions to S&W's Project Manager (Wendy Presler).
- Halt work, by themselves or by others, when they observe an unsafe act or potential unsafe working condition.
- Report accidents, illnesses, and near-misses to S&W's Project Manager and to S&W's Fairbanks office Health and Safety Manager (Fawn Glassburn).

A.3.2 Personnel Training

S&W personnel performing activities on this site and under this plan have completed the appropriate training requirements specified in 29 CFR 1910.120(e). Each individual has completed an annual eight-hour refresher-training course and/or initial 40-hour training course within the last year. Each individual is trained in the use of half-face and/or full-face air-purifying respirators.

A.3.3 Medical Surveillance Program

All field personnel performing activities on this site covered by this SSHP have undergone baseline and annual physical/medical examinations as part of S&W's Corporate Health and Safety Program. All field personnel are active participants S&W's Medical Monitoring Program or in a similar program, which complies with 29 CFR 1910.120(f).

A.4 PERSONAL PROTECTIVE EQUIPMENT

PPE will be required during the course of the field work. PPE selection will be based primarily on work-task requirements and potential exposure. Field personnel will use Level D protective equipment during normal work activities. If organic-vapor monitoring indicates a concentration of total volatile organics greater than 10 ppm above background levels in the breathing zone, personal protection will be upgraded to Level C. Personnel are trained in the use of PPE that is, or may be, required.

A.4.1 Level D PPE

All personnel shall wear as a minimum:

- standard work clothes or cotton overalls;
- reflective, high-visibility safety vest;
- safety-toe boots;
- safety glasses;
- gloves; and
- hard hat (although hard hats may not be necessary if no overhead hazard is present).

Disposable nitrile gloves will be worn during collection of field-screening and analytical samples.

A.4.2 Level C PPE

If air monitoring indicates the potential for exposure to high levels of hydrocarbon vapors, personnel shall upgrade to Level C protection. Level C protection will include as a minimum the required items for Level D PPE plus a half- or full-face air-purifying respirator with organic vapor cartridges (NIOSH/Mine Safety & Health Administration approved).

A.5 DECONTAMINATION PROCEDURES

Decontamination procedures for personnel and equipment are necessary to control contamination and protect field personnel.

A.5.1 Equipment Decontamination

Equipment that may require decontamination includes sampling tools (i.e., stainless steel spoons), hand tools, and certain PPE. The number and size of tools/equipment used to handle known contaminated soil will be kept to a minimum. Sampling tools and protective equipment will be decontaminated using a soft bristle brush and water/detergent solution, followed by tap-water rinse.

Following use at the site, disposable PPE will be bagged for disposal at the municipal landfill. Non-disposable PPE shall be decontaminated with a water/detergent solution followed by PFAS-free water rinse prior to leaving the site. Decontamination fluids will be collected and discharged onto the ground surface on site.

A.5.2 Personnel Decontamination

S&W will conduct field-screening and sampling activities in Level D and/or Level C PPE. For this reason, personnel will not need to follow a decontamination procedure when leaving the work site unless gross visual contamination of protective clothing is present. When decontamination is necessary, it will consist of the following:

- A decontamination station, at the perimeter of the work site, will be placed where personnel routinely enter/exit the work site. When exiting the work site, personnel will doff over boots, chemical resistant boots, coveralls, and outer gloves at the specified decontamination area. When in use, air-purifying respirators shall be removed last.
- Personnel shall be instructed in proper decontamination technique. This entails removal of protective equipment in an “inside-out” manner. Removal of contaminants from protective clothing or equipment by blowing, shaking, or other means that may disperse material into the air is prohibited.
- Personnel protective clothing that has been removed shall remain at the decontamination station pending personnel re-donning the clothing. At the conclusion of site work each day, PPE will be placed in trash bags for off-site disposal.
- Personnel will not exit the work site until contaminated clothing and equipment have been removed and employees have washed their hands and face with soap and water. A washtub with soap and water will be available to personnel as they exit the work site.
- Employees will wash their hands and face with soap and water before eating, drinking, smoking, or applying cosmetics. These activities will be restricted to designated rest area(s).
- Decontaminated items will be visually inspected for residual contamination to determine if decontamination procedures are effective.

A.6 ACCIDENTS AND EMERGENCIES

S&W field personnel are current in first aid and cardiopulmonary resuscitation (CPR) training. At a minimum, the following site safety equipment and first aid supplies shall be available in the field:

- PPE and clothing specialized for known site hazards;

- first aid kit, including first aid booklet;
- clean water in portable containers;
- other decontamination supplies; and
- fire extinguisher.

The primary emphasis of any health and safety plan is accident prevention. If an injury or illness occurs during the course of field work, the severity of the problem will dictate the level of response. Minor injuries or illness will be addressed with basic first aid measures. More serious injuries will require assistance from the medical staff at the Yakutat Community Health Center (YCHC), located at 115 Airport Road in Yakutat, Alaska. The telephone number for the YCHC is (907) 784-3275. Field phones will be kept easily accessible in the case of an emergency.

S&W's Corporate Health and Safety Program requires accident reporting when there is a site-related accident, near-miss incident, or medical emergency. If an employee is treated by medical personnel for a work-related injury or illness, the medical attendant will complete an Incident Medical Treatment Documentation form. Completion of an Alaska Department of Labor Report of Occupational Injury or Illness is also required within 10 days for any work-related injury or illness.

A.7 GENERAL SITE SAFETY REQUIREMENTS

The following measures are designed to augment the specific health and safety guidelines provided in this plan:

- Field personnel will refrain from smoking, eating, drinking, or chewing tobacco while in work zones or a potentially contaminated area.
- Flammable/combustible materials will not be ignited in the work zone, and equipment shall be bonded and grounded, spark-proof, and explosion-resistant, as appropriate.
- Field personnel should avoid contact with potentially contaminated surfaces and should avoid: walking through puddles or pools of liquid; kneeling on the ground; or leaning, sitting, or placing equipment on drums or contaminated soil.
- Field personnel will be familiar with procedures for initiating an emergency response.
- Hazard assessment is a continual process; personnel must be aware of their surroundings and any chemical/physical hazards present.
- Personnel in the exclusion area shall be the minimum number necessary to perform work tasks in a safe and efficient manner.
- The use of contact lenses is prohibited; soft lenses may absorb irritants, and all lenses concentrate irritants.

- Equipment contacting potentially contaminated soils must be decontaminated or properly discarded before leaving the site.

Field personnel will be familiar with the physical characteristics of the work site including wind direction, site access, and location of communication devices and safety equipment.

APPENDIX B: SAFETY DATA SHEETS

Appendix B

Safety Data Sheets

CONTENTS

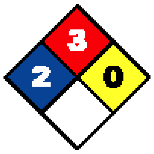
- Benzene
- Diesel Fuel (all types)
- Gasoline
- Isobutylene
- Lead
- Methanol
- PFAS

HOVENSA

MATERIAL SAFETY DATA SHEET

Benzene **MSDS No. 1785**

EMERGENCY OVERVIEW
DANGER!
FLAMMABLE - BLOOD TOXIN AND CARCINOGEN - ABSORBED THROUGH THE SKIN - CENTRAL NERVOUS SYSTEM - HARMFUL OR FATAL IF SWALLOWED - ASPIRATION HAZARD



NFPA 704 (Section 16)

High fire hazard. Keep away from heat, spark, open flame, and other ignition sources.

If ingested, do NOT induce vomiting, as this may cause chemical pneumonia (fluid in the lungs). Contact may cause eye, skin and mucous membrane irritation. Harmful if absorbed through the skin. Avoid prolonged breathing of vapors or mists. Inhalation may cause irritation, anesthetic effects (dizziness, nausea, headache, intoxication), and respiratory system effects.

Long-term exposure may cause blood disease, including anemia and leukemia.

1. CHEMICAL PRODUCT AND COMPANY INFORMATION

HOVENSA L.L.C.
1 Estate Hope
Christiansted, VI 00820-5652

EMERGENCY TELEPHONE NUMBER (24 hrs): **CHEMTREC (800) 424-9300**

COMPANY CONTACT (business hours): **Safety Department (340) 692-3000**

SYNONYMS: Benzol; Coal Naphtha; coal tar naphtha; Cyclohexatriene; Phenyl hydride
See Section 16 for abbreviations and acronyms.

2. COMPOSITION and CHEMICAL INFORMATION ON INGREDIENTS

INGREDIENT NAME (CAS No.)	CONCENTRATION PERCENT BY WEIGHT
Benzene (71-43-2)	100

3. HAZARDS IDENTIFICATION

EYES

Moderate to severe irritant. Contact with liquid or vapor may cause irritation.

SKIN

Moderate to severe irritant. May cause skin irritation with prolonged or repeated contact. Practically non-toxic if absorbed following acute (single) exposure. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are exposed repeatedly.

INGESTION

The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

INHALATION

Excessive exposure may cause irritation to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

Effects to the blood (including decreased platelet and white blood cell counts), cardiovascular system, nervous system, retina, lungs, gastrointestinal system, spleen, and kidneys have been reported from large, acute (short) and repeated or prolonged exposures.

CHRONIC EFFECTS and CARCINOGENICITY

Benzene is a regulated human carcinogen. Benzene has the potential to cause bone marrow depression, aplastic anemia (low red blood cell count) and other blood diseases, including leukemia, after repeated and prolonged exposure. Benzene can cause liver and kidney toxicity.

MEDICAL CONDITIONS AGGRAVATED BY EXPOSURE

Irritation from skin exposure may aggravate existing open wounds, skin disorders, and dermatitis (rash). Pre-existing chronic respiratory disease, liver or kidney dysfunction, or blood, cardiovascular and central nervous system disorders may be aggravated by exposure.

4. FIRST AID MEASURES

EYES

In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

SKIN

Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or waterless hand cleanser. Obtain medical attention if irritation or redness develops.

INGESTION

DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

INHALATION

Remove person to fresh air. If person is not breathing, ensure an open airway and provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

NOTE TO PHYSICIAN

OSHA and US Coast Guard require that a person exposed to benzene in an emergency have a urine sample taken at the end of the shift and have a urine phenol test performed within 72 hours. For results equal to or greater than 75 ml/L of urine, employees must have a complete blood count every month for three months after the emergency exposure. See OSHA 29 CFR 1910.1028 or USCG 49 CFR 193.

5. FIRE FIGHTING MEASURES

FLAMMABLE PROPERTIES:

FLASH POINT:	12 °F (-11 °C)
AUTOIGNITION TEMPERATURE:	928 °F (498 °C)
OSHA/NFPA FLAMMABILITY CLASS:	1B (flammable liquid)
LOWER EXPLOSIVE LIMIT (%):	1.3%
UPPER EXPLOSIVE LIMIT (%):	7.9%

FIRE AND EXPLOSION HAZARDS

Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. Flowing product may be ignited by self-generated static electricity. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

EXTINGUISHING MEDIA

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, or Halon.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

FIRE FIGHTING INSTRUCTIONS

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment.

Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing.

Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

See Section 16 for the NFPA 704 Hazard Rating.

6. ACCIDENTAL RELEASE MEASURES

ACTIVATE FACILITY SPILL CONTINGENCY or EMERGENCY PLAN.

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Product may release substantial amounts of flammable vapors and gases (e.g., methane, ethane, and propane), at or below ambient temperature depending on source and process conditions and pressure.

Carefully contain and stop the source of the spill, if safe to do so. Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection - do not discharge solid water stream patterns into the liquid resulting in splashing.

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal. Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

7. HANDLING and STORAGE

HANDLING and STORAGE PRECAUTIONS

Handle as a flammable liquid. Keep away from heat, sparks, and open flame! Electrical equipment should be approved for classified area. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents.

STORAGE PRECAUTIONS

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks".

WORK/HYGIENIC PRACTICES

Emergency eye wash capability should be available in the near proximity to operations presenting a potential splash exposure. Use good personal hygiene practices. Avoid repeated and/or prolonged skin exposure. Wash hands before eating, drinking, smoking, or using toilet facilities. Do not use as a cleaning solvent on the skin. Do not use solvents or harsh abrasive skin cleaners for washing this product from exposed skin areas. Waterless hand cleaners are effective. Promptly remove contaminated clothing and launder before reuse. Use care when laundering to prevent the formation of flammable vapors which could ignite via washer or dryer. Consider the need to discard contaminated leather shoes and gloves.

8. EXPOSURE CONTROLS and PERSONAL PROTECTION

EXPOSURE LIMITS

		Exposure Limits	
Components (CAS No.)	**Source**	**TWA/STEL**	**Note**
Benzene (71-43-2)	OSHA ACGIH	PEL = 1ppm; STEL = 5 ppm TLV = 0.5 ppm; STEL = 2.5 ppm	A1; skin; BEI

ENGINEERING CONTROLS

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

EYE/FACE PROTECTION

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

SKIN PROTECTION

Gloves constructed of nitrile or neoprene are recommended. Chemical protective clothing such as of E.I. DuPont Tyvek-Saranex 23 ®, Tychem®, Barricade® or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

RESPIRATORY PROTECTION

A NIOSH -approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited. Refer to OSHA 29 CFR 1910.134, ANSI Z88.2-1992, NIOSH Respirator Decision Logic, and the manufacturer for additional guidance on respiratory protection selection.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

9. PHYSICAL and CHEMICAL PROPERTIES

APPEARANCE

A clear, water-like liquid

ODOR

A sweet, aromatic odor.

ODOR THRESHOLD

4.7 ppm

BASIC PHYSICAL PROPERTIES

BOILING RANGE: 176 °F (80 °C)
VAPOR PRESSURE: 74.6 mm Hg @ 68 °F (20 °C)
VAPOR DENSITY (air = 1): 2.8
SPECIFIC GRAVITY (H_2O = 1): 0.87
EVAPORATION RATE: High
PERCENT VOLATILES: 100 %
SOLUBILITY (H_2O): Insoluble to slightly soluble

10. STABILITY and REACTIVITY

STABILITY: Stable. Hazardous polymerization will not occur.

CONDITIONS TO AVOID and INCOMPATIBLE MATERIALS

Material is stable under normal conditions. Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources

HAZARDOUS DECOMPOSITION PRODUCTS

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke). Contact with nitric and sulfuric acids will form nitrocresols that can decompose violently.

11. TOXICOLOGICAL PROPERTIES

ACUTE TOXICITY

Acute Dermal LD50 (rabbits): > 9.4 ml/kg
Acute inhalation LC50: 10,000 ppm (rat; 7 hours)
Primary dermal irritation (rabbits): mild to moderate
Acute Oral LD50 (mouse): 4.7 g/kg
Eye irritation (rabbit): mild to moderate

CHRONIC EFFECTS AND CARCINOGENICITY

Carcinogenicity: OSHA: YES IARC: (1) NTP: YES ACGIH: (A1)

Numerous epidemiological (human) and animal studies have reported an increased incidence or a causal relationship between leukemia and benzene exposure.

Mutagenicity: positive

12. ECOLOGICAL INFORMATION

Keep out of sewers, drainage areas, and waterways. Report spills and releases, as applicable, under Federal and State regulations.

13. DISPOSAL CONSIDERATIONS

Consult federal, state and local waste regulations to determine appropriate disposal options.

14. TRANSPORTATION INFORMATION

DOT PROPER SHIPPING NAME:	Benzene
DOT HAZARD CLASS and PACKING GROUP:	3, PG II
DOT IDENTIFICATION NUMBER:	UN 1114
DOT SHIPPING LABEL:	FLAMMABLE LIQUID

PLACARD:

15. REGULATORY INFORMATION

U.S. FEDERAL, STATE, and LOCAL REGULATORY INFORMATION

Any spill or uncontrolled release of this product, including any substantial threat of release, may be subject to federal, state and/or local reporting requirements. This product and/or its constituents may also be subject to other regulations at the state and/or local level. Consult those regulations applicable to your facility/operation.

CLEAN WATER ACT (OIL SPILLS)

Any spill or release of this product to "navigable waters" (essentially any surface water, including certain wetlands) or adjoining shorelines sufficient to cause a visible sheen or deposit of a sludge or emulsion must be reported immediately to the National Response Center (1-800-424-8802) as required by U.S. Federal Law. Also contact appropriate state and local regulatory agencies as required.

CERCLA SECTION 103 and SARA SECTION 304 (RELEASE TO THE ENVIRONMENT)

Benzene is a CERCLA Section 103 "hazardous substance" subject to CERCLA and SARA Section 304 reporting requirements.

Reportable Quantity: 10 pounds

SARA SECTION 311/312 - HAZARD CLASSES

ACUTE HEALTH	CHRONIC HEALTH	FIRE	SUDDEN RELEASE OF PRESSURE	REACTIVE
X	X	X	--	--

SARA SECTION 313 - SUPPLIER NOTIFICATION

This product contains the following toxic chemicals subject to the reporting requirements of section 313 of the Emergency Planning and Community Right-To-Know Act (EPCRA) of 1986 and of 40 CFR 372:

	INGREDIENT NAME	CONCENTRATION PERCENT BY WEIGHT
Benzene	CAS NUMBER: 71-43-2	< 0.1 to 2

CANADIAN REGULATORY INFORMATION (WHMIS)

Class B Division 2 (Flammable Liquid)
Class D Division 2 Subdivision A (Very toxic by other means)
Class D Division 1 Subdivision A (Very toxic acute)
Class D Division 2 Subdivision B (Toxic by other means)

CALIFORNIA PROPOSITON 65 LIST OF CHEMICALS

This product contains the following chemicals that are included on the Proposition 65 "List of Chemicals" required by the California Safe Drinking Water and Toxic Enforcement Act of 1986:

INGREDIENT NAME (CAS NUMBER)	**Date Listed**
Benzene	2/27/1987

NFPA® HAZARD RATING		
	HEALTH:	2
	FIRE:	3
	REACTIVITY:	0

Refer to NJPA 704 "Identification of the Fire Hazards of Materials" for further information

HMIS® HAZARD RATING			
	HEALTH:	3 *	Slight
	FIRE:	3	Moderate
	PHYSICAL:	0	Negligible
			* Chronic

SUPERSEDES MSDS DATED: 01/14/1999

ABBREVIATIONS:

AP = Approximately
N/A = Not Applicable
< = Less than
N/D = Not Determined
> = Greater than
ppm = parts per million

ACRONYMS:

ACGIH	American Conference of Governmental Industrial Hygienists
AIHA	American Industrial Hygiene Association
ANSI	American National Standards Institute (212) 642-4900
API	American Petroleum Institute (202) 682-8000
CERCLA	Comprehensive Emergency Response, Compensation, and Liability Act
DOT	U.S. Department of Transportation [General info: (800) 467-4922]
EPA	U.S. Environmental Protection Agency
HMIS	Hazardous Materials Information System
IARC	International Agency For Research On Cancer
MSHA	Mine Safety and Health Administration
NFPA	National Fire Protection Association (617)770-3000
NIOSH	National Institute of Occupational Safety and Health
NOIC	Notice of Intended Change (proposed change to ACGIH TLV)
NTP	National Toxicology Program
OPA	Oil Pollution Act of 1990
OSHA	U.S. Occupational Safety & Health Administration
PEL	Permissible Exposure Limit (OSHA)
RCRA	Resource Conservation and Recovery Act
REL	Recommended Exposure Limit (NIOSH)
SARA	Superfund Amendments and Reauthorization Act of 1986 Title III
SCBA	Self-Contained Breathing Apparatus
SPCC	Spill Prevention, Control, and Countermeasures
STEL	Short-Term Exposure Limit (generally 15 minutes)
TLV	Threshold Limit Value (ACGIH)
TSCA	Toxic Substances Control Act
TWA	Time Weighted Average (8 hr.)
WEEL	Workplace Environmental Exposure Level (AIHA)
WHMIS	Canadian Workplace Hazardous Materials Information System

DISCLAIMER OF EXPRESSED AND IMPLIED WARRANTIES

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

Safety Data Sheet

Material Name: Diesel Fuel, All Types

SDS No. 9909
US GHS

Synonyms: Ultra Low Sulfur Diesel; Low Sulfur Diesel; No. 2 Diesel; Motor Vehicle Diesel Fuel; Non-Road Diesel Fuel; Locomotive/Marine Diesel Fuel

* * * Section 1 - Product and Company Identification * * *

Manufacturer Information

Hess Corporation
1 Hess Plaza
Woodbridge, NJ 07095-0961

Phone: 732-750-6000 Corporate EHS
Emergency # 800-424-9300 CHEMTREC
www.hess.com (Environment, Health, Safety Internet Website)

* * * Section 2 - Hazards Identification * * *

GHS Classification:

Flammable Liquids - Category 3
Skin Corrosion/Irritation – Category 2
Germ Cell Mutagenicity – Category 2
Carcinogenicity - Category 2
Specific Target Organ Toxicity (Single Exposure) - Category 3 (respiratory irritation, narcosis)
Aspiration Hazard – Category 1
Hazardous to the Aquatic Environment, Acute Hazard – Category 3

GHS LABEL ELEMENTS

Symbol(s)

Signal Word

DANGER

Hazard Statements

Flammable liquid and vapor.
Causes skin irritation.
Suspected of causing genetic defects.
Suspected of causing cancer.
May cause respiratory irritation.
May cause drowsiness or dizziness.
May be fatal if swallowed and enters airways.
Harmful to aquatic life.

Precautionary Statements

Prevention

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.
Wash hands and forearms thoroughly after handling.
Obtain special instructions before use.
Do not handle until all safety precautions have been read and understood.
Avoid breathing fume/mist/vapours/spray.

Response
In case of fire: Use water spray, fog or foam to extinguish.
IF ON SKIN (or hair): Wash with plenty of soap and water. Remove/Take off immediately all contaminated clothing and wash it before reuse. If skin irritation occurs: Get medical advice/attention.
IF INHALED: Remove person to fresh air and keep comfortable for breathing. Call a poison center/doctor if you feel unwell.
If swallowed: Immediately call a poison center or doctor. Do NOT induce vomiting.
IF exposed or concerned: Get medical advice/attention.

Storage
Store in a well-ventilated place. Keep cool.
Keep container tightly closed.
Store locked up.

Disposal
Dispose of contents/container in accordance with local/regional/national/international regulations.

* * * Section 3 - Composition / Information on Ingredients * * *

CAS #	Component	Percent
68476-34-6	Fuels, diesel, no. 2	100
91-20-3	Naphthalene	<0.1

A complex mixture of hydrocarbons with carbon numbers in the range C9 and higher.

* * * Section 4 - First Aid Measures * * *

First Aid: Eyes

In case of contact with eyes, immediately flush with clean, low-pressure water for at least 15 min. Hold eyelids open to ensure adequate flushing. Seek medical attention.

First Aid: Skin

Remove contaminated clothing. Wash contaminated areas thoroughly with soap and water or with waterless hand cleanser. Obtain medical attention if irritation or redness develops. Thermal burns require immediate medical attention depending on the severity and the area of the body burned.

First Aid: Ingestion

DO NOT INDUCE VOMITING. Do not give liquids. Obtain immediate medical attention. If spontaneous vomiting occurs, lean victim forward to reduce the risk of aspiration. Monitor for breathing difficulties. Small amounts of material which enter the mouth should be rinsed out until the taste is dissipated.

First Aid: Inhalation

Remove person to fresh air. If person is not breathing, provide artificial respiration. If necessary, provide additional oxygen once breathing is restored if trained to do so. Seek medical attention immediately.

* * * Section 5 - Fire Fighting Measures * * *

General Fire Hazards

See Section 9 for Flammability Properties.

Vapors may be ignited rapidly when exposed to heat, spark, open flame or other source of ignition. When mixed with air and exposed to an ignition source, flammable vapors can burn in the open or explode in confined spaces. Being heavier than air, vapors may travel long distances to an ignition source and flash back. Runoff to sewer may cause fire or explosion hazard.

Hazardous Combustion Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

Extinguishing Media

SMALL FIRES: Any extinguisher suitable for Class B fires, dry chemical, CO2, water spray, fire fighting foam, and other gaseous agents.

LARGE FIRES: Water spray, fog or fire fighting foam. Water may be ineffective for fighting the fire, but may be used to cool fire-exposed containers.

Unsuitable Extinguishing Media

None

Fire Fighting Equipment/Instructions

Small fires in the incipient (beginning) stage may typically be extinguished using handheld portable fire extinguishers and other fire fighting equipment. Firefighting activities that may result in potential exposure to high heat, smoke or toxic by-products of combustion should require NIOSH/MSHA- approved pressure-demand self-contained breathing apparatus with full facepiece and full protective clothing. Isolate area around container involved in fire. Cool tanks, shells, and containers exposed to fire and excessive heat with water. For massive fires the use of unmanned hose holders or monitor nozzles may be advantageous to further minimize personnel exposure. Major fires may require withdrawal, allowing the tank to burn. Large storage tank fires typically require specially trained personnel and equipment to extinguish the fire, often including the need for properly applied fire fighting foam.

* * * Section 6 - Accidental Release Measures * * *

Recovery and Neutralization

Carefully contain and stop the source of the spill, if safe to do so.

Materials and Methods for Clean-Up

Take up with sand or other oil absorbing materials. Carefully shovel, scoop or sweep up into a waste container for reclamation or disposal. Caution, flammable vapors may accumulate in closed containers.

Emergency Measures

Evacuate nonessential personnel and remove or secure all ignition sources. Consider wind direction; stay upwind and uphill, if possible. Evaluate the direction of product travel, diking, sewers, etc. to confirm spill areas. Spills may infiltrate subsurface soil and groundwater; professional assistance may be necessary to determine the extent of subsurface impact.

Personal Precautions and Protective Equipment

Response and clean-up crews must be properly trained and must utilize proper protective equipment (see Section 8).

Environmental Precautions

Protect bodies of water by diking, absorbents, or absorbent boom, if possible. Do not flush down sewer or drainage systems, unless system is designed and permitted to handle such material. The use of fire fighting foam may be useful in certain situations to reduce vapors. The proper use of water spray may effectively disperse product vapors or the liquid itself, preventing contact with ignition sources or areas/equipment that require protection.

Prevention of Secondary Hazards

None

* * * Section 7 - Handling and Storage * * *

Handling Procedures

Handle as a combustible liquid. Keep away from heat, sparks, excessive temperatures and open flame! No smoking or open flame in storage, use or handling areas. Bond and ground containers during product transfer to reduce the possibility of static-initiated fire or explosion.

Special slow load procedures for "switch loading" must be followed to avoid the static ignition hazard that can exist when higher flash point material (such as fuel oil) is loaded into tanks previously containing low flash point products (such as this product) - see API Publication 2003, "Protection Against Ignitions Arising Out Of Static, Lightning and Stray Currents."

Storage Procedures

Keep away from flame, sparks, excessive temperatures and open flame. Use approved vented containers. Keep containers closed and clearly labeled. Empty product containers or vessels may contain explosive vapors. Do not pressurize, cut, heat, weld or expose such containers to sources of ignition.

Store in a well-ventilated area. This storage area should comply with NFPA 30 "Flammable and Combustible Liquid Code". Avoid storage near incompatible materials. The cleaning of tanks previously containing this product should follow API Recommended Practice (RP) 2013 "Cleaning Mobile Tanks In Flammable and Combustible Liquid Service" and API RP 2015 "Cleaning Petroleum Storage Tanks."

Incompatibilities

Keep away from strong oxidizers.

* * * Section 8 - Exposure Controls / Personal Protection * * *

Component Exposure Limits

Fuels, diesel, no. 2 (68476-34-6)

ACGIH:	100 mg/m3 TWA (inhalable fraction and vapor, as total hydrocarbons, listed under Diesel fuel) Skin - potential significant contribution to overall exposure by the cutaneous route (listed under Diesel fuel)

Naphthalene (91-20-3)

ACGIH:	10 ppm TWA 15 ppm STEL Skin - potential significant contribution to overall exposure by the cutaneous route
OSHA:	10 ppm TWA; 50 mg/m3 TWA
NIOSH:	10 ppm TWA; 50 mg/m3 TWA 15 ppm STEL; 75 mg/m3 STEL

Engineering Measures

Use adequate ventilation to keep vapor concentrations of this product below occupational exposure and flammability limits, particularly in confined spaces.

Personal Protective Equipment: Respiratory

A NIOSH/MSHA-approved air-purifying respirator with organic vapor cartridges or canister may be permissible under certain circumstances where airborne concentrations are or may be expected to exceed exposure limits or for odor or irritation. Protection provided by air-purifying respirators is limited.

Use a positive pressure, air-supplied respirator if there is a potential for uncontrolled release, exposure levels are not known, in oxygen-deficient atmospheres, or any other circumstance where an air-purifying respirator may not provide adequate protection.

Personal Protective Equipment: Hands

Gloves constructed of nitrile, neoprene, or PVC are recommended.

Personal Protective Equipment: Eyes

Safety glasses or goggles are recommended where there is a possibility of splashing or spraying.

Personal Protective Equipment: Skin and Body

Chemical protective clothing such as of E.I. DuPont TyChem®, Saranex® or equivalent recommended based on degree of exposure. Note: The resistance of specific material may vary from product to product as well as with degree of exposure. Consult manufacturer specifications for further information.

* * * Section 9 - Physical & Chemical Properties * * *

Appearance:	Clear, straw-yellow.	**Odor:**	Mild, petroleum distillate odor
Physical State:	Liquid	**pH:**	ND
Vapor Pressure:	0.009 psia @ 70 °F (21 °C)	**Vapor Density:**	>1.0
Boiling Point:	320 to 690 °F (160 to 366 °C)	**Melting Point:**	ND
Solubility (H2O):	Negligible	**Specific Gravity:**	0.83-0.876 @ 60°F (16°C)
Evaporation Rate:	Slow; varies with conditions	**VOC:**	ND
Percent Volatile:	100%	**Octanol/H2O Coeff.:**	ND
Flash Point:	>125 °F (>52 °C) minimum	**Flash Point Method:**	PMCC
Upper Flammability Limit (UFL):	7.5	**Lower Flammability Limit (LFL):**	0.6
Burning Rate:	ND	**Auto Ignition:**	494°F (257°C)

* * * Section 10 - Chemical Stability & Reactivity Information * * *

Chemical Stability

This is a stable material.

Hazardous Reaction Potential

Will not occur.

Conditions to Avoid

Avoid high temperatures, open flames, sparks, welding, smoking and other ignition sources.

Incompatible Products

Keep away from strong oxidizers.

Hazardous Decomposition Products

Carbon monoxide, carbon dioxide and non-combusted hydrocarbons (smoke).

* * * Section 11 - Toxicological Information * * *

Acute Toxicity

A: General Product Information

Harmful if swallowed.

B: Component Analysis - LD50/LC50

Naphthalene (91-20-3)

Inhalation LC50 Rat >340 mg/m3 1 h; Oral LD50 Rat 490 mg/kg; Dermal LD50 Rat >2500 mg/kg; Dermal LD50 Rabbit >20 g/kg

Potential Health Effects: Skin Corrosion Property/Stimulativeness

Practically non-toxic if absorbed following acute (single) exposure. May cause skin irritation with prolonged or repeated contact. Liquid may be absorbed through the skin in toxic amounts if large areas of skin are repeatedly exposed.

Potential Health Effects: Eye Critical Damage/ Stimulativeness

Contact with eyes may cause mild irritation.

Potential Health Effects: Ingestion

Ingestion may cause gastrointestinal disturbances, including irritation, nausea, vomiting and diarrhea, and central nervous system (brain) effects similar to alcohol intoxication. In severe cases, tremors, convulsions, loss of consciousness, coma, respiratory arrest, and death may occur.

Potential Health Effects: Inhalation

Excessive exposure may cause irritations to the nose, throat, lungs and respiratory tract. Central nervous system (brain) effects may include headache, dizziness, loss of balance and coordination, unconsciousness, coma, respiratory failure, and death.

WARNING: the burning of any hydrocarbon as a fuel in an area without adequate ventilation may result in hazardous levels of combustion products, including carbon monoxide, and inadequate oxygen levels, which may cause unconsciousness, suffocation, and death.

Respiratory Organs Sensitization/Skin Sensitization

This product is not reported to have any skin sensitization effects.

Generative Cell Mutagenicity

This material has been positive in a mutagenicity study.

Carcinogenicity

A: General Product Information

Suspected of causing cancer.

Studies have shown that similar products produce skin tumors in laboratory animals following repeated applications without washing or removal. The significance of this finding to human exposure has not been determined. Other studies with active skin carcinogens have shown that washing the animal's skin with soap and water between applications reduced tumor formation.

B: Component Carcinogenicity

Fuels, diesel, no. 2 (68476-34-6)

ACGIH:	A3 - Confirmed Animal Carcinogen with Unknown Relevance to Humans (listed under Diesel fuel)

Naphthalene (91-20-3)

ACGIH:	A4 - Not Classifiable as a Human Carcinogen
NTP:	Reasonably Anticipated To Be A Human Carcinogen (Possible Select Carcinogen)
IARC:	Monograph 82 [2002] (Group 2B (possibly carcinogenic to humans))

Reproductive Toxicity

This product is not reported to have any reproductive toxicity effects.

Specified Target Organ General Toxicity: Single Exposure

This product is not reported to have any specific target organ general toxicity single exposure effects.

Specified Target Organ General Toxicity: Repeated Exposure

This product is not reported to have any specific target organ general toxicity repeat exposure effects.

Aspiration Respiratory Organs Hazard

The major health threat of ingestion occurs from the danger of aspiration (breathing) of liquid drops into the lungs, particularly from vomiting. Aspiration may result in chemical pneumonia (fluid in the lungs), severe lung damage, respiratory failure and even death.

* * * Section 12 - Ecological Information * * *

Ecotoxicity

A: General Product Information

Keep out of sewers, drainage areas and waterways. Report spills and releases, as applicable, under Federal and State regulations.

B: Component Analysis - Ecotoxicity - Aquatic Toxicity

Fuels, diesel, no. 2 (68476-34-6)

Test & Species		Conditions
96 Hr LC50 Pimephales promelas	35 mg/L [flow-through]	

Naphthalene (91-20-3)

Test & Species		Conditions
96 Hr LC50 Pimephales promelas	5.74-6.44 mg/L [flow-through]	
96 Hr LC50 Oncorhynchus mykiss	1.6 mg/L [flow-through]	
96 Hr LC50 Oncorhynchus mykiss	0.91-2.82 mg/L [static]	
96 Hr LC50 Pimephales promelas	1.99 mg/L [static]	

96 Hr LC50 Lepomis macrochirus	31.0265 mg/L [static]
72 Hr EC50 Skeletonema costatum	0.4 mg/L
48 Hr LC50 Daphnia magna	2.16 mg/L
48 Hr EC50 Daphnia magna	1.96 mg/L [Flow through]
48 Hr EC50 Daphnia magna	1.09 - 3.4 mg/L [Static]

Persistence/Degradability

No information available.

Bioaccumulation

No information available.

Mobility in Soil

No information available.

* * * Section 13 - Disposal Considerations * * *

Waste Disposal Instructions

See Section 7 for Handling Procedures. See Section 8 for Personal Protective Equipment recommendations.

Disposal of Contaminated Containers or Packaging

Dispose of contents/container in accordance with local/regional/national/international regulations.

* * * Section 14 - Transportation Information * * *

DOT Information

Shipping Name: Diesel Fuel
NA #: 1993 **Hazard Class:** 3 **Packing Group:** III
Placard:

* * * Section 15 - Regulatory Information * * *

Regulatory Information

Component Analysis

This material contains one or more of the following chemicals required to be identified under SARA Section 302 (40 CFR 355 Appendix A), SARA Section 313 (40 CFR 372.65) and/or CERCLA (40 CFR 302.4).

Naphthalene (91-20-3)

CERCLA: 100 lb final RQ; 45.4 kg final RQ

SARA Section 311/312 – Hazard Classes

Acute Health	Chronic Health	Fire	Sudden Release of Pressure	Reactive
X	X	X	--	--

SARA SECTION 313 - SUPPLIER NOTIFICATION

This product may contain listed chemicals below the de minimis levels which therefore are not subject to the supplier notification requirements of Section 313 of the Emergency Planning and Community Right- To-Know Act (EPCRA) of 1986 and of 40 CFR 372. If you may be required to report releases of chemicals listed in 40 CFR 372.28, you may contact Hess Corporate Safety if you require additional information regarding this product.

State Regulations

Component Analysis - State

The following components appear on one or more of the following state hazardous substances lists:

Component	CAS	CA	MA	MN	NJ	PA	RI
Fuels, diesel, no. 2	68476-34-6	No	No	No	Yes	No	No
Naphthalene	91-20-3	Yes	Yes	Yes	Yes	Yes	No

The following statement(s) are provided under the California Safe Drinking Water and Toxic Enforcement Act of 1986 (Proposition 65):

WARNING! This product contains a chemical known to the state of California to cause cancer.

Component Analysis - WHMIS IDL

No components are listed in the WHMIS IDL.

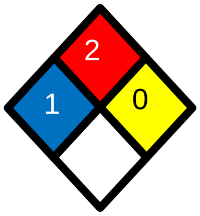
Additional Regulatory Information

Component Analysis - Inventory

Component	CAS #	TSCA	CAN	EEC
Fuels, diesel, no. 2	68476-34-6	Yes	DSL	EINECS
Naphthalene	91-20-3	Yes	DSL	EINECS

* * * Section 16 - Other Information * * *

NFPA® Hazard Rating		
	Health	1
	Fire	2
	Reactivity	0



HMIS® Hazard Rating			
	Health	1*	Slight
	Fire	2	Moderate
	Physical	0	Minimal
			*Chronic

Key/Legend

ACGIH = American Conference of Governmental Industrial Hygienists; ADG = Australian Code for the Transport of Dangerous Goods by Road and Rail; ADR/RID = European Agreement of Dangerous Goods by Road/Rail; AS = Standards Australia; DFG = Deutsche Forschungsgemeinschaft; DOT = Department of Transportation; DSL = Domestic Substances List; EEC = European Economic Community; EINECS = European Inventory of Existing Commercial Chemical Substances; ELINCS = European List of Notified Chemical Substances; EU = European Union; HMIS = Hazardous Materials Identification System; IARC = International Agency for Research on Cancer; IMO = International Maritime Organization; IATA = International Air Transport Association; MAK = Maximum Concentration Value in the Workplace; NDSL = Non-Domestic Substances List; NFPA = National Fire Protection Association; NOHSC = National Occupational Health & Safety Commission; NTP = National Toxicology Program; STEL = Short-term Exposure Limit; TDG = Transportation of Dangerous Goods; TLV = Threshold Limit Value; TSCA = Toxic Substances Control Act; TWA = Time Weighted Average

Literature References

None

Other Information

Information presented herein has been compiled from sources considered to be dependable, and is accurate and reliable to the best of our knowledge and belief, but is not guaranteed to be so. Since conditions of use are beyond our control, we make no warranties, expressed or implied, except those that may be contained in our written contract of sale or acknowledgment.

Vendor assumes no responsibility for injury to vendee or third persons proximately caused by the material if reasonable safety procedures are not adhered to as stipulated in the data sheet. Additionally, vendor assumes no responsibility for injury to vendee or third persons proximately caused by abnormal use of the material, even if reasonable safety procedures are followed. Furthermore, vendee assumes the risk in their use of the material.

End of Sheet

MATERIAL SAFETY DATA SHEET

This Material Safety Data Sheet (MSDS) complies with the United Nations Globally Harmonized System (GHS) of Classification and Labeling, Second revised Edition and meets or exceeds the Canadian and United States Requirements for Hazard Communication

1. Product and Supplier Identification

Product Name: Methanol
GHS Product Identifier: Methanol

Recommended Use: Solvent, fuel, feedstock

Restrictions on Use: Do not use in a confined area without proper ventilation. Contact lenses may cause further damage in case of splash into eye. Avoid use near heat, flames, sparks, and other sources of ignition.

Product:	**Methanol (CH_3OH)**	**Methanex Tel. #:** (604) 661-2600
Synonyms:	Methanol, methyl hydrate, wood spirit, methyl hydroxide	**Emergency Tel. #:** 1-800-262-8200 **(CHEMTREC)** (Canada and USA)
Company Identification:	**Methanex Corporation** **1800 Waterfront Centre** **200 Burrard Street** **Vancouver, B.C.** **V6C 3M1**	
Importer:	**Methanex Methanol Company** **15301 Dallas Parkway, Suite 900** **Addison, Texas 75001** **Telephone: (972) 702-0909**	

2. Hazards Identification

Classification: Flammable Liquid, Category 1, Acute Toxicity Category 1*, Reproductive Toxicity 1B, Specific Target Organ Toxicity (Repeated Exposure)

Label:

Hazard Communication: DANGER! Extremely flammable liquid and vapour. Fatal if swallowed.
May damage fertility or the unborn child (fetotoxic and teratogenic effects).
May cause damage to eyes and central nervous system if ingested or inhaled.

***Note:** Assigned to classification based on human experience rather than the strict application of classification criteria set out in the Recommendations on the Transport of Dangerous Goods, Model Regulations Special Provision 279.

Hazards: Colourless liquid, with a mild, characteristic alcohol odour when pure. Crude methanol may have a repulsive, pungent odour. Hygroscopic (moisture absorbing).

***FLAMMABLE LIQUID AND VAPOUR*:** Burns with a clean, clear flame, which is almost invisible in daylight, or a light blue flame. Can decompose at high temperatures forming carbon monoxide and formaldehyde.

Confined space toxicity hazard. Mild central nervous system depressant following inhalation, skin absorption or ingestion. May cause headache, nausea, dizziness, drowsiness, and un-coordination. Severe vision effects, including increased sensitivity to light, blurred vision, and blindness may develop following an 8-24 hour symptom-free period. Coma and death may result.

IRRITANT: Causes eye irritation. Aspiration hazard. Swallowing or vomiting of the liquid may result in aspiration (breathing) into the lungs.

POSSIBLE REPRODUCTIVE HAZARD: May cause fetotoxic (toxic to the fetus during the latter stages of pregnancy, often through the placenta) and teratogenic effects (causing malformations of the fetus), based on animal information.

NFPA Ratings: (Health, Fire, Reactivity): 1, 3, 0

3. Composition

Component	**% (w/w)**	**Exposure Limits (ACGIH)***	**LD$_{50}$**	**LC$_{50}$**
Methanol (CAS 67-56-1)	99-100	ACGIH* TLV-TWA: 200 ppm, skin; TLV-STEL: 250 ppm, skin PEL-TWA: 200 ppm, skin PEL-STEL: 250 ppm, skin IDLH: 6000 ppm, acute inhalation toxicity to animals TLV Basis, critical effects: neuropathy, vision, central nervous system(CNS)	5628 mg/kg (oral/rat) 15800 mg/kg (dermal/ rabbit)	64000 ppm (inhalation/rat)

* Exposure limits may vary from time to time and from one jurisdiction to another. Check with local regulatory agency for the exposure limits in your area. ACGIH, American Conference of Governmental Industrial Hygienists.

4. First Aid Measures

Note: *Emergency assistance may also be available from the local poison control centre.*

Eye Contact: Remove contact lenses if worn. In case of contact, immediately flush eyes with plenty of clean running water for at least 15 minutes, lifting the upper and lower eyelids occasionally. Obtain medical attention.

Skin Contact: In case of contact, remove contaminated clothing. In a shower, wash affected areas with soap and water for at least 15 minutes. Seek medical attention if irritation occurs or persists. Wash clothing before reuse. Prolonged contact with methanol may defat skin tissue, resulting in drying and cracking.

Inhalation: Remove to fresh air, restore or assist breathing if necessary. Obtain medical attention.

Ingestion: Swallowing methanol is potentially life threatening. Onset of symptoms may be delayed for 18 to 24 hours after digestion. If conscious and medical aid is not immediately available, do not induce vomiting. In actual or suspected cases of ingestion, transport to medical facility immediately.

NOTE TO PHYSICIAN: Acute exposure to methanol, either through ingestion or breathing high airborne concentrations can result in symptoms appearing between 40 minutes and 72 hours after exposure. Symptoms and signs are usually limited to the Central Nervous System (CNS), eyes and gastrointestinal tract. Because of the initial CNS's effects of headache, vertigo, lethargy and confusion, there may be an impression of ethanol intoxication. Blurred vision, decreased acuity and photophobia are common complaints. Treatment with ipecac or lavage is indicated in any patient presenting within two hours of ingestion. A profound metabolic acidosis occurs in severe poisoning and serum bicarbonate levels are a more accurate measure of severity than serum methanol levels. Treatment protocols are available from most major hospitals and early collaboration with appropriate hospitals is recommended.

Ethanol significantly decreases the toxicity of methanol because it competes for the same metabolic enzymes, and has been used to treat methanol poisoning.

5. Fire Fighting Measures

Suitable Extinguishing Media: Extinguishing Media: Small fires: Dry chemical, CO_2, water spray
Large fires: Water spray(see note in Unsuitable Extinguishing Media), AFFF(R) (Aqueous Film Forming Foam (alcohol resistant)) type with either a 3% or 6% foam proportioning system.

Unsuitable Extinguishing Media: General purpose synthetic foams or protein foams may work, but much less effectively. Water may be effective for cooling, but may not be effective for extinguishing a fire because it may not cool methanol below its flash point.

Specific Hazards: Methanol vapours may burn with an invisible flame. During a fire, carbon monoxide, carbon dioxide and irritation and toxic gases such as formaldehyde may be generated. Vapours can accumulate in confined spaces resulting in a toxicity and flammability hazard. Closed containers may rupture violently and suddenly release large quantities of methanol when exposed to fire or excessive heat for a sufficient period of time. Vapours are slightly heavier than air and may travel long distances toward sources of ignition.

Hazardous Combustion Products: Toxic gases and vapours; oxides of carbon and formaldehyde.

Fire Fighting Instructions: Methanol burns with a clean clear flame that is almost invisible in daylight. Stay upwind! Isolate and restrict area access. Concentrations of greater that 25% methanol in water can be ignited. Use fine water spray or fog to control fire spread and cool adjacent structures or containers. Contain fire control water for later disposal. Fire fighters must wear full face, positive pressure, self-contained breathing apparatus or airline and appropriate protective fire fighting clothing as per NFPA. Note that methanol fires may require proximity suits. Take care not to walk through any spilled chemical.

Special Information: Vapours can flow along surfaces to distant ignition sources and flash back.

6. Accidental Release Measures

Overview: Flammable liquid! Can burn without a visible flame. Release can cause an immediate risk of fire and explosion. Eliminate all ignition sources, stop leak and use absorbent materials. If necessary, contain spill by diking. Fluorocarbon alcohol resistant foams may be applied to spill to diminish vapour and fire hazard. Maximize methanol recovery for recycling or re-use. Restrict access to area until completion of cleanup. Ensure cleanup is conducted by trained personnel only. Wear adequate personal protection and remove all sources of ignition. Notify all governmental agencies as required by law.

Personal Protection: Full face, positive pressure self-contained breathing apparatus or airline, and fire resistant protective clothing with chemical resistant splash suit must be worn. If product ignites, approach and fire fighting must be done with appropriate fire fighting clothing.

Environmental Precautions: Biodegrades easily in water. Methanol in fresh or salt water may have serious effects on aquatic life. A study on methanol's toxic efffects on sewage sludge bacteria reported little effect on digestion at 0.1% while 0.5% methanol retarded digestion. Methanol will be broken down to carbon dioxide and water.

Remedial Measures: Flammable liquid. Release can cause an immediate fire/explosion hazard. Eliminate all sources of ignition, stop leak and use absorbent materials. Collect liquid with explosion proof pumps. Do not walk through spill product as it may be on fire and not visible.

Small Spills: Soak up spill with non-combustible absorbent material. Recover methanol and dilute with water to reduce fire hazard. Prevent spilled methanol from entering sewers, confined spaces, drains, or waterways. Restict access to unprotected personnel. Put material in suitable, covered, labeled containers. Flush area with water.

Large Spills: If necessary, contain spill by diking. Fluorocarbon alcohol resistant foams may be applied to spill to diminish vapour and fire hazard. Maximize methanol recovery for recycling or reuse. Collect liquid with explosion proof pumps.

7. Handling and Storage

Precautions for Handling: No smoking or open flame in storage, use or handling areas. Use explosion proof electrical equipment. Ensure proper electrical grounding procedures are in place.

Storage: Store in totally enclosed equipment, designed to avoid ignition and human contact. Tanks must be grounded, vented, and should have vapour emission controls. Tanks must be diked as per NFPA or API Standards. A flammable mixture of methanol vapour and air is possible inside a storage tank or transportation tank, and handlers should take appropriate precautions to reduce the risk of ignition. Handlers must eliminate ignition sources or purge the tank with an inert gas such as nitrogen. All equipment must be grounded - bonded when transferring product in order to avoid static discharge from the equipment, and subsequent possible fire. Avoid storage with incompatible materials. Anhydrous methanol is non-corrosive to most metals at ambient temperatures except for lead, nickel, monel, cast iron and high silicon iron. Coatings of copper (or copper alloys), zinc (including galvanized steel), or aluminum are unsuitable for storage. These materials may be attacked slowly by the methanol. Storage tanks of welded construction are normally satisfactory. They should be designed and built in conformance with good engineering practice for the material being stored. While plastics can be used for short term storage, they are generally not recommended for long-term storage due to deterioration effects and the subsequent risk of contamination.

Corrosion rates for several construction materials:

<0.508 mm/year:	Cast iron, monel, lead, nickel
<0.051 mm/year:	High silicon iron
Some attack:	Polyethylene
Satisfactory:	Neoprene, phenolic resins, polyesters, natural rubber, butyl rubber
Resistant:	Polyvinyl chloride, unplasticized

8. Exposure Controls, Personal Protection

Occupational Controls: ACGIH* TLV-TWA: 200 ppm, skin (262 mg/m^3);
TLV-STEL: 250 ppm, skin (328 mg/m^3);
PEL-TWA: 200 ppm, skin
PEL-STEL: 250 ppm, skin
TLV Basis: critical effects: neuropathy, vision,
central nervous system(CNS)
IDLH: 6000 ppm, acute inhalation toxicity to animals

Engineering Controls: In confined areas, local and general ventilation should be provided to maintain airborne concentrations below permissable exposure limits. Ventilation systems must be designed according to approved engineering standards.

Respiratory Protection: NIOSH/OSHA recommendations for methanol concentrations in air:

Up to 2000 ppm: supplied air respirator
Up to 5000 ppm: supplied air respirator operated in a continuous-flow mode.
Up to 6000 ppm: supplied air respirator with a tight-fitting facepiece operated in a continuous- flow mode; or Full-facepiece self-contained breathing apparatus or Full-facepiece supplied air respirator.

Cartridge type respirators are NOT recommended.

Emergency or Planned entry into unkown concentrations or IDLH (immediately dangerous to life or health) conditions:

Respirator selection must be done by a qualified person and be based upon a risk assessment of the work activities and exposure levels. Respirators must be fit tested and users must be clean shaven where the respirator seals to the face. Exposure must be kept at or below the applicable exposure limits and the maximum use concentration of the respirator must not be exceeded.

Positive pressure, full-facepiece self-contained breathing apparatus; or Positive pressure, full-facepiece supplied air respirator with an auxiliary positive pressure self-contained breathing apparatus.

Skin Protection: Butyl and nitrile rubbers are recommended for gloves. Check with manufacturer. Wear chemical resistant pants and jackets, preferably of butyl or nitrile rubber. Check with manufacturer.

Eye and Face Protection: Face shield and chemical splash goggles when transferring is taking place. Contact lenses should not be worn when working with methanol.

Footwear: Chemical resistant and as specified by the workplace.

Other: Eyewash and showers should be located near work areas. NOTE: PPE must not be considered a long-term solution to exposure control. PPE usage must be accompanied by employer programs to properly select, maintain, clean, fit and use. Consult a competent industrial hygiene resource to determine hazard potential and/or the PPE manufacturers to ensure adequate protection.

Careful consideration must be made of the added danger of the concenentration being in the LEL/UEL range and so there may be a fire/explosion hazard.

9. Physical and Chemical Properties

Appearance: Liquid, clear, colourless
Odour: Mild characteristic alcohol odour
Odour Threshold: detection: 4.2 - 5960 ppm
(geometric mean) 160 ppm
recognition: 53 – 8940 ppm
(geometric mean) 690 ppm
pH: Not applicable
Freezing Point: -97.8°C
Boiling Point: 64.7°C
Boiling Range: Not determined
Flash Point: 11.0^{o}C
Solubility: Completely soluble
Partial Coefficient: Log P (oct) = -0.82
Vapour Pressure: 12.8 kPa @ 20°C

Upper Explosive Limit (UEL): 36.5 %
Lower Explosive Limit (LEL): 6%
Auto Ignition Temperature: 464°C
Solvent Solubility: Soluble in all proportions in ethanol, benzene, other alcohols, chloroform, diethyl ether, other ethers, esters, ketones and most organic solvents
Critical Temperature: 239.4°C
Specific Gravity: 0.791 @ 20°C
Evaporation Rate: 4.1 (n-butyl acetate =1)
Vapour Density: 1.105 @ 15°C (air = 1)
Decomposition Temperature: Not determined
Sensitivity to Impact: No
Sensitivity to Static Charge: Low

10. Stability and Reactivity

Chemical Stability: Stable as supplied.

Hazardous Reactions: Yes. Avoid contact with strong oxidizers, strong mineral or organic acids, and strong bases. Contact with these materials may cause a violent or explosive reaction. May be corrosive to lead, aluminum, magnesium, and platinum.

Conditions to Avoid: Avoid contact with sparks, heat, open flame, or ignition sources.

Incompatibility: Yes. Avoid contact with strong oxidizers, strong mineral or organic acids, and strong bases. Contact with these materials may cause a violent or explosive reaction. May be corrosive to lead, aluminum, magnesium, and platinum. May react with metallic aluminum or magnesium and generate hydrogen gas. May attack some forms of plastic, rubber, and coatings.

Hazardous Decomposition Products: Formaldehyde, carbon dioxide, and carbon monoxide.

Hazardous Polymerization: Will not occur.

11. Toxicological Information

Signal Word/Label: DANGER! Extremely flammable liquid and vapour. Fatal if swallowed.
May damage fertility or the unborn child (fetotoxic and teratogenic effects).
May cause damage to eyes and central nervous system if ingested or inhaled.

Primary Routes of Entry:

Skin Contact:	Yes
Skin Absorption:	Yes
Eye Contact:	Yes
Ingestion:	Yes
Inhalation:	Yes

Emergency Overview: Colourless liquid, with a mild, characteristic alcohol odour when pure. Crude methanol may have a repulsive, pungent odour. Hygroscopic. Can decompose at high temperatures forming carbon monoxide and formaldehyde. Confined space toxicity hazard. Mild central nervous system depressant following inhalation, skin absorption or ingestion. May cause headache, nausea, dizziness, drowsiness, and incoordination. Severe vision effects, including increased sensitivity to light, blurred vision, and blindness may develop following an 8-24 hour symptom-free period. Coma and death may result. Causes eye irritation. Aspiration hazard. Swallowing or vomiting of the liquid may result in aspiration (breathing) into the lungs. May cause fetotoxic (toxic to the fetus during the latter stages of pregnancy, often through the placenta) and teratogenic effects (causing malformations of the fetus), based on animal information.

Acute Exposure:

Inhalation: Inhalation of high airborne concentrations can also irriate mucous membranes, cause headaches, sleepiness, nausea, confusion, loss of consciousness, digestive and visual disturbances and even death. NOTE: Odour threshhold of methanol is several times higher than the TLV-TWA. Depending upon severity of poisoning and the promptness of treatment, survivors may recover completely or may have permanent blindness, vision disturbances and/or nervous system effects. Concentrations in air exceeding 1000 ppm may cause irritation of the mucous membranes.

Skin Contact: Methanol is moderately irritating to the skin. Methanol can be absorbed through the skin and harmful effects have been reported by this route of entry. Effects are similar to those described in “Inhalation”.

Eye Contact: Methanol is a mild to moderate eye irritant. High vapour concentration or liquid contact with eyes causes irritation, tearing and burning.

Ingestion: Swallowing even small amounts of methanol could potentially cause blindness or death. Effects of sub lethal doses may be nausea, headache, abdominal pain, vomiting and visual disturbances ranging from blurred vision to light sensitivity.

Chronic Exposure:

Irritancy: Prolonged contact with skin may defat tissue causing dermititis or aggravate existing skin problems.

Sensitization: None reported.

Carcinogenicity: Not listed by IARC, NTP, ACGIH, or OSHA as a carcinogen.

Teratogenicity: Methanol has produced fetotoxicity in rats and teratogenicity in mice exposed by inhalation to high concentrations of methanol vapours **.**

Reproductive Toxicity: Information available does not suggest that methanol is a reproductive toxin.

Mutagenicity: There is insufficient information available to conclude that methanol is mutagenic.

Synergistic Products: In animals, high concentrations of methanol can increase the toxicity of other chemicals, particularly liver toxins like carbon tetrachloride. Ethanol significantly reduces the toxicity of methanol because it competes for the same metabolic enzymes, and has been usd to treat methanol poisoning.

Potential for Accumulation: Methanol is readily absorbed into the body following inhalation and ingestion. Skin absorption may occur if the skin is broken or exposure is prolonged. Once absorbed, methanol is rapidly distributed to body tissues. A small amount is excreted unchanged in exhaled air and the urine. The rest is first metabolized to formaldehyde, which is then metabolized to formic acid and/or formate. The formic acid and formate are eventually converted to carbon dioxide and water. In humans, methanol clears from the body, after inhalation or oral exposure, with a half-life of 1 day or more for high doses (greater than 1000 mg/kg) or about 1.5-3 hours for low doses (less than 100 mg/kg or 76.5-230 ppm (100-300 mg/m^3)).

Medical Conditions Aggravated By Exposure: Persons with pre-existing skin disorders, eye problems, respiratory conditions, or impaired liver or kidney functions may be more susceptable to the effects of this substance.

12. Ecological Information

Environmental toxicity: DO NOT discharge into sewer or waterways.

Methanol:

LC_{50} Pimephales promelas (fathead minnows) 29.4 g/L/96 hr, (28-29 days old), confidence limit= 28.5-30.4; Test conditions: Water temp= 25°C, dissolved oxygen= 7.3 mg/L, water hardness= 43.5 mg/l $CaCO_3$, alkalinity= 46.6 $CaCO_3$, tank volume= 6.3 L, additions= 5.71 V/D, pH= 7.66
LC_{50} Pimephales promelas (Fathead minnow, 28-32 day old, 0.126 g) 29,700 mg/L/24 hr; flow-through, 23.3+/-1.7°C, hardness 46.4 mg/L $CaCO_3$, pH 7.0-8.0
LC_{50} Pimephales promelas (Fathead minnow, 30 day old 0.12 g) 28,100 mg/L/96 hr; flow-through, 24-26°C, hardness 45.5 mg/L $CaCO_3$, pH 7.5
LC_{50} Daphnia pulex (Water flea, <24 hr old) 19,500 mg/L/18 hr; static, 22°C, hardness 23+/-2 mg/L $CaCO_3$
EC_{50} Daphnia obtusa (Water flea, <24 hr old; immobilization) 23,500 mg/L/24 hr; static, 20+/-2°C, hardness 250 mg/L $CaCO_3$, pH 7.8+/-0.2
EC_{50} Daphnia obtusa (Water flea, <24 hr old; immobilization) 22,200 mg/L/48 hr; static, 20+/-2°C, hardness 250 mg/L $CaCO_3$, pH 7.8+/-0.2

log K_{ow}: -0.82 – -0.66
Half-life (hr) air: 427
Half-life (hr) H_2O surface water: 5.3 – 64
Henry's Law constant (atm m^3/mol): $4.55X10^{-6}$
BOD 5 if unstated: 0.76 – 1.12
COD: 1.05 – 1.50, 99%
ThOD: 1.05
BCF: 0.2 – 10
TLm(48 hr): 8000mg/L (trout)
Toxicity Arthropoda: NOEL 10 g/L/48 hr (Daphnia)
HSNO Classification: 9.3C – Harmful to terrestrial vertebrates

Methanol in fresh or salt water may have serious effects on aquatic life. A study on methanol's toxic effects on sewage sludge bacteria reported little effect on digestion at 0.1% while 0.5% methanol retarded digestion. Methanol will be broken down into carbon dioxide and water.

Environmental Fate:

Biodegradability: Biodegrades easily in water and soil.

Bioaccumulation:

- **TERRESTRIAL FATE:** Based on a classification scheme, an estimated Koc value of 1 determined from a structure estimation method indicates that methanol is expected to have very high mobility in soil. Volatilization of methanol from moist soil surfaces is expected to be an important fate process given a Henry's Law constant of $4.55X10^{-6}$ (atm m^3/mol). The potential for volatilization of methanol from dry soil surfaces may exist based upon a vapor pressure of 127 mm Hg. Biodegradation is expected to be an important fate process for methanol.

- **AQUATIC FATE:** Based on a classification scheme, an estimated Koc value of 1, determined from a structure estimation method, indicates that methanol is not expected to adsorb to suspended solids and sediment. Volatilization from water surfaces is expected based upon a Henry's Law constant of $4.55X10^{-6}$ (atm m^3/mol). Using this Henry's Law constant and an estimation method, volatilization half-lives for a model river and model lake are three and 35 days, respectively. According to a classification scheme, a BCF of less than 10 measured in fish, suggests bioconcentration in aquatic organisms is low. Hydrolysis and photolysis in sunlit surface waters is not expected to be an important environmental fate process for methanol since this compound lacks functional groups that hydrolyze or absorb light under environmentally relevant conditions. Methanol has been shown to undergo rapid biodegradation in a variety of screening studies using sewage seed and activated sludge inoculum, which suggests that biodegradation will occur in aquatic environments.
- **ATMOSPHERIC FATE:** According to a model of gas/particle partitioning of semi volatile organic compounds in the atmosphere, methanol, which has a vapor pressure of 127 mm Hg at 25°C, is expected to exist solely as a vapor in the ambient atmosphere. Vapor-phase methanol is degraded in the atmosphere by reaction with photo chemically-produced hydroxyl radicals; the half-life for this reaction in air is estimated to be 17 days, calculated from its rate constant of $9.4X10^{-13}$ cu cm/molecule-sec at 25°C

13. Disposal Considerations

Review federal, provincial or state, and local government requirements prior to disposal. Store material for disposal as indicated in Section #7, ***Handling and Storage***. Disposal by controlled incineration or by secure land fill may be acceptable.

Recycle wherever possible. Large volumes may be suitable for re-distillation or, if contaminated, incinerated. Can be disposed of in a sewage treatment facility. Methanol levels of up to 0.1% act as a food source for bacteria; above this level may be toxic to bacteria. When pumping through sewage collection systems, the level of methanol should be kept below the flammable range (a 25% methanol/water mixture is non-flammable at temperatures below 39**°C**). 1 ppm of methanol is equivalent to 1.5 ppm BOD loading in the sewage plant.

Container disposal:

Empty containers may contain hazardous residue. Return to supplier for reuse if possible. Never weld, cut or grind empty containers. If disposing of containers, ensure they are well rinsed with water, then disposed of at an authorised landfill. After cleaning, all existing labels should be removed.

14. Transport Information

Canada Transportation of Dangerous Goods (TDG):	UN 1230, Methanol, Class 3(6.1), P.G. II Limited Quantity: ≤ 1 litres ERG Guide Number: 131
United States Department of Transport (49CFR): (Domestic Only)	UN 1230, Methanol, Class 3, P.G. II, (RQ 5000 lbs/2270 kg) Limited Quantity: ≤ 1 litres ERG Guide Number: 131
International Air Transport Association (IATA):	UN 1230, Methanol, Class 3(6.1), P.G. II Packaging Instruction (passenger aircraft): 305, 1 litre maximum per package,
International Maritime Organization (IMO):	UN 1230, Methanol, Class 3(6.1), P.G.II, Flash Point = 11°C EmS No. F-E, S-D Stowage Category "B", Clear of living quarters
Marine Pollutant:	No

15. Regulatory Information

CANADIAN FEDERAL REGULATIONS:

CEPA, DOMESTIC SUBSTANCES LIST:	Listed (Canadian Environmental Protection Act (CEPA) Schedule I)
WHMIS CLASSIFICATION:	B2, D1B, D2A, D2B

UNITED STATES REGULATIONS:

29CFR 1910.1200 (OSHA):	Hazardous
40CFR 116-117 (EPA):	Hazardous
40CFR 355, Appendices A and B:	Subject to Emergency Planning and Notification
40CFR 372 (SARA Title III):	Listed
40CFR 302 (CERCLA):	Listed

TOXIC SUBSTANCES CONTROL ACT (TSCA): Listed in the inventory.

16. Other Information

References:

1. International Programme on Chemical Safety, Methanol, Environmental Health Criteria, World Health Organization 1997.
2. Patty's Industrial Hygiene and Toxicology, 5th Edition.
3. Fire Protection Guide to Hazardous Materials, 13th Edition.
4. Lanigan, S., Final report on the Safety Assessment of Methyl Alcohol, International Journal of Toxicology., Volume 20, Supplement 1 (2001).
5. Forsberg, K., Quick Selection Guide to Chemical Protective Clothing.
6. Nelson, B.K., Teratological assessment of Methanol and Ethanol at high inhalation levels in rats, Fundamental and Applied Toxicology, Volume 5.
7. NIOSH Guide to Chemical Hazards
8. Hazardous Substance Data Base (HSDB).
9. Cheminfo.

Original Preparation Date: September 22, 2005

Prepared by: Kel-Ex Agencies Ltd., P.O. Box 52201, Lynnmour RPO, North Vancouver, B.C., Canada,
V7J 3V5

Disclaimer: The information above is believed to be accurate and represents the best information currently available to us. Users should make their own investigations to determine the suitability of the information for their particular purposes. This document is intended as a guide to the appropriate precautionary handling of the material by a properly trained person using this product.

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This Material Safety Data Sheet may not be changed, or altered in any way without the expressed knowledge and permission of Methanex Corporation

Revisions: Revised and re-issued in GHS Format September 22, 2008

Material Safety Data Sheet

Airgas

Isobutylene

Section 1. Chemical product and company identification

Product name	: Isobutylene
Supplier	: AIRGAS INC., on behalf of its subsidiaries 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253
Product use	: Synthetic/Analytical chemistry.
Synonym	: Propene, 2-methyl-; γ-Butylene; Isobutene; Isobutylene; Isopropylidenemethylene; 1,1-Dimethylethylene; 2-Methyl-1-propene; 2-Methylpropene; iso-C4H8; Methylpropene; 2-Methylpropene-isobutylene; UN 1055; UN 1075
MSDS #	: 001031
Date of Preparation/Revision	: **11/10/2010.**
In case of emergency	: 1-866-734-3438

Section 2. Hazards identification

Physical state	: Gas. [COLORLESS LIQUEFIED COMPRESSED GAS WITH A SWEET GASOLINELIKE ODOR]
Emergency overview	: WARNING! FLAMMABLE GAS. MAY CAUSE FLASH FIRE. CONTENTS UNDER PRESSURE. Keep away from heat, sparks and flame. Do not puncture or incinerate container. Use only with adequate ventilation. Keep container closed. Contact with rapidly expanding gases can cause frostbite.
Routes of entry	: Inhalation
Potential acute health effects	
Eyes	: Contact with rapidly expanding gas may cause burns or frostbite.
Skin	: Contact with rapidly expanding gas may cause burns or frostbite.
Inhalation	: Acts as a simple asphyxiant.
Ingestion	: Ingestion is not a normal route of exposure for gases
Potential chronic health effects	: **CARCINOGENIC EFFECTS**: A4 (Not classifiable for humans or animals.) by ACGIH. **MUTAGENIC EFFECTS**: Not available. **TERATOGENIC EFFECTS**: Not available.
Medical conditions aggravated by over-exposure	: Acute or chronic respiratory conditions may be aggravated by overexposure to this gas.

See toxicological information (section 11)

Section 3. Composition, Information on Ingredients

Name	CAS number	% Volume	Exposure limits
Isobutylene	115-11-7	100	**ACGIH TLV (United States, 2/2010).** TWA: 250 ppm 8 hour(s).

Section 4. First aid measures

No action shall be taken involving any personal risk or without suitable training.If it is suspected that fumes are still present, the rescuer should wear an appropriate mask or self-contained breathing apparatus.It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

Eye contact : Check for and remove any contact lenses. Immediately flush eyes with plenty of water for at least 15 minutes, occasionally lifting the upper and lower eyelids. 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. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Wash clothing before reuse. Clean shoes thoroughly before reuse. Get medical attention immediately.

Frostbite : Try to warm up the frozen tissues and seek medical attention.

Inhalation : Move exposed person to fresh air. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. Loosen tight clothing such as a collar, tie, belt or waistband. Get medical attention immediately.

Ingestion : As this product is a gas, refer to the inhalation section.

Section 5. Fire-fighting measures

Flammability of the product : Flammable.

Auto-ignition temperature : 465°C (869°F)

Flammable limits : Lower: 1.8% Upper: 9.6%

Products of combustion : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

Fire hazards in the presence of various substances : Extremely flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and oxidizing materials.

Fire-fighting media and instructions : In case of fire, use water spray (fog), foam or dry chemical.

In case of fire, allow gas to burn if flow cannot be shut off immediately. Apply water from a safe distance to cool container and protect surrounding area. If involved in fire, shut off flow immediately if it can be done without risk.

Contains gas under pressure. Flammable gas. In a fire or if heated, a pressure increase will occur and the container may burst, with the risk of a subsequent explosion.

Special protective equipment for fire-fighters : Fire-fighters should wear appropriate protective equipment and self-contained breathing apparatus (SCBA) with a full face-piece operated in positive pressure mode.

Section 6. Accidental release measures

Personal precautions : Immediately contact emergency personnel. Keep unnecessary personnel away. Use suitable protective equipment (section 8). Shut off gas supply if this can be done safely. Isolate area until gas has dispersed.

Environmental precautions : Avoid dispersal of spilled material and runoff and contact with soil, waterways, drains and sewers.

Methods for cleaning up : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment. Note: see section 1 for emergency contact information and section 13 for waste disposal.

Section 7. Handling and storage

Handling : Use only with adequate ventilation. Use explosion-proof electrical (ventilating, lighting and material handling) equipment. High pressure gas. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Keep container closed. Keep away from heat, sparks and flame. To avoid fire, eliminate ignition sources. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

Storage : Keep container in a cool, well-ventilated area. Keep container tightly closed and sealed until ready for use. Avoid all possible sources of ignition (spark or flame). Segregate from oxidizing materials. Cylinders should be stored upright, with valve protection cap in place, and firmly secured to prevent falling or being knocked over. Cylinder temperatures should not exceed 52 °C (125 °F).

Section 8. Exposure controls/personal protection

Engineering controls : Use only with adequate ventilation. Use process enclosures, local exhaust ventilation or other engineering controls to keep worker exposure to airborne contaminants below any recommended or statutory limits. The engineering controls also need to keep gas, vapor or dust concentrations below any lower explosive limits. Use explosion-proof ventilation equipment.

Personal protection

Eyes : Safety eyewear complying with an approved standard should be used when a risk assessment indicates this is necessary to avoid exposure to liquid splashes, mists or dusts.

Skin : Personal protective equipment for the body should be selected based on the task being performed and the risks involved and should be approved by a specialist before handling this product.

Respiratory : Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator.

The applicable standards are (US) 29 CFR 1910.134 and (Canada) Z94.4-93

Hands : Chemical-resistant, impervious gloves complying with an approved standard should be worn at all times when handling chemical products if a risk assessment indicates this is necessary.

Personal protection in case of a large spill : Self-contained breathing apparatus (SCBA) should be used to avoid inhalation of the product.

Product name	
2-methylpropene	**ACGIH TLV (United States, 2/2010).** TWA: 250 ppm 8 hour(s).

Consult local authorities for acceptable exposure limits.

Section 9. Physical and chemical properties

Molecular weight : 56.12 g/mole

Molecular formula : C4-H8

Boiling/condensation point : -6.9°C (19.6°F)

Melting/freezing point : -140°C (-220°F)

Critical temperature : 144.8°C (292.6°F)

Vapor pressure : 24.3 (psig)

Vapor density : 1.9 (Air = 1)

Specific Volume (ft^3/lb) : 6.6845

Gas Density (lb/ft^3) : 0.1496

Section 10. Stability and reactivity

Stability and reactivity : The product is stable.

Incompatibility with various substances : Extremely reactive or incompatible with the following materials: oxidizing materials.

Hazardous decomposition products : Under normal conditions of storage and use, hazardous decomposition products should not be produced.

Hazardous polymerization : Under normal conditions of storage and use, hazardous polymerization will not occur.

Section 11. Toxicological information

Toxicity data

Product/ingredient name	Result	Species	Dose	Exposure
2-methylpropene	LC50 Inhalation Vapor	Rat	550000 mg/m3	4 hours

Chronic effects on humans : **CARCINOGENIC EFFECTS**: A4 (Not classifiable for humans or animals.) by ACGIH.

Other toxic effects on humans : No specific information is available in our database regarding the other toxic effects of this material to humans.

Specific effects

Carcinogenic effects : No known significant effects or critical hazards.

Mutagenic effects : No known significant effects or critical hazards.

Reproduction toxicity : No known significant effects or critical hazards.

Section 12. Ecological information

Aquatic ecotoxicity

Not available.

Products of degradation : Products of degradation: carbon oxides (CO, CO_2) and water.

Environmental fate : Not available.

Environmental hazards : No known significant effects or critical hazards.

Toxicity to the environment : Not available.

Section 13. Disposal considerations

Product removed from the cylinder must be disposed of in accordance with appropriate Federal, State, local regulation.Return cylinders with residual product to Airgas, Inc.Do not dispose of locally.

Section 14. Transport information

Regulatory information	UN number	Proper shipping name	Class	Packing group	Label	Additional information
DOT Classification	UN1055	ISOBUTYLENE	2.1	Not applicable (gas).		**Limited quantity** Yes. **Packaging instruction** **Passenger aircraft** Quantity limitation: Forbidden. **Cargo aircraft** Quantity limitation: 150 kg **Special**

						provisions 19, T50
TDG Classification	UN1055	ISOBUTYLENE	2.1	Not applicable (gas).		**Explosive Limit and Limited Quantity Index** 0.125 **ERAP Index** 3000 **Passenger Carrying Ship Index** Forbidden **Passenger Carrying Road or Rail Index** Forbidden **Special provisions** 29
Mexico Classification	UN1055	ISOBUTYLENE	2.1	Not applicable (gas).		-

"Refer to CFR 49 (or authority having jurisdiction) to determine the information required for shipment of the product."

Section 15. Regulatory information

United States

U.S. Federal regulations : **United States inventory (TSCA 8b):** This material is listed or exempted.

SARA 302/304/311/312 extremely hazardous substances: No products were found.
SARA 302/304 emergency planning and notification: No products were found.
SARA 302/304/311/312 hazardous chemicals: 2-methylpropene
SARA 311/312 MSDS distribution - chemical inventory - hazard identification: 2-methylpropene: Fire hazard, Sudden release of pressure

Clean Water Act (CWA) 307: No products were found.

Clean Water Act (CWA) 311: No products were found.

Clean Air Act (CAA) 112 accidental release prevention: 2-methylpropene

Clean Air Act (CAA) 112 regulated flammable substances: 2-methylpropene

Clean Air Act (CAA) 112 regulated toxic substances: No products were found.

State regulations : **Connecticut Carcinogen Reporting:** This material is not listed.
Connecticut Hazardous Material Survey: This material is not listed.
Florida substances: This material is not listed.
Illinois Chemical Safety Act: This material is not listed.
Illinois Toxic Substances Disclosure to Employee Act: This material is not listed.
Louisiana Reporting: This material is not listed.
Louisiana Spill: This material is not listed.
Massachusetts Spill: This material is not listed.
Massachusetts Substances: This material is listed.
Michigan Critical Material: This material is not listed.

Minnesota Hazardous Substances: This material is not listed.
New Jersey Hazardous Substances: This material is listed.
New Jersey Spill: This material is not listed.
New Jersey Toxic Catastrophe Prevention Act: This material is not listed.
New York Acutely Hazardous Substances: This material is not listed.
New York Toxic Chemical Release Reporting: This material is not listed.
Pennsylvania RTK Hazardous Substances: This material is listed.
Rhode Island Hazardous Substances: This material is not listed.

Canada

WHMIS (Canada) : Class A: Compressed gas.
Class B-1: Flammable gas.

CEPA Toxic substances: This material is not listed.
Canadian ARET: This material is not listed.
Canadian NPRI: This material is not listed.
Alberta Designated Substances: This material is not listed.
Ontario Designated Substances: This material is not listed.
Quebec Designated Substances: This material is not listed.

Section 16. Other information

United States

Label requirements : FLAMMABLE GAS.
MAY CAUSE FLASH FIRE.
CONTENTS UNDER PRESSURE.

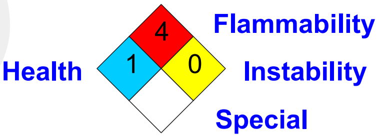
Canada

Label requirements : Class A: Compressed gas.
Class B-1: Flammable gas.

Hazardous Material Information System (U.S.A.) :

Health	1
Flammability	4
Physical hazards	0

National Fire Protection Association (U.S.A.) :



Notice to reader

To the best of our knowledge, the information contained herein is accurate. However, neither the above-named supplier, nor any of its subsidiaries, assumes any liability whatsoever for the accuracy or completeness of the information contained herein.
Final determination of suitability of any material is the sole responsibility of the user. All materials may present unknown hazards and should be used with caution. Although certain hazards are described herein, we cannot guarantee that these are the only hazards that exist.

MATERIAL SAFETY DATA SHEET

1. Product and Company Identification

Material name	**UNLEADED GASOLINE**
Version #	03
Issue date	07-28-2011
Revision date	11-13-2012
Supersedes date	09-28-2012
MSDS Number	002
Product use	Motor fuels.
Synonym(s)	Regular/Premium/Midgrade - Unleaded Gasoline, RFG - Reformulated Unleaded Gasoline, Conventional Unleaded Gasoline, Oxygenated Unleaded Gasoline, Non-Oxygenated Unleaded Gasoline, CARB (California Air Resource Board) Unleaded Gasoline, RBOB - Reformulated Blendstock for Oxygenate Blending, CBOB - Conventional Blendstock for Oxygenate Blending, Petrol, Motor Fuel. See section 16 for complete information.
Manufacturer/Supplier	Valero Marketing & Supply Company and Affiliates P.O. Box 696000 San Antonio, TX 78269-6000
General Assistance	210-345-4593
Emergency	24 Hour Emergency 866-565-5220 1-800-424-9300 (CHEMTREC USA)

2. Hazards Identification

Physical state	Liquid.
Appearance	Light straw to red clear liquid with characteristic strong odor of gasoline.
Emergency overview	DANGER! Extremely flammable liquid and vapor - vapor may cause flash fire. Will be easily ignited by heat, spark or flames. Heat may cause the containers to explode. Harmful if inhaled, absorbed through skin, or swallowed. Aspiration may cause lung damage. Irritating to eyes, respiratory system and skin. In high concentrations, vapors and spray mists are narcotic and may cause headache, fatigue, dizziness and nausea. Contains benzene. Cancer hazard - can cause cancer. Mutagen. May cause heritable genetic damage. May cause adverse reproductive effects - such as birth defects, miscarriages, or infertility. Toxic to aquatic organisms, may cause long-term adverse effects in the aquatic environment. 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).
OSHA regulatory status	This product is considered hazardous under 29 CFR 1910.1200 (Hazard Communication).
Potential health effects	
Routes of exposure	Inhalation. Ingestion. Skin contact. Eye contact.
Eyes	Contact may irritate or burn eyes. Eye contact may result in corneal injury.
Skin	Harmful if absorbed through skin. Irritating to skin. Frequent or prolonged contact may defat and dry the skin, leading to discomfort and dermatitis.
Inhalation	Harmful if inhaled. Irritating to respiratory system. In high concentrations, vapors and spray mists are narcotic and may cause headache, fatigue, dizziness and nausea. May cause breathing disorders and lung damage. May cause cancer by inhalation. Prolonged inhalation may be harmful.
Ingestion	Harmful if swallowed. Ingestion may result in vomiting; aspiration (breathing) of vomitus into lungs must be avoided as even small quantities may result in aspiration pneumonitis. Irritating to mouth, throat, and stomach.
Target organs	Blood. Eyes. Liver. Respiratory system. Skin. Kidneys. Central nervous system.

Chronic effects	Cancer hazard. Contains material which may have reproductive toxicity, teratogenetic or mutagenic effects. Liver injury may occur. Kidney injury may occur. May cause central nervous system disorder (e.g., narcosis involving a loss of coordination, weakness, fatigue, mental confusion and blurred vision) and/or damage. Frequent or prolonged contact may defat and dry the skin, leading to discomfort and dermatitis.
Signs and symptoms	Irritation of nose and throat. Irritation of eyes and mucous membranes. Skin irritation. Unconsciousness. Corneal damage. Narcosis. Cyanosis (blue tissue condition, nails, lips, and/or skin). Decrease in motor functions. Behavioral changes. Edema. Liver enlargement. Jaundice. Conjunctivitis. Proteinuria. Defatting of the skin. Rash.
Potential environmental effects	Toxic to aquatic organisms. Harmful to aquatic life with long lasting effects.

3. Composition / Information on Ingredients

Components	CAS #	Percent
Gasoline	86290-81-5	0-100
Toluene	108-88-3	0-30
Hexane (Other Isomers)	96-14-0	5-25
Xylene (o, m, p isomers)	1330-20-7	0-25
Octane (All isomers)	111-65-9	0-18.5
Ethanol	64-17-5	0-10
1,2,4, Trimethylbenzene	95-63-6	0-6
n-Heptane	142-82-5	1-5
Pentane	109-66-0	1-5
Cumene	98-82-8	0-5
Ethylbenzene	100-41-4	0-5
Benzene	71-43-2	0-4.9
n-Hexane	110-54-3	0-3
Cyclohexane	110-82-7	0-3

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.
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.
Inhalation	Move to fresh air. If breathing is difficult, give oxygen. If not breathing, give artificial respiration. Get medical attention.
Ingestion	Rinse mouth thoroughly. Do not induce vomiting without advice from poison control center. Do not give mouth-to-mouth resuscitation. If vomiting occurs, keep head low so that stomach content does not get into the lungs. Get medical attention immediately.
Notes to physician	In case of shortness of breath, give oxygen. Keep victim warm. Keep victim under observation. Symptoms may be delayed.
General advice	If exposed or concerned: get medical attention/advice. 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. Wash contaminated clothing before re-use.

5. Fire Fighting Measures

Flammable properties	Flammable by OSHA criteria. Containers may explode when heated.

Extinguishing media

Suitable extinguishing media	Water spray. Water fog. Foam. Dry chemical powder. Carbon dioxide (CO2).
Unsuitable extinguishing media	Do not use a solid water stream as it may scatter and spread fire.

Protection of firefighters	
Specific hazards arising from the chemical	Vapor may cause flash fire. Vapors can flow along surfaces to distant ignition source and flash back. Sensitive to static discharge.
Protective equipment and precautions for firefighters	Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask.
Fire fighting equipment/instructions	Wear full protective clothing, including helmet, self-contained positive pressure or pressure demand breathing apparatus, protective clothing and face mask. Withdraw immediately in case of rising sound from venting safety devices or any discoloration of tanks due to fire. Fight fire from maximum distance or use unmanned hose holders or monitor nozzles. Move containers from fire area if you can do it without risk. In the event of fire, cool tanks with water spray. Cool containers exposed to flames with water until well after the fire is out. For massive fire, use unmanned hose holders or monitor nozzles; if this is impossible, withdraw from area and let fire burn. Vapors may form explosive air mixtures even at room temperature. Prevent buildup of vapors or gases to explosive concentrations. Some of these materials, if spilled, may evaporate leaving a flammable residue. Water runoff can cause environmental damage. Use compatible foam to minimize vapor generation as needed.
Specific methods	In the event of fire and/or explosion do not breathe fumes. Use water spray to cool unopened containers.
Hazardous combustion products	Carbon monoxide. Carbon Dioxide. Sulfur oxides. Nitrogen oxides (NOx). Hydrocarbons.

6. Accidental Release Measures

Personal precautions	Keep unnecessary personnel away. Local authorities should be advised if significant spills cannot be contained. 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. See Section 8 of the MSDS for Personal Protective Equipment.
Environmental precautions	Gasoline may contain oxygenated blend products (Ethanol, etc.) that are soluble in water and therefore precautions should be taken to protect surface and groundwater sources from contamination. 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 Firefighting Measures, Section 5, 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. Use compatible foam to minimize vapor generation as needed. 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. If spill of any amount is made into or upon navigable waters, the contiguous zone, or adjoining shorelines, contact the National Response Center at 1-800-424-8802. For highway or railways spills, contact Chemtrec at 1-800-424-9300.
Methods for containment	Eliminate all ignition sources (no smoking, flares, sparks, or flames in immediate area). 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.
Methods for cleaning up	Use non-sparking tools and explosion-proof equipment. 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.
Other information	Clean up in accordance with all applicable regulations.

7. Handling and Storage

Handling	Eliminate sources of ignition. Avoid spark promoters. Ground/bond container and equipment. These alone may be insufficient to remove static electricity. Wear personal protective equipment. Do not breathe dust/fume/gas/mist/vapors/spray. Avoid contact with eyes, skin, and clothing. Do not taste or swallow. Avoid prolonged exposure. Use only with adequate ventilation. Wash thoroughly after handling. The product is extremely flammable, and explosive vapor/air mixtures may be formed even at normal room temperatures. DO NOT handle, store or open near an open flame, sources of heat or sources of ignition. Protect material from direct sunlight. Take precautionary measures against static discharges. All equipment used when handling the product must be grounded. Use non-sparking tools and explosion-proof equipment. When using, do not eat, drink or smoke. Avoid release to the environment.
Storage	Flammable liquid storage. Do not handle or store near an open flame, heat or other sources of ignition. This material can accumulate static charge which may cause spark and become an ignition source. The pressure in sealed containers can increase under the influence of heat. Keep container tightly closed in a cool, well-ventilated place. Keep away from food, drink and animal feedingstuffs. Keep out of the reach of children.

8. Exposure Controls / Personal Protection

Occupational exposure limits

US. ACGIH Threshold Limit Values

Components	Type	Value
1,2,4, Trimethylbenzene (CAS 95-63-6)	TWA	25 ppm
Benzene (CAS 71-43-2)	STEL	2.5 ppm
	TWA	0.5 ppm
Cumene (CAS 98-82-8)	TWA	50 ppm
Cyclohexane (CAS 110-82-7)	TWA	100 ppm
Ethanol (CAS 64-17-5)	STEL	1000 ppm
Ethylbenzene (CAS 100-41-4)	TWA	20 ppm
Gasoline (CAS 86290-81-5)	STEL	500 ppm
	TWA	300 ppm
Hexane (Other Isomers) (CAS 96-14-0)	STEL	1000 ppm
	TWA	500 ppm
n-Heptane (CAS 142-82-5)	STEL	500 ppm
	TWA	400 ppm
n-Hexane (CAS 110-54-3)	TWA	50 ppm
Octane (All isomers) (CAS 111-65-9)	TWA	300 ppm
Pentane (CAS 109-66-0)	TWA	600 ppm
Toluene (CAS 108-88-3)	TWA	20 ppm
Xylene (o, m, p isomers) (CAS 1330-20-7)	STEL	150 ppm
	TWA	100 ppm

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Components	Type	Value
Benzene (CAS 71-43-2)	STEL	5 ppm
	TWA	1 ppm

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value
Cumene (CAS 98-82-8)	PEL	245 mg/m3
		50 ppm
Cyclohexane (CAS 110-82-7)	PEL	1050 mg/m3
		300 ppm
Ethanol (CAS 64-17-5)	PEL	1900 mg/m3

US. OSHA Table Z-1 Limits for Air Contaminants (29 CFR 1910.1000)

Components	Type	Value
		1000 ppm
Ethylbenzene (CAS 100-41-4)	PEL	435 mg/m3 100 ppm
n-Heptane (CAS 142-82-5)	PEL	2000 mg/m3 500 ppm
n-Hexane (CAS 110-54-3)	PEL	1800 mg/m3 500 ppm
Octane (All isomers) (CAS 111-65-9)	PEL	2350 mg/m3 500 ppm
Pentane (CAS 109-66-0)	PEL	2950 mg/m3 1000 ppm
Xylene (o, m, p isomers) (CAS 1330-20-7)	PEL	435 mg/m3 100 ppm

US. OSHA Table Z-2 (29 CFR 1910.1000)

Components	Type	Value
Benzene (CAS 71-43-2)	Ceiling	25 ppm
	TWA	10 ppm
Toluene (CAS 108-88-3)	Ceiling	300 ppm
	TWA	200 ppm

Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2)

Components	Type	Value
1,2,4, Trimethylbenzene (CAS 95-63-6)	TWA	123 mg/m3 25 ppm
Benzene (CAS 71-43-2)	STEL	8 mg/m3 2.5 ppm
	TWA	1.6 mg/m3 0.5 ppm
Cumene (CAS 98-82-8)	TWA	246 mg/m3 50 ppm
Cyclohexane (CAS 110-82-7)	TWA	344 mg/m3 100 ppm
Ethanol (CAS 64-17-5)	TWA	1880 mg/m3 1000 ppm
Ethylbenzene (CAS 100-41-4)	STEL	543 mg/m3 125 ppm
	TWA	434 mg/m3 100 ppm
Gasoline (CAS 86290-81-5)	STEL	500 ppm
	TWA	300 ppm
Hexane (Other Isomers) (CAS 96-14-0)	STEL	3500 mg/m3 1000 ppm
	TWA	1760 mg/m3 500 ppm
n-Heptane (CAS 142-82-5)	STEL	2050 mg/m3 500 ppm
	TWA	1640 mg/m3 400 ppm
n-Hexane (CAS 110-54-3)	TWA	176 mg/m3 50 ppm

Canada. Alberta OELs (Occupational Health & Safety Code, Schedule 1, Table 2)

Components	Type	Value
Octane (All isomers) (CAS 111-65-9)	TWA	1400 mg/m3
		300 ppm
Pentane (CAS 109-66-0)	TWA	1770 mg/m3
		600 ppm
Toluene (CAS 108-88-3)	TWA	188 mg/m3
		50 ppm
Xylene (o, m, p isomers) (CAS 1330-20-7)	STEL	651 mg/m3
		150 ppm
	TWA	434 mg/m3
		100 ppm

Canada. British Columbia OELs. (Occupational Exposure Limits for Chemical Substances, Occupational Health and Safety Regulation 296/97, as amended)

Components	Type	Value
1,2,4, Trimethylbenzene (CAS 95-63-6)	TWA	25 ppm
Benzene (CAS 71-43-2)	STEL	2.5 ppm
	TWA	0.5 ppm
Cumene (CAS 98-82-8)	STEL	75 ppm
	TWA	25 ppm
Cyclohexane (CAS 110-82-7)	TWA	100 ppm
Ethanol (CAS 64-17-5)	STEL	1000 ppm
Ethylbenzene (CAS 100-41-4)	TWA	20 ppm
Gasoline (CAS 86290-81-5)	STEL	500 ppm
	TWA	300 ppm
Hexane (Other Isomers) (CAS 96-14-0)	TWA	200 ppm
n-Heptane (CAS 142-82-5)	STEL	500 ppm
	TWA	400 ppm
n-Hexane (CAS 110-54-3)	TWA	20 ppm
Octane (All isomers) (CAS 111-65-9)	TWA	300 ppm
Pentane (CAS 109-66-0)	TWA	600 ppm
Toluene (CAS 108-88-3)	TWA	20 ppm
Xylene (o, m, p isomers) (CAS 1330-20-7)	STEL	150 ppm
	TWA	100 ppm

Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents)

Components	Type	Value
1,2,4, Trimethylbenzene (CAS 95-63-6)	TWA	25 ppm
Benzene (CAS 71-43-2)	STEL	2.5 ppm
	TWA	0.5 ppm
Cumene (CAS 98-82-8)	TWA	50 ppm
Cyclohexane (CAS 110-82-7)	TWA	100 ppm
Ethanol (CAS 64-17-5)	STEL	1000 ppm
Ethylbenzene (CAS 100-41-4)	STEL	125 ppm
	TWA	100 ppm
Gasoline (CAS 86290-81-5)	STEL	500 ppm
	TWA	300 ppm
Hexane (Other Isomers) (CAS 96-14-0)	STEL	1000 ppm
	TWA	500 ppm

Canada. Ontario OELs. (Control of Exposure to Biological or Chemical Agents)

Components	Type	Value
n-Heptane (CAS 142-82-5)	STEL	500 ppm
	TWA	400 ppm
n-Hexane (CAS 110-54-3)	TWA	50 ppm
Octane (All isomers) (CAS 111-65-9)	TWA	300 ppm
Pentane (CAS 109-66-0)	STEL	2210 mg/m3
		750 ppm
	TWA	1770 mg/m3
		600 ppm
Toluene (CAS 108-88-3)	TWA	20 ppm
Xylene (o, m, p isomers) (CAS 1330-20-7)	STEL	150 ppm
	TWA	100 ppm

Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment)

Components	Type	Value
1,2,4, Trimethylbenzene (CAS 95-63-6)	TWA	123 mg/m3
		25 ppm
Benzene (CAS 71-43-2)	STEL	15.5 mg/m3
		5 ppm
	TWA	3 mg/m3
		1 ppm
Cumene (CAS 98-82-8)	TWA	246 mg/m3
		50 ppm
Cyclohexane (CAS 110-82-7)	TWA	1030 mg/m3
		300 ppm
Ethanol (CAS 64-17-5)	TWA	1880 mg/m3
		1000 ppm
Ethylbenzene (CAS 100-41-4)	STEL	543 mg/m3
		125 ppm
	TWA	434 mg/m3
		100 ppm
Hexane (Other Isomers) (CAS 96-14-0)	STEL	3500 mg/m3
		1000 ppm
	TWA	1760 mg/m3
		500 ppm
n-Heptane (CAS 142-82-5)	STEL	2050 mg/m3
		500 ppm
	TWA	1640 mg/m3
		400 ppm
n-Hexane (CAS 110-54-3)	TWA	176 mg/m3
		50 ppm
Octane (All isomers) (CAS 111-65-9)	STEL	1750 mg/m3
		375 ppm
	TWA	1400 mg/m3
		300 ppm
Pentane (CAS 109-66-0)	TWA	350 mg/m3
		120 ppm
Toluene (CAS 108-88-3)	TWA	188 mg/m3
		50 ppm
Xylene (o, m, p isomers) (CAS 1330-20-7)	STEL	651 mg/m3
		150 ppm
	TWA	434 mg/m3

Canada. Quebec OELs. (Ministry of Labor - Regulation Respecting the Quality of the Work Environment)

Components	Type	Value
		100 ppm

Mexico. Occupational Exposure Limit Values

Components	Type	Value
1,2,4, Trimethylbenzene (CAS 95-63-6)	STEL	170 mg/m3
		35 ppm
	TWA	125 mg/m3
		25 ppm
Benzene (CAS 71-43-2)	STEL	16 mg/m3
		5 ppm
	TWA	3.2 mg/m3
		1 ppm
Cumene (CAS 98-82-8)	STEL	365 mg/m3
		75 ppm
	TWA	245 mg/m3
		50 ppm
Cyclohexane (CAS 110-82-7)	STEL	1300 mg/m3
		375 ppm
	TWA	1050 mg/m3
		300 ppm
Ethanol (CAS 64-17-5)	TWA	1900 mg/m3
		1000 ppm
Ethylbenzene (CAS 100-41-4)	STEL	545 mg/m3
		125 ppm
	TWA	435 mg/m3
		100 ppm
Hexane (Other Isomers) (CAS 96-14-0)	STEL	3500 mg/m3
		1000 ppm
	TWA	1760 mg/m3
		500 ppm
n-Heptane (CAS 142-82-5)	STEL	2000 mg/m3
		500 ppm
	TWA	1600 mg/m3
		400 ppm
n-Hexane (CAS 110-54-3)	TWA	176 mg/m3
		50 ppm
Octane (All isomers) (CAS 111-65-9)	STEL	1800 mg/m3
		375 ppm
	TWA	1450 mg/m3
		300 ppm
Pentane (CAS 109-66-0)	STEL	2250 mg/m3
		760 ppm
	TWA	1800 mg/m3
		600 ppm
Toluene (CAS 108-88-3)	TWA	188 mg/m3
		50 ppm
Xylene (o, m, p isomers) (CAS 1330-20-7)	STEL	655 mg/m3
		150 ppm
	TWA	435 mg/m3
		100 ppm

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.
Personal protective equipment	
Eye / face protection	Wear safety glasses. If splash potential exists, wear full face shield or chemical goggles.
Skin protection	Wear chemical-resistant, impervious gloves. Full body suit and boots are recommended when handling large volumes or in emergency situations. Flame retardant protective clothing is recommended.
Respiratory protection	Use a properly fitted, air-purifying or air-fed respirator complying with an approved standard if a risk assessment indicates this is necessary. Respirator selection must be based on known or anticipated exposure levels, the hazards of the product and the safe working limits of the selected respirator. If workplace exposure limits for product or components are exceeded, NIOSH approved equipment should be worn. Proper respirator selection should be determined by adequately trained personnel, based on the contaminants, the degree of potential exposure and published respiratory protection factors. This equipment should be available for nonroutine and emergency use.
General hygiene considerations	Consult supervisor for special handling instructions. Avoid contact with eyes. Avoid contact with skin. Keep away from food and drink. Wash hands before breaks and immediately after handling the product. Provide eyewash station and safety shower. Handle in accordance with good industrial hygiene and safety practice.

9. Physical & Chemical Properties

Appearance	Light straw to red clear liquid with characteristic strong odor of gasoline.
Physical state	Liquid.
Form	Liquid.
Color	Light straw to red clear.
Odor	Characteristic Gasoline Odor (Strong).
Odor threshold	Not available.
pH	Not available.
Vapor pressure	60.8 - 101.3 kPa (20°C)
Vapor density	3 - 4 (Air=1)
Boiling point	80.1 - 440.1 °F (26.7 - 226.7 °C)
Melting point/Freezing point	44 °F (6.67 °C) May start to solidify at this temperature. This is based on data for the following ingredient: Cyclohexane. Weighted average: -91.9 deg C (-133.4 deg F)
Solubility (water)	Very slightly soluble.
Specific gravity	0.66 - 0.75 (Water=1) (60°F)
Flash point	-40 °F (-40 °C) (closed cup)
Flammability limits in air, upper, % by volume	7.1 %
Flammability limits in air, lower, % by volume	1.3 %
Auto-ignition temperature	> 500 °F (> 260 °C)
VOC	100 %
Evaporation rate	10 - 11 BuAc
Other data	
Flash point class	Flammable IA

10. Chemical Stability & Reactivity Information

Chemical stability	Stable under normal temperature conditions and recommended use.
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.
Incompatible materials	Strong oxidizing agents.
Hazardous decomposition products	Carbon oxides. Sulfur oxides. Nitrogen oxides (NOx). Hydrocarbons.
Possibility of hazardous reactions	Hazardous polymerization does not occur.

11. Toxicological Information

Toxicological data

Components	Species	Test Results
1,2,4, Trimethylbenzene (CAS 95-63-6)		
Acute		
Dermal		
LD50	Rabbit	> 3160 mg/kg
Inhalation		
LC50	Rat	> 2000 mg/l, 48 Hours
Oral		
LD50	Rat	6 g/kg
Benzene (CAS 71-43-2)		
Acute		
Oral		
LD50	Rat	3306 mg/kg
Cumene (CAS 98-82-8)		
Acute		
Inhalation		
LC50	Mouse	2000 mg/l, 7 Hours
	Rat	8000 mg/l, 4 Hours
Oral		
LD50	Rat	1400 mg/kg
		2.91 g/kg
Cyclohexane (CAS 110-82-7)		
Acute		
Oral		
LD50	Rat	12705 mg/kg
Ethanol (CAS 64-17-5)		
Acute		
Inhalation		
LC50	Rat	30000 mg/m3
Oral		
LD50	Rat	11.5 g/kg
Ethylbenzene (CAS 100-41-4)		
Acute		
Dermal		
LD50	Rabbit	> 5000 mg/kg
Oral		
LD50	Rat	5.46 g/kg
n-Heptane (CAS 142-82-5)		
Acute		
Inhalation		
LC50	Rat	103 mg/l, 4 Hours
Octane (All isomers) (CAS 111-65-9)		
Acute		
Inhalation		
LC50	Rat	118 mg/l, 4 Hours
Pentane (CAS 109-66-0)		
Acute		
Inhalation		
LC50	Rat	364 mg/l, 4 Hours

Components	Species	Test Results
Toluene (CAS 108-88-3)		
Acute		
Dermal		
LD50	Rabbit	14.1 ml/kg
Inhalation		
LC50	Rat	49000 mg/m³, 4 Hours
Oral		
LD50	Rat	636 mg/kg
Xylene (o, m, p isomers) (CAS 1330-20-7)		
Acute		
Oral		
LD50	Rat	4300 mg/kg

Sensitization This substance may have a potential for sensitization which may provoke an allergic reaction among sensitive individuals.

Acute effects Harmful if inhaled, absorbed through skin, or swallowed. Harmful: may cause lung damage if swallowed. Irritating to eyes, respiratory system and skin. In high concentrations, vapors and spray mists are narcotic and may cause headache, fatigue, dizziness and nausea.

Local effects

US. ACGIH Threshold Limit Values

Benzene (CAS 71-43-2)	Can be absorbed through the skin.
n-Hexane (CAS 110-54-3)	Can be absorbed through the skin.

Chronic effects Repeated exposure of laboratory animals to high concentrations of gasoline vapors has caused kidney damage and cancer in rats and cancer in mice. Gasoline was evaluated for genetic activity in assays using microbial cells, cultured mammalian cells and rat bone marrow cells. The results were all negative so gasoline was considered nonmutagenic under these conditions. Overexposure to this product or its components has been suggested as a cause of liver abnormalities in laboratory animals and humans. Lifetime studies by the American Petroleum Institute have shown that kidney damage and kidney cancer can occur in male rats after prolonged inhalation exposures at elevated concentrations of total gasoline. Kidneys of mice and female rats were unaffected. The U.S. EPA Risk Assessment Forum has concluded that the male rat kidney tumor results are not relevant for humans. Total gasoline exposure also produced liver tumors in female mice only. The implication of these data for humans has not been determined.

Subchronic effects Subchronic inhalation of benzene by rats produced decreased white blood cell counts, decreased bone marrow cell activity, increased red blood cell activity and cataracts. Blood disorders may occur after prolonged inhalation, prolonged skin contact and/or ingestion. Liver and kidney damage may occur after prolonged and repeated exposure.

Carcinogenicity

ACGIH Carcinogens

Benzene (CAS 71-43-2)	A1 Confirmed human carcinogen.
Ethanol (CAS 64-17-5)	A3 Confirmed animal carcinogen with unknown relevance to humans.
Ethylbenzene (CAS 100-41-4)	A3 Confirmed animal carcinogen with unknown relevance to humans.
Gasoline (CAS 86290-81-5)	A3 Confirmed animal carcinogen with unknown relevance to humans.
Toluene (CAS 108-88-3)	A4 Not classifiable as a human carcinogen.
Xylene (o, m, p isomers) (CAS 1330-20-7)	A4 Not classifiable as a human carcinogen.

IARC Monographs. Overall Evaluation of Carcinogenicity

Benzene (CAS 71-43-2)	1 Carcinogenic to humans.
Cumene (CAS 98-82-8)	2B Possibly carcinogenic to humans.
Ethylbenzene (CAS 100-41-4)	2B Possibly carcinogenic to humans.
Gasoline (CAS 86290-81-5)	2B Possibly carcinogenic to humans.
Toluene (CAS 108-88-3)	3 Not classifiable as to carcinogenicity to humans.
Xylene (o, m, p isomers) (CAS 1330-20-7)	3 Not classifiable as to carcinogenicity to humans.

US NTP Report on Carcinogens: Known carcinogen

Benzene (CAS 71-43-2)	Known To Be Human Carcinogen.

US. OSHA Specifically Regulated Substances (29 CFR 1910.1001-1050)

Benzene (CAS 71-43-2)	Cancer hazard.

Epidemiology	Contains benzene. Human epidemiology studies indicate that prolonged and/or repeated overexposure to benzene may cause damage to the blood-producing system and serious blood disorders, including leukemia. Animal tests suggest that prolonged and/or repeated overexposure to benzene may damage the embryo/fetus. The relevance of these animal studies to humans has not been fully established. Studies have shown a risk of spontaneous abortions in women exposed to high concentrations of organic solvents during pregnancy.
Mutagenicity	In in-vitro experiments, neither benzene, toluene nor xylene changed the number of sister-chromatid exchanges (SCEs) or the number of chromosomal aberrations in human lymphocytes. However, toluene and xylene caused a significant cell growth inhibition which was not observed with benzene in the same concentrations. In in-vivo experiments, toluene changed the number of sister-chromatid exchanges (SCEs) in human lymphocytes. Toluene may cause heritable genetic damage.
Neurological effects	Chronic exposure to high concentrations of various hydrocarbon blends may lead to polyneuropathy (peripheral nerve damage), characterized by progressive weakness and numbness in the extremities, loss of deep tendon reflexes and reduction of motor nerve conduction velocity. Numerous cases of polyneuritis have been reported following prolonged exposures to a petroleum fraction containing various isomers of heptane as major ingredients. May cause central nervous system disorder (e.g., narcosis involving a loss of coordination, weakness, fatigue) and/or damage.
Reproductive effects	Benzene, xylene and toluene have demonstrated animal effects of reproductive toxicity. Animal studies of benzene have shown testicular effects, alterations in reproductive cycles, chromosomal aberrations and embryo/fetotoxicity. Ethanol has demonstrated human effects of reproductive toxicity. May damage fertility or the unborn child. Can cause adverse reproductive effects - such as birth defects, miscarriages, or infertility. Avoid exposure to women during early pregnancy. Avoid contact during pregnancy/while nursing.
Teratogenicity	Abusive inhalation of toluene ("glue sniffing") has been reported to be associated with birth defects in the offspring of abusers. Rats exposed to benzene and xylene vapor during pregnancy showed embryo/fetotoxic effects. Ethanol has demonstrated human effects of teratogenicity.
Further information	Symptoms may be delayed.

12. Ecological Information

Ecotoxicological data

Components			**Species**	**Test Results**
1,2,4, Trimethylbenzene (CAS 95-63-6)				
	Aquatic			
	Fish	LC50	Fathead minnow (Pimephales promelas)	7.19 - 8.28 mg/l, 96 hours
Benzene (CAS 71-43-2)				
	Aquatic			
	Crustacea	EC50	Water flea (Daphnia magna)	8.76 - 15.6 mg/l, 48 hours
	Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	5.3 mg/l, 96 hours
Cumene (CAS 98-82-8)				
	Aquatic			
	Crustacea	EC50	Brine shrimp (Artemia sp.)	3.55 - 11.29 mg/l, 48 hours
	Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	2.7 mg/l, 96 hours
Cyclohexane (CAS 110-82-7)				
	Aquatic			
	Fish	LC50	Fathead minnow (Pimephales promelas)	3.961 - 5.181 mg/l, 96 hours
Ethanol (CAS 64-17-5)				
	Aquatic			
	Algae	EC50	Freshwater algae	275 mg/l, 72 Hours
			Marine water algae	1970 mg/l
	Fish	LC50	Fathead minnow (Pimephales promelas)	> 100 mg/l, 96 hours
			Freshwater fish	11200 mg/l, 96 Hours

Components		Species	Test Results
Invertebrate	EC50	Freshwater invertebrate	5012 mg/l, 48 Hours
		Marine water invertebrate	857 mg/l, 48 Hours
Ethylbenzene (CAS 100-41-4)			
Aquatic			
Crustacea	EC50	Water flea (Daphnia magna)	1 - 4 mg/l, 48 hours
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	4 mg/l, 96 hours
n-Hexane (CAS 110-54-3)			
Aquatic			
Fish	LC50	Fathead minnow (Pimephales promelas)	2.101 - 2.981 mg/l, 96 hours
Toluene (CAS 108-88-3)			
Aquatic			
Crustacea	EC50	Water flea (Daphnia magna)	5.46 - 9.83 mg/l, 48 hours
Fish	LC50	Coho salmon,silver salmon (Oncorhynchus kisutch)	5.5 mg/l, 96 hours
Xylene (o, m, p isomers) (CAS 1330-20-7)			
Aquatic			
Fish	LC50	Rainbow trout,donaldson trout (Oncorhynchus mykiss)	8 mg/l, 96 Hours

Ecotoxicity Contains a substance which causes risk of hazardous effects to the environment.

Environmental effects The product contains a substance which is toxic to aquatic organisms and which may cause long-term adverse effects in the aquatic environment.

Aquatic toxicity Toxic to aquatic organisms. May cause long-term adverse effects in the aquatic environment.

Persistence and degradability Not available.

Bioaccumulation / Accumulation Not available.

Partition coefficient

Ethanol	-0.31
Benzene	2.13
Toluene	2.73
Ethylbenzene	3.15
Xylene (o, m, p isomers)	3.2
Pentane	3.39
Cyclohexane	3.44
Hexane (Other Isomers)	3.6
Cumene	3.66
n-Hexane	3.9
n-Heptane	4.66
Octane (All isomers)	5.18

13. Disposal Considerations

Waste codes D001: Waste Flammable material with a flash point <140 °F
D018: Waste Benzene

Disposal instructions Dispose in accordance with all applicable regulations. Dispose of this material and its container to hazardous or special waste collection point. Incinerate the material under controlled conditions in an approved incinerator. Do not allow this material to drain into sewers/water supplies. Do not contaminate ponds, waterways or ditches with chemical or used container.

14. Transport Information

DOT

Basic shipping requirements:

UN number UN1203
Proper shipping name Gasoline

Hazard class	3
Packing group	II
Additional information:	
Special provisions	139, B33, B101, T8
Packaging exceptions	150
Packaging non bulk	202
Packaging bulk	242

IATA

UN number	UN1203
UN proper shipping name	Gasoline
Transport hazard class(es)	3
Packing group	II
ERG code	3H

IMDG

UN number	UN1203
UN proper shipping name	Gasoline
Transport hazard class(es)	3
Packing group	II
EmS	F-E, S-E

TDG

Proper shipping name	GASOLINE; MOTOR SPIRIT; or PETROL, MARINE POLLUTANT
Hazard class	3
UN number	UN1203
Packing group	II
Marine pollutant	Yes
Special provisions	17

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.

TSCA Section 12(b) Export Notification (40 CFR 707, Subpt. D)

Not regulated.

Clean Air Act (CAA) Section 112 Hazardous Air Pollutants (HAPs) List

Benzene (CAS 71-43-2)
Cumene (CAS 98-82-8)
Ethylbenzene (CAS 100-41-4)
n-Hexane (CAS 110-54-3)
Toluene (CAS 108-88-3)
Xylene (o, m, p isomers) (CAS 1330-20-7)

US EPCRA (SARA Title III) Section 313 - Toxic Chemical: De minimis concentration

1,2,4, Trimethylbenzene (CAS 95-63-6)	1.0 %
Benzene (CAS 71-43-2)	0.1 %
Cumene (CAS 98-82-8)	1.0 %
Cyclohexane (CAS 110-82-7)	1.0 %
Ethylbenzene (CAS 100-41-4)	0.1 %
n-Hexane (CAS 110-54-3)	1.0 %
Toluene (CAS 108-88-3)	1.0 %
Xylene (o, m, p isomers) (CAS 1330-20-7)	1.0 %

US EPCRA (SARA Title III) Section 313 - Toxic Chemical: Listed substance

1,2,4, Trimethylbenzene (CAS 95-63-6)	Listed.
Benzene (CAS 71-43-2)	Listed.
Cumene (CAS 98-82-8)	Listed.
Cyclohexane (CAS 110-82-7)	Listed.
Ethylbenzene (CAS 100-41-4)	Listed.
n-Hexane (CAS 110-54-3)	Listed.
Toluene (CAS 108-88-3)	Listed.
Xylene (o, m, p isomers) (CAS 1330-20-7)	Listed.

CERCLA (Superfund) reportable quantity (lbs) (40 CFR 302.4)

Gasoline: 100
Toluene: 1000
Hexane (Other Isomers): 100
Xylene (o, m, p isomers): 100
Octane (All isomers): 100
Pentane: 100
Cumene: 5000
Ethylbenzene: 1000
Benzene: 10
n-Hexane: 5000
Cyclohexane: 1000

Superfund Amendments and Reauthorization Act of 1986 (SARA)

Hazard categories	Immediate Hazard - Yes Delayed Hazard - Yes Fire Hazard - Yes Pressure Hazard - No Reactivity Hazard - No
Section 302 extremely hazardous substance (40 CFR 355, Appendix A)	No
Section 311/312 (40 CFR 370)	No

Drug Enforcement Administration (DEA) (21 CFR 1308.11-15)	Not controlled
Canadian regulations	This product has been classified in accordance with the hazard criteria of the CPR and the MSDS contains all the information required by the CPR.
WHMIS status	Controlled
WHMIS classification	B2 - Flammable Liquids D1A - Immediate/Serious-VERY TOXIC D2A - Other Toxic Effects-VERY TOXIC D2B - Other Toxic Effects-TOXIC

WHMIS labeling

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)	No
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)	Yes
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	No

*A "Yes" indicates this product complies with the inventory requirements administered by the governing country(s)

State regulations	WARNING: This product contains a chemical known to the State of California to cause cancer and birth defects or other reproductive harm.

US - California Hazardous Substances (Director's): Listed substance

1,2,4, Trimethylbenzene (CAS 95-63-6)	Listed.
Benzene (CAS 71-43-2)	Listed.

Cumene (CAS 98-82-8)	Listed.
Cyclohexane (CAS 110-82-7)	Listed.
Ethanol (CAS 64-17-5)	Listed.
Ethylbenzene (CAS 100-41-4)	Listed.
Hexane (Other Isomers) (CAS 96-14-0)	Listed.
n-Heptane (CAS 142-82-5)	Listed.
n-Hexane (CAS 110-54-3)	Listed.
Octane (All isomers) (CAS 111-65-9)	Listed.
Pentane (CAS 109-66-0)	Listed.
Toluene (CAS 108-88-3)	Listed.
Xylene (o, m, p isomers) (CAS 1330-20-7)	Listed.

US - California Proposition 65 - Carcinogens & Reproductive Toxicity (CRT): Listed substance

Benzene (CAS 71-43-2)	Listed.
Cumene (CAS 98-82-8)	Listed.
Ethylbenzene (CAS 100-41-4)	Listed.
Toluene (CAS 108-88-3)	Listed.

US - California Proposition 65 - CRT: Listed date/Carcinogenic substance

Benzene (CAS 71-43-2)	Listed: February 27, 1987 Carcinogenic.
Cumene (CAS 98-82-8)	Listed: April 6, 2010 Carcinogenic.
Ethylbenzene (CAS 100-41-4)	Listed: June 11, 2004 Carcinogenic.

US - California Proposition 65 - CRT: Listed date/Developmental toxin

Benzene (CAS 71-43-2)	Listed: December 26, 1997 Developmental toxin.
Toluene (CAS 108-88-3)	Listed: January 1, 1991 Developmental toxin.

US - California Proposition 65 - CRT: Listed date/Female reproductive toxin

Toluene (CAS 108-88-3)	Listed: August 7, 2009 Female reproductive toxin.

US - California Proposition 65 - CRT: Listed date/Male reproductive toxin

Benzene (CAS 71-43-2)	Listed: December 26, 1997 Male reproductive toxin.

US - New Jersey RTK - Substances: Listed substance

1,2,4, Trimethylbenzene (CAS 95-63-6)	Listed.
Benzene (CAS 71-43-2)	Listed.
Cumene (CAS 98-82-8)	Listed.
Cyclohexane (CAS 110-82-7)	Listed.
Ethanol (CAS 64-17-5)	Listed.
Ethylbenzene (CAS 100-41-4)	Listed.
n-Heptane (CAS 142-82-5)	Listed.
n-Hexane (CAS 110-54-3)	Listed.
Octane (All isomers) (CAS 111-65-9)	Listed.
Pentane (CAS 109-66-0)	Listed.
Toluene (CAS 108-88-3)	Listed.
Xylene (o, m, p isomers) (CAS 1330-20-7)	Listed.

US - Pennsylvania RTK - Hazardous Substances: Special hazard

Benzene (CAS 71-43-2)	Special hazard.

US. Massachusetts RTK - Substance List

1,2,4, Trimethylbenzene (CAS 95-63-6)	Listed.
Benzene (CAS 71-43-2)	Listed.
Cumene (CAS 98-82-8)	Listed.
Cyclohexane (CAS 110-82-7)	Listed.
Ethanol (CAS 64-17-5)	Listed.
Ethylbenzene (CAS 100-41-4)	Listed.
Hexane (Other Isomers) (CAS 96-14-0)	Listed.
n-Heptane (CAS 142-82-5)	Listed.
n-Hexane (CAS 110-54-3)	Listed.
Octane (All isomers) (CAS 111-65-9)	Listed.
Pentane (CAS 109-66-0)	Listed.
Toluene (CAS 108-88-3)	Listed.
Xylene (o, m, p isomers) (CAS 1330-20-7)	Listed.

US. New Jersey Worker and Community Right-to-Know Act

1,2,4, Trimethylbenzene (CAS 95-63-6)	500 LBS
Benzene (CAS 71-43-2)	500 LBS
Cumene (CAS 98-82-8)	500 LBS
Cyclohexane (CAS 110-82-7)	500 LBS
Ethylbenzene (CAS 100-41-4)	500 LBS
n-Hexane (CAS 110-54-3)	500 LBS

Pentane (CAS 109-66-0)	500 LBS
Toluene (CAS 108-88-3)	500 LBS
Xylene (o, m, p isomers) (CAS 1330-20-7)	500 LBS

US. Pennsylvania RTK - Hazardous Substances

1,2,4, Trimethylbenzene (CAS 95-63-6)	Listed.
Benzene (CAS 71-43-2)	Listed.
Cumene (CAS 98-82-8)	Listed.
Cyclohexane (CAS 110-82-7)	Listed.
Ethanol (CAS 64-17-5)	Listed.
Ethylbenzene (CAS 100-41-4)	Listed.
Gasoline (CAS 86290-81-5)	Listed.
Hexane (Other Isomers) (CAS 96-14-0)	Listed.
n-Heptane (CAS 142-82-5)	Listed.
n-Hexane (CAS 110-54-3)	Listed.
Octane (All isomers) (CAS 111-65-9)	Listed.
Pentane (CAS 109-66-0)	Listed.
Toluene (CAS 108-88-3)	Listed.
Xylene (o, m, p isomers) (CAS 1330-20-7)	Listed.

16. Other Information

Further information	HMIS® is a registered trade and service mark of the NPCA.
Other information	Note: This Material Safety Data Sheet applies to the listed products and synonym descriptions for Hazard Communication purposes only. Technical Specifications vary greatly depending on the products and are not reflected in this document. Consult specification sheets for technical information.
HMIS® ratings	Health: 2* Flammability: 3 Physical hazard: 0
NFPA ratings	Health: 1 Flammability: 3 Instability: 0
Disclaimer	This Material Safety Data Sheet (MSDS) was prepared in accordance with 29 CFR 1910.1200 by Valero Marketing & Supply Co., ("VALERO"). VALERO does not assume any liability arising out of product use by others. The information, recommendations, and suggestions presented in this MSDS are based upon test results and data believed to be reliable. The end user of the product has the responsibility for evaluating the adequacy of the data under the conditions of use, determining the safety, toxicity and suitability of the product under these conditions, and obtaining additional or clarifying information where uncertainty exists. No guarantee expressed or implied is made as to the effects of such use , the results to be obtained, or the safety and toxicity of the product in any specific application. Furthermore, the information herein is not represented as absolutely complete, since it is not practicable to provide all the scientific and study information in the format of this document, plus additional information may be necessary under exceptional conditions of use, or because of applicable laws or government regulations.

Lead

Safety Data Sheet

according to Federal Register / Vol. 77, No. 58 / Monday, March 26, 2012 / Rules and Regulations

Date of issue: 12/15/2014 Revision date: 12/15/2014 Version: 1.1

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1. Product identifier

Product form	:	Substance
CAS No	:	7439-92-1
Formula	:	Pb
Synonyms	:	C.I. 77575, in massive state / elemental lead, in massive state / glover, in massive state
BIG no	:	10073

1.2. Relevant identified uses of the substance or mixture and uses advised against

Use of the substance/mixture	:	Solder Battery: component Construction Electrodes

1.3. Details of the supplier of the safety data sheet

GSC International, Inc.
1747 N. Deffer Drive
Nixa,
MO 65714
United States of America

Tel: 417-374-7431
Fax: 417-374-7442
Email: info@gscinternationalinc.com

1.4. Emergency telephone number

Country	Organization/Company	Address	Emergency number
MEXICO	Servicio de Informacion Toxicologica Sintox	Tintoreto #32 Edif. a Desp. Col. Nochebuena Mixcoac México, D.F.	1 800 009 2800 +52 55 5611 2634 /+52 55 5598 9095
UNITED STATES OF AMERICA	American Association of Poison Control Centers		1-800-222-1222

SECTION 2: Hazards identification

2.1. Classification of the substance or mixture

Classification (GHS-US)

Acute Tox. 4 (Oral)	H302
Acute Tox. 4 (Inhalation)	H332
Carc. 1B	H350
Repr. 1A	H360
STOT RE 2	H373
Aquatic Acute 1	H400
Aquatic Chronic 1	H410

Full text of H-phrases: see section 16

2.2. Label elements

GHS-US labeling

Hazard pictograms (GHS-US) :


GHS07


GHS08


GHS09

Signal word (GHS-US) : Danger

Hazard statements (GHS-US) : H302+H332 - Harmful if swallowed or if inhaled
H350 - May cause cancer
H360 - May damage fertility or the unborn child
H373 - May cause damage to organs through prolonged or repeated exposure

H400 - Very toxic to aquatic life
H410 - Very toxic to aquatic life with long lasting effects

Precautionary statements (GHS-US) : P201 - Obtain special instructions before use
P202 - Do not handle until all safety precautions have been read and understood
P260 - Do not breathe dust, fume
P264 - Wash hands thoroughly after handling
P270 - Do not eat, drink or smoke when using this product
P273 - Avoid release to the environment
P304+P340 - If inhaled: Remove person to fresh air and keep comfortable for breathing
P308+P313 - If exposed or concerned: Get medical advice/attention
P314 - Get medical advice/attention if you feel unwell
P501 - Dispose of contents/container to a licensed hazardous-waste disposal contractor or collection site except for empty clean containers which can be disposed of as non-hazardous waste

2.3. Other hazards

No additional information available

2.4. Unknown acute toxicity (GHS-US)

Not applicable

SECTION 3: Composition/information on ingredients

3.1. Substance

Name	Product identifier	%	Classification (GHS-US)
Lead (Main constituent)	(CAS No) 7439-92-1	> 99,9	Acute Tox. 4 (Oral), H302 Acute Tox. 4 (Inhalation), H332 Carc. 1B, H350 Repr. 1A, H360 STOT RE 2, H373 Aquatic Acute 1, H400 Aquatic Chronic 1, H410

Full text of H-phrases: see section 16

3.2. Mixture

Not applicable

4.1. Description of first aid measures

First-aid measures general	:	If you feel unwell, seek medical advice. IF exposed or concerned: Get medical advice/attention. Call a poison center/doctor/physician if you feel unwell.
First-aid measures after inhalation	:	Remove person to fresh air and keep comfortable for breathing. Not applicable. Call a poison center/doctor/physician if you feel unwell.
First-aid measures after skin contact	:	Not applicable. Wash skin with plenty of water.
First-aid measures after eye contact	:	Not applicable. Rinse eyes with water as a precaution.
First-aid measures after ingestion	:	Not applicable. Rinse mouth. Call a poison center/doctor/physician if you feel unwell.

4.2. Most important symptoms and effects, both acute and delayed

Symptoms/injuries after inhalation	:	No effects known.
Symptoms/injuries after skin contact	:	No effects known.
Symptoms/injuries after eye contact	:	No effects known.
Symptoms/injuries after ingestion	:	No effects known.
Chronic symptoms	:	No effects known.

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	:	Adapt extinguishing media to the environment.
Unsuitable extinguishing media	:	No unsuitable extinguishing media known.

5.2. Special hazards arising from the substance or mixture

Fire hazard	:	DIRECT FIRE HAZARD. Non combustible.

Explosion hazard	: DIRECT EXPLOSION HAZARD. No data available on direct explosion hazard. INDIRECT EXPLOSION HAZARD. No data available on indirect explosion hazard.
Reactivity	: On burning: formation of metallic fumes. Oxidizes on exposure to air.

5.3. Advice for firefighters

Precautionary measures fire	: Exposure to fire/heat: keep upwind. Exposure to fire/heat: consider evacuation. Exposure to heat: have neighborhood close doors and windows.
Firefighting instructions	: Dilute toxic gases with water spray. Take account of toxic fire-fighting water. Use water moderately and if possible collect or contain it.
Protection during firefighting	: Heat/fire exposure: compressed air/oxygen apparatus. Do not attempt to take action without suitable protective equipment. Self-contained breathing apparatus. Complete protective clothing.

SECTION 6: Accidental release measures

6.1. Personal precautions, protective equipment and emergency procedures

6.1.1. For non-emergency personnel

Protective equipment	: Gloves. Protective clothing. See "Material-Handling" to select protective clothing.
Emergency procedures	: Mark the danger area. No naked flames.

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".

6.2. Environmental precautions

Avoid release to the environment. Prevent soil and water pollution. Prevent spreading in sewers. Notify authorities if product enters sewers or public waters.

6.3. Methods and material for containment and cleaning up

For containment	: Not applicable. Collect spillage.
Methods for cleaning up	: Recover mechanically the product. Pick-up the material. Take collected spill to manufacturer/competent authority. Notify authorities if product enters sewers or public waters.
Other information	: Dispose of materials or solid residues at an authorized site.

6.4. Reference to other sections

For further information refer to section 13.

SECTION 7: Handling and storage

7.1. Precautions for safe handling

Precautions for safe handling	: Meet the legal requirements. Do not discharge the waste into the drain. Handle unclean empty containers as full ones. Observe strict hygiene. Measure the concentration in the atmosphere. Carry out operations in the open/under local exhaust/ventilation or with respiratory protection. Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Do not breathe dust, fume. Use only outdoors or in a well-ventilated area. Take all necessary technical measures to avoid or minimize the release of the product on the workplace. Limit quantities of product at the minimum necessary for handling and limit the number of exposed workers. Provide local exhaust or general room ventilation. Wear personal protective equipment. Floors, walls and other surfaces in the hazard area must be cleaned regularly.
Hygiene measures	: Separate working clothes from town clothes. Launder separately. 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	: Does not require any specific or particular technical measures. Comply with applicable regulations.
Storage conditions	: Store locked up. Store in a well-ventilated place. Keep cool.
Incompatible materials	: Strong acids, strong bases and oxidation agents.
Heat-ignition	: KEEP SUBSTANCE AWAY FROM: heat sources.
Prohibitions on mixed storage	: KEEP SUBSTANCE AWAY FROM: oxidizing agents. Strong acids. Strong bases.
Storage area	: Meet the legal requirements.
Special rules on packaging	: SPECIAL REQUIREMENTS: closing. correctly labeled. meet the legal requirements. Secure fragile packaging in solid containers.

7.3. Specific end use(s)

No additional information available

SECTION 8: Exposure controls/personal protection

8.1. Control parameters

Lead (7439-92-1)		
ACGIH	ACGIH TWA (mg/m³)	0,05 mg/m³
ACGIH	Remark (ACGIH)	CNS & PNS impair
OSHA	Not applicable	

8.2. Exposure controls

Appropriate engineering controls : Provide adequate general and local exhaust ventilation. Ensure good ventilation of the work station.

Personal protective equipment : Protective goggles. Gloves.

Materials for protective clothing : GIVE EXCELLENT RESISTANCE: No data available. GIVE GOOD RESISTANCE: butyl rubber. PVC. GIVE LESS RESISTANCE: No data available. GIVE POOR RESISTANCE: No data available.

Hand protection : protective gloves.

Eye protection : Safety glasses.

Skin and body protection : Not required for normal conditions of use.

Respiratory protection : Wear respiratory protection.

Environmental exposure controls : Avoid release to the environment.

SECTION 9: Physical and chemical properties

9.1. Information on basic physical and chemical properties

Physical state : Solid

Appearance : Metal.

Molecular mass : 207,20 g/mol

Color : White to blue-grey

Odor : Odorless

Odor threshold : No data available

pH : No data available

Relative evaporation rate (butyl acetate=1) : No data available

Melting point : 327 °C

Freezing point : No data available

Boiling point : 1740 °C

Flash point : Not applicable

Auto-ignition temperature : No data available

Decomposition temperature : No data available

Flammability (solid, gas) : No data available

Vapor pressure : < 0,1 hPa

Relative vapor density at 20 °C : No data available

Relative density : 11,3

Specific gravity / density : 11340 kg/m³

Solubility : insoluble in water. Substance sinks in water. Soluble in nitric acid. Insoluble in organic solvents. Water: < 0,1 g/100ml

Log Pow : 0,73 (Estimated value)

Log Kow : No data available

Viscosity, kinematic	: Not applicable
Viscosity, dynamic	: No data available
Explosive properties	: No data available
Oxidizing properties	: No data available
Explosive limits	: No data available

9.2. Other information

VOC content : Not applicable (inorganic)

SECTION 10: Stability and reactivity

10.1. Reactivity

On burning: formation of metallic fumes. Oxidizes on exposure to air.

10.2. Chemical stability

Unstable on exposure to air.

10.3. Possibility of hazardous reactions

No additional information available

10.4. Conditions to avoid

No additional information available

10.5. Incompatible materials

Acids. Bases.

10.6. Hazardous decomposition products

Thermal decomposition generates : fume.

SECTION 11: Toxicological information

11.1. Information on toxicological effects

Acute toxicity : Oral: Harmful if swallowed. Inhalation: Harmful if inhaled.

Lead (\f)7439-92-1	
LD50 oral rat	> 2000 mg/kg body weight (Rat; Weight of evidence)
LD50 dermal rat	> 2000 mg/kg body weight (Rat; Experimental value; OECD 402: Acute Dermal Toxicity)
ATE US (oral)	500,000 mg/kg body weight
ATE US (gases)	4500,000 ppmV/4h
ATE US (vapors)	11,000 mg/l/4h
ATE US (dust, mist)	1,500 mg/l/4h
Additional information	Lead massive metal is not considered to be acutely toxic. It is not easily inhaled or ingested, and if it is accidentally ingested normally passes through the gastrointestinal system without significant absorption into the body. Lead is not easily absorbed through the skin.

Skin corrosion/irritation	: Not classified (Based on available data, the classification criteria are not met)
Serious eye damage/irritation	: Not classified (Based on available data, the classification criteria are not met)
Respiratory or skin sensitization	: Not classified (Based on available data, the classification criteria are not met)
Germ cell mutagenicity	: Not classified (Based on available data, the classification criteria are not met)
Carcinogenicity	: May cause cancer.

Lead (7439-92-1)	
Additional information	There is some evidence that inorganic lead compounds may have a carcinogenic effect, and they have been classified by IARC as probably carcinogenic to humans. However, it is considered that this classification does not apply to lead in articles, given the very low bioavailability of metallic lead. Carcinogenicity studies of lead metal powder have been negative. Epidemiology studies of workers exposed to inorganic lead compounds have found a limited association with stomach cancer. IARC has concluded that lead metal is possibly carcinogenic to humans (Group aB).
IARC group	2B - Possibly carcinogenic to humans
National Toxicology Program (NTP) Status	3 - Reasonably anticipated to be Human Carcinogen

Reproductive toxicity : May damage fertility or the unborn child.

Specific target organ toxicity (single exposure) : Not classified

(Based on available data, the classification criteria are not met)

Specific target organ toxicity (repeated exposure) : May cause damage to organs through prolonged or repeated exposure.

Lead (7439-92-1)	
Additional information	Lead is a cumulative poison and may be absorbed into the body through ingestion or inhalation. Although inhalation and ingestion of lead in massive form are unlikely, poor hygiene practises may result in hand to mouth transfer which maybe significant over a prolonged period of time. Inorganic lead compounds have been documented in observational human studies to produce toxicity in multiple organ systems and body function including the haemotopoetic (blood) system, kidney function, reproductive function and the central nervous system.

Aspiration hazard : Not classified

(Based on available data, the classification criteria are not met)

Symptoms/injuries after inhalation : No effects known.

Symptoms/injuries after skin contact : No effects known.

Symptoms/injuries after eye contact : No effects known.

Symptoms/injuries after ingestion : No effects known.

Chronic symptoms : No effects known.

SECTION 12: Ecological information

12.1. Toxicity

Ecology - general : Dangerous for the environment. Very toxic to aquatic life with long lasting effects.

Ecology - air : Not dangerous for the ozone layer (Regulation (EC) No 1005/2009). Not included in the list of fluorinated greenhouse gases (Regulation (EC) No 842/2006). TA-Luft Klasse 5.2.2/II.

Ecology - water : No water pollutant (surface water). Maximum concentration in drinking water: 0.010 mg/l (lead) (Directive 98/83/EC). Highly toxic to aquatic organisms.

Lead (7439-92-1)	
LC50 fish 1	2,8 (0,44 - 542) mg/l (96h) Coughlan, D.J., S.P. Gloss, and J. Kubota 1986. Acute and Sub-Chronic Toxicity of Lead to the Early Life Stages of Small mouth Bass (Micropterus dolomieui). Water Air Soil Pollut. 28(3/4):265-275
EC50 Daphnia 1	4,46 (0,53 - 5,1) mg/l (48h) Govindarajan, S., C.P. Valsaraj, R. Mohan, V. Hariprasad, and R. Ramasubramanian 1993. Toxicity of Heavy Metals in Aquaculture Organisms: Penaeus indicus, Perna viridis, Artemia salina and Skeletonema costatum. Pollut.Res. 12(3):187-189

12.2. Persistence and degradability

Lead (7439-92-1)	
Persistence and degradability	Biodegradability: Not applicable. No (test)data available on mobility of the substance.
ThOD	Not applicable (inorganic)

12.3. Bioaccumulative potential

Lead (7439-92-1)	
Log Pow	0,73 (Estimated value)
Bioaccumulative potential	Low bioaccumulation potential (Log Kow < 4).

12.4. Mobility in soil

No additional information available

12.5. Other adverse effects

Effect on ozone layer :

SECTION 13: Disposal considerations

13.1. Waste treatment methods

Waste disposal recommendations : Dispose in a safe manner in accordance with local/national regulations. Hazardous waste shall not be mixed together with other waste. Different types of hazardous waste shall not be mixed together if this may entail a risk of pollution or create problems for the further management of the waste. Hazardous waste shall be managed responsibly. All entities that store, transport or handle hazardous waste shall take the necessary measures to prevent risks of pollution or damage to people or animals. Reuse or recycle following decontamination. Remove to an authorized dump (Class I). Do not discharge into surface water (2000/60/EC, Council decision 2455/2001/EC, O.J. L331 of 15/12/2001).

Additional information : LWCA (the Netherlands): KGA category 05. Hazardous waste according to Directive 2008/98/EC.

SECTION 14: Transport information

In accordance with DOT

Transport document description : UN3077 Environmentally hazardous substances, solid, n.o.s. Lead(7439-92-1), 9, III

UN-No.(DOT) : UN3077

Proper Shipping Name (DOT) : Environmentally hazardous substances, solid, n.o.s.
Lead(7439-92-1)

Department of Transportation (DOT) Hazard Classes : 9 - Class 9 - Miscellaneous hazardous material 49 CFR 173.140

Hazard labels (DOT) : 9 - Class 9 (Miscellaneous dangerous materials)

DOT Symbols : G - Identifies PSN requiring a technical name

Packing group (DOT) : III - Minor Danger

DOT Special Provisions (49 CFR 172.102)	8 - A hazardous substance that is not a hazardous waste may be shipped under the shipping description “Other regulated substances, liquid or solid, n.o.s.”, as appropriate. In addition, for solid materials, special provision B54 applies. 146 - This description may be used for a material that poses a hazard to the environment but does not meet the definition for a hazardous waste or a hazardous substance, as defined in 171.8 of this subchapter, or any hazard class as defined in Part 173 of this subchapter, if it is designated as environmentally hazardous by the Competent Authority of the country of origin, transit or destination. 335 - Mixtures of solids that are not subject to this subchapter and environmentally hazardous liquids or solids may be classified as “Environmentally hazardous substances, solid, n.o.s,” UN3077 and may be transported under this entry, provided there is no free liquid visible at the time the material is loaded or at the time the packaging or transport unit is closed. Each transport unit must be leak-proof when used as bulk packaging. A112 - Notwithstanding the quantity limits shown in Column (9A) and (9B) for this entry, the following IBCs are authorized for transportation aboard passenger and cargo-only aircraft. Each IBC may not exceed a maximum net quantity of 1,000 kg: a. Metal: 11A, 11B, 11N, 21A, 21B and 21N b. Rigid plastics: 11H1, 11H2, 21H1 and 21H2 c. Composite with plastic inner receptacle: 11HZ1, 11HZ2, 21HZ1 and 21HZ2 d. Fiberboard: 11G e. Wooden: 11C, 11D and 11F (with inner liners) f. Flexible: 13H2, 13H3, 13H4, 13H5, 13L2, 13L3, 13L4, 13M1 and 13M2 (flexible IBCs must be sift-proof and water resistant or must be fitted with a sift-proof and water resistant liner). B54 - Open-top, sift-proof rail cars are also authorized. IB8 - Authorized IBCs: Metal (11A, 11B, 11N, 21A, 21B, 21N, 31A, 31B and 31N); Rigid plastics (11H1, 11H2, 21H1, 21H2, 31H1 and 31H2); Composite (11HZ1, 11HZ2, 21HZ1, 21HZ2, 31HZ1 and 31HZ2); Fiberboard (11G); Wooden (11C, 11D and 11F); Flexible (13H1, 13H2, 13H3, 13H4, 13H5, 13L1, 13L2, 13L3, 13L4, 13M1 or 13M2). IP3 - Flexible IBCs must be sift-proof and water-resistant or must be fitted with a sift-proof and water-resistant liner. N20 - A 5M1 multi-wall paper bag is authorized if transported in a closed transport vehicle. T1 - 1.5 178.274(d)(2) Normal............. 178.275(d)(2) TP33 - The portable tank instruction assigned for this substance applies for granular and powdered solids and for solids which are filled and discharged at temperatures above their melting point which are cooled and transported as a solid mass. Solid substances transported or offered for transport above their melting point are authorized for transportation in portable tanks conforming to the provisions of portable tank instruction T4 for solid substances of packing group III or T7 for solid substances of packing group II, unless a tank with more stringent requirements for minimum shell thickness, maximum allowable working pressure, pressure-relief devices or bottom outlets are assigned in which case the more stringent tank instruction and special provisions shall apply. Filling limits must be in accordance with portable tank special provision TP3. Solids meeting the definition of an elevated temperature material must be transported in accordance with the applicable requirements of this subchapter.
DOT Packaging Exceptions (49 CFR 173.xxx)	155
DOT Packaging Non Bulk (49 CFR 173.xxx)	213
DOT Packaging Bulk (49 CFR 173.xxx)	240
DOT Quantity Limitations Passenger aircraft/rail (49 CFR 173.27)	No limit
DOT Quantity Limitations Cargo aircraft only (49 CFR 175.75)	No limit
DOT Vessel Stowage Location	A - The material may be stowed ‘‘on deck’’ or ‘‘under deck’’ on a cargo vessel and on a passenger vessel.

Additional information

Other information : No supplementary information available.

ADR

No additional information available

Transport by sea

UN-No. (IMDG)	3077
Proper Shipping Name (IMDG)	ENVIRONMENTALLY HAZARDOUS SUBSTANCE, SOLID, N.O.S.
Class (IMDG)	9 - Miscellaneous dangerous compounds
Packing group (IMDG)	III - substances presenting low danger

Air transport

UN-No.(IATA) : 3077
Proper Shipping Name (IATA) : Environmentally hazardous substance, solid, n.o.s.
Class (IATA) : 9 - Miscellaneous Dangerous Goods
Packing group (IATA) : III - Minor Danger

SECTION 15: Regulatory information

15.1. US Federal regulations

Lead (7439-92-1)	
Listed on the United States TSCA (Toxic Substances Control Act) inventory Listed on United States SARA Section 313 Not listed on the United States SARA Section 313	
RQ (Reportable quantity, section 304 of EPA's List of Lists)	10 lb

15.2. International regulations

CANADA

No additional information available

EU-Regulations

No additional information available

Classification according to Regulation (EC) No. 1272/2008 [CLP]

Repr. 1A	H360Df
Acute Tox. 4 (Inhalation)	H332
Acute Tox. 4 (Oral)	H302
STOT RE 2	H373
Aquatic Acute 1	H400
Aquatic Chronic 1	H410

Full text of H-phrases: see section 16

Classification according to Directive 67/548/EEC [DSD] or 1999/45/EC [DPD]

Repr.Cat.1; R61
Repr.Cat.3; R62
Xn; R20/22
R33
N; R50/53

Full text of R-phrases: see section 16

15.2.2. National regulations

Lead (7439-92-1)
Listed on IARC (International Agency for Research on Cancer) Listed as carcinogen on NTP (National Toxicology Program)

15.3. US State regulations

No additional information available

SECTION 16: Other information

Revision date : 12/15/2014

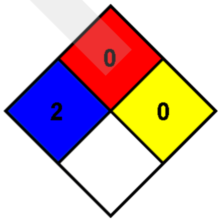
Full text of H-phrases:

Acute Tox. 4 (Inhalation)	Acute toxicity (inhalation) Category 4
Acute Tox. 4 (Oral)	Acute toxicity (oral) Category 4
Aquatic Acute 1	Hazardous to the aquatic environment - Acute Hazard Category 1
Aquatic Chronic 1	Hazardous to the aquatic environment - Chronic Hazard Category 1
Carc. 1B	Carcinogenicity Category 1B
Repr. 1A	Reproductive toxicity Category 1A
STOT RE 2	Specific target organ toxicity (repeated exposure) Category 2
H302	Harmful if swallowed
H332	Harmful if inhaled
H350	May cause cancer
H360	May damage fertility or the unborn child
H373	May cause damage to organs through prolonged or repeated exposure
H400	Very toxic to aquatic life
H410	Very toxic to aquatic life with long lasting effects

NFPA health hazard : 2 - Intense or continued exposure could cause temporary incapacitation or possible residual injury unless prompt medical attention is 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 : * Chronic Hazard - Chronic (long-term) health effects may result from repeated overexposure

Flammability : 0 Minimal Hazard

Physical : 0 Minimal Hazard

Personal Protection : B

SDS US (GHS HazCom 2012)

SAFETY DATA SHEET

Version 6.13
Revision Date 05/24/2023
Print Date 08/12/2023

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Perfluorooctanoic acid

Product Number : 171468
Brand : Aldrich
CAS-No. : 335-67-1

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 4), H302
Acute toxicity, Inhalation (Category 4), H332
Skin corrosion (Category 1C), H314
Serious eye damage (Category 1), H318
Carcinogenicity (Category 2), H351
Reproductive toxicity (Category 1B), H360
Effects on or via lactation, H362
Specific target organ toxicity - repeated exposure (Category 1), Liver, H372

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram	
Signal Word	Danger
Hazard statement(s)	
H302 + H332	Harmful if swallowed or if inhaled.
H314	Causes severe skin burns and eye damage.
H351	Suspected of causing cancer.
H360	May damage fertility or the unborn child.
H362	May cause harm to breast-fed children.
H372	Causes damage to organs (Liver) through prolonged or repeated exposure.
Precautionary statement(s)	
P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dust.
P263	Avoid contact during pregnancy/ while nursing.
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 + P330	IF SWALLOWED: Call a POISON CENTER/ doctor if you feel unwell. Rinse mouth.
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 + P310	IF INHALED: Remove person to fresh air and keep comfortable for breathing. Immediately call a POISON CENTER/ doctor.
P305 + P351 + P338 + P310	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.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P363	Wash contaminated clothing before reuse.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

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SECTION 3: Composition/information on ingredients

3.1 Substances

Synonyms : Pentadecafluorooctanoic acid
Perfluorocaprylic acid
Perfluorooctanoic acid

Formula : $C_8HF_{15}O_2$
Molecular weight : 414.07 g/mol

CAS-No. : 335-67-1
EC-No. : 206-397-9

Component	Classification	Concentration
pentadecafluorooctanoic acid		
	Acute Tox. 4; Skin Corr. 1C; Eye Dam. 1; Carc. 2; Repr. 1B; Lact. ; STOT RE 1; H302, H332, H314, H318, H351, H360, H362, H372	<= 100 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
First aiders need to protect themselves. Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Immediately call in physician. If breathing stops: immediately apply artificial respiration, if necessary also oxygen.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Call a physician immediately.

In case of eye contact
After eye contact: rinse out with plenty of water. Immediately call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: make victim drink water (two glasses at most), avoid vomiting (risk of perforation). Call a physician immediately. Do not attempt to neutralise.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Foam Carbon dioxide (CO2) Dry powder

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture

Carbon oxides
Hydrogen fluoride
Combustible.
Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters

Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information

Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Avoid generation and inhalation of dusts in all circumstances. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions

Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully. Dispose of properly. Clean up affected area.
Avoid generation of dusts.

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling

Work under hood. Do not inhale substance/mixture.

Hygiene measures

Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions

Tightly closed. Dry. Keep in a well-ventilated place. Keep locked up or in an area accessible only to qualified or authorized persons.

Storage class

Storage class (TRGS 510): 6.1C: Combustible, acute toxic Cat.3 / toxic compounds or compounds which causing chronic effects

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

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SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Tightly fitting safety goggles

Skin protection

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN374 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).
Full contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

This recommendation applies only to the product stated in the safety data sheet, supplied by us and for the designated use. When dissolving in or mixing with other substances and under conditions deviating from those stated in EN374 please contact the supplier of CE-approved gloves (e.g. KCL GmbH, D-36124 Eichenzell, Internet: www.kcl.de).
Splash contact
Material: Nitrile rubber
Minimum layer thickness: 0.11 mm
Break through time: 480 min
Material tested:KCL 741 Dermatril® L

Body Protection

Acid-resistant protective clothing

Respiratory protection

required when dusts are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: flakes Color: colorless
b)	Odor	stinging
c)	Odor Threshold	No data available
d)	pH	2.6 at 1 g/l at 20 °C (68 °F)
e)	Melting point/freezing point	Melting point/range: 55 - 56 °C (131 - 133 °F) - lit.
f)	Initial boiling point and boiling range	189 °C 372 °F at 981 hPa - lit.
g)	Flash point	No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapor pressure	0.69 hPa at 25 °C (77 °F)
l)	Vapor density	No data available
m)	Density	1.8 g/cm3 at 20 °C (68 °F)
	Relative density	No data available
n)	Water solubility	3.4 g/l at 20 °C (68 °F)
o)	Partition coefficient: n-octanol/water	log Pow: 6.30 - Potential bioaccumulation, (Lit.)
p)	Autoignition temperature	No data available
q)	Decomposition temperature	> 300 °C (> 572 °F) -
r)	Viscosity	No data available
s)	Explosive properties	No data available
t)	Oxidizing properties	none

9.2 Other safety information

No data available

SECTION 10: Stability and reactivity

10.1 Reactivity

The following applies in general to flammable organic substances and mixtures: in correspondingly fine distribution, when whirled up a dust explosion potential may generally be assumed.

10.2 Chemical stability

The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions

Violent reactions possible with:
Strong oxidizing agents
Strong acids
Bases

10.4 Conditions to avoid

no information available

10.5 Incompatible materials

No data available

10.6 Hazardous decomposition products

In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Acute toxicity

Acute toxicity estimate Oral - 500.1 mg/kg
(Expert judgment)
Acute toxicity estimate Inhalation - 4 h - 11.1 mg/l - vapor

(Expert judgment)
Dermal: No data available

Skin corrosion/irritation

No data available

Serious eye damage/eye irritation

No data available

Respiratory or skin sensitization

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

Suspected of causing cancer.

IARC: 2B - Group 2B: Possibly carcinogenic to humans (pentadecafluorooctanoic acid)

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.

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity
May damage the unborn child.
Studies indicating a hazard to babies during the lactation period

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
Causes damage to organs through prolonged or repeated exposure.
- Liver

Aspiration hazard
No data available

11.2 Additional Information

RTECS: RH0781000
Cough, Shortness of breath, Headache, Nausea, Vomiting
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.

After absorption:

gastric pain
Nausea
Vomiting
Drowsiness
somnolence

Handle in accordance with good industrial hygiene and safety practice.

Stomach - Irregularities - Based on Human Evidence

Stomach - Irregularities - Based on Human Evidence

SECTION 12: Ecological information

12.1 Toxicity

No data available

Toxicity to daphnia and other aquatic invertebrates	Remarks: No data available (pentadecafluorooctanoic acid)
Toxicity to algae	Remarks: No data available (pentadecafluorooctanoic acid)
Toxicity to daphnia and other aquatic invertebrates(Chronic toxicity)	Remarks: No data available (pentadecafluorooctanoic acid)

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties
No data available

12.7 Other adverse effects
Discharge into the environment must be avoided.

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product

Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself.

SECTION 14: Transport information

DOT (US)

UN number: 3261 Class: 8 Packing group: III
Proper shipping name: Corrosive solid, acidic, organic, n.o.s. (pentadecafluorooctanoic acid)
Reportable Quantity (RQ):
Poison Inhalation Hazard: No

IMDG

UN number: 3261 Class: 8 Packing group: III EMS-No: F-A, S-B
Proper shipping name: CORROSIVE SOLID, ACIDIC, ORGANIC, N.O.S. (pentadecafluorooctanoic acid)

IATA

UN number: 3261 Class: 8 Packing group: III
Proper shipping name: Corrosive solid, acidic, organic, n.o.s. (pentadecafluorooctanoic acid)

SECTION 15: Regulatory information

SARA 302 Components

This material does not contain any components with a section 302 EHS TPQ.

SARA 313 Components

The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
pentadecafluorooctanoic acid	335-67-1	2021-01-12

SARA 311/312 Hazards

Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components

No components are subject to the Massachusetts Right to Know Act.

California Prop. 65 Components

, which is/are known to the State of California to cause cancer and birth defects or other reproductive harm. For more information go to www.P65Warnings.ca.gov.pentadecafluorooctanoic acid	CAS-No. 335-67-1	Revision Date 2022-02-25

SECTION 16: Other information

Further information

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 applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

The branding on the header and/or footer of this document may temporarily not visually match the product purchased as we transition our branding. However, all of the information in the document regarding the product remains unchanged and matches the product ordered. For further information please contact mlsbranding@sial.com.

Version: 6.13 Revision Date: 05/24/2023 Print Date: 08/12/2023

SAFETY DATA SHEET

Version 6.6
Revision Date 07/22/2022
Print Date 08/12/2023

SECTION 1: Identification of the substance/mixture and of the company/undertaking

1.1 Product identifiers

Product name : Heptadecafluorooctanesulfonic acid solution

Product Number : 77283
Brand : Aldrich

1.2 Relevant identified uses of the substance or mixture and uses advised against

Identified uses : Laboratory chemicals, Synthesis of substances

1.3 Details of the supplier of the safety data sheet

Company : Sigma-Aldrich Inc.
3050 SPRUCE ST
ST. LOUIS MO 63103
UNITED STATES

Telephone : +1 314 771-5765
Fax : +1 800 325-5052

1.4 Emergency telephone

Emergency Phone # : 800-424-9300 CHEMTREC (USA) +1-703-527-3887 CHEMTREC (International) 24 Hours/day; 7 Days/week

SECTION 2: Hazards identification

2.1 Classification of the substance or mixture

GHS Classification in accordance with 29 CFR 1910 (OSHA HCS)

Acute toxicity, Oral (Category 4), H302
Carcinogenicity (Category 2), H351
Reproductive toxicity (Category 1B), H360
Effects on or via lactation, H362
Specific target organ toxicity - repeated exposure (Category 1), H372
Long-term (chronic) aquatic hazard (Category 2), H411

For the full text of the H-Statements mentioned in this Section, see Section 16.

2.2 GHS Label elements, including precautionary statements

Pictogram

Signal Word Danger

Hazard statement(s)

H302	Harmful if swallowed.
H351	Suspected of causing cancer.
H360	May damage fertility or the unborn child.
H362	May cause harm to breast-fed children.
H372	Causes damage to organs through prolonged or repeated exposure.
H411	Toxic to aquatic life with long lasting effects.

Precautionary statement(s)

P201	Obtain special instructions before use.
P202	Do not handle until all safety precautions have been read and understood.
P260	Do not breathe dust/ fume/ gas/ mist/ vapors/ spray.
P263	Avoid contact during pregnancy/ while nursing.
P264	Wash skin thoroughly after handling.
P270	Do not eat, drink or smoke when using this product.
P273	Avoid release to the environment.
P280	Wear protective gloves/ protective clothing/ eye protection/ face protection.
P301 + P312 + P330	IF SWALLOWED: Call a POISON CENTER/ doctor if you feel unwell. Rinse mouth.
P308 + P313	IF exposed or concerned: Get medical advice/ attention.
P391	Collect spillage.
P405	Store locked up.
P501	Dispose of contents/ container to an approved waste disposal plant.

2.3 Hazards not otherwise classified (HNOC) or not covered by GHS - none

SECTION 3: Composition/information on ingredients

3.2 Mixtures

Formula : $C_8HF_{17}O_3S$
Molecular weight : 500.13 g/mol

Component		Classification	Concentration
Heptadecafluorooctane-1-sulphonic acid			
CAS-No. EC-No. Index-No.	1763-23-1 217-179-8 607-624-00-8	Acute Tox. 4; Carc. 2; Repr. 1B; Lact. ; STOT RE 1; Aquatic Chronic 2; H302, H332, H351, H360, H362, H372, H411	>= 30 - < 50 %

For the full text of the H-Statements mentioned in this Section, see Section 16.

SECTION 4: First aid measures

4.1 Description of first-aid measures

General advice
Show this material safety data sheet to the doctor in attendance.

If inhaled
After inhalation: fresh air. Call in physician.

In case of skin contact
In case of skin contact: Take off immediately all contaminated clothing. Rinse skin with water/ shower. Consult a physician.

In case of eye contact
After eye contact: rinse out with plenty of water. Call in ophthalmologist. Remove contact lenses.

If swallowed
After swallowing: immediately make victim drink water (two glasses at most). Consult a physician.

4.2 Most important symptoms and effects, both acute and delayed

The most important known symptoms and effects are described in the labelling (see section 2.2) and/or in section 11

4.3 Indication of any immediate medical attention and special treatment needed

No data available

SECTION 5: Firefighting measures

5.1 Extinguishing media

Suitable extinguishing media
Water Foam Carbon dioxide ($CO2$) Dry powder

Unsuitable extinguishing media
For this substance/mixture no limitations of extinguishing agents are given.

5.2 Special hazards arising from the substance or mixture

Carbon oxides
Sulfur oxides
Hydrogen fluoride
Mixture with combustible ingredients.
Development of hazardous combustion gases or vapours possible in the event of fire.

5.3 Advice for firefighters

Stay in danger area only with self-contained breathing apparatus. Prevent skin contact by keeping a safe distance or by wearing suitable protective clothing.

5.4 Further information

Suppress (knock down) gases/vapors/mists with a water spray jet. Prevent fire extinguishing water from contaminating surface water or the ground water system.

SECTION 6: Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures

Advice for non-emergency personnel: Do not breathe vapors, aerosols. Avoid substance contact. Ensure adequate ventilation. Evacuate the danger area, observe emergency procedures, consult an expert.
For personal protection see section 8.

6.2 Environmental precautions

Do not let product enter drains.

6.3 Methods and materials for containment and cleaning up

Cover drains. Collect, bind, and pump off spills. Observe possible material restrictions (see sections 7 and 10). Take up carefully with liquid-absorbent material (e.g. Chemizorb®). Dispose of properly. Clean up affected area.

6.4 Reference to other sections

For disposal see section 13.

SECTION 7: Handling and storage

7.1 Precautions for safe handling

Advice on safe handling

Work under hood. Do not inhale substance/mixture. Avoid generation of vapours/aerosols.

Hygiene measures

Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.
For precautions see section 2.2.

7.2 Conditions for safe storage, including any incompatibilities

Storage conditions

Tightly closed. Keep in a well-ventilated place. Keep locked up or in an area accessible only to qualified or authorized persons.

Storage class

Storage class (TRGS 510): 6.1C: Combustible, acute toxic Cat.3 / toxic compounds or compounds which causing chronic effects

7.3 Specific end use(s)

Apart from the uses mentioned in section 1.2 no other specific uses are stipulated

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SECTION 8: Exposure controls/personal protection

8.1 Control parameters

Ingredients with workplace control parameters

Contains no substances with occupational exposure limit values.

8.2 Exposure controls

Appropriate engineering controls

Immediately change contaminated clothing. Apply preventive skin protection. Wash hands and face after working with substance.

Personal protective equipment

Eye/face protection

Use equipment for eye protection tested and approved under appropriate government standards such as NIOSH (US) or EN 166(EU). Safety glasses

Skin protection

required

Body Protection

protective clothing

Respiratory protection
required when vapours/aerosols are generated.
Our recommendations on filtering respiratory protection are based on the following standards: DIN EN 143, DIN 14387 and other accompanying standards relating to the used respiratory protection system.

Control of environmental exposure
Do not let product enter drains.

SECTION 9: Physical and chemical properties

9.1 Information on basic physical and chemical properties

a)	Appearance	Form: clear, liquid Color: light red
b)	Odor	No data available
c)	Odor Threshold	No data available
d)	pH	No data available
e)	Melting point/freezing point	No data available
f)	Initial boiling point and boiling range	No data available
g)	Flash point	()No data available
h)	Evaporation rate	No data available
i)	Flammability (solid, gas)	No data available
j)	Upper/lower flammability or explosive limits	No data available
k)	Vapor pressure	No data available
l)	Vapor density	No data available
m)	Density	1.250 g/cm3
	Relative density	No data available
n)	Water solubility	soluble
o)	Partition coefficient: n-octanol/water	No data available
p)	Autoignition temperature	No data available
q)	Decomposition temperature	No data available
r)	Viscosity	No data available
s)	Explosive properties	Not classified as explosive.
t)	Oxidizing properties	none

9.2 Other safety information

No data available

SECTION 10: Stability and reactivity

10.1 Reactivity

No data available

10.2 Chemical stability

The product is chemically stable under standard ambient conditions (room temperature) .

10.3 Possibility of hazardous reactions

No data available

10.4 Conditions to avoid

no information available

10.5 Incompatible materials

Strong oxidizing agents

10.6 Hazardous decomposition products

In the event of fire: see section 5

SECTION 11: Toxicological information

11.1 Information on toxicological effects

Mixture

Acute toxicity

Oral: No data available

Inhalation: No data available

Dermal: No data available

Skin corrosion/irritation

No data available

Serious eye damage/eye irritation

No data available

Respiratory or skin sensitization

No data available

Germ cell mutagenicity

No data available

Carcinogenicity

Evidence of a carcinogenic effect.

IARC: No ingredient of this product present at levels greater than or equal to 0.1% is identified as probable, possible or confirmed human carcinogen by IARC.

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.

OSHA: No component of this product present at levels greater than or equal to 0.1% is on OSHA's list of regulated carcinogens.

Reproductive toxicity
May harm the unborn child.
May impair fertility.

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
Mixture causes damage to organs through prolonged or repeated exposure.**Aspiration hazard**
No data available

11.2 Additional Information

burning sensation, Cough, wheezing, laryngitis, Shortness of breath, spasm, inflammation and edema of the larynx, spasm, inflammation and edema of the bronchi, pneumonitis, pulmonary edema, Material is extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin.
To the best of our knowledge, the chemical, physical, and toxicological properties have not been thoroughly investigated.
Other dangerous properties can not be excluded.

This substance should be handled with particular care.

Handle in accordance with good industrial hygiene and safety practice.

Components

Heptadecafluorooctane-1-sulphonic acid

Acute toxicity
Acute toxicity estimate Oral - 500.1 mg/kg
(Expert judgment)
Acute toxicity estimate Inhalation - 4 h - 11.1 mg/l - vapor
(Expert judgment)
Dermal: No data available

Skin corrosion/irritation
No data available

Serious eye damage/eye irritation
Causes serious eye damage.

Respiratory or skin sensitization
No data available

Germ cell mutagenicity
No data available
No data available
No data available

Carcinogenicity
Suspected of causing cancer.

Reproductive toxicity
May damage the unborn child.
Studies indicating a hazard to babies during the lactation period

Specific target organ toxicity - single exposure
No data available

Specific target organ toxicity - repeated exposure
Causes damage to organs through prolonged or repeated exposure.**Aspiration hazard**
No data available

SECTION 12: Ecological information

12.1 Toxicity

Mixture
No data available

12.2 Persistence and degradability
No data available

12.3 Bioaccumulative potential
No data available

12.4 Mobility in soil
No data available

12.5 Results of PBT and vPvB assessment
PBT/vPvB assessment not available as chemical safety assessment not required/not conducted

12.6 Endocrine disrupting properties
No data available

12.7 Other adverse effects
No data available

Components

Heptadecafluorooctane-1-sulphonic acid
No data available

Toxicity to daphnia and other aquatic invertebrates	Remarks: No data available
Toxicity to algae	Remarks: No data available

SECTION 13: Disposal considerations

13.1 Waste treatment methods

Product
Waste material must be disposed of in accordance with the national and local regulations. Leave chemicals in original containers. No mixing with other waste. Handle uncleaned containers like the product itself. See www.retrologistik.com for processes regarding the return of chemicals and containers, or contact us there if you have further questions.

SECTION 14: Transport information

DOT (US)
Not dangerous goods

IMDG
UN number: 3082 Class: 9 Packing group: III EMS-No: F-A, S-F
Proper shipping name: ENVIRONMENTALLY HAZARDOUS SUBSTANCE, LIQUID, N.O.S. (Heptadecafluorooctane-1-sulphonic acid)
Marine pollutant : yes
Marine pollutant : no

IATA
UN number: 3082 Class: 9 Packing group: III
Proper shipping name: Environmentally hazardous substance, liquid, n.o.s. (Heptadecafluorooctane-1-sulphonic acid)

Further information
Packages smaller than or equal to 5 kg / L , not dangerous goods of Class 9

SECTION 15: Regulatory information

SARA 302 Components
This material does not contain any components with a section 302 EHS TPQ.

SARA 313 Components
The following components are subject to reporting levels established by SARA Title III, Section 313:

	CAS-No.	Revision Date
Heptadecafluorooctane-1-sulphonic acid	1763-23-1	2021-01-12

SARA 311/312 Hazards
Acute Health Hazard, Chronic Health Hazard

Massachusetts Right To Know Components
No components are subject to the Massachusetts Right to Know Act.

No components are subject to the Massachusetts Right to Know Act.

Pennsylvania Right To Know Components

	CAS-No.	Revision Date
water	7732-18-5	
Heptadecafluorooctane-1-sulphonic acid	1763-23-1	2021-01-12

New Jersey Right To Know Components

	CAS-No.	Revision Date
water	7732-18-5	
Heptadecafluorooctane-1-sulphonic acid	1763-23-1	2021-01-12

SECTION 16: Other information

Further information

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 applicable to the product with regard to appropriate safety precautions. It does not represent any guarantee of the properties of the product. Sigma-Aldrich Corporation and its Affiliates shall not be held liable for any damage resulting from handling or from contact with the above product. See www.sigma-aldrich.com and/or the reverse side of invoice or packing slip for additional terms and conditions of sale.

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Version: 6.6 Revision Date: 07/22/2022 Print Date: 08/12/2023

APPENDIX C: FIELD FORMS

Appendix C

Field Forms

CONTENTS

- Field Activities Daily Log
- Field Log of Boring
- Sample Collection Log

FIELD ACTIVITIES DAILY LOG

Date _______________

Sheet ______ of ______

Project No. _________________

Project Name: ____

Field Activity Subject: ____

Calibration: ____

Safety: ____

Description of daily activities and events: ____

Visitors on site: ____

Changes from plans/specifications and other special orders and important decisions: ________________________

Weather conditions: ____

Important telephone calls: ____

Personnel on site: ____

QC: ___________ Signature: ____________________________ Date: ______________

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIELD LOG OF BORING

DRILL COMPANY/DRILLER:
DRILL RIG EQUIPMENT:
DRILLING METHOD:
HAMMER TYPE: ROD TYPE/DIA.:
HAMMER WEIGHT: HAMMER DROP:
CASING SIZE/TYPE: HOLE SIZE:

JOB NO: BORING NO:
JOB NAME:
LOGGED BY:
LOCATION: ELEV.:
START DATE: END DATE:
WEATHER DURING DRILLING:

SAMPLE DATA

TIME DATE	SAMP. NO. TYPE	DEPTH FROM TO	DRIVING RESISTANCE BLOWS / 6 INCH	L. REC. # JARS	DRILL ACTION	CONTACTS / GROUNDWATER	PID	ENV. SAMPLE	FIELD CLASSIFICATION [density/consistency; color; slightly, minor, MAJOR, then trace constituents; moisture; structure; other; USCS classification (geology)]

SUMMARY FIELD LOG OF BORING

DEPTH		USCS CLASSIF.	GENERALIZED SOIL DESCRIPTION FOR DRAFTED GINT LOG
FROM	TO		

COMMENTS (i.e. materials used, visitors, problems, etc.):

GROUNDWATER DATA

WATER DEPTH	TIME	DATE

SUMMARY OF TIME AND FOOTAGE

FOOTAGE DRILLED:
SAMPLES: Attempted
Recovered
DRILL/SAMPLE hrs. STANDBY: hrs.
SETUP/CLEANUP: hrs. WELL INSTALL: hrs.
OTHER:

BORING: SHEET OF

SHANNON & WILSON

SAMPLE COLLECTION LOG

Project Number:	PID Number: Page of
Project Name:	Calibration Time:
Sampler:	Calibration: *Pass / Fail*

Date	Sample Time	Sample ID	Location	Depth (ft)	Sample Type	Matrix Type	PID Reading	Analyses

Sample Type: FS = Field screening measurement only ES = Environmental sample FD = Field duplicate TB = Trip blank

Matrix Type: GW = Groundwater SW = Surface Water W = Water SS = Surface Soil SB = Subsurfrace Soil SE = Sediment

QC: ________

Appendix D

PFAS Sampling

Special Considerations

APPENDIX D: PFAS SAMPLING SPECIAL CONSIDERATIONS

RD-B74

PFAS

TABLE OF CONTENTS

1.0 SCOPE AND APPLICABILITY

The procedures described herein define per- and polyfluoroalkyl substances (PFAS) specific sampling and handling techniques for various media, outline special considerations for communications about PFAS to clients and the general public, and provide additional guidance for projects involving PFAS. These techniques are necessary to prevent cross-contamination of water and soil samples collected for PFAS analysis and to navigate a rapidly changing and controversial regulatory environment.

This reference document (RD) is subject to change as new information becomes available. This RD is supplemental to current Shannon and Wilson, Inc. (SWI) RDs as befits the project. Additional RDs are listed in Section 8.0.

This RD defines a standard set of procedures applicable to a range of site conditions and projects. These procedures may be modified according to equipment limitations or project needs. Modifications to this RD will be described in a project-specific Work Plan or other document, and documented in the field notes, as applicable.

2.0 RESPONSIBILITY

The *Project Manager* (PM) is responsible for overseeing and ensuring that analytical samples are collected at required locations and with the appropriate frequency. The PM will ensure environmental samples are collected in accordance with this RD and any site-specific or project specific planning documents (e.g. approved Work Plan or Scope of Work).

It is the responsibility of the *Field Technician* (FT) to request the appropriate laboratory containers, coordinate with the analytical laboratory, and collect analytical water samples in accordance with this RD.

3.0 DEFINITIONS

PFAS are a group of man-made chemicals that include PFOA, PFOS, PFHxS, PFHpA, GenX, and many other compounds. These chemicals are considered an emerging contaminant.

4.0 REQUIRED MATERIALS / EQUIPMENT

The materials needed for this RD are project dependent. Materials may include but are not limited to the following:

- Field note paper and notebook
- Camera
- Residential Well Sampling Log (project specific)
- Well survey (project specific)
- Field Activities Daily Log
- Conversation record documents
- Business cards
- Chain of custody records (COCs)
- Sample cooler
- Gel ice packs
- YSI
- Nitrile gloves
- Sample labels
- Residential sampling bucket (green- different color than other purge buckets to avoid bringing residue from contaminated purge water into homes/businesses or sampling equipment stored in bucket
- Purge cup
- Ziploc baggies
- Paper towels
- Filter wrench(es)
- Plastic cups
- Extra buckets
- Garden hose- flexible hose is best for travel but needs to be clipped or it will spray uncontrollably
- Trash bags
- Toolbox (optional)- at a minimum, bring a wrench for removing stubborn hoses
- Project specific sample jars or bottles
- Cell phone
- Public information packets, if applicable
- Clipboard
- Spare batteries - headlamp and YSI
- Headlamp - for crawlspaces, basements, utility rooms

The following for is needed for water supply well samples collected outside of the structures plumbing, or for soils:

- Soil sample jars
- Plastic spoons (or other soil collection tool)
- PFAS-free water for field or equipment blanks
- Peri-pump or whale pump and controller box
- Pump tubing
- Battery for pumps
- Water sounder
- Measuring tap
- Decontamination set-up

*see specific project details for water sample preservation requirements. Requirements may vary by state regulations and analyses requested.

4.1 Special considerations for materials when sampling for the presences of PFAS

Investigations of the presence of PFAS in consumer products are ongoing. Future testing may change the general cautions outlined in this section. This list is not comprehensive. See *Special Considerations for PFAS Sampling* document.

The following list has been updated. We note, caution during sampling to avoid these materials is needed, but it may be approved to have these items while sampling. However, none of these items should have contact with the sample.

4.1.1 Sunblock and insect repellant ingredients should be verified PFAS-free prior to use during sampling.

4.1.2 Clothing and personal protective equipment (PPE) treated for water, fire, or stain resistance, or UV protection should not be worn during sampling. Clothing should not be new or recently washed with fabric softeners.

4.1.3 Food and food packaging should be avoided during sampling or near sampling areas.

4.1.4 Do not use waterproof paper or notebooks.

4.1.5 Use aluminum clipboards and ball point pens that are known to be PFAS free. Some felt-tip pens are known to have PFAS. Confirm Sharpie or other felt tip, erasable, or waterproof pens are PFAS free prior to use.

4.1.6 Glues may contain PFAS, sticky type note pads (Post-it), adhesive labels, and tape should be verified PFAS free prior to use.

4.1.7 Chemical ice packs should be verified PFAS free and placed in liner bags for use in sample coolers. Sample jars and/or bottles should not be allowed to touch the ice packs.

4.1.8 Disposable, powderless, nitrile gloves should be worn during sampling and handling activities. Gloves should be changed frequently especially when potential contamination has occurred (i.e. touching clothing, skin, hair, or consumer products in the sampling area).

4.1.9 If sampling during rain, snow, or cold, confirm that weather-protection gear is PFAS free or take extra care to avoid touching clothing and shoes.

4.1.10 Pumps and pump tubing should be verified PFAS free.

5.0 PROCEDURES

5.1 General Sampling Procedures

5.1.1 All sample containers should be provided by the laboratory and made of polypropylene (PP) or high-density polyethylene (HDPE). PFAS are known to attach to the sample containers made of glass and other materials.

5.1.2 Any required sample preservatives should be laboratory provided and stored in PFAS-free containers.

5.1.3 If reusable equipment is used for sampling, proper decontamination is necessary before and after each sample. See *RD-B13- Equipment Decontamination.*

5.1.3.1 Decontamination reagents must be PFAS free.

5.1.3.2 Water used for final decontaminations rinse should be certified PFAS free by the laboratory, or a source water sample should be submitted for analysis.

5.1.3.3 Verify decontamination reagents are effective at removing PFAS. See project manager to confirm effective decontamination agent.

5.1.4 Equipment blanks should be used at the frequency described in the work plan or scope of work. Water used to collect equipment and field blanks should be certified PFAS-free water, provided by a laboratory.

5.1.5 Care should be taken to avoid cross contamination in PFAS samples, where samples for other analytes are also being collected. Gloves should be changed prior to collecting PFAS samples and PFAS samples should be bagged separately to avoid touching other sample jars and/or bottles.

5.1.6 Only handle sample containers while wearing gloves. Samples labels should be filled out prior to donning gloves for sample collection.

5.1.7 Avoid touching clothing, skin, hair, and/or consumer products while wearing gloves. Gloves should be changed frequently. A fresh pair should be donned immediately prior to collecting PFAS samples.

5.1.8 Sample containers should be stored in closed boxes or coolers when not in use. Storage boxes should be labeled as containing PFAS sampling equipment. Storing sample containers in plastic baggies is recommended to prevent inadvertent exposure to potential contaminants. If leaving a storage container for long periods of time, a custody seal should be added.

5.1.9 Laboratory provided sample containers do not need to be and should not be rinsed prior to collection.

5.1.10 Some softeners have bypass valves. DO NOT force a bypass valve. Have the homeowner do this, if possible. When they break, they can unleash the contents of the pressure tank (and will continue to pump water until pump/power is off).

5.2 Groundwater Sampling Procedures

See *RD-B41 Analytical Water Sample Collection*, *RD-B42- Monitoring Well Sampling*, or *RD-B44- Potable Water (Private) Well Sampling* for general groundwater sample collection techniques. Confirm purging requirements (e.g. three well volumes versus parameter stabilization) prior to collecting samples.

5.2.1 If a monitoring well has permanent fixtures that may contain PFAS, the sample results may need to be flagged or rejected in the analytical database at the discretion of the project manager.

5.2.1.1 If dedicated tubing or fixtures that may contain PFAS can be removed from a monitoring well, extra precautions should be taken. This may include removal of equipment fourteen days prior to sample, or doubling purge requirements. Please confirm procedures with a project manager prior to sampling.

5.2.2 Do not filter samples prior to PFAS analysis.

5.2.3 Do not collect a sample through a hose or reusable tubing. Note on the sampling sheet if a sample was collected through a hose. Results may need to be flagged in the analytical database at the discretion of the project manager.

5.2.4 When collecting samples from private or public water-supply wells, note any fixtures or hardware that may contain PFAS that cannot be removed or bypassed for sample collection (Teflon plumbing tape, piping of unknown material, etc.). In residential/public spaces, it can be difficult or impossible to remove products that may contain PFAS from the sampling area. Take extra precautions to avoid touching products in the area and note any potential contamination sources in the sampling area. Where possible, locate a different sampling location.

5.2.5 If transfer containers are necessary, use PFAS-free plastic cups. Thoroughly rinse the transfer container with the water source being sampled prior to filling the sample bottles.

5.2.6 For private well samples, collect samples upstream of water treatment such as water softeners, chlorine systems, and filtration units. For some projects, we do not consider small (i.e., less than 18 inches in height) particulate filters to be treatment. Discuss with your project manager prior to sample collection. Charcoal filters can remove PFAS, ask or check what type of filters are used prior to taking sample after filters. Note: Clear the pipes at the sample point after purging is complete, if the sample location is different than the purge location.

5.2.6.1 If a pre-treatment location cannot be accessed, samples results may need to be flagged in the analytical database at the discretion of the project manager.

5.3 Surface Water Sampling Procedures

See *RD-B45-Surface-Water Sampling* for general surface water sample collection techniques.

5.3.1 If transfer bottles are necessary to collect surface water, they must be PFAS-free and made of the same material as laboratory provided containers. Transfer bottles should be rinsed using the water to be sampled prior to filling the sample containers.

5.3.2 Avoid standing in the water you are sampling. If necessary, stand downstream of your sample collection point (in flowing water), and wait for disturbed sediment to settle prior to collecting the sample.

5.3.3 If collecting from a boat, wearing waders or waterproof footwear, using water column samplers or other equipment that may contain PFAS, sample results may need to be flagged in the analytical database at the discretion of the project manager. You should note on the sample log when these items are used.

5.4 Soil Sampling Procedures

Techniques may vary. See *RD-B31- Analytical Soil Sample Collection* for general soil sample collection techniques.

5.4.1 Surface soil samples should be collected using decontaminated stainless steels spoons, shovels, laboratory-provided sampling tools, or disposable PFAS free plastic spoons.

5.4.2 Equipment used for subsurface sampling or soil borings should be PFAS free.

5.4.3 Samples should be collected near the surface immediately below vegetation, where present.

6.0 HEALTH AND SAFETY

A Site Safety & Health Plan (SSHP) and/or Job Safety Analysis worksheet (JSA) will be prepared for each project and will discuss safety issues involved. Any staff working on the project must read and abide by the SSHP and sign the SSHP acknowledgement form.

Personnel using this procedure will utilize PPE in accordance with these plans.

The SSHP will provide Safety Data Sheets (SDSs) for any chemicals that will be used on the project or that are known possible exposure risks for the site. Personnel using this procedure must be trained on the information contained in the SDSs, any engineering controls, and any required PPE.

7.0 QUALITY ASSURANCE / QUALITY CONTROL

QC activities are designed to allow self-verification of the quality and consistency of the work.

7.1 Interferences and Potential Problems

7.1.1 Inability to locate or access pre-treatment sampling location.

7.1.2 Presence of PFAS or PFAS-containing products in sampling area, monitoring well structure, drilling equipment, plumbing, pumps, or other equipment. In these cases, a field blank may need to be collected along with the project sample.

7.1.3 Inability to achieve stable parameters in residential well sampling situations.

7.2 Applicable Quality Assurance Manual procedures:

7.2.1 QP 05 Preparation of Field Activity Reports

7.2.2 QP 13 Document Control and Retention

8.0 OTHER REFERENCES

- *RD-A11- Field notes and Documentation*
- *RD-A12- Field Instrument Calibration*
- *RD-B11- Environmental Sample Handling*
- *RD-B13- Equipment Decontamination*
- *RD-B15- Environmental Database Operations*

- *RD-B25- Equipment Use - YSI-SW*
- *RD-B31- Analytical Soil Sample Collection*
- *RD-B34-Contaminated Soil Stockpiling and Sampling*
- *RD-B41-Analytical Water Sample Collection*
- *RD-B42- Monitoring-Well Sampling*
- *RD-B43-Well-Point Sampling*
- *RD-B44- Potable Water (Private) Well Sampling*
- *RD-B45-Surface-Water Sampling*
- *RD-B46- Pore-Water Sampling*
- *RD-B51-Monitoring Well Installation*
- *RD-B52- Monitoring Well Maintenance*
- *RD-B54- Water Supply Well Decommissioning*
- *RD-B72- Sediment Sampling*
- *Special Considerations for PFAS Sampling*
- Denly E, Occhialini J, Bassignani P, Eberle M, Rabah N. Per- and polyfluoroalkyl substances in environmental sampling products: Fact or fiction? *Remediation.* 2019;29:65–76. *https://doi.org/10.1002/rem.21614*

9.0 DOCUMENTATION

9.1 Review

The Project Manager will review the field-work records pertaining to the activities under their supervision. The elements of this review will include technical content, consistency, and compliance with the project plans, and RDs.

9.2 Archive

At the completion of the project, all original field logbooks and records will be stored in the project files in accordance with project procedures. Project file lifetime is established according to standard Shannon & Wilson file-retention procedures, or sometimes controlled and spelled out in contractual agreements with clients.

Correspondence (including email, telephone, and in-person conversations) with the clients, sub-contractors, and the public will be documented and stored in accordance with project procedures.

10.0 TRAINING AND PREREQUISITES

In order to perform sampling activities without supervision, the Field Technician must accomplish the following:

- Read this RD.
- Familiarize themselves with the applicable QAM procedures (listed in Section 7.2) as well as the references applicable to the project (Section 8.0).
- Complete supervised, on-the-job instruction with experienced field technicians or project managers. Number of hours and days will differ for each individual, determined by a project manager or experienced field technicians.
- Residential sampling program training prior to sampling alone.

Environmental sampling will be performed by a State of Alaska Qualified Sampler (18 AAC 75.333[c] and 18 AAC 78.088[c]) and/or Qualified Environmental Professional (18 AAC 75.333[b], 18 AAC 78.088[b]), or a supervised individual in training to become a Qualified Sampler. Per ADEC, a Qualified Sampler will, at a minimum, hold a "completed degree in environmental science or another related scientific field… [and have] at least three months of experience in environmental sampling under the direct supervision of a qualified environmental professional."

Before performing this procedure, field staff will also be trained in analytical sample collection by an experienced staff member. Training will entail at least one day of supervised, on-the-job instruction.

11.0 ATTACHMENTS

A selection of relevant forms as of the publication date of this RD and are included here for reference only. Always obtain necessary forms from the project folder or project manager.

- Chain-of-Custody Form
- Well sampling log
- Field Activity Daily Log
- Monitoring well log
- Soil sample collection log

12.0 DOCUMENT HISTORY AND VERSION CONTROL

Version: 1.0 Date: 03/25/2020 Approved by:KRF

Version	Date	Reason/Description of Change(s)	Author	Reviews
1.0	5/25/2020	New.	ARM	KRF
1.1	9/10/2022	Updated to address current standards	ARM	KRF

Important Information

About Your Environmental/Geotechnical Report

IMPORTANT INFORMATION

IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL/ENVIRONMENTAL REPORT

CONSULTING SERVICES ARE PERFORMED FOR SPECIFIC PURPOSES AND FOR SPECIFIC CLIENTS.

Consultants prepare reports to meet the specific needs of specific individuals. A report prepared for a civil engineer may not be adequate for a construction contractor or even another civil engineer. Unless indicated otherwise, your consultant prepared your report expressly for you and expressly for the purposes you indicated. No one other than you should apply this report for its intended purpose without first conferring with the consultant. No party should apply this report for any purpose other than that originally contemplated without first conferring with the consultant.

THE CONSULTANT'S REPORT IS BASED ON PROJECT-SPECIFIC FACTORS.

A geotechnical/environmental report is based on a subsurface exploration plan designed to consider a unique set of project-specific factors. Depending on the project, these may include the general nature of the structure and property involved; its size and configuration; its historical use and practice; the location of the structure on the site and its orientation; other improvements such as access roads, parking lots, and underground utilities; and the additional risk created by scope-of-service limitations imposed by the client. To help avoid costly problems, ask the consultant to evaluate how any factors that change subsequent to the date of the report may affect the recommendations. Unless your consultant indicates otherwise, your report should not be used (1) when the nature of the proposed project is changed (for example, if an office building will be erected instead of a parking garage, or if a refrigerated warehouse will be built instead of an unrefrigerated one, or chemicals are discovered on or near the site); (2) when the size, elevation, or configuration of the proposed project is altered; (3) when the location or orientation of the proposed project is modified; (4) when there is a change of ownership; or (5) for application to an adjacent site. Consultants cannot accept responsibility for problems that may occur if they are not consulted after factors that were considered in the development of the report have changed.

SUBSURFACE CONDITIONS CAN CHANGE.

Subsurface conditions may be affected as a result of natural processes or human activity. Because a geotechnical/environmental report is based on conditions that existed at the time of subsurface exploration, construction decisions should not be based on a report whose adequacy may have been affected by time. Ask the consultant to advise if additional tests are desirable before construction starts; for example, groundwater conditions commonly vary seasonally.

Construction operations at or adjacent to the site and natural events such as floods, earthquakes, or groundwater fluctuations may also affect subsurface conditions and, thus, the continuing adequacy of a geotechnical/environmental report. The consultant should be kept apprised of any such events and should be consulted to determine if additional tests are necessary.

MOST RECOMMENDATIONS ARE PROFESSIONAL JUDGMENTS.

Site exploration and testing identifies actual surface and subsurface conditions only at those points where samples are taken. The data were extrapolated by your consultant, who then applied judgment to render an opinion about overall subsurface conditions. The actual interface between materials may be far more gradual or abrupt than your report indicates. Actual conditions in areas not sampled may differ from those predicted in your report. While nothing can be done to prevent such situations, you and your consultant can work together to help reduce their impacts. Retaining your consultant to observe subsurface construction operations can be particularly beneficial in this respect.

A REPORT'S CONCLUSIONS ARE PRELIMINARY.

The conclusions contained in your consultant's report are preliminary, because they must be based on the assumption that conditions revealed through selective exploratory sampling are indicative of actual conditions throughout a site. Actual subsurface conditions can be discerned only during earthwork; therefore, you should retain your consultant to observe actual conditions and to provide conclusions. Only the consultant who prepared the report is fully familiar with the background information needed to determine whether or not the report's recommendations based on those conclusions are valid and whether or not the contractor is abiding by applicable recommendations. The consultant who developed your report cannot assume responsibility or liability for the adequacy of the report's recommendations if another party is retained to observe construction.

THE CONSULTANT'S REPORT IS SUBJECT TO MISINTERPRETATION.

Costly problems can occur when other design professionals develop their plans based on misinterpretation of a geotechnical/environmental report. To help avoid these problems, the consultant should be retained to work with other project design professionals to explain relevant geotechnical, geological, hydrogeological, and environmental findings, and to review the adequacy of their plans and specifications relative to these issues.

BORING LOGS AND/OR MONITORING WELL DATA SHOULD NOT BE SEPARATED FROM THE REPORT.

Final boring logs developed by the consultant are based upon interpretation of field logs (assembled by site personnel), field test results, and laboratory and/or office evaluation of field samples and data. Only final boring logs and data are customarily included in geotechnical/environmental reports. These final logs should not, under any circumstances, be redrawn for inclusion in architectural or other design drawings, because drafters may commit errors or omissions in the transfer process.

To reduce the likelihood of boring log or monitoring well misinterpretation, contractors should be given ready access to the complete geotechnical engineering/environmental report prepared or authorized for their use. If access is provided only to the report prepared for you, you should advise contractors of the report's limitations, assuming that a contractor was not one of the specific persons for whom the report was prepared, and that developing construction cost estimates was not one of the specific purposes for which it was prepared. While a contractor may gain important knowledge from a report prepared for another party, the contractor should discuss the report with your consultant and perform the additional or alternative work believed necessary to obtain the data specifically appropriate for construction cost estimating purposes. Some clients hold the mistaken impression that simply disclaiming responsibility for the accuracy of subsurface information always insulates them from attendant liability. Providing the best available information to contractors helps prevent costly construction problems and the adversarial attitudes that aggravate them to a disproportionate scale.

READ RESPONSIBILITY CLAUSES CLOSELY.

Because geotechnical/environmental engineering is based extensively on judgment and opinion, it is far less exact than other design disciplines. This situation has resulted in wholly unwarranted claims being lodged against consultants. To help prevent this problem, consultants have developed a number of clauses for use in their contracts, reports, and other documents. These responsibility clauses are not exculpatory clauses designed to transfer the consultant's liabilities to other parties; rather, they are definitive clauses that identify where the consultant's responsibilities begin and end. Their use helps all parties involved recognize their individual responsibilities and take appropriate action. Some of these definitive clauses are likely to appear in your report, and you are encouraged to read them closely. Your consultant will be pleased to give full and frank answers to your questions.

The preceding paragraphs are based on information provided by the Geoprofessional Business Association (https://www.geoprofessional.org)