

Chevron Environmental Management Company

OFF-PROPERTY SURVEY AND GROUNDWATER MONITORING WORK PLAN

Texaco 211577 Monterey

631 Queen Anne Avenue North, Seattle WA

3/18/2020



OFF-PROPERTY SURVEY AND GROUNDWATER MONITORING WORK PLAN



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Appendix A – Technical Guidance Instructions (TGIs) and Standard Operating Procedures (SOPs)

Appendix B – Boring Logs

Appendix C – Health and Safety Plan (HASP)

ACRONYMS AND ABBREVIATIONS

AO	Agreed Order
Arcadis	Arcadis U.S., Inc.
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
CSID	Cleanup Site Identification Number
DUP	Duplicate
DRO	Diesel Range Organics
Ecology	Washington State Department of Ecology
EIM	Environmental Information Management
EMC	Chevron Environmental Management Company
FSID	Facility Site Identification Number
GRO	Gasoline Range Organics
HO	Heavy Oil Range Organics
NAVD 88	North American Vertical Datum of 1988
NWTPH-Gx	Northwest Total Petroleum Hydrocarbons Method – Gasoline
NWTPH-Dx	Northwest Total Petroleum Hydrocarbons Method – Diesel
Off-Property	Off-property areas of the site, further described in Section 2.1
Property	631 Queen Anne Avenue North, Seattle, WA 98109
QAPP	Quality Assurance Project Plan
QA/QC	Quality Assurance/Quality Control
RIWP	Remedial Investigation Work Plan
ROW	Right-of-way
site	Area surrounding 631 Queen Anne Avenue North, Seattle, WA 98109
SOP	Standard Operating Procedure
TGI	Technical Guidance Document
USEPA	United States Department of Environmental Protection
Work Plan	Off-Property Survey and Groundwater Monitoring Work Plan

1 INTRODUCTION

Arcadis U.S., Inc. (Arcadis), on behalf of Chevron Environmental Management Company (EMC), is submitting this Off-Property Survey and Groundwater Monitoring Work Plan (Work Plan) to Washington State Department of Ecology (Ecology). This Work Plan proposes conducting a baseline inspection and condition survey, groundwater monitoring and sampling event, and elevation survey in the area surrounding the Texaco 211577 Monterey facility (site) located at 631 Queen Anne Avenue North (Property) in Seattle, WA.

The site is formally known as Texaco 211577 Monterey in the Ecology database. A Site Location Map and Site Plan are provided as Figure 1 and Figure 2, respectively. Identifiers are:

- Facility Site Identification Number (FSID): 77774779
- Cleanup Site Identification Number (CSID): 6663
- Agreed Order Number: 16537
- Address: area surrounding 631 Queen Anne Avenue North, Seattle, WA 98109

Ecology's website for the site is available at and documents available electronically can be accessed from this web page <https://apps.ecology.wa.gov/gsp/CleanupSiteDocuments.aspx?csid=6663>. Ecology's Environmental Information Management (EIM) database identification number for the site is PMART005.

Under Agreed Order No. DE 16537 (AO), effective August 21, 2019, the Property is defined as King County parcel number 3879900425 (Ecology 2019). As described in the AO, EMC is responsible for tasks involving the off-property areas of the site (Off-Property) as further described in Section 2.1. This commitment includes a requirement to submit an Agency Review Draft Remedial Investigation Work Plan (RIWP) no later than 120 days following the AO effective date. In a letter dated December 2, 2019, on behalf of EMC, Arcadis requested an extension to complete the RIWP within 90 days after reception of validated data for a proposed site survey, groundwater sampling, and Property excavation sidewall sampling. In a letter dated December 27, 2019, Ecology approved the extension request for submittal of the RIWP no later than 60 days following receipt of validated Off-Property groundwater sampling data. In this letter, Ecology also requested EMC provide a work plan describing the Off-Property monitoring well and soil vapor probe survey and the groundwater sampling within 30 days of receipt of Ecology's approval letter.

This work plan addresses Ecology's requests and proposes completion of an Off-Property baseline inspection and condition survey, groundwater monitoring and sampling event, and elevation survey.

2 SCOPE OF WORK

As part of the ongoing site characterization, several subsurface installations have been installed Off-Property. As part of the RIWP preparation and submittal, Arcadis will perform inspection, monitoring, and sampling at these locations. Inspection will be performed at groundwater monitoring wells and soil vapor probes, with monitoring and sampling performed at groundwater monitoring wells where feasible.

2.1 Access Agreements and Permitting

Based on a review of available historical documents, the groundwater monitoring wells and soil vapor probes located Off-Property are summarized in the table below. These locations are shown as approximate on Figure 2.

Parcel Number	Parcel Use	Address	Wells on Parcel ¹	Access Agreement in Place
3879900435	Lindberg Apartments	617 Queen Ann Ave N	MW-7/VP-8, MW-12/DB-1, MW-23, DB-4, RW-2	Yes
3879900500	Del Roy Apartments	25 West Roy Street	MW-14/DB-6, MW-20, MW-22/DPE-8, MW-24, MW-25	In Progress
389900490	Monterey Apartments	622 1 st Avenue West	MW-3/VP-7, MW-4, MW-5/VP-5, MW-13, MW-18, MW-19, VP-2, VP-4, DPE-1, DPE-2, DPE-3, MP-1, DPE-4, DPE-9, RW-3, RW-7, RW-5, DB-5, DB-7	Yes
3879900485	Alvena Vista Apartments	612 1 st Avenue West	MW-15/DB-8	Well in ROW
3879900465	18 Mercer Street Building	18 West Mercer Street	MW-11	Well in ROW
3879900640	U-Park parking lot	100 West Roy Street	MW-16/DB-9, MW-26, MW-35	Yes
3879900590	Chandler Hall Apartments	119 West Roy Street	MW-34	In Progress
387900580	Uptown Studios Apartments	610 2 nd Avenue West	MW-30	Well in ROW
3879900570	Tup Tim Thai restaurant	118 West Mercer Street	MW-31	Well in ROW
3879900530	Queen Anne Arms Apartments	621 1 st Avenue West	MW-32, MW-33, NV-1, NV-2, MW-17/DB-10	In Progress
3880400050	Shah Safari	14 West Roy Street	MW-20	Well in ROW
1792530000	Courtyard at Queen Anne Square condominiums	275 West Roy Street	MW-27	Well in ROW

7015350000	Queen Anne Square condominiums and offices	200 West Mercer Street	MW-28, MW-29	Wells in ROW
3879900540	Bank of America	100 West Mercer Street	MW-21, DB-11	Yes

¹ Exact locations of wells will be confirmed during survey. Some wells may be in the right-of-way (ROW) or on neighboring parcels.

Arcadis has requested access to the parcels listed in the above table and continues to engage the parcel owners in pursuit of obtaining access agreements. Arcadis has submitted the application for a ROW permit from the City of Seattle Department of Transportation. The proposed inspection and monitoring work will be completed within 30 days of receiving the executed access agreements. Pending significant delays in obtaining a complete list of access agreements, Arcadis will evaluate and work with Ecology to potentially move forward with performing the work at a subset of the above locations.

2.2 Wells and Soil Vapor Probes Assessment

Arcadis field staff will assess the location, presence, and condition of groundwater monitoring wells and soil vapor probes located Off-Property for which access agreements have been obtained. These locations are shown as approximate in Figure 2 and will be field verified as part of this activity. Field work will be conducted in accordance with Arcadis health and safety protocols as described in the Health and Safety Plan included as Appendix C.

As part of this assessment, Arcadis field staff will perform the following activities using field notes, photographs, and other equipment as described below.

- Document general field observations such as site-specific hazards and site conditions
- Confirm well location and accessibility
- Assess well monument and wellhead integrity such as presence and condition of cap, lock, casing, and surrounding pavement
- Conduct gauging in groundwater monitoring wells using an interface probe to measure depth to water, confirm the potential presence of non-aqueous phase liquid, and confirm the depth to bottom of the well
- Compare groundwater monitoring well specifications to historical boring logs (Appendix B)

In addition to the above, existing soil vapor probes installed Off-Property will be inspected and leak tested, if feasible. Soil vapor probes to be inspected are soil vapor probes installed to depth external to existing structures. Soil vapor probes will be inspected for cracks in the annular seals and surface coverings that may lead to ambient air dilution during sampling. Fittings, tubing and other soil vapor probe construction materials may be replaced using industry standard inert materials to allow for future sample collection. Arcadis' TGI for soil vapor leak testing is included in Appendix A.

Pending completion of this assessment, Arcadis will evaluate the need for replacing or reinstalling Off-Property groundwater monitoring wells or soil vapor probes based on objectives identified as part of the RIWP.

2.3 Groundwater Sampling

Pending the assessment activities described in Section 2.2, Arcadis will collect groundwater samples at select monitoring wells identified as in acceptable condition. Wells observed to have screens submerged below the water table will not be sampled as they are not considered representative of subsurface concentrations. Groundwater samples will be collected according to the sampling and analysis plan described in Section 3.

2.4 Elevation Survey

Pending the assessment activities described in Section 2.2, Arcadis will subcontract a state registered land surveyor to conduct an elevation survey to include sampled wells for location and top of casing. The survey will be conducted with a horizontal accuracy of +/- 1 ft and vertical accuracy of +/- 0.01 ft. Survey data will be reported in the North American Vertical Datum of 1988 (NAVD 88).

Additionally, and as appropriate, a horizontal and vertical extent survey may be performed following completion of the excavation work described in the Interim Action Work Plan (RileyGroup, 2019).

3 SAMPLING AND ANALYSIS PLAN

Based on the results of the assessment activities described in Section 2.2, Arcadis will collect groundwater samples at select groundwater monitoring wells in accordance with the Arcadis Technical Guidance Instructions (TGIs) provided in Appendix A. At each monitoring well selected for sampling, groundwater samples will be collected using low-flow methods and in accordance with the methodology described in the TGI for Standard Groundwater Sampling for Monitoring Wells (Appendix A).

During purging, water quality parameters (dissolved oxygen, oxidation-reduction potential, pH, conductivity, and temperature) will be monitored. Groundwater elevation and sampling times will be recorded. Samples will be labeled, handled, and shipped using the procedures described in the Arcadis Standard Operating Procedure for Sample Chain of Custody (Appendix A). Samples will be submitted to an Ecology approved laboratory for the following analysis:

- Benzene, toluene, ethylbenzene, and total xylenes (collectively known as BTEX) by United States Environmental Protection Agency (USEPA) Method 8021B
- Gasoline range organics (GRO) by Ecology Method NWTPH-Gx
- Diesel range organics (DRO) and heavy oil range organics (HO) by Ecology Method NWTPH-Dx with and without silica gel cleanup
- Lead by USEPA Method 6010

In accordance with Ecology's letter dated February 13, 2020, groundwater samples collected during this event will also be sampled for the following substances unrelated to historical service station operations, by USEPA Method 8260:

- tetrachloroethene (PCE)
- trichloroethene (TCE)
- cis-1,2-dichloroethene (1,2-cis-DCE)
- 1,3,5-trimethylbenzene
- 1,2,4-trimethylbenzene
- naphthalene

As stated in Agreed Order No. 16537, "[f]rom 1991 to 2004, tetrachloroethene (PCE) and trichloroethene (TCE) were detected at concentrations above MTCA cleanup levels in groundwater samples collected in wells located west, southwest, and southeast of the Property. PCE has been detected in sub-slab soil gas samples at concentrations above MTCA cleanup levels southwest of the Property. PCE concentrations in the most recent sub-slab soil gas and indoor air samples collected in 2009 were below the MTCA cleanup levels. Based on direction of groundwater flow to the southwest, these contaminants are suspected to be from an upgradient source – a former dry cleaners located northeast of the Property, at 14 Roy Street in Seattle, Washington".

3.1 Quality Assurance and Quality Control Samples

The following quality assurance and quality control (QA/QC) samples will be collected during the event.

- One field duplicate sample per 10 field samples. Field duplicate samples will be sequentially numbered and submitted as blind samples to the analytical laboratory
- One matrix spike/matrix spike duplicate per 20 field samples
- One rinsate blank sample per day for decontaminated, non-dedicated sampling equipment, as needed
- One trip blank per cooler containing samples that will be analyzed for BTEX and GRO

3.2 Sample Nomenclature

Samples will be identified with a unique alpha-numeric nomenclature that will identify the type of sample and the location where the sample was collected. The following sample nomenclature will be used:

- Groundwater samples will be labeled with the monitoring well designation
- Quality assurance samples will be given the following labels:
 - Field duplicate samples will be given the prefix "DUP-" and the date the sample was collected. For example, a field duplicate for a groundwater sample collected on March 1, 2020 would be labeled DUP-1-030120

- Matrix spike and matrix spike duplicate samples will be labeled with the sample ID followed by an “MS” for matrix spike or “MSD” for matrix spike duplicate. For example, a matrix spike sample collected from MW-21 would be labeled MW-21-MS
- Rinsate blank samples will be given the prefix “RS-“ and the date the sample was collected. For example, a rinsate blank for decontaminated, non-dedicated sampling equipment collected on March 1, 2020 would be labeled RS-1-030120
- Trip blank samples will be given the prefix “TB-“ followed by the date of the shipment. For example, a trip blank sample collected on March 1, 2020 would be labeled TB-030120

3.3 Sample Labeling, Handling, and Chain of Custody

Sampling handling and packaging will be performed in accordance with the procedures outlined in the Standard Operating Procedure (SOP) for Sample Chain of Custody (Appendix A). All sample container labels will be completed with the following information:

- Project name and project number
- Sample designation
- Name or initials of the sampler
- Date and time of sample collection

3.4 Equipment Decontamination and Residuals Management

Equipment decontamination will be performed using the procedures outlined in the TGI for Field Equipment Decontamination (Appendix A). Site personnel will perform decontamination of all equipment prior to leaving the site and between sample locations.

All water, decontamination liquids, personal protective equipment and other waste generated during the field sampling activities will be managed in accordance with applicable local, state, and federal requirements.

Waste profiles will be generated for each waste stream to be transported off site as required by the selected disposal facility. Disposal characterization samples will be collected as needed to meet facility requirements.

4 QUALITY ASSURANCE PROJECT PLAN (QAPP)

4.1 Field Instruments and Equipment

Prior to field sampling, each piece of field equipment will be inspected to confirm that it is operational and calibrated in accordance with the manufacturer’s instruction manual or the analytical method used. All meters that require charging or batteries will be fully charged or have fresh batteries. If instrument servicing is required, the maintenance arrangements will be made for timely service. Field instruments will

be maintained according to the instructions provided by the manufacturer. Logbooks for each piece of equipment will be maintained in project records.

4.2 Laboratory Instruments and Equipment

Laboratory instrument and equipment documentation procedures include details of any observed problems, corrective measure(s), routine maintenance, and instrument repair (including information regarding the repair and the individual who performed the repair). Preventive maintenance of laboratory equipment generally will follow the guidelines recommended by the manufacturer. A malfunctioning instrument will be repaired immediately by in-house laboratory staff or through a service call from the manufacturer. Paperwork associated with service calls and preventative maintenance calls will be kept on file by the laboratory.

The laboratory manager will be responsible for the routine maintenance of instruments used in the particular laboratory. Any routine preventative maintenance carried out is logged into the appropriate logbooks. The frequency of routine maintenance is dictated by the nature of samples being analyzed, the requirements of the method used, and/or the judgment of the laboratory manager.

All major instruments are backed up by comparable (if not equivalent) instrument systems in the event of unscheduled downtime. An inventory of spare parts is also available to minimize equipment/instrument downtime.

4.3 Data Management

The purpose of data management is to confirm that the necessary data are accurate and readily accessible to meet the analytical and reporting objectives of the project. The field activities will include a significant number of samples that require a structured, comprehensive, and efficient program for management of data.

Data management procedures will be employed to efficiently process the information collected, such that the data are readily accessible and accurate.

4.3.1 Field Data Management

Field activities require consistent documentation and accurate record keeping. Complete and accurate record keeping will be maintained, including field notes and chain of custody forms. Field notes will include detailed observations and measurements made during the site work. Field notes will be dated and signed. Erroneous entries on paper field notes will be corrected by a single line strike out of the original entry, initialing, dating and then documenting the proper information. Certain media sample locations will be surveyed to accurately record their locations. The survey crew will use its own field notes and will supply the sampling location coordinates to Arcadis.

Chain of custody forms will be used to document and track sample possession from time of collection to the time of disposal. A chain of custody form will accompany each field sample collected, and one copy of the form will be filed in the field office. Field personnel will be briefed on the proper use of the chain of custody procedure.

All paper field documentation will be scanned and saved to the Arcadis electronic project folder. Field documentation will be submitted electronically to Ecology as an attachment to quarterly progress reports. Hard copies will be stored in the Arcadis Seattle, Washington office.

4.3.2 Analytical Data Management and Data Validation

Analytical data packages received from the laboratory will be reviewed and compared against the information on the chain of custody to confirm that the correct analyses were performed for each sample and that results for all samples submitted for analysis were received. Any discrepancies noted will be promptly corrected in coordination with the laboratory.

In accordance with the AO, data validation during this project will be performed consistent with USEPA Stage 2B criteria, which involves completeness and compliance checks of sample receipt conditions and sample related and instrument related quality control results. Data validation on this project will be completed by an independent third party.

Data collected as part of these activities will be uploaded in Ecology's EIM database under EIM identification number PMART005 within 30 days of analytical data validation.

4.4 Corrective Action

Corrective actions are required when field or analytical data are not within the objectives specified in this QAPP. Corrective actions include procedures to promptly investigate, document, evaluate, and correct data collection and/or analytical procedures. All corrective actions for situations including analytical or field equipment malfunctions, nonconformance or noncompliance with the QA requirements, or changes to the sampling procedures will be documented with the project records and maintained in the project file. All corrective action procedures must be initiated prior to continuing with the field or analytical procedure.

4.5 Laboratory Reports

The laboratory will maintain QA records related to analyses, QC, and corrective action. This information will be made available upon request. Routine reporting will include documenting all internal QC checks performed for the project.

5 REFERENCES

RileyGroup, 2019. Interim Action Work Plan, Roystone Redevelopment. August 20.

USEPA, 1999. Contract Laboratory Program National Functional Guidelines for Organic Data Review. EPA 540-R-04-004.

USEPA, 2004. Contract Laboratory Program National Functional Guidelines for Inorganic Data Review. EPA 540-R-04-004.

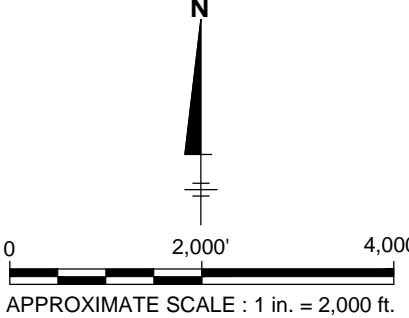
Washington State Department of Ecology, 2019. Agreed Order No. DE 16537.

FIGURES





SOURCE: BASE MAP USGS 7.5. MIN. TOPO. SEATTLE NORTH, WA, 2017 AND SEATTLE SOUTH, WA, 2017



FORMER CHEVRON FACILITY #211577
 631 QUEEN ANNE AVENUE NORTH
 SEATTLE, WA 98109

SITE LOCATION MAP

Appendix A

Technical Guidance Instructions (TGIs) and Standard Operating Procedures (SOPs)




TGI - ADMINISTERING HELIUM TRACER GAS LEAK TEST

Rev #: 1

Rev Date: October 14, 2016



APPROVAL SIGNATURES

Prepared by:  _____ Date: 10/14/2016
Eric Cathcart

Reviewed by:  _____ Date: 10/14/2016
Mitch Wacksman

I. INTRODUCTION

This Technical Guidance Instruction (TGI) document describes the procedures to conduct a building survey prior to indoor air sampling.

This document describes general and/or specific procedures, methods, actions, steps, and considerations to be used and observed by Arcadis staff when performing work, tasks, or actions under the scope and relevancy of this document. This document may describe expectations, requirements, guidance, recommendations, and/or instructions pertinent to the service, work task, or activity it covers.

It is the responsibility of the Arcadis Certified Project Manager (CPM) to provide this document to the persons conducting services that fall under the scope and purpose of this procedure, instruction, and/or guidance. The Arcadis CPM will also ensure that the persons conducting the work falling under this document are appropriately trained and familiar with its content. The persons conducting the work under this document are required to meet the minimum competency requirements outlined herein, and inquire to the CPM regarding any questions, misunderstanding, or discrepancy related to the work under this document.

This document is not considered to be all inclusive nor does it apply to all projects. It is the CPM's responsibility to determine the proper scope and personnel required for each project. There may be project- and/or client- and/or state-specific requirements that may be more or less stringent than what is described herein. The CPM is responsible for informing Arcadis and/or Subcontractor personnel of omissions and/or deviations from this document that may be required for the project. In turn, project staff are required to inform the CPM if or when there is a deviation or omission from work performed as compared to what is described herein.

In following this document to execute the scope of work for a project, it may be necessary for staff to make professional judgment decisions to meet the project's scope of work based upon site conditions, staffing expertise, regulation-specific requirements, health and safety concerns, etc. Staff are required to consult with the CPM when or if a deviation or omission from this document is required that has not already been previously approved by the CPM. Upon approval by the CPM, the staff can perform the deviation or omission as confirmed by the CPM.

II. SCOPE AND APPLICATION

When collecting subsurface vapor samples as part of a vapor intrusion evaluation, a tracer gas serves as a quality assurance/quality control method to verify the integrity of the vapor port seal and the numerous connections comprising the sample train. Without the use of a tracer, verification that a soil vapor sample has not been diluted by ambient or indoor air is difficult.

This Technical Guidance Instruction (TGI) focuses on using helium as a tracer gas. It should be noted that a field helium meter could register a false positive if methane is present in the subsurface. In this case an alternative method should be employed (i.e., water dam test). The protocol for using a tracer gas includes the following basic steps: (1) enrich the atmosphere in the immediate vicinity of the sample port where ambient air could enter the sampling train during sampling with the tracer gas; and (2) measure a vapor sample from the sample tubing for the presence of elevated concentrations (> 10%) of the tracer. A plastic pail, bucket, garbage can or

even a plastic bag can serve as a shroud to keep the tracer gas in contact with the port during the testing.

There are two basic approaches to testing for the tracer gas:

1. Include the tracer gas in the list of target analytes reported by the laboratory; and/or
2. Use a portable monitoring device to analyze a sample of soil vapor for the tracer prior to sampling for the compounds of concern. (Note that tracer gas samples can be collected via syringe, Tedlar bag, etc. They need not be collected in SUMMA® canisters or mini-cans.)

This TGI focuses on monitoring helium using a portable sampling device, although helium can also be analyzed by the laboratory along with other volatile organic compounds (VOCs). Real-time tracer sampling allows the investigator to confirm the integrity of the port seals prior to formal sample collection.

During the initial stages of a subsurface vapor sampling program, tracer gas samples should be collected at each of the sampling points. If the results of the initial samples indicate that the port seals are adequate, the Project Manager can consider reducing the number of locations at which tracer gas samples are used in future monitoring rounds. At a minimum, at least 10% of the subsequent samples should be supported with tracer gas analyses. When using permanent soil vapor points as part of a long-term monitoring program, the port should be tested prior to the first sampling event. Tracer gas testing of subsequent sampling events may often be reduced or eliminated unless conditions have changed at the site. Soil gas port integrity should certainly be rechecked with Tracer gas if land clearing/grading activities, freeze thaw cycles, or soil desiccation may have occurred. Points should also be rechecked if more than 2 years have elapsed since the last check of that port.

III. PERSONNEL QUALIFICATIONS

Arcadis field sampling personnel will have current health and safety training, including 40-hour HAZWOPER training, site supervisor training, site-specific training, first aid, and cardiopulmonary resuscitation (CPR), as needed. Arcadis field sampling personnel will be competent in the relevant procedures and possess the required skills and experience necessary to successfully complete the desired field work. Arcadis personnel responsible for directing tracer gas testing must have previous experience conducting similar tests without direct supervision.

IV. EQUIPMENT LIST

The equipment required to conduct a helium tracer gas test is presented below:

- Appropriate PPE for site (as required by the Health and Safety Plan)
- Helium (laboratory grade)
- Regulator for helium tank
- Shroud (plastic bucket, garbage can, plastic bag, etc)

- The size of the shroud should be sufficient to fit over the sample port. It is worth noting that using the smallest shroud possible will minimize the volume of helium needed; this may be important when projects require a large number of helium tracer tests.
 - The shroud will need to have three small holes in it. These holes will include one on the top (to accommodate the sample tubing), and two on the side (one for the helium detector probe, and one for the helium line).
 - The shroud should ideally enclose the sample port and as much as possible of the sampling train.
- Helium detector capable of measuring from 1 - 100% (Dielectric MGD-2002, Mark Model 9522, or equivalent)
 - Tedlar bag
 - Seal material for shroud (rubber gasket, VOC-free modeling clay, bentonite, etc) to keep helium levels in shroud high in windy conditions. Although the sealing material is not in direct contact with the sample if leakage does not occur, sealing materials with high levels of VOC emissions should be avoided, since they could contaminate a sample if a leak occurs.
 - Sample logs
 - Field notebook

V. CAUTIONS

Helium is an asphyxiant! Be cautious with its use indoors! Never release large volumes of helium within a closed room!

Field sampling equipment must be carefully handled to minimize the potential for injury and the spread of hazardous substances. All sampling personnel should review the appropriate health and safety plan (HASp) and job safety analysis (JSA) prior to beginning work to be aware of all potential hazards associated with the job site and the specific task. Field staff should review the attachment on safely handling compressed gas cylinders prior to commencing field work.

Compressed gas cylinders should be handled with caution; see attachment on the use and storage of compressed gasses before beginning field work.

Care should be taken not to pressurize the shroud while introducing helium. If the shroud is completely air tight and the helium is introduced quickly, the shroud can be over-pressurized and helium can be pushed into the ground. Provide a relief valve or small gap where the helium can escape.

Because minor leakage around the port seal should not materially affect the usability of the soil vapor sampling results, the mere presence of the tracer gas in the sample should not be a cause for alarm. Consequently, portable field monitoring devices with detection limits in the low ppm range are more than adequate for screening samples for the tracer. If high concentrations (> 10%) of tracer gas are observed in a sample, the port seal should be enhanced and fittings within the sampling train should be checked and/or tightened to reduce the infiltration of ambient air

and the tracer test re-administered. If the problem cannot be rectified, a new sample point should be installed or an alternate sampling train used.

VI. PROCEDURE

The helium tracer test can be conducted when using temporary or permanent sampling points and inside or outside a facility. A visual of an example helium tracer gas test equipment set up is included as Figure 1.

1. Attach Teflon or nylon (Nylaflo) sample tubing to the sample point. This can be accomplished utilizing a number of different methods depending on the sample install (i.e., Swage-Lok or comparable fittings).
2. Place the shroud over the sample point and tubing.
3. Pull the tubing through hole in top of shroud. Seal opening at top of shroud with VOC free modeling clay.
4. Place weight on top of shroud to help maintain a good seal with the ground.
5. Insert helium tubing and helium detector probe into side of shroud. Seal both with modeling clay to prevent leaks.
6. Fill shroud with helium. Fill shroud slowly, allowing atmospheric air to escape either by leaving a gap where the shroud meets the ground surface or by providing a release valve on the side of the shroud. Do not pressurize the shroud!
7. Use the helium detector to monitor helium concentration within the shroud from the lowest hole drilled in the shroud (bottom of the shroud nearest where the sample tubing intersects the ground). Helium should be added until the environment inside the shroud has > 40% helium.
8. Purge the sample point through the sample tubing into a Tedlar bag using a syringe equipped with a three-way leuc lock valve. The purge rate should at least match the sample collection rate but not exceed 100 ml/min. Test the air in the Tedlar bag for helium using portable helium detector. If the point is free of leaks there should be very low helium in the purge air from the soil. The natural concentration of helium in the atmosphere is 0.00052% by volume and there are few if any natural sources of helium to soil gas.
9. If > 10% of the amount of helium present in the shroud is noted in purge air, rectify issues with the seal at the sample port and repeat the testing procedure. If the seal cannot be fixed, reinstall sample point.
10. Monitor and record helium level in shroud before, during and after tracer test.
11. Monitor and record helium level in purge exhaust.
12. At successful completion of tracer test and sample point purging, the soil vapor sample can be collected (if the helium shroud must be removed prior to sample collection be mindful not disturb the sample tubing and any established seals).

VII. WASTE MANAGEMENT

No specific waste management procedures are required.

VIII. DATA RECORDING AND MANAGEMENT

Measurements will be recorded on the sample logs at the time of measurement with notations of the project name, sample date, sample start and finish time, sample location, and the helium concentrations in both the shroud and the purge air before, during, and after tracer testing. Any problems encountered should also be recorded in the field notes.

IX. QUALITY ASSURANCE

Conduct quality assurance as required by the project-specific work plan and/or Quality Assurance Project Plan (QAPP).

ATTACHMENT: Compressed Gases – Use and Storage

In general, a compressed gas is any material contained under pressure that is dissolved or liquefied by compression or refrigeration. Compressed gas cylinders should be handled as high- energy sources and therefore as potential explosives and projectiles. Prudent safety practices should be followed when handling compressed gases since they expose workers to both chemical and physical hazards.

Handling

- Safety glasses with side shields (or safety goggles) and other appropriate personal protective equipment should be worn when working with compressed gases.
- Cylinders should be marked with a label that clearly identifies the contents.
- All cylinders should be checked for damage prior to use. Do not repair damaged cylinders or valves. Damaged or defective cylinders, valves, etc., should be taken out of use immediately and returned to the manufacturer/distributor for repair.
- All gas cylinders (full or empty) should be rigidly secured to a substantial structure at 2/3 height. Only two cylinders per restraint are allowed in the laboratory and only soldered link chains or belts with buckles are acceptable. Cylinder stands are also acceptable but not preferred.
- Handcarts shall be used when moving gas cylinders. Cylinders must be chained to the carts.
- All cylinders must be fitted with safety valve covers before they are moved.
- Only three-wheeled or four-wheeled carts should be used to move cylinders.
- A pressure-regulating device shall be used at all times to control the flow of gas from the cylinder.
- The main cylinder valve shall be the only means by which gas flow is to be shut off. The correct position for the main valve is all the way on or all the way off.
- Cylinder valves should never be lubricated, modified, forced, or tampered with.
- After connecting a cylinder, check for leaks at connections. Periodically check for leaks while the cylinder is in use.
- Regulators and valves should be tightened firmly with the proper size wrench. Do not use adjustable wrenches or pliers because they may damage the nuts.
- Cylinders should not be placed near heat or where they can become part of an electrical circuit.
- Cylinders should not be exposed to temperatures above 50 °C (122 °F). Some rupture devices on cylinders will release at about 65 °C (149 °F). Some small cylinders, such as

lecture bottles, are not fitted with rupture devices and may explode if exposed to high temperatures.

- Rapid release of a compressed gas should be avoided because it will cause an unsecured gas hose to whip dangerously and also may build up enough static charge to ignite a flammable gas.
- Appropriate regulators should be used on each gas cylinder. Threads and the configuration of valve outlets are different for each family of gases to avoid improper use. Adaptors and homemade modifications are prohibited.
- Cylinders should never be bled completely empty. Leave a slight pressure to keep contaminants out.

Storage

- When not in use, cylinders should be stored with their main valve closed and the valve safety cap in place.
- Cylinders must be stored upright and not on their side. All cylinders should be secured.
- Cylinders awaiting use should be stored according to their hazard classes.
- Cylinders should not be located where objects may strike or fall on them.
- Cylinders should not be stored in damp areas or near salt, corrosive chemicals, chemical vapors, heat, or direct sunlight. Cylinders stored outside should be protected from the weather.

Special Precautions

Flammable Gases

- No more than two cylinders should be manifolded together; however, several instruments or outlets are permitted for a single cylinder.
- Valves on flammable gas cylinders should be shut off when the laboratory is unattended and no experimental process is in progress.
- Flames involving a highly flammable gas should not be extinguished until the source of the gas has been safely shut off; otherwise it can reignite causing an explosion.

Acetylene Gas Cylinders

- Acetylene cylinders must always be stored upright. They contain acetone, which can discharge instead of or along with acetylene. Do not use an acetylene cylinder that has been stored or handled in a nonupright position until it has remained in an upright position for at least 30 minutes.
- A flame arrestor must protect the outlet line of an acetylene cylinder.

- Compatible tubing should be used to transport gaseous acetylene. Some tubing like copper forms explosive acetylides.

Lecture Bottles

- All lecture bottles should be marked with a label that clearly identifies the contents.
- Lecture bottles should be stored according to their hazard classes.
- Lecture bottles that contain toxic gases should be stored in a ventilated cabinet.
- Lecture bottles should be stored in a secure place to eliminate them from rolling or falling.
- Lecture bottles should not be stored near corrosives, heat, direct sunlight, or in damp areas.
- To avoid costly disposal fees, lecture bottles should only be purchased from suppliers that will accept returned bottles (full or empty). Contact the supplier before purchasing lecture bottles to ensure that they have a return policy.
- Lecture bottles should be dated upon initial use. It is advised that bottles be sent back to the supplier after one year to avoid accumulation of old bottles.

TGI – GROUNDWATER AND SOIL SAMPLING EQUIPMENT DECONTAMINATION

Rev: 0

Rev Date: February 23, 2017




VERSION CONTROL

Revision No	Revision Date	Page No(s)	Description	Reviewed by
0	February 23, 2017	ALL	Conversion from SOP to TGI	Cassandra McCloud / Pete Frederick

APPROVAL SIGNATURES

Prepared by:  Date: 02/23/2017
Derrick Maurer

Technical Expert Reviewed by:  Date: 02/23/2017
Cassandra McCloud (Technical Expert)

1 INTRODUCTION

This document describes general and/or specific procedures, methods, actions, steps, and considerations to be used and observed by Arcadis staff when performing work, tasks, or actions under the scope and relevancy of this document. This document may describe expectations, requirements, guidance, recommendations, and/or instructions pertinent to the service, work task, or activity it covers.

It is the responsibility of the Arcadis Certified Project Manager (CPM) to provide this document to the persons conducting services that fall under the scope and purpose of this procedure, instruction, and/or guidance. The Arcadis CPM will also ensure that the persons conducting the work falling under this document are appropriately trained and familiar with its content. The persons conducting the work under this document are required to meet the minimum competency requirements outlined herein, and inquire to the CPM regarding any questions, misunderstanding, or discrepancy related to the work under this document.

This document is not considered to be all inclusive nor does it apply to any and all projects. It is the CPM's responsibility to determine the proper scope and personnel required for each project. There may be project- and/or client- and/or state-specific requirements that may be more or less stringent than what is described herein. The CPM is responsible for informing Arcadis and/or Subcontractor personnel of omissions and/or deviations from this document that may be required for the project. In turn, project staff are required to inform the CPM if or when there is a deviation or omission from work performed as compared to what is described herein.

In following this document to execute the scope of work for a project, it may be necessary for staff to make professional judgment decisions to meet the project's scope of work based upon site conditions, staffing expertise, state-specific requirements, health and safety concerns, etc. Staff are required to consult with the CPM when or if a deviation or omission from this document is required that has not already been previously approved by the CPM. Upon approval by the CPM, the staff can perform the deviation or omission as confirmed by the CPM.

2 SCOPE AND APPLICATION

Decontamination is performed on sampling equipment prior to sample collection to ensure that the sampling equipment that contacts a sample, or monitoring equipment that is brought into contact with environmental media to be sampled, is free from analytes of interest and/or constituents that could interfere with laboratory analysis for analytes of interest. Sampling equipment must be appropriately cleaned prior to use for sampling or coming into contact with environmental media to be sampled, and following completion of the sampling event prior to shipment or storage. The effectiveness of the decontamination procedure should be verified by collecting and analyzing equipment blank samples.

The sampling equipment cleaning procedures described herein includes pre-field, in the field, and post-field cleaning of sampling equipment which may be conducted at an established equipment decontamination area (EDA) on site, as appropriate and necessary. Sampling equipment that may require decontamination at a given site includes: soil sampling tools; groundwater, sediment, and surface-water sampling devices; water testing instruments; down-hole instruments; and other activity-specific sampling equipment. Non-disposable equipment will be cleaned before collecting each sample, between each

sample collected, and prior to placing sampling equipment in protective cases, or containers for transport. Cleaning procedures for sampling equipment should be monitored by collecting equipment blank samples as required in project work plans, field sampling plans, quality assurance project plans (QAPP), or other pertinent project documents. Dedicated and/or single-use (i.e., not to be re-used) sampling equipment will not require decontamination.

3 PERSONNEL QUALIFICATIONS

Arcadis field sampling personnel will have completed or are in the process of completing site-specific training as well as having current health and safety training as required by Arcadis, client, or regulations, such as 40-hour HAZWOPER training and/or OSHA HAZWOPER site supervisor training. Arcadis personnel will also have current training as specified in the Health and Safety Plan (HASP) which may include first aid, cardiopulmonary resuscitation (CPR), Blood Borne Pathogens (BBP) as needed. In addition, Arcadis field sampling personnel will be knowledgeable in the relevant processes, procedures, and Technical Guidance Instructions (TGIs) and possess the demonstrated required skills and experience necessary to successfully complete the desired field work. The project health and safety plan (HASP) and other documents will identify other training requirements or access control requirements.

4 EQUIPMENT LIST

The equipment required for equipment decontamination is presented below:

- Health and safety equipment, including appropriate PPE, as required in the site Health and Safety Plan (HASP)
- Deionized water that meets that analytical criteria for deionized water with no detectable constituents above the reporting limits for the methods to be used and analytes being analyzed for. Deionized water is used for inorganics, and organic-free water for VOCs, SVOCs, pesticides, etc.
- Non-phosphate detergent such as Alconox or, if sampling for phosphorus or phosphorus-containing compounds, Liquinox (or equivalent).
- Tap water
- Rinsate collection plastic containers
- DOT-approved waste shipping container(s), as specified in the work plan, field sampling plan, or regulatory requirements if decontamination waste is to be shipped for disposal
- Brushes
- Large heavy-duty garbage bags
- Spray bottles
- (Optional) – Isopropyl alcohol (free of ketones) or methanol. These can be wipes or diluted with water (usually 1part isopropyl/methanol to 10 parts water) if a spray is needed.
- Airtight, sealable plastic baggies, such as Ziploc-type
- Plastic sheeting

5 CAUTIONS

Rinse equipment thoroughly and allow the equipment to dry before re-use or storage to prevent introducing solvent into sample medium. If manual drying of equipment is required, use clean lint-free material to wipe the equipment dry. Ensure all rinsate materials do not adversely affect sample collection efficiency or analytical results.

Store decontaminated equipment in a clean, dry environment. Do not store near combustion engine exhausts. Properly containerize equipment to ensure cross-contamination doesn't happen from other uncontaminated surfaces or equipment.

If equipment is damaged to the extent that decontamination is uncertain due to cracks, gouges, crevices, or dents, the equipment should not be used and should be discarded or submitted for repair prior to use for sample collection.

A proper shipping determination regarding hazardous materials will be performed by a DOT-trained individual for cleaning materials shipped by Arcadis.

Caution should be exercised to avoid contact with the pump casing and water in the container while the pump is running (do not use metal drums or garbage cans) to avoid electric shock.

6 HEALTH AND SAFETY CONSIDERATIONS

Review the safety data sheets (SDS) for the cleaning agents and materials used in decontamination. If solvent is used during decontamination, use appropriate PPE and work in a well-ventilated area and stand upwind while applying solvent to equipment. Apply solvent in a manner that minimizes potential for exposure to workers and bystanders. Follow health and safety procedures outlined in the HASP.

7 PROCEDURE

A designated area will be established to clean sampling equipment in the field prior to and following sample collection. Equipment cleaning areas will be set up within or adjacent to the specific work area, but not at a location that expose equipment to contamination (i.e. exposed to combustion engine exhaust). Detergent solutions will be prepared in clean containers for use in equipment decontamination. Decontaminated equipment should be handled by workers wearing clean gloves, properly changed to prevent cross-contamination.

Cleaning Sampling Equipment

1. Wash the equipment/pump with potable water.
2. Wash with detergent solution (Alconox, Liquinox or equivalent) to remove all visible particulate matter and any residual oils or grease.
3. If equipment is very dirty, precleaning gross debris with a brush and tap water may be necessary.
4. If non-aqueous phase liquids are present, the use of isopropyl alcohol (free of ketones) or methanol is recommended. Cloth wipes or diluted solution can be used to remove the non-aqueous phase liquids that are hard to remove with detergent solution in step 2. Consult with project manager if

non-aqueous phase liquids are present onsite and design an appropriate decontamination procedure that includes step 4.

5. Rinse with deionized water.

Decontaminating Submersible Pumps

Submersible pumps may be used during well development, groundwater sampling, or other investigative activities. The pumps must be cleaned and flushed before and between uses. This cleaning process will consist of an external detergent solution wash and tap water rinse, a flush of detergent solution through the pump, followed by a flush of potable water through the pump. Flushing will be accomplished by using an appropriate container filled with detergent solution and another container filled with potable water. The pump should be flushed with deionized water as the last step prior to use. The pump will run long enough to effectively flush the pump housing and hose (unless new, disposable hose is used). Disconnect the pump from the power source before handling. The pump and hose should be placed on or in clean polyethylene sheeting to avoid contact with the ground surface.

8 WASTE MANAGEMENT

Equipment decontamination rinsate will be managed in conjunction with all other waste produced during the field sampling effort. Waste management procedures are outlined in the work plan or Waste Management Plan (WMP).

9 DATA RECORDING AND MANAGEMENT

Equipment cleaning and decontamination will be noted in the field notebook for project documentation. Information will include the type of equipment cleaned, the decontamination location, specific procedures utilized, solvents and/or cleaning agents used, source of water, and deviations or omissions from this TGI.

Unusual field conditions should be noted if there is potential to impact the efficacy of the decontamination or subsequent sample collection.

An inventory of the solvents brought on site and used and removed from the site will be maintained in the project documentation. Records will be maintained for solvents used in decontamination, including lot number and expiration date.

Containers with decontamination fluids will be labeled.

10 QUALITY ASSURANCE

Equipment blanks should be collected to verify that the decontamination procedures are effective in minimizing potential for cross contamination. The equipment blank is prepared by pouring deionized water (or organic-free water, for organic analyses) over the clean and dry tools and collecting the water into appropriate sample containers. Equipment blanks should be analyzed for the same set of parameters that are performed on the field samples collected with the equipment that was cleaned as specified in the sampling and analysis plan. Equipment blanks are collected per equipment set, which represents all of the tools needed to collect a specific sample.

11 REFERENCES

USEPA Region 9 - Field Sampling Guidance #1230, Sampling Equipment Decontamination.

USEPA Region 1 - Low Stress (low flow) Purging and Sampling Procedure for the Collection of Groundwater Samples from Monitoring Wells.

SOP - SAMPLE CHAIN OF CUSTODY

Rev: #1

Rev Date: May 23, 2017



VERSION CONTROL

Revision No	Revision Date	Page No(s)	Description	Reviewed by
0	April 19, 2017	All	Re-write to COC only	Richard Murphy
1	May 23, 2017	4	Add: Guidance on use of previous version of SOP.	Peter Frederick
		9	Add: Info on COCs for multiple shipping containers	
		7	Modify: Move letter i. to letter m. and change to “when appropriate”	

APPROVAL SIGNATURES

Prepared by: 
Peter C. Frederick

05/23/2017
Date:

Technical Expert Reviewed by: 
Richard J. Murphy

05/23/2017
Date:

1 INTRODUCTION

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2 SCOPE AND APPLICATION

This Standard Operating Procedure (SOP) describes the general Chain of Custody (COC) procedures and guidance instructions for samples collected from project sites that are relinquished from Arcadis' possession.

COC is defined as the maintenance of an unbroken record of possession of an item from the time of its collection through some analytical or testing procedure. COC is typically documented by a written record of the collection, possession, and handling of samples collected from a project location. Each sample will be tracked by a documented record that efficiently documents the individuals who were responsible for the sample during each successive transfer of that sample to various recipients beyond Arcadis' possession. This information can be used to legally establish the integrity of the samples and therefore the analytical results derived from the samples. This information can be used in addition to other records and documentation regarding the samples, such as field forms, field logs, and photographs.

A sample is considered under custody if:

- It is in your possession; or
- It is in your view, after being in your possession; or
- It was in your possession and then you then locked it up to prevent tampering; or
- It is in a designated secure area.

Continued use of previous version of SOP:

Although not recommended, Arcadis program-, project-, and client-teams may be able to use the previous version of this SOP provided that it meets all of the quality expectations of Arcadis and client, and meets applicable regulatory requirements. It is up to the program, project, and/or client-team leader to determine whether it is appropriate to adopt the current SOP or to continue using the previous version.

However, all new work not associated with the previous version of this SOP must be performed with the current version of the SOP.

When adopting this new SOP, users of the previous versions must be aware that specific handling, packing, and shipping procedures and guidance has been removed and that those should be addressed within program or project plans (e.g. QAPPs, Work Plans, SAPs, etc.) or in a more detailed SOP or TGI specific to that sampling activity, whether related to media, constituent/analyte, client, state, etc.

In addition, adopting this new SOP will require users to refer to the Arcadis DOT Safety Program for procedures and guidance on the determination and handling, packing, and shipping of samples that are or may be considered hazardous materials.

3 PERSONNEL QUALIFICATIONS

Arcadis personnel performing work under the purview of this SOP will have received appropriate training and have field experience regarding the collection of samples from project locations. Arcadis personnel will have all other applicable and appropriate training relevant to the sampling work and project site.

4 EQUIPMENT LIST

The following list provides materials that may be required for each COC. Project reporting and documentation requirements must be reviewed with the CPM prior to execution of work. Additional materials, tools, equipment, etc. may be required, and project staff are required to verify with the CPM and/or Technical Expert what specific equipment is required to complete the COC.

- Indelible ink pen (preferably either black or blue ink);
- COC form <https://thesourceus.arcadissource.com/TKI/Documents/COC%20Form.pdf> (**Appendix A**) from either Arcadis, laboratory receiving and analyzing the samples, or other applicable and appropriate entity for the work performed;
- When appropriate, such as for litigation or expert testimony work, custody seals or tape.

5 CAUTIONS

One way in which the law tries to ensure the integrity of evidence is by requiring proof of the chain of custody by the party who is seeking to introduce a particular piece of evidence.

A proper chain of custody requires three types of affirmations: (1) affirmation that a sample is what it purports to be (for example, soil collected from a specified location and depth); (2) affirmation of continuous possession by each individual who has had possession of the sample from the time it is collected until the time it is analyzed or held by a laboratory; and (3) affirmation by each person who has had possession that sample remained in substantially the same condition and not contaminated or affected by outside influences from the moment one person took possession until the moment that person released the evidence into the custody of another (for example, affirmation that the sample was stored in a secure location where no one but the person in custody had access to it).

Proving chain of custody is necessary to "lay a foundation" for the samples in question, by showing the absence of alteration, substitution, or change of condition.

Ensure that appropriate sample containers with applicable preservatives, coolers, and packing material are planned for and provided at the site at the time of sample collection.

Understand the offsite transfer requirements of the samples for the facility at which samples are collected.

If overnight courier service is required schedule pick-up or know where the drop-off service center is located and the hours of operation.

An Arcadis employee appropriately trained at the correct level of internal hazardous materials/DOT (Department of Transportation) shipping must complete an Arcadis shipping determination to address applicable DOT and IATA (International Air Transport Association) shipping requirements. Review the applicable Arcadis procedures and guidance instructions for sample packaging, and labeling. Prior to using air transportation, confirm air shipment is acceptable under DOT and IATA regulations.

The person relinquishing possession of the samples or other member of the project team should contact the final recipient of the samples to confirm receipt and review any special provisions on the COC or questions that they may have.

6 HEALTH AND SAFETY CONSIDERATIONS

Follow the health and safety procedures outlined in the project/site Health and Safety Plan (HASP) as well as other applicable H&S requirements, such as:

- Arcadis Hazardous Material/DOT handling, packaging, and shipping training
- Project site-specific H&S training
- Client-specific H&S training
- Constituent-specific H&S training
- Media-specific H&S training

7 PROCEDURE

Collected samples must be uniquely identified, and properly documented, containerized, labeled with unique identifier, possessed in a secure manner during remainder of sampling event, packaged, and shipped to recipient laboratory.

Sample Identification

The method of sample identification depends on the type of measurement or analyses performed. In some cases, in-situ measurements of existing conditions and/or sample location must be made during sample collection. These data will be recorded directly on field forms, logbooks, or other project record data sheets used to permanently retain this information for the project file. Examples of location identification information includes: latitude/longitudinal measurements, compass directions, well number, building number, floor number, room name, or proximity to a site feature unique to the site. Examples of in-situ measurements are pH, temperature, conductivity, flow measurement, or physical condition of the media being sampled. Physical samples collected are identified by a unique identifying number or code on a sample tag or label. These physical samples are removed from the sample location and transported to a laboratory for analyses.

In some cases, before samples are placed into individual containers and labeled as individual samples, samples may be separated into portions depending upon the analytical methods and required duplicate or triplicate analyses to be performed.

When completing a COC for samples, personnel must complete the following:

1. Written COCs must be completed with indelible ink (preferably either black or blue colored ink).
2. Written COCs must be completed using legible printed writing, and not cursive writing.
3. All entry fields on the COC form must be completed. If information is not applicable for a specific entry field, personnel will either put "N/A" or use a strike-out line or dash like "-----" to indicate no applicable information is needed for that field.
4. Use of quotation marks or lines/down arrows to represent repetitive/duplicative text in similar fields.
5. Regardless of the type or specific COC form, the following pertinent information must be provided on the COC form:
 - a. Arcadis project number
 - b. Arcadis project name
 - c. Project location, including street address, city, state, building number, providing as much detail as appropriate
 - d. Recipient laboratory contact and sample receiving shipping location information
 - e. Entities'/persons' contact information for who will be receiving analytical results
 - f. Name of sampler, i.e. person collecting sample and relinquishing possession of samples to the next entity in the chain of custody
 - g. Date of sample collection

- h. If appropriate for the sample media, contaminant/constituent of concern, or analytical method, document time of sample collection using standard military time
 - i. Sample analytical method(s)
 - j. Turnaround time required for analyses and/or reporting
 - k. Instructions to laboratory regarding handling, timing, analyses, etc. as applicable and appropriate
 - l. Printed name and signature of the individual person who collected the samples and relinquishing possession of the samples
 - m. If appropriate or when documentation of the specific sample collection method will influence how the laboratory handles, prepares, or analyzes the samples, document the sample collection methodology used for collecting the samples (e.g. ASTM D5755)
6. The following additional specific information will be entered on the COC form, regardless of what type of COC is being used:
- a. Unique Sample Identifier – The sample identifier (ID) must be unique to the individual sample it is applied to. The information in which the sample ID conveys is determined by the CPM, Technical Expert, and/or other project team members in advance of sample collection so that sample identification is consistently applied for the project. The sample nomenclature may be dictated by a specific client, program, or project database and require unique identification for each sample collected for the project. Consult with the CPM and/or Technical Expert for additional information regarding sample identification.

The sample ID could convey specific information regarding the sample to aid personnel in recognizing what the sample represents, or they may be arbitrary so as to facilitate the anonymity of the sample location, media, constituent of concern, project site, etc.

Examples of unique identifiers include:

- 1. Well locations, grid points, or soil boring identification numbers (e.g., MW-3, X-20, SB-30). When the depth interval is included, the complete sample ID would be “SB-30 (0.5-1.0) where the depth interval is in feet. Please note it is very important that the use of hyphens in sample names and depth units (i.e., feet or inches) remain consistent for all samples entered on the chain of custody form. DO NOT use the apostrophe or quotes in the sample ID.
 - 2. Sample names may also use the abbreviations “FB,” “TB,” and “DUP” as prefixes or suffixes to indicate that the sample is a field blank, trip blank, or field duplicate, respectively.
- b. List the date of sample collection. All indicated dates must be formatted using either mm/dd/yy (e.g., 03/07/09) or mm/dd/yyyy (e.g. 03/07/2009).
 - c. When appropriate for the analytical procedure used, list the local time that the sample was collected. The time value should be presented using military format. For example, 3:15 P.M. should be entered as 15:15.

- d. Samples should be indicated to be either “Grab” or “Composite”. Grab samples are collected from only one unique location at one specific point in time.
- e. Composite samples are a group of individual samples that are combined for analysis in their totality. Composite samples need to be documented if they are either collected from a number of different locations over a broader area to be representative of the entire area being sampled, or if they are representative of a single location over an extended period of time.
- f. If used, preservatives for the individual sample will be noted.
- g. The requested analytical method(s) that the samples are being analyzed for must be indicated. As much detail, as necessary, should be presented to allow the analytical laboratory to properly analyze the samples. For example, polychlorinated biphenyl (PCB) analyses may be represented by entering “EPA Method 8082 – PCBs” or “EPA PLM 600-R93-116.” In cases where multiple analytical methods and/or analytical parameters are required for an individual sample, each method should be indicated for the sample (e.g., EPA 8082/8260/8270 or EPA PLM/400-point count).
- h. If there are project-specific sample analytes to be reported, they should be specifically listed for each individual sample (e.g., 40 CFR 264 Appendix IX).
- i. The total number of containers for each analytical method requested should be documented. This information may be included under the parameter or as a total for the sample.
- j. When necessary, note which samples should be used for site specific matrix spikes.
- k. Indicate special project-specific requirements pertinent to the handling, shipping, or analyses. These requirements may be on a per sample basis such as “extract and hold sample until notified,” or may be used to inform the laboratory of special reporting requirements for the entire sample delivery group (SDG).
- l. Indicate turnaround time (TAT) required for samples on COC. If individual samples have differing TATs, the different TATs for each sample or groups of samples must be clearly indicated.
- m. Provide contact name and phone number in the event that problems are encountered when samples are received at the laboratory. The person relinquishing possession of the samples or other member of the project team should contact the final recipient of the samples to confirm receipt and review any special provisions on the COC or questions that they may have.
- n. If available, attach the Laboratory Task Order or Work Authorization forms.
- o. The “Relinquished By” field must contain the signature of the Arcadis person who relinquished custody of the samples to the next entity in the chain of custody, which may be another person, the shipping courier, or the analytical laboratory.
- p. Dates and times must be indicated using the following format:
 - 1) Date: either mm/dd/yy e.g., 01/01/17 OR mm/dd/yyyy e.g., 01/01/2017
 - 2) Time: use military format, e.g. 9:30 a.m. is 0930 and 9:30 p.m. is 2130

- q. The “Received By” section is signed by sample courier or laboratory representative who received the samples from the sampler or it is signed upon laboratory receipt from the overnight courier service.
4. When more than one page of the COC form is required to complete the total number of samples, use as many sheets as necessary to accurately and clearly document the samples and information. Some COCs may have a standard first page/cover page, and subsequent pages may not contain all the detailed fields as the first page/cover page. Ensure that any subsequent pages convey all of the necessary and pertinent information for each individual sample as required in this procedure document.
5. Pages of the COC must retain a page count of the total number of pages; e.g., Page 1 of 3, Page 2 of 3, Page 3 of 3.
6. Upon completing the COC forms, forward the original signed COC with the sample package. Ensure that the original COC form is secured with the sample package so that it remains with the physical samples for the duration of transport and handling to its final destination and ensure that the COC form will not be become damaged or rendered unreadable due to sample breakage/leakage if stored inside the sample shipping container or outside influences if COC is stored in an outside plastic pouch to the container.
7. If you’ve collected enough samples that would require more than one container to ship them all to the same laboratory or location, then each separate/individual container that contains any number of samples must have a separate COC representing only those samples contained within that specific container. For example, if you have 3 total shipping containers for all of your samples, you must have a total of 3 separate, individual COCs for each of the 3 containers representing only those samples in their representative container. Thus, every container holding samples must have its own, individual COC.
8. If electronic chain of custody (eCOC) forms are utilized, ensure that the requirements of this procedure and guidance instructions are followed to the extent possible. Verify that proper signature and COC procedures are maintained with the CPM and/or Technical Expert when using eCOC.

8 WASTE MANAGEMENT

Not Applicable.

9 DATA RECORDING AND MANAGEMENT

The original signed COC shall be submitted with the samples. Copies of COC records will be transmitted to the CPM or designee at the end of each day unless otherwise directed by the CPM. The sampling team leader retains copies of the chain of custody forms for filing in the project file. Record retention shall be in accordance with client- and project-specific requirements and Arcadis policies, the most stringent will apply.

10 QUALITY ASSURANCE

COC forms will be legibly completed in accordance with this procedure and guidance instruction document, as well as other applicable and appropriate project documents such as Sampling and Analysis Plan (SAP), Quality Assurance Project Plan (QAPP), Work Plan, or other project guidance documents.

COC records will be reviewed by the CPM or their appropriate designee for completeness and accuracy to the applicable requirements. Non-conformances will be noted and corrected in a timely manner on the copies retained by Arcadis as well as contacting the ultimate receiving entity for correction to the originally signed COC in their possession.

11 REFERENCES

Arcadis Client Document Retention Guide

Arcadis Transportation Safety Program requirements, procedures, and guidance instructions

EPA Samplers' Guide – Contract Laboratory Program Guidance for Field Samplers, EPA document EPA-540-R014-013 October 2014

EPA Region III – Sample Submission Procedures for the Office of Analytical Services and Quality Assurance (OASQA) Laboratory Branch revision 13.0 January 29, 2014

EPA Region I Office Environmental Measurement and Evaluation – Standard Operating Procedures for Chain of Custody of Samples revision 1 March 25, 2002

EPA Region IV Science and Ecosystem Support Division Operating Procedure for Sample and Evidence Management January 29, 2013

TGI - STANDARD GROUNDWATER SAMPLING FOR MONITORING WELLS

Rev #: 0

Rev Date: October 8, 2018

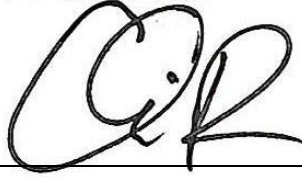


VERSION CONTROL

Revision No	Revision Date	Page No(s)	Description	Reviewed by
0	October 8, 2018	All	Updated and re-written as a TGI	Marc Killingstad

APPROVAL SIGNATURES

Prepared by:

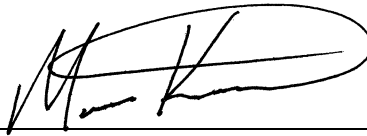


Christopher Keen

10/08/2018

Date:

Technical Expert Reviewed by:



Marc Killingstad (Technical Expert)

10/08/2018

Date:

1 INTRODUCTION

This document describes general and/or specific procedures, methods, actions, steps, and considerations to be used and observed by Arcadis staff when performing work, tasks, or actions under the scope and relevancy of this document. This document may describe expectations, requirements, guidance, recommendations, and/or instructions pertinent to the service, work task, or activity it covers.

It is the responsibility of the Arcadis Certified Project Manager (CPM) to provide this document to the persons conducting services that fall under the scope and purpose of this procedure, instruction, and/or guidance. The Arcadis CPM will also ensure that the persons conducting the work falling under this document are appropriately trained and familiar with its content. The persons conducting the work under this document are required to meet the minimum competency requirements outlined herein, and inquire to the CPM regarding any questions, misunderstanding, or discrepancy related to the work under this document.

This document is not considered to be all inclusive nor does it apply to any and all projects. It is the CPM's responsibility to determine the proper scope and personnel required for each project. There may be project- and/or client- and/or state-specific requirements that may be more or less stringent than what is described herein. The CPM is responsible for informing Arcadis and/or Subcontractor personnel of omissions and/or deviations from this document that may be required for the project. In turn, project staff are required to inform the CPM if or when there is a deviation or omission from work performed as compared to what is described herein.

In following this document to execute the scope of work for a project, it may be necessary for staff to make professional judgment decisions to meet the project's scope of work based upon site conditions, staffing expertise, state-specific requirements, health and safety concerns, etc. Staff are required to consult with the CPM when or if a deviation or omission from this document is required that has not already been previously approved by the CPM. Upon approval by the CPM, the staff can perform the deviation or omission as confirmed by the CPM.

2 SCOPE AND APPLICATION

This Technical Guidance Instruction (TGI) describes the methods to be used to collect groundwater samples using traditional purging and sampling techniques. For low-flow purging techniques, please refer to the *TGI - Low-Flow Groundwater Purging and Sampling Procedures for Monitoring Wells*. For no-purge/passive sampling techniques such as passive diffusion bag (PDB), HydraSleeve™ and bailer-grab groundwater sampling please refer to: *TGI – Passive Diffusion Bag Sampling*, *TGI – Groundwater Sampling with HydraSleeves™*, and *TGI - Bailer-Grab Groundwater Sampling*.

NOTE: Monitoring wells will not be sampled until the well has been properly developed. Monitoring wells must be appropriately developed after installation and at least one (1) week prior to groundwater sample collection (refer TGI – Monitoring Well Development). Project teams will consider the last time the wells were developed and if additional development may be required to ensure adequate communication with the surrounding formation and collection of representative groundwater samples.

During precipitation events, groundwater sampling will be discontinued until precipitation ceases or a cover has been erected over the sampling area and monitoring well.

Both filtered and unfiltered groundwater samples may be collected using this TGI. Filtered samples may be obtained using a 1.0-, 0.45-, or 0.1-micron disposable filter.

3 PERSONNEL QUALIFICATIONS

Arcadis field sampling personnel will have completed or are in the process of completing site-specific training as well as having current health and safety training as required by Arcadis, client, or regulations, such as 40-hour HAZWOPER training and/or OSHA HAZWOPER site supervisor training. Arcadis personnel will also have current training as identified in the site-specific Health and Safety Plan (HASP) which may include first aid, cardiopulmonary resuscitation (CPR), Blood Borne Pathogens (BBP) as needed. The HASP will also identify any access control requirements.

Prior to mobilizing to the field, the groundwater sampling team will review and be thoroughly familiar with relevant site-specific documents including but not limited to the task-specific work plan or field implementation plan (FIP)/field sampling plan, Quality Assurance Project Plan (QAPP), HASP, historical information, and other relevant site documents.

Arcadis field sampling personnel will be knowledgeable in the relevant processes, procedures, and TGIs and possess the demonstrated required skills and experience necessary to successfully complete the desired field work. Additionally, the groundwater sampling team will review and be thoroughly familiar with documentation provided by equipment manufacturers and become familiar with the operation of (i.e., hands-on experience) all equipment that will be used in the field prior to mobilization.

Ideally, Arcadis personnel directing, supervising, or leading groundwater sample collection activities will have a minimum of one (1) year of previous groundwater sampling experience. Field employees with less than six (6) months of experience will be accompanied by a supervisor (as described above) to ensure that proper sample collection techniques are employed.

4 EQUIPMENT LIST

The following materials will be available, as required, during groundwater sampling:

- Site-specific HASP and health and safety documents identified in the HASP
- Field Implementation Plan (FIP) that includes site map, well construction records (table or logs), sampling plan (sample analyses, sample volume required, and sample holding time), and prior groundwater sampling records (if available)
- Field notebook and/or smart device (smart phone or tablet)
- Groundwater sampling field forms (**Attachment A**)
- Appropriate personal protective equipment (PPE) (e.g., latex or nitrile gloves, safety glasses, etc.) as specified in the HASP
- Traffic cones, delineators, and caution tape as appropriate for securing the work area as specified in the Traffic Safety Plan (TSP)

- Photoionization detector (PID), flame ionization detector (FID) or other air monitoring equipment, as needed, in accordance with the HASP
- Dedicated plastic sheeting (e.g., Weatherall Visqueen) or other clean surface to prevent sampling equipment from coming in contact with the ground
- If bailers are to be used in sampling:
 - appropriate number of dedicated bottom-loading, bottom-emptying bailers (i.e., polyvinyl chloride [PVC], polyethylene, Teflon®, or stainless steel)
 - polypropylene or nylon rope
- If submersible pumps are to be used in sampling:
 - appropriate amount of dedicated tubing (polyethylene, Teflon®, Teflon®-lined polyethylene, Tygon®) and other equipment necessary for purging selected in accordance with the FIP/sampling plan/work plan
 - generator or battery for operation of pumps (if required)
 - a pump selected in accordance with the FIP/sampling plan/work plan (parameter-specific [e.g., submersible, bladder, peristaltic])
- Graduated buckets to measure purge water volume
- Electronic water-level indicator (e.g., Solinst Model 101) or oil/water interface probe with 0.01-foot accuracy (oil/water as appropriate, note that sampling will not be performed when sheen or light non-aqueous phase liquid [LNAPL] is present)
- Down-hole multiparameter water-quality sonde (temperature/pH/specific conductivity/oxidation reduction [ORP]/turbidity/dissolved oxygen) meter and flow-through measurement cell; for example:
 - YSI 6-Series Multi-Parameter Instrument
 - Horiba U-22 Multi-Parameter Instrument.
 - Hydrolab Series 3 or Series 4a Multiprobe and Display.
- Groundwater sample containers and labels (supplied by the laboratory) appropriate for the analytical method(s) with preservative, as needed (parameter-specific)
- Filter, as needed, in accordance with the analytical method and parameter, and as specified in the FIP/sampling plan
- Decontamination equipment (buckets, distilled or deionized water, cleansers appropriate for removing expected chemicals of concern, paper towels)
- Appropriate blanks (trip blank supplied by the laboratory), as specified in the FIP/sampling plan
- Ziploc-type freezer bags for use as ice containers;
- Appropriate transport containers (coolers) with ice and appropriate labeling, packing, and shipping materials

- Chain-of-custody forms
- Digital camera (or phone with camera)
- Keys to wells and contingent bolt cutters for rusted locks and replacement keyed-alike locks
- Drums or other containers appropriate for purge water, as specified by the site investigation-derived waste (IDW) management plan and/or FIP/sampling plan and appropriate drum labels

5 CAUTIONS

Different USEPA regions and/or state regulatory agencies may stipulate deviations from this document. It is the responsibility of the Project Team (Project Manager and Technical Lead) to be fully aware of the requirements from the applicable regulatory framework.

If heavy precipitation occurs and no cover over the sampling area and monitoring well can be erected, sampling must be discontinued until adequate cover is provided. Rain water could contaminate groundwater samples.

Avoid extreme weather situations. Be aware that thermal currents and vertical mixing of cold and warm water inside the well casing could create a convection cell within the well and compromise data collection (e.g., biological mechanisms).

- Direct sunlight and hot ambient temperatures may cause the groundwater in the tubing or flow-through-cell to heat up and de-gas. This may result in the loss of volatile organic compounds (VOCs) and dissolved gases. Shade the equipment from direct sunlight, keep the tubing as short as possible, and avoid the hottest times of the day. Store and/or stage empty and full sample containers and coolers out of direct sunlight.
- Sampling during freezing conditions may adversely impact the data quality objectives. USEPA recommends low-flow sampling be conducted at air temperatures above 32°F (0°C) or taking special precautions to prevent groundwater from freezing in the equipment.

It may be necessary to field filter the groundwater for some parameters (e.g., metals) during collection, depending on preservation, analytical method, and project quality objectives. The task-kick-off notes and the FIP/sampling plan will list the samples that require field filtering.

To mitigate potential cross-contamination, groundwater samples are to be collected in a pre-determined order from least impacted to more impacted based on previous analytical data. If no analytical data are available, samples are to be collected in the following order:

1. First sample the upgradient well(s).
2. Next, sample the well located furthest downgradient of the interpreted or known source.
3. The remaining wells will be progressively sampled in order from downgradient to upgradient, such that the wells closest to the interpreted or known source are sampled last.

When using a gasoline generator, this power source will be set-up at least 30 feet downwind from the well to avoid exhaust fumes to contaminate samples.

Be careful not to over-tighten lids with Teflon® liners or septa (e.g., 40-mL vials). Over-tightening can cause the glass to shatter and/or impair the integrity of the seal.

NOTE: Field logs and some forms are considered to be legal documents. All field logs and forms will be filled out in indelible ink. Do not use permanent marker or felt-tipped pens for labels on sample container or sample coolers. Permanent markers could introduce volatile constituents into the samples.

NOTE: An Arcadis employee that is appropriately trained at the correct level of internal hazardous materials/DOT (Department of Transportation) shipping must complete an Arcadis shipping determination to address applicable DOT and IATA (International Air Transport Association) shipping requirements. Review the applicable Arcadis procedures and guidance instructions for sample packaging and labeling. Prior to using air transportation, confirm air shipment is acceptable under DOT and IATA regulations.

6 HEALTH AND SAFETY CONSIDERATIONS

The HASP will be followed, as appropriate, to ensure the safety of field personnel.

Appropriate personal protective equipment (PPE) will be worn at all times in line with the task and the site-specific HASP.

Review all site-specific and procedural hazards as they are provided in the HASP, and review Job Safety Analysis (JSA) documents in the field each day prior to beginning work.

Access to wells may expose field personnel to hazardous materials such as contaminated groundwater or non-aqueous phase liquid (NAPL) (e.g., oil). Other potential hazards include pressurized wells, stinging insects that may inhabit well heads, other biologic hazards (e.g. ticks in long grass/weeds around well head), and potentially the use of sharp cutting tools (scissors, knife)—open well caps slowly and keep face and body away to allow to vent any built-up pressure; only use non-toxic peppermint oil spray for stinging insect nests; review client-specific health and safety requirements, which may preclude the use of fixed/folding-blade knives, and use appropriate hand protection. Overtightening of lids with Teflon® liners can cause the glass to shatter and create a risk for hand injuries.

Generators and cord and plug equipment will employ an overcurrent protection device such as an integrated ground fault circuit interrupter (GFCI) cord. Grundfos pump controllers will not run properly with a GFCI, so the power source will be equipped with other overcurrent protection means.

If thunder or lightning is present, discontinue sampling until 30 minutes have passed after the last occurrence of thunder or lightning.

7 PROCEDURE

The general procedure for using traditional purging and sampling techniques to sample monitoring wells are outlined below:

1. Review equipment list (**Section 4** above) to confirm that the appropriate equipment has been acquired.
2. Don PPE as required in the HASP

- a. NOTE: *Depending on site-specific security and safety considerations, this often must be done prior to entering the work area*
3. Calibrate field instruments according to manufacturer procedures for calibration and document accordingly on the calibration logs, field form, and/or field logbook
4. All equipment will either be new or decontaminated in accordance with appropriate guidance document (*TGI – Groundwater and Soil Sampling Equipment Decontamination*) prior to use
5. Record site and monitoring well identification on the groundwater sampling log (**Attachment A**), along with date, arrival time, weather conditions, personnel present, equipment utilized, and other relevant data requested on the log.
6. Label all sample containers with indelible ink
7. Place plastic sheeting adjacent to the well for use as a clean work area, if conditions allow, otherwise, exercise care to prevent sampling equipment from contacting the ground or other surface that could compromise sample integrity
8. Visually inspect the well to ensure that it is undamaged, properly labeled and secured
 - a. Damage or other conditions that may affect the integrity of the well will be recorded in the Field Activity Daily Log and brought to the attention of the designated Field Manager and/or Project Manager
 - b. Record well construction and conditions on the Groundwater Sampling Field Form (**Attachment A**)
9. Remove lock from well and if rusted or broken, replace with a new brass keyed-alike lock
10. Safely open well
 - a. Unlock and open the well cover while standing upwind of the well
 - b. Remove well cap and place on the plastic sheeting
 - c. Insert the PID probe approximately 4 to 6 inches into the casing or the well headspace and cover it with a gloved hand
 - d. Record the PID reading on the field log
 - e. Perform air monitoring in the breathing zone according to the HASP and/or JSA
11. Set the sampling device, meters, and other sampling equipment on the plastic sheeting
 - a. If a dedicated sampling device stored in the well is to be used, this may also be set temporarily on the plastic sheeting
 - b. If a dedicated sampling device is stored below the water table, removing it may compromise water-level data, so water-level measurements will be taken prior to removing the device (see next step)
12. Obtain a water-level depth and bottom-of-well depth using an electric well probe prior to placing the pump and record on the groundwater sampling log using indelible ink

- a. Make sure to decontaminate the probe(s) after each use in accord with the FIP/sampling plan or the equipment decontamination TGI

NOTE: *Water levels may be measured at all wells prior to initiating any sampling activities, depending on FIP requirements.*

13. Prepare for pump installation:

- a. For submersible and non-dedicated bladder pumps, decontaminate the pump according to site decontamination procedures
- b. Non-dedicated bladder pumps will require a new bladder and attachment of an air-line, sample discharge line, and safety cable prior to placement in the well
- c. Attach the air-line tubing to the air-port on the top of the bladder pump
- d. Attach the sample discharge tubing to the water port on the top of the bladder pump taking care not to reverse the air and discharge tubing lines during bladder pump setup, as this could result in bladder failure or rupture
- e. Attach and secure a safety cable to the eyebolt on the top of bladder pump (if present, depending on pump model used)

14. Slowly lower the pump, safety cable, tubing, and electrical lines into the well to a depth corresponding to the approximate center of the saturated screen section of the well

- a. Avoid twisting and tangling of safety cable, tubing, and electrical lines while lowering the pump into the well; twisted and tangled lines could result in the pump becoming stuck in the well casing
- b. Make sure to keep tubing and lines from touching the ground or other surfaces while introducing them into the well, as this could lead to well contamination
- c. If a peristaltic pump is being used, slowly lower the sample tubing into the well to a depth corresponding to the approximate center of the saturated screen section of the well
- d. The pump intake or sample tubing must be kept at least 2 feet above the bottom of the well to prevent mobilization of any sediment present in the bottom of the well

15. If using a bladder pump, connect the air-line to the pump controller output port

- a. The pump controller will then be connected to a supply line from an air compressor or compressed gas cylinder using an appropriate regulator and air hose
- b. Tighten the regulator connector onto the gas cylinder (if used) to prevent leaks. Teflon® tape may be used on the threads of the cylinder to provide a tighter seal
- c. Once the air compressor or gas cylinder is connected to the pump controller, turn on the compressor or open the valve on the cylinder to begin the gas flow
- d. Turn on the pump controller power if an on/off switch is present and verify that all batteries are charged and fully operating before beginning to pump

16. Calculate the number of gallons of water in the well using the length of water column (in feet).
Record the well volume on the groundwater sampling log using indelible ink
17. Remove the required purge volume of water from the well (measure purge water volume in measuring buckets)
 - a. The required purge volume will be three to five well volumes (the water column in the well screen and casing) unless the well runs dry, in which case, the water that comes into the well will be sampled (USEPA, 1986)
 - b. For wells screened across the water table, the well may be pumped dry and sampling can commence as soon as the volume in the well has recovered sufficiently to permit collection of samples
 - c. For wells screened entirely below the water table, the well may be pumped until the drawdown is at a level slightly higher than top of the well screen
 - d. Sampling may commence after one well volume has been removed and the well has recovered sufficiently to permit collection of samples
 - e. In any case, the pumping rate will be decreased during sampling to limit the potential for volatilization of organics potentially present in the groundwater
18. Field parameter measurements will be periodically collected in accordance with FIP/sampling plan specifications
 - a. Typical time intervals of field parameter measurement are (1) after each well volume removed, and (2) before sampling
 - b. If the field parameters are being measured above-ground (rather than with a downhole probe), then the final pre-sampling parameter measurement will be collected at the reduced flow rate to be used during sampling
 - c. Physical appearance of the purged water will be noted on the groundwater sampling log
 - d. Water-level measurements will be collected and recorded to verify that the well purging is in accordance with the guidelines set forth in the previous step
19. Unless otherwise specified by the applicable regulatory agencies, all purge water will be containerized
 - a. Containerized purge water will be managed in accordance with the FIP/sampling plan/work plan
 - b. If historical concentrations in the well are less than federal- or state-regulated concentrations appropriate for current land use, *and permission has been granted by the oversight regulatory agency to dispose of clean purge water on the ground next to the well(s), then purge water may be allowed to infiltrate into the ground surface downgradient from the monitoring well after the well is sampled—this will be specified in the FIP/sampling plan*

20. After the appropriate purge volume of groundwater in the well has been removed, or if the well has run dry and allowed to recover, obtain the groundwater sample needed for analysis via the dedicated bailer or from the dedicated sample tubing, pour the groundwater directly from the sampling device into the appropriate container in the order of volatilization sensitivity of the parameters sampled, and tightly screw on the cap (snug, but not too tight)

NOTE: The suggested order for sample parameter collection, based on volatilization sensitivity, is presented below:

- a. volatile organic compounds (VOCs);*
- b. semi-volatile organic compounds (SVOCs);*
- c. polychlorinated biphenyls (PCBs)/pesticides;*
- d. metals; and*
- e. wet chemistry.*

NOTE: When sampling for volatiles, water samples will be collected directly from the bailer or dedicated tubing into 40-mL vials with Teflon®-lined septa.

NOTE: For other analytical samples, sample containers for each analyte type will be filled in the order specified by the FIP/sampling plan. If a bailer is used, then the sample for dissolved metals and/or filtered PCBs will either be placed directly from the bailer into a pressure filter apparatus or pumped directly from the bailer with a peristaltic pump, through an in-line filter, into the pre-preserved sample bottle. If dedicated sample tubing is used, then the filter will be installed in-line just prior to filtered sample collection.

NOTE: If sampling for total and filtered metals and/or PCBs, a filtered and unfiltered sample will be collected. Sample filtration for the filtered sample will be performed in the field utilizing a pump prior to preservation. Attach (clamp) a new 1.0-, 0.45-, or 0.1-micron filter to the discharge tubing of the pump (note the filter flow direction). Turn the pump on and allow 100 mL (or manufacturer recommended amount) of fluid to flow through the filter before sample collection. Dispense the filtered liquid directly into the laboratory sample bottles. If bailers are used for purging and sampling, a proper volume of purge water will be placed in a disposable or decontaminated polyethylene container and pumped through the filter and into the sample container using a peristaltic pump.

21. As samples are collected, note the corresponding time on the sample label
22. Secure sample containers with packing material and maintain at approximately 4°C on wet ice contained in double Ziploc-type freezer bags stored in an insulated, durable transport cooler
23. Turn off the pump and air compressor or close the gas cylinder valve if using a bladder pump setup.
24. Slowly remove the pump, tubing, lines, and safety cable from the well
- a. If using dedicated tubing/lines, do not allow them to touch the ground or any other surfaces which could result in contamination

- b. If tubing is to be dedicated to a well, it will be folded to a length – without pinching it – that will allow the well to be capped and also facilitate retrieval of the tubing during later sampling events
 - c. Use a length of rope or string to tie the tubing to the well cap
 - d. Alternatively, if tubing and safety line are to be saved and reused for sampling the well at a later date, they may be coiled neatly and placed in a clean plastic bag that is clearly labeled with the well ID and tightly sealed before placing it in storage
25. Record the time sampling procedures were completed on the groundwater sampling field forms using indelible ink
26. Secure the well: replace the well cap and lock well or install a new lock if needed
 - a. If new locks were installed, forward copies of the keys to the client Project Manager (PM) and Arcadis CPM at the end of the sampling activities
27. Complete the procedures for chain-of-custody, handling, packing, and shipping
 - a. Chain-of-custody forms will be filled out and checked against the labels on the sample containers progressively after each sample is collected
28. Properly dispose of personal protective equipment (PPE) and disposable equipment—place all disposable sampling materials (e.g., plastic sheeting, disposable tubing or bailers, and PPE) in appropriate containers
29. Complete decontamination of sampling equipment (e.g., submersible or bladder pump) as appropriate (*TGI – Groundwater and Soil Sampling Equipment Decontamination*)
30. At the end of each day of the sampling event, perform calibration check of field instruments and record procedure and results in field log

8 WASTE MANAGEMENT

Investigation-Derived Waste (IDW), including purge water, decontamination liquids, and disposable materials (plastic sheeting, PPE, etc.) will be stored on site in appropriately labeled containers (disposable materials will be contained separately) and disposed of properly. Containers must be labeled at the time of collection and will include date, location(s), site name, city, state, and description of matrix contained (e.g., soil, PPE). Waste will be managed in accordance with the *TGI – Investigation-Derived Waste Handling and Storage*, the procedures identified in the FIP or QAPP as well as state-, federal- or client-specific requirements. Be certain that waste containers are properly labeled and documented in the field log book.

9 DATA RECORDING AND MANAGEMENT

Management of the original documents from the field will be completed in accordance with the site-specific QAPP. Records generated as a result of this TGI will be controlled and maintained in the project record files in accordance with project requirements.

In general, sampling activities will be documented on appropriate field logs as well as in a proper field notebook. All field data will be recorded in indelible ink. Field forms, logs/notes (including daily field and calibration logs), digital records, and chain-of-custody records will be maintained by the field team lead.

Initial field logs and chain-of-custody records will be transmitted to the Arcadis CPM and/or Technical Lead at the end of each day unless otherwise directed by the CPM. The field team leader retains copies of the field documentation.

Additionally, all documents (and photographs) will be scanned and electronically filed in the appropriate project directory for easy access.

10 QUALITY ASSURANCE

Quality assurance procedures will be conducted in accordance with the Arcadis Quality Management System or the site-specific QAPP.

Field-derived quality assurance blanks will be collected as specified in the FIP/sampling plan, depending on the project quality objectives. Typically, field rinse blanks (equipment blanks) will be collected when non-dedicated equipment (e.g., submersible pump) is used during groundwater sampling. Field rinse blanks will be used to confirm that decontamination procedures are sufficient and samples are representative of site conditions. Trip blanks for VOCs, which aid in the detection of contaminants from other media, sources, or the container itself, will be kept with the coolers and the sample containers throughout the sampling activities and during transport to the laboratory.

In addition to the quality control samples to be collected in accordance with this TGI, the following quality control procedures will be observed in the field:

- Collect samples from monitoring wells, in order of increasing concentration, to the extent known based on review of historical site information if available
- Equipment blanks will include the pump and tubing (if using disposable tubing) or the pump only (if using tubing dedicated to each well)
- Collect equipment blanks after wells with higher concentrations (if known) have been sampled
- Operate all monitoring instrumentation in accordance with manufacturer's instructions and calibration procedures
 - Calibrate instruments at the beginning of each day and verify the calibration at the end of each day
 - Record all calibration activities in the field notebook
- Clean all groundwater sampling equipment prior to use in the first well and after each subsequent well following the procedures outlined for equipment decontamination

11 REFERENCES

- United States Environmental Protection Agency (USEPA). 1986. RCRA Groundwater Monitoring Technical Enforcement Guidance Document (September 1986).
- USEPA. 1991. Handbook Ground Water, Volume II: Methodology, Office of Research and Development, Washington, DC. EPA/625/6-90/016b (July 1991).
- U.S. Geological Survey (USGS). 1977. National Handbook of Recommended Methods for Water-Data Acquisition: USGS Office of Water Data Coordination. Reston, Virginia.

12 ATTACHMENTS

Attachment 1 – Groundwater Sampling Field Form

ATTACHMENTS 1

Groundwater Sampling Field Form

Appendix B

Boring Logs



SITE No: 211577

DRILLER: Cascade

WELL DIAMETER: 4"

LOCATION: 631 Queen Ave, Seattle

DRILL METHOD: Hollow-Stem Auger

SCREEN INTERVAL: 10-25'

CLIENT: Chevron

SAMPLE METHOD: Split-Spoon

WELL CASING: Sch. 40 PVC

DATE: 3/15/04

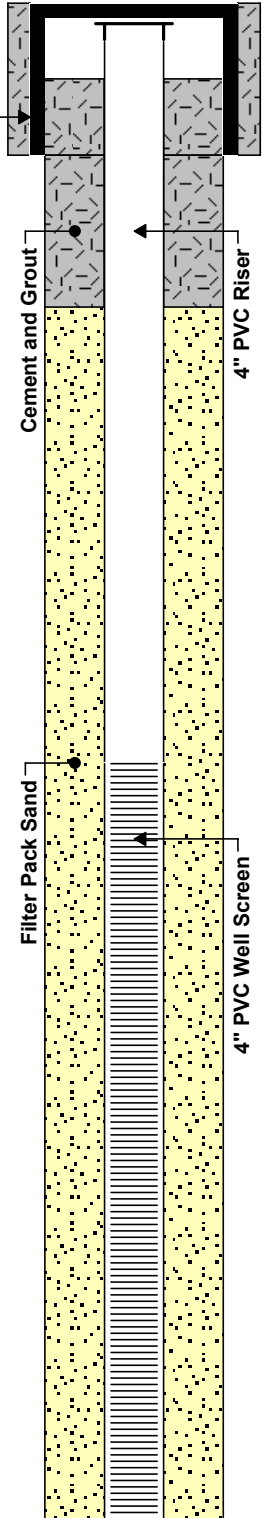
HOLE DIAMETER: 8"

FILTER PACK: 2/12 Monterey Sand

LOGGED BY: GC

HOLE DEPTH: 25'

TOC ELEVATION:

MOISTURE	PID (ppm)	BLOWS / 6"	DEPTH	GRAPHIC LOG	SAMPLE INTERVAL	DESCRIPTION	WELL COMPLETION DETAILS
			0			Ground Surface	 <p>8" Casing</p> <p>Cement and Grout</p> <p>Filter Pack Sand</p> <p>4" PVC Riser</p> <p>4" PVC Well Screen</p> <p>3/19/04</p>
			1			Previously VP-6.	
			2			No boring samples were taken. Drilled out previous well and installed a 4" well in its place.	
			3				
			4				
			5				
			6				
			7				
			8				
			9				
			10				
			11				
			12				
			13				
			14				
			15				
			16				
			17				
			18				
			19				



BORING/MONITORING WELL LOG: DPE-1/VP-6

SITE No: 211577

DRILLER: Cascade

WELL DIAMETER: 4"

LOCATION: 631 Queen Ave, Seattle

DRILL METHOD: Hollow-Stem Auger

SCREEN INTERVAL: 10-25'

CLIENT: Chevron

SAMPLE METHOD: Split-Spoon

WELL CASING: Sch. 40 PVC

DATE: 3/15/04

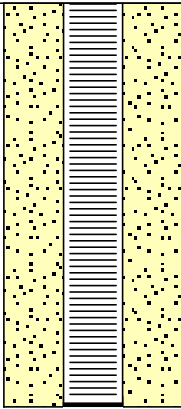
HOLE DIAMETER: 8"

FILTER PACK: 2/12 Monterey Sand

LOGGED BY: GC

HOLE DEPTH: 25'

TOC ELEVATION:

MOISTURE	PID (ppm)	BLOWS / 6"	DEPTH	GRAPHIC LOG	SAMPLE INTERVAL	DESCRIPTION	WELL COMPLETION DETAILS
			20				
			21				
			22				
			23				
			24				
			25				
			26				
			27				
			28				
			29				
			30				
			31				
			32				
			33				
			34				
			35				
			36				
			37				
			38				
			39				

SITE No: 211577

DRILLER: Cascade

WELL DIAMETER: 4"

LOCATION: 631 Queen Ave, Seattle

DRILL METHOD: Hollow-Stem Auger

SCREEN INTERVAL: 10-25'

CLIENT: Chevron

SAMPLE METHOD: Split-Spoon

WELL CASING: Sch. 40 PVC

DATE: 3/12 & 15/04

HOLE DIAMETER: 8"

FILTER PACK: 2/12 Monterey Sand



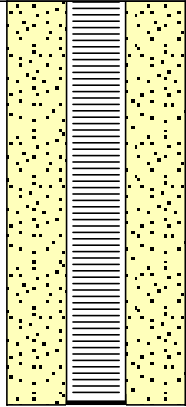




LOGGED BY: GC

HOLE DEPTH: 26'

TOC ELEVATION:

MOISTURE	PID (ppm)	BLOWS / 6"	DEPTH	GRAPHIC LOG	SAMPLE INTERVAL	DESCRIPTION	WELL COMPLETION DETAILS
			0			Ground Surface	
			1			Airknife to 8' Asphalt 0-3" bgs	
			2			Geoprobed from 8' to 20'	
			3				
			4				
			5				
			6			SAND (SP-SM) Gray, dense, medium to coarse SAND with minor gravel and silt; Hydrocarbon odor; light sheen.	
			7				
			8				
	1.6		9				
Moist to Wet	10.3		10				
	35.8		11			SAND (SP-SM) Gray to brown, SAND with minor silt and gravel; HC odor; no sheen.	
	>4040		12				
	>4040		13				
	>4040		14			SAND (SP-SM) Same as above; strong HC odor; strong sheen.	
	>4040		15				
Wet to Sat	98.6		16				
	243.3		17				
	101.5		18				
	180.3		19			SAND (SP-SM) Brown, SAND with minor gravel and silt.	

SITE No: 211577	DRILLER: Cascade	WELL DIAMETER: 4"
LOCATION: 631 Queen Ave, Seattle	DRILL METHOD: Hollow-Stem Auger	SCREEN INTERVAL: 10-25'
CLIENT: Chevron	SAMPLE METHOD: Split-Spoon	WELL CASING: Sch. 40 PVC
DATE: 3/12 & 15/04	HOLE DIAMETER: 8"	FILTER PACK: 2/12 Monterey Sand
LOGGED BY: GC	HOLE DEPTH: 26'	TOC ELEVATION:

MOISTURE	PID (ppm)	BLOWS / 6"	DEPTH	GRAPHIC LOG	SAMPLE INTERVAL	DESCRIPTION	WELL COMPLETION DETAILS
Sat	38.3	50	20			SAND (SP) Brown, very dense, medium to coarse SAND, no gravel, no silt; no odor; no sheen.	
			21				
Sat	1120	50	23			SAND (SP) Same as above.	
			24				
Dry	1350	50-4"	25			CLAY (CL) Olive gray, very hard, clay, little plasticity; no odor, no sheen.	
			26				
			27				
			28				
			29				
			30				
			31				
			32				
			33				
			34				
			35				
			36				
			37				
			38				
			39				



SOIL BORING LOG

BORING No: DPE-3

PAGE 1 of 2

PROJECT: 21-1577

DRILLER: Cascade Drilling, Inc.

WELL DIAMETER: 4-inch

LOCATION: 631 Queen Anne Ave N, Seattle, WA

DRILL METHOD: Hollow-Stem Auger

WELL DEPTH: 22 feet

CLIENT: Chevron

SAMPLE METHOD: Hand Auger, Split Spoon

WELL CASING: 2" SCH 40 PVC

DATE: 9/15/06

HOLE DIAMETER: 10.25 inches

WELL SCREEN: 10-18 feet, .010-inch slots

LOGGED BY: G. Cisneros

HOLE DEPTH: 22 feet

FILTER PACK: 16-30 Colorado Sand

CASING ELEVATION: --

Analytical Sample Number	Moisture Content	PID (ppm)	BLOWS/6"	Water Level	Sample Recovery Interval	DEPTH (ft.)	SOIL TYPE	LITHOLOGY / DESCRIPTION	Well Completion Details
						0	AS	2" of Asphalt. Airknifed to 8 feet BGS. Airknifed to 8 feet BGS.	
						1			
						2	SM	Gravelly silty SAND. Fill.	
						3			
						4			
	Moist	0	--			5	SP	Brown, fine to medium, SAND w/ <5% gravel, loose; no odor, no sheen.	
						6			
						7			
	Moist	0	--			8	SP/SM	Gray, fine to medium SAND with 1" gray and brown silt layers embedded, dense; slight odor, no sheen.	
						9			
		5.2	24			10		Brown to gray, fine to coarse SAND with 0.5 to 1" layers of silt embedded; slight odor, slight sheen. DPE-3-10 collected at 1000.	
DPE-3-10	Moist	15.7	29			11			

NOTES:



SOIL BORING LOG

BORING No: DPE-3

PAGE 2 of 2

PROJECT: 21-1577	DRILLER: Cascade Drilling, Inc.	WELL DIAMETER: 4-inch
LOCATION: 631 Queen Anne Ave N, Seattle, WA	DRILL METHOD: Hollow-Stem Auger	WELL DEPTH: 22 feet
CLIENT: Chevron	SAMPLE METHOD: Hand Auger, Split Spoon	WELL CASING: 2" SCH 40 PVC
DATE: 9/15/06	HOLE DIAMETER: 10.25 inches	WELL SCREEN: 10-18 feet, .010-inch slots
LOGGED BY: G. Cisneros	HOLE DEPTH: 22 feet	FILTER PACK: 16-30 Colorado Sand

CASING ELEVATION: --

Analytical Sample Number	Moisture Content	PID (ppm)	BLOWS/6"	Water Level	Sample Recovery Interval	DEPTH (ft.)	SOIL TYPE	LITHOLOGY / DESCRIPTION	Well Completion Details
DPE-3-12.5	Moist	15.7	31			12	SP/SM	Same as above; brown to gray, fine to coarse SAND with 0.5 to 1" layers of silt embedded; slight odor, slight sheen.	
	Moist	78.8	27			13		Gray, fine to medium SAND, no silt; no odor, slight odor. DPE-3-12.5 collected at 1020.	
	Moist	15.7	50			14		Water level indicator (inverted triangle) at approximately 14.5 ft depth.	
	Moist	1088	31			15	SP	Same as above; strong odor, strong sheen. Grades to fine to medium SAND with 5% silt; no odor, no sheen. DPE-3-15 collected at 1030.	
	Moist	26.3	50			16		Brown to slightly gray, fine to medium SAND with 5% silt; slight odor, slight sheen.	
		78	13			17		Brown to slightly gray, fine to medium SAND with 5% silt; slight odor, slight sheen.	
		15	15			18		Brown to slightly gray, fine to medium SAND with 5% silt; slight odor, slight sheen.	
		26	17			19		Brown to slightly gray, fine to medium SAND with 5% silt; slight odor, slight sheen.	
						20	ML	Brown to gray, clayey silt to silty clay; no odor, no sheen.	
						21		Brown to gray, clayey silt to silty clay; no odor, no sheen.	
						22		Brown to gray, clayey silt to silty clay; no odor, no sheen.	
Total depth = 22 ft bgs									

NOTES:



SOIL BORING LOG

BORING No: DPE-4

PAGE 1 of 3

PROJECT: 21-1577

DRILLER: Cascade Drilling, Inc.

WELL DIAMETER: 4-inch

LOCATION: 631 Queen Anne Ave N, Seattle, WA

DRILL METHOD: Hollow-Stem Auger

WELL DEPTH: 23.5 feet

CLIENT: Chevron

SAMPLE METHOD: Hand Auger, Split Spoon

WELL CASING: 2" SCH 40 PVC

DATE: 9/14-15/06

HOLE DIAMETER: 10.25 inches

WELL SCREEN: 10.5-20.5 feet, .010-inch slots

LOGGED BY: G. Cisneros

HOLE DEPTH: 23.5 feet

FILTER PACK: 16-30 Colorado Sand

CASING ELEVATION: --

Analytical Sample Number	Moisture Content	PID (ppm)	BLOWS/6"	Water Level	Sample Recovery Interval	DEPTH (ft.)	SOIL TYPE	LITHOLOGY / DESCRIPTION	Well Completion Details
						0	AS	Asphalt Airknifed to 8 feet BGS.	
						1			
						2		Brown, silty gravelly SAND; no odor.	
						3			
						4			
	Moist	0	--			5		Brown, fine to medium SAND, 5% silt, loose; no odor, no sheen.	
						6	SP/SM		
						7			
	Moist	0	--			8		Brown to dark brown, fine to medium SAND, 10% silt, dense; slight odor, no sheen.	
						9			
			20			10		Brown to dark brown, fine to medium SAND, 10% silt, medium dense; slight odor, no sheen.	
		0	23			11			

NOTES:



SOIL BORING LOG

BORING No: DPE-4

PAGE 2 of 3

PROJECT: 21-1577	DRILLER: Cascade Drilling, Inc.	WELL DIAMETER: 4-inch
LOCATION: 631 Queen Anne Ave N, Seattle, WA	DRILL METHOD: Hollow-Stem Auger	WELL DEPTH: 23.5 feet
CLIENT: Chevron	SAMPLE METHOD: Hand Auger, Split Spoon	WELL CASING: 2" SCH 40 PVC
DATE: 9/14-15/06	HOLE DIAMETER: 10.25 inches	WELL SCREEN: 10.5-20.5 feet, .010-inch slots
LOGGED BY: G. Cisneros	HOLE DEPTH: 23.5 feet	FILTER PACK: 16-30 Colorado Sand

CASING ELEVATION: --

Analytical Sample Number	Moisture Content	PID (ppm)	BLOWS/6"	Water Level	Sample Recovery Interval	DEPTH (ft.)	SOIL TYPE	LITHOLOGY / DESCRIPTION	Well Completion Details
DPE-4-13	Moist	0	21	▼	12-13	12	SP/SM	Same as above.	↑
		78.9 2546	25 26 22		13-14	13 14			
DPE-4-16	Wet	79	15	▼	15-16	15	SP	Brown to gray, fine to medium SAND, medium density; moderate hydrocarbon odor, moderate sheen. DPE-4-13 collected at 1330.	↑
		194	13 17		16-17	16 17			
	Wet	163	36 50	▼	18-19	18	ML/CL	Gray, medium to coarse SAND, no silt, no gravel; slight odor, no sheen.	↑
		0	9		19-20	19			
		0	11	▼	20-21	20	ML/CL	Brownish gray, soft clayey silt to silt clay.	↑
		0	10		21-22	21			
				▼	22-23	22			↑

16-30 Colorado Sand

Sump

NOTES:



SOIL BORING LOG

BORING No: DPE-4

PAGE 3 of 3

PROJECT: 21-1577

DRILLER: Cascade Drilling, Inc.

WELL DIAMETER: 4-inch

LOCATION: 631 Queen Anne Ave N, Seattle, WA

DRILL METHOD: Hollow-Stem Auger

WELL DEPTH: 23.5 feet

CLIENT: Chevron

SAMPLE METHOD: Hand Auger, Split Spoon

WELL CASING: 2" SCH 40 PVC

DATE: 9/14-15/06

HOLE DIAMETER: 10.25 inches

WELL SCREEN: 10.5-20.5 feet, .010-inch slots

LOGGED BY: G. Cisneros

HOLE DEPTH: 23.5 feet

FILTER PACK: 16-30 Colorado Sand

CASING ELEVATION: --

Analytical Sample Number	Moisture Content	PID (ppm)	BLOWS/6"	Water Level	Recovery Interval	Sample Interval	DEPTH (ft.)	SOIL TYPE	LITHOLOGY / DESCRIPTION	Well Completion Details
							23	ML/CL	Same as above.	
							24		Total depth = 23.5 ft bgs	
							25			
							26			
							27			
							28			
							29			
							30			
							31			
							32			
							33			

NOTES:

BORING LOG

Well No: DPE-5

Chevron Site No: 211577

Site Location: 631 QUEEN ANNE AVE N SEATTLE WA

Date: 10/26/2005 - 10/31/2005



Well Diameter: 4 in

Well Depth: 28 Ft

Well Screen: 14-24 Ft 10 Slot

Filter Pack: 16/30 Colorado Snd

Driller: Cascade Drilling, Inc.

Drilling Method: Sonic Drilling

Consultant: SAIC

Well Casing: Sch 40 PVC

Elevation (TOC): 146.68 Ft

Total Depth: 28.0 Ft

GW Depth: 18.0 Ft

Recov.	Depth Ft	Moist.	Blow Cnt	PPM	Soil Code	Soil Pattern	Soil Description	Well Construction
	0						Concrete and Asphalt. Airknife to 10 feet bgs.	<p>Casing Stainless Steel Well Box</p> <p>Grout Concrete</p> <p>Seal Bentonite Chips</p>
	5	Moist			SW	.....	Brown, very dense, fine to coarse SAND with silt and gravel.	
	10	Moist			SP	.....	Brown, dense, fine to medium SAND.	



BORING LOG

Well No: DPE-5

Chevron Site No: 211577

Site Location: 631 QUEEN ANNE AVE N SEATTLE WA

Date: 10/26/2005 - 10/31/2005



Well Diameter: 4 in

Well Depth: 28 Ft

Well Screen: 14-24 Ft 10 Slot

Filter Pack: 16/30 Colorado Sand

Driller: Cascade Drilling, Inc.

Drilling Method: Sonic Drilling

Consultant: SAIC

Well Casing: Sch 40 PVC

Elevation (TOC): 146.68 Ft

Total Depth: 28.0 Ft

GW Depth: 18.0 Ft

Recov.	Depth Ft	Moist.	Blow Cnt	PPM	Soil Code	Soil Pattern	Soil Description	Well Construction
	10	Moist		45.1	SW	Brown to gray, dense, fine to coarse SAND with 10% gravel and 5% silt; no odor; no sheen.	<p>Seal Bentonite Chips</p> <p>Filter Pack 16/30 Colorado Sand</p> <p>Screen 10 Slot Sch. 40 PVC</p>
		Moist		86.9		.....	Same as above; moderate odor; strong sheen.
	15	Moist		215	SP	.....	Gray, fine to medium SAND with 10% silt and no gravel; strong odor; moderate sheen.
		Moist		2073		.....	Gray, fine to medium SAND, no gravel, no silt; strong odor; moderate sheen.
		Wet		2214	SM-SP	.....	Gray, fine to medium SAND with two 2-inch silt layers interbedded; no gravel; strong odor; moderate sheen.
		Moist		2806	ML	.....	Brown, reddish, sandy silt with 15% fine to medium sand and 5% gravel; dropstones and iron oxidation present; slight HC odor; slight sheen. (TILL?)
		Moist		1656		.....	
	20	Moist		1165	SP	.....	



BORING LOG

Well No: DPE-5

Chevron Site No: 211577

Site Location: 631 QUEEN ANNE AVE N SEATTLE WA

Date: 10/26/2005 - 10/31/2005



Well Diameter: 4 in

Well Depth: 28 Ft

Well Screen: 14-24 Ft 10 Slot

Filter Pack: 16/30 Colorado Snd

Driller: Cascade Drilling, Inc.

Drilling Method: Sonic Drilling

Consultant: SAIC

Well Casing: Sch 40 PVC

Elevation (TOC): 146.68 Ft

Total Depth: 28.0 Ft

GW Depth: 18.0 Ft

Recov.	Depth Ft	Moist.	Blow Cnt	PPM	Soil Code	Soil Pattern	Soil Description	Well Construction
█	20	Moist		1569	SP		Gray, fine to coarse SAND with 5% silt and 10% gravel; moderate HC odor; moderate sheen.	<p>Filter Pack 16/30 Colorado Sand</p> <p>Screen 10 Slot Sch. 40 PVC</p> <p>Sump</p> <p>Backfill</p>
		Wet		1412	ML		Gray, fine sandy SILT with 15% SAND; moderate HC odor; strong sheen.	
		Wet		2107	SP-SM		Brown to slightly gray, fine to coarse SAND with 15% gravel and 10% silt; strong HC odor; strong sheen.	
				782				
				852				
				176				
	25	Dry		217	ML/CL		Gray, SILT with moderate plasticity and 10% gravel in upper 1.5 feet; no odor; no sheen.	
				29				
				31.8				
				40.0				
	28.0							



BORING LOG

Well No: DPE-6

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle, WA

Date: 10/17/2005



Well Diameter: 4 inches

Well Depth: 33.5 ft

Well Screen: 15.5-30.5 ft 10-Slot

Filter Pack: 16/30 Colorado Snd

Driller: Cascade Drilling, Inc.

Method: AirPercussion, Hollow Stem

Consultant: Gabriel Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 146.19 msl

Total Depth: 33.5 Ft

GW Depth: 19.5 Ft

Recov.	Depth Ft	Moist.	Blow Cnt	OVM	Soil Code	Soil Pattern	Soil Description	Well Construction
	0							<p>Casing Stainless Steel Casing</p> <p>Grout Quickset</p> <p>Concrete/Quickset</p> <p>Seal Bentonite</p>
		Moist			SW		Asphalt top 2-inches. Airknifed to 8 feet bgs. FILL: Brown, silty, gravelly SAND with chunks of concrete.	
	5							
		Moist					Gray to brown, silty, fine to medium SAND with a silt layer at 8.25 feet and organics, no gravel; no odor; no sheen.	
			8/13/16		SP-SM		Brown, fine to coarse SAND with thin interbeds of silt; less than 5% silt in sand beds, no gravel; slight odor; moderate sheen.	
	10							
		Moist					Brown to gray, fine to medium, SAND interbedded with thin, organic, gray silt layers; no gravel and less than 5% silt in sandy layers; slight odor; moderate sheen in sandy layers.	
			15/50					
	12							



BORING LOG

Well No: DPE-6

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle, WA

Date: 10/17/2005



Well Diameter: 4 inches

Well Depth: 33.5 ft

Well Screen: 15.5-30.5 ft 10-Slot

Filter Pack: 16/30 Colorado Snd

Driller: Cascade Drilling, Inc.

Method: AirPercussion, Hollow Stem

Consultant: Gabriel Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 146.19 msl

Total Depth: 33.5 Ft

GW Depth: 19.5 Ft

Recov.	Depth Ft	Moist.	Blow Cnt	OVM	Soil Code	Soil Pattern	Soil Description	Well Construction
	12	Moist					Same as above; moderate odor; moderate sheen.	
			50				Same as above.	
	15	Moist			SP-SM		Same as above; Brown to gray, fine to medium SAND with a 2-inch silt layer at top and 1-inch silt layer at bottom; 10% silt in sand layers; HC odor; moderate sheen.	
		Moist	50				Same as above.	
		Moist					Same as above; moderate HC odor; moderate sheen.	
			16/50				Orangish brown; fine to medium SAND; no silt; no gravel; no odor; no sheen.	
	20	Moist			SP-SM		Gray, silty, fine to medium SAND with 30% silt and an organic silt layer at top; strong HC odor; moderate sheen.	
			13/32/50		SP		Gray, fine to medium SAND with 5% silt; moderate HC odor; moderate sheen.	
		Moist			SM		Gray, fine, silty SAND with 30% silt; moderate odor; no sheen.	
		Wet					Same as above.	
		Wet	50		SP		Orangish brown, fine to coarse SAND with 5% silt; no gravel; slight HC odor; slight sheen.	



BORING LOG

Well No: DPE-6

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle, WA

Date: 10/17/2005



Well Diameter: 4 inches

Well Depth: 33.5 ft

Well Screen: 15.5-30.5 ft 10-Slot

Filter Pack: 16/30 Colorado Snd

Driller: Cascade Drilling, Inc.

Method: AirPercussion, Hollow Stem

Consultant: Gabriel Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 146.19 msl

Total Depth: 33.5 Ft

GW Depth: 19.5 Ft

Recov.	Depth Ft	Moist.	Blow Cnt	OVM	Soil Code	Soil Pattern	Soil Description	Well Construction
	24	Wet						
	25	Sat	50		SP		Same as above; no odor; no sheen.	
		Sat.	50				Gray, fine to medium SAND; no silt; no gravel; no odor; no sheen.	
		Sat.					Same as above; no odor; no sheen.	
	30	Moist	13/22/37		ML/CL		Gray, hard, SILT with low plasticity; no odor; no sheen.	

BORING LOG

Well No: DPE-7

Chevron Site No: 211577

Site Location: 631 Queen Anne N, Seattle, WA

Date: 10/17/2005 - 10/21/2005



Well Diameter: 4 inches

Well Depth: 32 ft

Well Screen: 11-29 ft 10-Slot

Filter Pack: 16/30 Colorado Snd

Driller: Cascade Drilling, Inc.

Method: AirPercussion, Hollow Stem

Consultant: Gabriel Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 146.02 msl

Total Depth: 33.5 Ft

GW Depth: 23.0 Ft

Recov.	Depth Ft	Moist.	Blow Cnt	OVM	Soil Code	Soil Pattern	Soil Description	Well Construction
	0							
	5	Moist			SW		Asphalt top 2-inches Silty, gravelly, fine to coarse SAND with blocks of concrete and large rocks; (FILL). Airknifed down to 8 feet bgs.	
					SM		Silty, hard SAND (Till?)	
	9	Moist	3/4/8	7.5			Gray, dark brown, silty fine-grained SAND with 13% silt and large angular clasts of silt; no odor; no sheen.	



BORING LOG

Well No: DPE-7

Chevron Site No: 211577

Site Location: 631 Queen Anne N, Seattle, WA

Date: 10/17/2005 - 10/21/2005



Well Diameter: 4 inches

Well Depth: 32 ft

Well Screen: 11-29 ft 10-Slot

Filter Pack: 16/30 Colorado Snd

Driller: Cascade Drilling, Inc.

Method: AirPercussion, Hollow Stem

Consultant: Gabriel Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 146.02 msl

Total Depth: 33.5 Ft

GW Depth: 23.0 Ft

Recov.	Depth Ft	Moist.	Blow Cnt	OVM	Soil Code	Soil Pattern	Soil Description	Well Construction
	9		3/4/8	7.5	SM	Gray, dark brown, silty fine-grained SAND with 13% silt and large angular clasts of silt; no odor; no sheen.	
	10	Moist	5/8	8.3		.....	
			11	722	SP	.....	Gray to dark gray, fine to medium SAND with 5% silt, no gravel; strong HC odor; moderate sheen.
		Moist	8/11	182		.....	Light brown, fine to medium SAND with no silt and no gravel; slight odor; slight sheen.
		Moist	11	16.7	SM	.....	Light brown to gray, silty fine SAND with 20% silt and no gravel; slight HC odor; slight sheen.
	15	Moist	2/11	573	SM-SP	.....	Light gray to brown, fine to medium SAND with 10% silt, no gravel; moderate HC odor; slight sheen.
		Moist	16	17.6		.....	Same as above but with 5% silt and a 2-inch thick silt/clay layer interbedded within fine SAND; slight HC odor; slight sheen.
			14/14	231	SP	.....	Brown, fine to coarse SAND with no silt and no gravel; slight odor; moderate sheen.
	18	Wet				.....	



BORING LOG

Well No: DPE-7

Chevron Site No: 211577

Site Location: 631 Queen Anne N, Seattle, WA

Date: 10/17/2005 - 10/21/2005



Well Diameter: 4 inches

Well Depth: 32 ft

Well Screen: 11-29 ft 10-Slot

Filter Pack: 16/30 Colorado Sand

Driller: Cascade Drilling, Inc.

Method: AirPercussion, Hollow Stem

Consultant: Gabriel Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 146.02 msl

Total Depth: 33.5 Ft

GW Depth: 23.0 Ft

Recov.	Depth Ft	Moist.	Blow Cnt	OVM	Soil Code	Soil Pattern	Soil Description	Well Construction	
	18	Wet	14/14	231	SP		Brown, fine to coarse SAND with no silt and no gravel; slight odor; moderate sheen.		
		Wet							Gray, fine medium SAND with 5% silt; no gravel; slight odor; moderate sheen.
	20		12/16	17					Same as above but with a 2-inch silt layer interbedded within the sand at 20.5' bgs; strong HC odor; strong sheen.
		Wet	22	580					
			13/18	527					
			18	630	ML		Gray, stiff SILT with moderate plasticity; moderate HC odor; strong sheen.		
	25	Wet							
			Sat.	22/50	590	SP			Gray, fine to medium SAND with no silt and no gravel; strong HC odor; moderate to heavy sheen.
	27								



BORING LOG

Well No: DPE-7

Chevron Site No: 211577

Site Location: 631 Queen Anne N, Seattle, WA

Date: 10/17/2005 - 10/21/2005



Well Diameter: 4 inches

Well Depth: 32 ft

Well Screen: 11-29 ft 10-Slot

Filter Pack: 16/30 Colorado Snd

Driller: Cascade Drilling, Inc.

Method: AirPercussion, Hollow Stem

Consultant: Gabriel Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 146.02 msl

Total Depth: 33.5 Ft

GW Depth: 23.0 Ft

Recov.	Depth Ft	Moist.	Blow Cnt	OVM	Soil Code	Soil Pattern	Soil Description	Well Construction
	27	Sat.	10/30	450	SP		Gray, fine to coarse SAND with no silt and 5% gravel; moderate HC odor; no sheen.	
			48	384				
	30	Moist	7/9	402	ML/CL		Gray, clayey SILT with moderate to high plasticity; slight odor; very slight sheen at bottom.	
			11	15.8				



SOIL BORING LOG

BORING No: DPE-8

PAGE 1 of 3

PROJECT: 21-1577

DRILLER: Cascade Drilling, Inc.

WELL DIAMETER: 4-inch

LOCATION: 631 Queen Anne Ave N, Seattle, WA

DRILL METHOD: <20 BGS Geoprobe, >20 BGS HSA

WELL DEPTH: 24 feet

CLIENT: Chevron

SAMPLE METHOD: Hand Auger, Split Spoon

WELL CASING: 2" SCH 40 PVC

DATE: 9/18/06

HOLE DIAMETER: 10.25 inches

WELL SCREEN: 10-20 feet, .010-inch slots

LOGGED BY: G. Cisneros

HOLE DEPTH: 24 feet

FILTER PACK: 16-30 Colorado Sand

CASING ELEVATION: --

Analytical Sample Number	Moisture Content	PID (ppm)	BLOWS/6"	Water Level	Sample Recovery Interval	DEPTH (ft.)	SOIL TYPE	LITHOLOGY / DESCRIPTION	Well Completion Details
						0	GW	Top 6" is peagravel, thin asphalt layer at 6" BGS.	
						1	SW	Airknife to 8 feet BGS. Drilled out MW-22 and replaced with DPE-8 (log used for MW-22 from 0 to 20 ft bgs). Fill - sand with little gravel no silt	
						2			
						3			
	Dry/Moist	2.9				4	SP	Brownish gray, dense medium to coarse SAND, 5% gravel; no odor, no sand.	
						5			
	Dry/Moist	4.2				6	SP/SM	Light brown to reddish speckled, dense fine to medium SAND, 1" silty SAND layers, 10% silt, 5% gravel; no odor, no sheen.	
						7			
	Dry	4.2				8			
	Moist	5.5				9	ML	Light brown, very hard sandy SILT, 5% clay, 15-20% sand; no odor, no sheen.	
	Moist	278				10			
	Moist	30				11	SP	10-11' gray, very dense fine to medium SAND, 5% silt, moderate hydrocarbon odor, slight sheen.	

NOTES:



SOIL BORING LOG

BORING No: DPE-8

PAGE 2 of 3

PROJECT: 21-1577	DRILLER: Cascade Drilling, Inc.	WELL DIAMETER: 4-inch
LOCATION: 631 Queen Anne Ave N, Seattle, WA	DRILL METHOD: <20 BGS Geoprobe, >20 BGS HSA	WELL DEPTH: 24 feet
CLIENT: Chevron	SAMPLE METHOD: Hand Auger, Split Spoon	WELL CASING: 2" SCH 40 PVC
DATE: 9/18/06	HOLE DIAMETER: 10.25 inches	WELL SCREEN: 10-20 feet, .010-inch slots
LOGGED BY: G. Cisneros	HOLE DEPTH: 24 feet	FILTER PACK: 16-30 Colorado Sand

CASING ELEVATION: --

Analytical Sample Number	Moisture Content	PID (ppm)	BLOWS/6"	Water Level	Sample Recovery Interval	DEPTH (ft.)	SOIL TYPE	LITHOLOGY / DESCRIPTION	Well Completion Details
	Damp	29.1		▼		12		11-12' Same as above; moderate odor, slight sheen.	
	Moist	8.6				13	SP	12-13' Same as above, no silt, 5% gravel; strong odor, strong sheen.	
	Moist	78.9				14		13-14' Same as above; strong odor, strong sheen.	
	Wet					15		14-15' Same as above; strong odor, strong sheen.	
	Sat.	82				16		15-16' Same as above; strong odor, strong sheen.	
	Sat.	5900				17		16-17' gray, dense fine to coarse SAND, <5% silt, 5% gravel; strong odor, moderate sheen.	
	Wet	6100				18	SW	17-18' Same as above; strong odor, moderate sheen.	
	Wet	5836				19		18-19' Same as above; strong odor, moderate sheen.	
	Wet	2058				20	ML	19-20' gray to brown, very hard clayey silt, 10% sand, moderate plasticity; slight odor, no sheen.	
	Wet	257				21	CL/ML	Brownish gray CLAY, high plasticity; slight odor, no sheen.	
		32				22			
		50				23	ML	Gray, clayey SILT; no odor, no sheen.	

NOTES:



SOIL BORING LOG

BORING No: DPE-8

PAGE 3 of 3

PROJECT: 21-1577

DRILLER: Cascade Drilling, Inc.

WELL DIAMETER: 4-inch

LOCATION: 631 Queen Anne Ave N, Seattle, WA

DRILL METHOD: <20 BGS Geoprobe, >20 BGS HSA

WELL DEPTH: 24 feet

CLIENT: Chevron

SAMPLE METHOD: Hand Auger, Split Spoon

WELL CASING: 2" SCH 40 PVC

DATE: 9/18/06

HOLE DIAMETER: 10.25 inches

WELL SCREEN: 10-20 feet, .010-inch slots

LOGGED BY: G. Cisneros

HOLE DEPTH: 24 feet

FILTER PACK: 16-30 Colorado Sand

CASING ELEVATION: --

Analytical Sample Number	Moisture Content	PID (ppm)	BLOWS/6"	Water Level	Recovery	Sample Interval	DEPTH (ft.)	SOIL TYPE	LITHOLOGY / DESCRIPTION	Well Completion Details
							23	ML	Same as above.	
							24		Total depth = 24 ft bgs	
							25			
							26			
							27			
							28			
							29			
							30			
							31			
							32			
							33			

NOTES:



SOIL BORING LOG

BORING No: DPE-9

PAGE 1 of 2

PROJECT: 21-1577

DRILLER: Cascade Drilling, Inc.

WELL DIAMETER: 4-inch

LOCATION: 631 Queen Anne Ave N, Seattle, WA

DRILL METHOD: Hollow Stem Auger

WELL DEPTH: 19.5 feet

CLIENT: Chevron

SAMPLE METHOD: Hand Auger, Split Spoon

WELL CASING: 2" SCH 40 PVC

DATE: 9/18/06

HOLE DIAMETER: 10.25 inches

WELL SCREEN: 10.5-15.5 feet, .010-inch slots

LOGGED BY: G. Cisneros

HOLE DEPTH: 21.5 feet

FILTER PACK: 16-30 Colorado Silica Sand

CASING ELEVATION: --

Analytical Sample Number	Moisture Content	PID (ppm)	BLOWS/6"	Water Level	Sample		DEPTH (ft.)	SOIL TYPE	LITHOLOGY / DESCRIPTION	Well Completion Details
					Recovery	Interval				
								AS Asphalt		
								Fill Fill Material. Airknife to 8 feet BGS		
							1			
							2	SP/SM	Silty SAND/ sandy SILT.	
							3			
							4		Sand increases.	
	Moist	0					5	SP	Brown fine to medium SAND, no silt; no odor, no sheen.	
							6			
							7		7-7.5' Silt	
	Moist	0					8		Brown to gray fine to medium SAND, 10-15% silt, silt layers embedded; no odor, no sheen.	
							9	SP/SM		
			26				10		Brown fine to medium Sand, 1" silt layers embedded; no odor, no sheen.	
	Moist	0	38				11			

NOTES:



SOIL BORING LOG

BORING No: DPE-9

PAGE 2 of 2

PROJECT: 21-1577	DRILLER: Cascade Drilling, Inc.	WELL DIAMETER: 4-inch
LOCATION: 631 Queen Anne Ave N, Seattle, WA	DRILL METHOD: Hollow Stem Auger	WELL DEPTH: 19.5 feet
CLIENT: Chevron	SAMPLE METHOD: Hand Auger, Split Spoon	WELL CASING: 2" SCH 40 PVC
DATE: 9/18/06	HOLE DIAMETER: 10.25 inches	WELL SCREEN: 10.5-15.5 feet, .010-inch slots
LOGGED BY: G. Cisneros	HOLE DEPTH: 21.5 feet	FILTER PACK: 16-30 Colorado Silica Sand

CASING ELEVATION: --

Analytical Sample Number	Moisture Content	PID (ppm)	BLOWS/6"	Water Level	Sample Recovery Interval	DEPTH (ft.)	SOIL TYPE	LITHOLOGY / DESCRIPTION	Well Completion Details
DPE-9-13.5	Moist	0	21			12	SP/SM	Same as above.	
	Wet	0	27			13	SP	Brown (gray at 13'), fine to medlum SAND, no silt; strong odor, strong sheen. DPE-9-13.5 collected at 1000.	
	Moist	390	21			15		Gray, clayey SILT; slight odor, slight sheen.	
	Moist	51	50			16	ML/CL	Gray, clayey SILT, 5% sand, 5 % fines; slight odor, slight sheen.	
	Moist	0	50		18	ML/CL	Gray, clayey SILT, 5% sand, 5 % fines; slight odor, slight sheen.		
	Moist	0	50		20	ML/CL	Gray, clayey SILT, 5% sand, 5 % fines; slight odor, slight sheen.		
							22	Total depth = 21.5 ft bgs	

NOTES:

WELL/BORING LOCATION MAP

Delta Environmental Consultants, Inc.

WELL/BORING: DVP-1

INSTALLATION DATE: 9/12/02

DRILLING METHOD: Hand Auger

PROJECT: TW21577

SAMPLING METHOD: DM Split Spoon

CLIENT: Chevron 21-1577

BORING DIAMETER: 3"

LOCATION: 631 Queen Anne Ave No.

BORING DEPTH: 7'

CITY: Seattle

WELL CASING: 1/4" Stainless Steel

STATE: WA

WELL SCREEN: 0.02 Hole Dia. Screen

DRILLER: Cascade

SAND PACK: 0.25 - 2.0 (2 X12)

WELL/BORING COMPLETION	FIRST ▽	STABILIZED ▼	MOISTURE	PID (ppm)	DEPTH (FEET)	RECOVERY	SAMPLE INTERVAL	USCS SYMBOL	GRAPHIC	CASING ELEVATION
										SURVEY DATE:
										DTW:
										DESCRIPTION/LOGGED BY: SHAWN MADISON
			DP	1480	1			SP		CONCRETE
			WT		1			SM		SAND: brown; <5% fines; fine to medium sand, no odor.
			WT		2			SM		SILTY SAND: gray; 25% fines; ;fine sand; odor; sheen.
					2			CL		CLAY: brownish gray; medium plasticity; odor.
					3			SM		SILTY SAND: gray; 10% fines; fine to medium sand; odor; sheen.
					4					@3.5' Same as above but 25% silt.
				2000	5					
	▽	▼			6			SP		SAND: gray;<5% fines; fine sand; odor; sheen.
			SAT	2000	7					
					8					
					9					
					10					
					11					

Ⓐ = 1 Inch PVC monitoring well with 0.010 slotted screen. Well screened from 3' to 7'. Well abandoned after purging and sampling on 9/12/02.

WELL/BORING LOCATION MAP

Delta Environmental Consultants, Inc.

WELL/BORING: DVP-2

INSTALLATION DATE: 9/12/02

DRILLING METHOD: Hand Auger

PROJECT: TW21577

SAMPLING METHOD: DM Split Spoon

CLIENT: Chevron 21-1577

BORING DIAMETER: 3"

LOCATION: 631 Queen Anne Ave No.

BORING DEPTH: 7'

CITY: Seattle

WELL CASING: 1/4" Stainless Steel

STATE: WA

WELL SCREEN: 0.02 Hole Dia. Screen

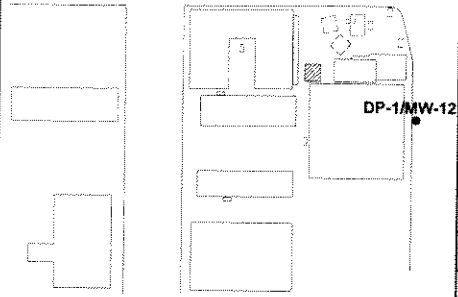
DRILLER: Cascade

SAND PACK: 0.25 - 2.0 (2 X12)

WELL/BORING COMPLETION	FIRST ▽	STABILIZED ▼	MOISTURE	PID (ppm)	DEPTH (FEET)	RECOVERY SAMPLE INTERVAL	USCS SYMBOL	GRAPHIC	CASING ELEVATION
									SURVEY DATE:
									DTW:
									DESCRIPTION/LOGGED BY: SHAWN MADISON
			DP				SP	CONCRETE	
				13.9	1			SAND: brown; <5% fines; very fine to fine sand; no odor.	
			WT		2			SAND: brownish gray; <5% fines; very fine to fine sand; odor	
								*Sand is inter bedded with layers of silt less than 0.25" thick.	
			WT	649	3				
					4		SM	SILTY SAND: gray; 10% fines; very fine to fine sand; odor.	
			WT		5				
				1327	6		SP	SAND: gray; <5% fines; fine sand; odor.	
	▽	▼	SAT		7				
					8				
					9				
					10				
					11				

(A) = 1 Inch PVC monitoring well with 0.010 slotted screen. Well screened from 3' to 7'. Well abandoned after purging and sampling on 9/12/02.

WELL/BORING LOCATION MAP



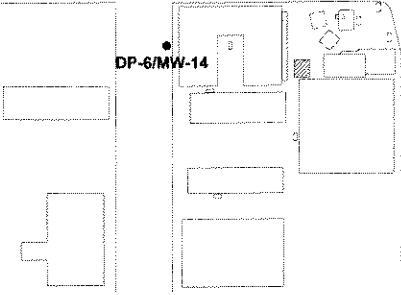
Delta Environmental Consultants, Inc.

WELL/BORING: DB-1
MW-12

INSTALLATION DATE: 9/26/02	DRILLING METHOD: Hollow Stem Auger
PROJECT: TW21577	SAMPLING METHOD: DM Split Spoon
CLIENT: Chevron 21-1577	BORING DIAMETER: 8 "
LOCATION: 631 Queen Anne Ave No.	BORING DEPTH: 17'
CITY: Seattle	WELL CASING: SCH 40 PVC 2"
STATE: WA	WELL SCREEN: 7-17' (0.010")
DRILLER: Cascade	SAND PACK: 5-17' (2 X12)

WELL/BORING COMPLETION	FIRST	STABILIZED	MOISTURE	PID (ppm)	DENSITY BLOWS / 6"	DEPTH (FEET)	RECOVERY	SAMPLE INTERVAL	USCS SYMBOL	GRAPHIC	CASING ELEVATION	113.36
	▽	▼									SURVEY DATE:	9/26/02
											DTW:	13.0
DESCRIPTION/LOGGED BY: MATT MILLER												
Concrete						1			SP	Concrete surface		
Bentonite						2				SAND: dark brown; trace fines; very fine to fine sand; 10% medium to coarse sand; trace gravel; very dense; no hydrocarbon odor.		
						3						
						4						
						5						
						6						
						7						
						8						
						9						
						10			SP			
Sand			DP	6	50-6"	11						
						12						
						13						
						14						
						15			SM	SILTY SAND: dark grayish brown; 20% fines; very fine to fine sand; trace to 5% medium to coarse sand; very dense; no hydrocarbon odor		
			WT	10	19 50-6"	16						
						17				Refusal @17' (concrete); Driller was reasonably certain that a concrete slab was encountered based on the action of the drilling during refusal.		
						18						
						19						
						20						
						21						
						22						

WELL/BORING LOCATION MAP



Delta Environmental Consultants, Inc.

WELL/BORING: DB-6
MW-14

INSTALLATION DATE: 9/25/02

DRILLING METHOD: Hollow Stem Auger

PROJECT: TW21577

SAMPLING METHOD: DM Split Spoon

CLIENT: Chevron 21-1577

BORING DIAMETER: 8 "

LOCATION: 631 Queen Anne Ave No.

BORING DEPTH: 26.5'

CITY: Seattle

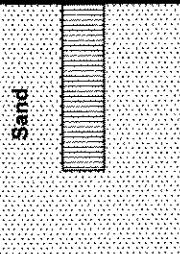

WELL CASING: SCH 40 PVC 2"

STATE: WA

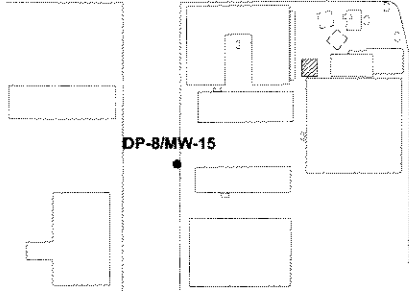
WELL SCREEN: 10-25' (0.010")

DRILLER: Cascade

SAND PACK: 7-26.5' (2 X12)

WELL/BORING COMPLETION	FIRST	STABILIZED	MOISTURE	PID (ppm)	DENSITY BLOWS / 6"	DEPTH (FEET)	RECOVERY SAMPLE INTERVAL	USCS SYMBOL	GRAPHIC	CASING ELEVATION	101.64
										SURVEY DATE:	9/26/02
										DTW:	
											DESCRIPTION/LOGGED BY: MATT MILLER
			WT	180	9 12 12	23		SP		CLAY: dark gray; moderate plasticity; trace very fine to medium sand; 10% gravel; very stiff; hydrocarbon odor.	
						24					
						25					
						26					
						27					
						28					
						29					
						30					
						31					
						32					
						33					
						34					
						35					
						36					
						37					
						38					
						39					
						40					
						41					
						42					
						43					
						44					

WELL/BORING LOCATION MAP



Delta Environmental Consultants, Inc.

WELL/BORING: DB-8
MW-15

INSTALLATION DATE: 9/25/02

DRILLING METHOD: Hollow Stem Auger

PROJECT: TW21577

SAMPLING METHOD: DM Split Spoon

CLIENT: Chevron 21-1577

BORING DIAMETER: 8 "

LOCATION: 631 Queen Anne Ave No.

BORING DEPTH: 35'

CITY: Seattle

WELL CASING: SCH 40 PVC 2"

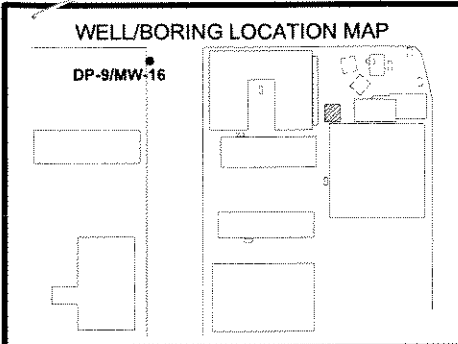
STATE: WA

WELL SCREEN: 10-25' (0.010")

DRILLER: Cascade

SAND PACK: 7-35' (2 X12)

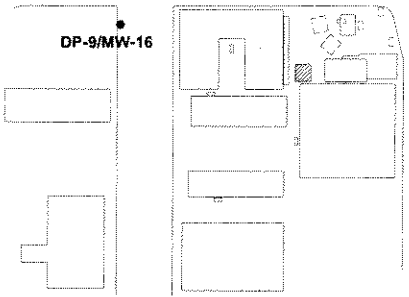
WELL/BORING COMPLETION	FIRST	STABILIZED	MOISTURE	PID (ppm)	DENSITY BLOWS / 6"	DEPTH (FEET)	RECOVERY	SAMPLE INTERVAL	USCS SYMBOL	GRAPHIC	CASING ELEVATION	99.03	
											SURVEY DATE:	9/26/02	
	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>									DTW:	9.25	
												DESCRIPTION/LOGGED BY: MATT MILLER	
Sand			WT	-	50-2"	23			SM				
						24							
						25						No recovery @25'	
						26							
						27							
						28							
						29			SP			SAND: dark gray; trace to 5% fines; fine sand; very dense; no hydrocarbon odor.	
			WT	13	50-6"	30							
						31						Heaving sands No samples collected @35'	
						32							
						33							
						34							
						35							
						36							
						37							
						38							
						39							
						40							
						41							
						42							
						43							
						44							



Delta Environmental Consultants, Inc.		WELL/BORING: DB-9 MW-16
INSTALLATION DATE: 9/24/02	DRILLING METHOD: Hollow Stem Auger	
PROJECT: TW21577	SAMPLING METHOD: DM Split Spoon	
CLIENT: Chevron 21-1577	BORING DIAMETER: 8 "	
LOCATION: 631 Queen Anne Ave No.	BORING DEPTH: 31'	
CITY: Seattle	WELL CASING: SCH 40 PVC 2"	
STATE: WA	WELL SCREEN: 10-25' (0.010")	
DRILLER: Cascade	SAND PACK: 7-31' (2 X12)	

WELL/BORING COMPLETION	FIRST	STABILIZED	MOISTURE	PID (ppm)	DENSITY BLOWS / 6"	DEPTH (FEET)	RECOVERY SAMPLE INTERVAL	USCS SYMBOL	GRAPHIC	CASING ELEVATION		SURVEY DATE:		DTW:	DESCRIPTION/LOGGED BY: MATT MILLER
										101.83	9/26/02	11.85			
Concrete						1									Concrete surface
Bentonite						2		SP							
Sand			DP	2	25 30 30	10									SAND: olive brown; trace to 5% fines; fine sand; very dense; no hydrocarbon odor.
			MST WT	12	26 50-5"	15									@16'; as above.
			WT	34	50-6"	20									@20'; as above.

WELL/BORING LOCATION MAP



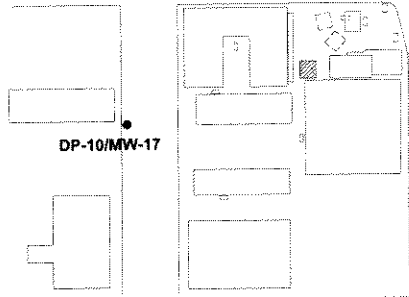
Delta Environmental Consultants, Inc.

WELL/BORING: DB-9
MW-16

INSTALLATION DATE: 9/24/02	DRILLING METHOD: Hollow Stem Auger
PROJECT: TW21577	SAMPLING METHOD: DM Split Spoon
CLIENT: Chevron 21-1577	BORING DIAMETER: 8 "
LOCATION: 631 Queen Anne Ave No.	BORING DEPTH: 31'
CITY: Seattle	WELL CASING: SCH 40 PVC 2"
STATE: WA	WELL SCREEN: 10-25' (0.010")
DRILLER: Cascade	SAND PACK: 7-31' (2 X12)

WELL/BORING COMPLETION	FIRST ▽	STABILIZED ▼	MOISTURE	PID (ppm)	DENSITY BLOWS / 6"	DEPTH (FEET)	RECOVERY SAMPLE INTERVAL	USCS SYMBOL	GRAPHIC	CASING ELEVATION	
										101.83	
										SURVEY DATE:	
										9/26/02	
										DTW:	
										11.85	
										DESCRIPTION/LOGGED BY: MATT MILLER	
Sand						23		SP		SILTY SAND: olive gray; 10% fines; very fine to fine sand; very dense; no hydrocarbon odor.	
			WT	12	50-6"	24		SM			
						25					
						26					
						27					
						28					
						29					
						30					
			DP	20	22 50-6"	31		CL		CLAY: dark gray; low plasticity; very hard; no hydrocarbon odor.	
						32					
						33					
						34					
						35					
						36					
						37					
						38					
						39					
						40					
						41					
						42					
						43					
						44					

WELL/BORING LOCATION MAP



Delta Environmental Consultants, Inc.

WELL/BORING: DB-10
MW-17

INSTALLATION DATE: 9/23/02

DRILLING METHOD: Hollow Stem Auger

PROJECT: TW21577

SAMPLING METHOD: DM Split Spoon

CLIENT: Chevron 21-1577

BORING DIAMETER: 8 "

LOCATION: 631 Queen Anne Ave No.

BORING DEPTH: 34'

CITY: Seattle

WELL CASING: SCH 40 PVC 2"

STATE: WA

WELL SCREEN: 10-25' (0.010")

DRILLER: Cascade

SAND PACK: 7-34' (2 X12)

WELL/BORING COMPLETION	FIRST	STABILIZED	MOISTURE	PID (ppm)	DENSITY BLOWS / 6"	DEPTH (FEET)	RECOVERY	SAMPLE INTERVAL	USCS SYMBOL	GRAPHIC	CASING ELEVATION	99.29
	▽	▼									SURVEY DATE:	9/26/02
											DTW:	9.72
DESCRIPTION/LOGGED BY: MATT MILLER												
Sand			WT	11	37	23			SM		SILTY SAND: dark gray; 5% fines; very fine to fine sand; very dense.	
					50-6"	24						
			WT		50-3"	25						
			WT		50-2"	26						
						27						
						28						
						29						
						30						
						31						
						32						
			WT	12	9	33			CL		@33'; as above; interbedded clay lenses.	
					11	34						CLAY: very dark gray; moderate plasticity; very stiff; no hydrocarbon odor.
					11	35						
						36						
						37						
						38						
						39						
						40						
						41						
						42						
						43						
						44						

SITE No: 211577

DRILLER: Cascade

WELL DIAMETER: 2"

LOCATION: 631 Queen Ave, Seattle

DRILL METHOD: Hollow-Stem Auger

SCREEN INTERVAL: 5-25'

CLIENT: Chevron

SAMPLE METHOD: Split-Spoon

WELL CASING: Sch. 40 PVC

DATE: 3/16/04

HOLE DIAMETER: 8"

FILTER PACK: 2/12 Monterey Sand

LOGGED BY: GC

HOLE DEPTH: 25.5'

TOC ELEVATION:

MOISTURE	PID (ppm)	BLOWS / 6"	DEPTH	GRAPHIC LOG	SAMPLE INTERVAL	DESCRIPTION	WELL COMPLETION DETAILS
			0			Ground Surface	<p>8" Casing</p> <p>Bentonite Chips</p> <p>Filter Pack Sand</p> <p>PVC Well Screen</p> <p>PVC Riser</p> <p>3/19/04</p>
			1			Airknifed to 8' Asphalt 0-3" bgs	
			2				
			3				
			4				
			5				
			6			SAND (SP-SM) Gray, dense, medium to coarse SAND with silt; Hydrocarbon odor; sheen.	
			7				
			8				
			9				
Moist to Wet	11.3	20	10			Silty SAND (SM) Brown to gray, well-graded, fine to coarse, dense, silty SAND with 30% silt and thin interbedded layers of clayey silt; slight odor; no sheen.	
		18 17	11				
Sat.	588	50	15			SAND (SP) Gray, poorly graded, very dense, medium to coarse SAND; hydrocarbon odor; no sheen.	
		50	16				
		50	17				
			18				
			19				

SITE No: 211577

DRILLER: Cascade

WELL DIAMETER: 2"

LOCATION: 631 Queen Ave, Seattle

DRILL METHOD: Hollow-Stem Auger

SCREEN INTERVAL: 5-25'

CLIENT: Chevron

SAMPLE METHOD: Split-Spoon

WELL CASING: Sch. 40 PVC

DATE: 3/16/04

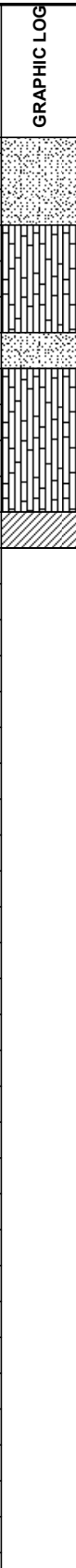

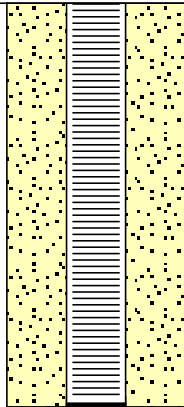
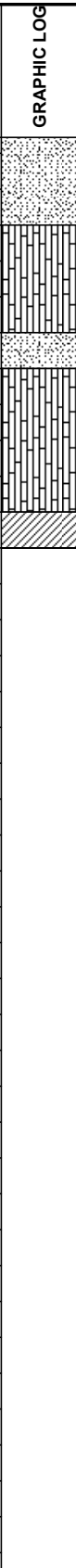

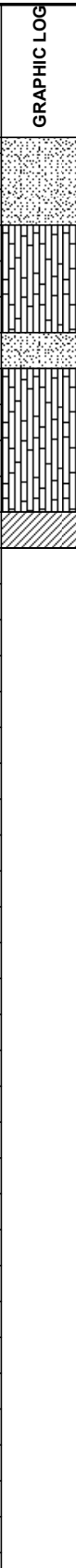

HOLE DIAMETER: 8"

FILTER PACK: 2/12 Monterey Sand

LOGGED BY: GC

HOLE DEPTH: 25.5'

TOC ELEVATION:

MOISTURE	PID (ppm)	BLOWS / 6"	DEPTH	GRAPHIC LOG	SAMPLE INTERVAL	DESCRIPTION	WELL COMPLETION DETAILS	
Wet to Sat	152	20	20			<p>Silty SAND (SM) Brownish olive, dense, well-graded, fine to medium SAND with 20% silt; no odor, no sheen.</p>		
		21	22					<p>SAND (SP) Gray to Brown, poorly graded, medium dense, coarse to medium SAND; slight odor; no sheen.</p>
		22	23					<p>Silty SAND (SM) Brown, medium dense, well-graded, fine to coarse SAND with 15% silt.</p>
Wet	91.1	10	23			<p>Silty SAND (SM) Brown, poorly graded, very hard, very fine, silty CLAY; no odor.</p>		
		21	24			<p>Silty SAND (SM) Brown, medium dense, well-graded, fine to coarse SAND with 15% silt.</p>		
Dry	7.0	18	25			<p>Silty SAND (SM) Brown, medium dense, well-graded, fine to coarse SAND with 15% silt.</p>		
		50	26			<p>Silty CLAY (CL) Brown, poorly graded, very hard, very fine, silty CLAY; no odor.</p>		
			27					
			28					
			29					
			30					
			31					
			32					
			33					
			34					
			35					
			36					
			37					
			38					
			39					

SITE No: 211577

DRILLER: Cascade

WELL DIAMETER: 2"

LOCATION: 631 Queen Ave, Seattle

DRILL METHOD: Hollow-Stem Auger

SCREEN INTERVAL: 5-25'

CLIENT: Chevron

SAMPLE METHOD: Split-Spoon

WELL CASING: Sch. 40 PVC

DATE: 3/16/04

HOLE DIAMETER: 8"

FILTER PACK: 2/12 Monterey Sand

LOGGED BY: GC

HOLE DEPTH: 25.5'

TOC ELEVATION:

MOISTURE	PID (ppm)	BLOWS / 6"	DEPTH	GRAPHIC LOG	SAMPLE INTERVAL	DESCRIPTION	WELL COMPLETION DETAILS
			0			Ground Surface	<p>8" Casing</p> <p>Bentonite Chips</p> <p>PVC Riser</p> <p>PVC Well Screen</p> <p>Filter Pack Sand</p> <p>3/19/04</p>
			1			Airknifed to 8' Asphalt 0-3" bgs	
			2				
			3				
			4				
			5				
			6			SAND (SP-SM) Gray, dense, medium to coarse, silty SAND with 10% silt; hydrocarbon odor; light sheen.	
			7				
			8				
			9				
			10				
Moist to Wet	23.9	7 17 19	11			Silty SAND (SM) Brown to olive-gray, well-graded, fine to medium, dense SAND with 25% silt and a thin 2" layer of clay; slight odor; no sheen.	
			12			SAND (SP) Gray, poorly graded, dense, medium to coarse SAND.	
			13				
			14				
Wet to Sat	208	50	15			SAND (SP) Gray, poorly graded, very dense, medium to coarse SAND; slight hydrocarbon odor; no sheen.	
			16				
			17				
			18				
			19				

SITE No: 211577

DRILLER: Cascade

WELL DIAMETER: 2"

LOCATION: 631 Queen Ave, Seattle

DRILL METHOD: Hollow-Stem Auger

SCREEN INTERVAL: 5-25'

CLIENT: Chevron

SAMPLE METHOD: Split-Spoon

WELL CASING: Sch. 40 PVC

DATE: 3/16/04

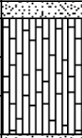

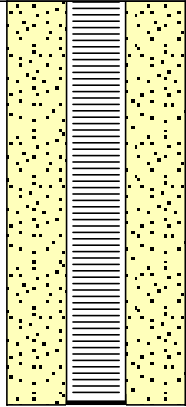
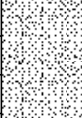




HOLE DIAMETER: 8"

FILTER PACK: 2/12 Monterey Sand

LOGGED BY: GC

HOLE DEPTH: 25.5'

TOC ELEVATION:

MOISTURE	PID (ppm)	BLOWS / 6"	DEPTH	GRAPHIC LOG	SAMPLE INTERVAL	DESCRIPTION	WELL COMPLETION DETAILS
Sat to Wet	27.5	50	20			Silty SAND (SM) Brownish gray, very dense, well-graded, silty, fine to medium SAND with 30% silt and 5% clay; no odor, no sheen.	
			21				
Wet	9.2	50	22			SAND (SP) Gray to Brown, poorly graded, medium dense, coarse to medium SAND; slight odor; no sheen.	
			23				
Dry	0.6	50	24			Silty SAND (SM) Olive gray to brown, very dense, well-graded, silty, fine to medium SAND with 30% silt and 5% clay. No odor; no sheen.	
			25				
			26						Silty CLAY (CL) Light olive-brown, very hard CLAY with silt; no odor; no sheen.
			27				
			28				
			29				
			30				
			31				
			32				
			33				
			34				
			35				
			36				
			37				
			38				
			39				

CVX #: 21-1577	DRILLER: Cascade Drilling	WELL DEPTH: 20 feet
ADDRESS: 631 Queen Anne Ave N	DRILL METHOD: Hollow-Stem Auger	CASING: 2-inch SCH 40 PVC
CITY: Seattle, WA	SAMPLE METHOD: Split Spoon	SCREEN INTERVAL: 5 - 20 feet
DATE: 8/6/04	HOLE DIAMETER: 8-inch	FILTER PACK: 2/12 Monterey Sand
LOGGED BY: Christopher Houck	BORING DEPTH: 31.5 feet	TOC ELEVATION: 105.64 feet

Analytical Sample	Sample Method	Blow Count	PID (ppm)	Sample Interval	Depth	Graphic Log	Description	Water Level	Well Construction Details
					0		Ground Surface		
					1		Concrete Sidewalk		
					2		SAND (SW) Brown, fine to coarse SAND. Minor fine gravel; minor silt; trace coarse gravel and cobbles; loose; damp. No odor. Air knife to 8 feet below ground surface.		
					3				
					4				
					5				
					6				
					7				
					8			SILTY SAND (SM) Slightly mottled, brown to orange SILTY SAND. Medium to fine sand; trace coarse sand; some coarse to fine gravel; dense; very moist. No odor. Till.	
SB-20-8	SS	15 18 28	0		9				
					10				
					11		SILT (ML) Light brown SILT. Very hard; massive, blocky texture; dry. No odor.		
					12				
					13				
SB-20-13	SS	25 50-6	0		14				
					15				
					16		CLAYEY SILT (ML) Gray to olive gray CLAYEY SILT. Very hard; low plasticity; dry to slightly damp. No odor.		
-	SS	12 18 32	0		17				
					18				
					19				
					20				



SOIL BORING/MONITORING WELL LOG: SB-20/MW-20

CVX #: 21-1577	DRILLER: Cascade Drilling	WELL DEPTH: 20 feet
ADDRESS: 631 Queen Anne Ave N	DRILL METHOD: Hollow-Stem Auger	CASING: 2-inch SCH 40 PVC
CITY: Seattle, WA	SAMPLE METHOD: Split Spoon	SCREEN INTERVAL: 5 - 20 feet
DATE: 8/6/04	HOLE DIAMETER: 8-inch	FILTER PACK: 2/12 Monterey Sand
LOGGED BY: Christopher Houck	BORING DEPTH: 31.5 feet	TOC ELEVATION: 105.64 feet

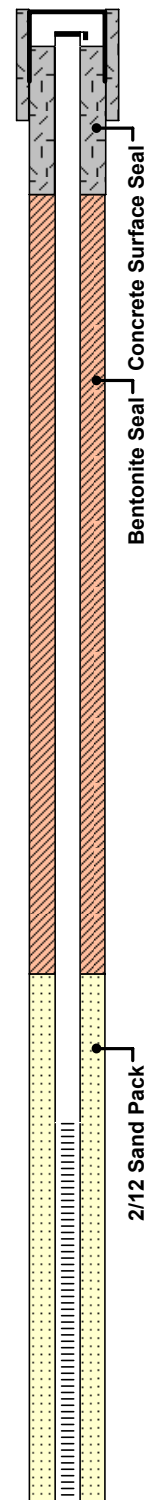
Analytical Sample	Sample Method	Blow Count	PID (ppm)	Sample Interval	Depth	Graphic Log	Description	Water Level	Well Construction Details
SB-20-20	SS	22 50-6	0	█	21				
-	SS	25 24 32	0	█	23				
SB-20-25	SS	25 30 50-5	0	█	25		<p>CLAYEY SILT (ML) Gray to olive gray CLAYEY SILT. Very hard; low plasticity; dry to slightly damp. No odor.</p>		Bentonite Backfill
-	SS	27 26 50-6	0	█	26				
					27				
					28				
					29				
					30				
					31				
					32		Boring SB-20 completed at 31.5 feet. Backfilled with bentonite to 20 feet to set well.		
					33				
					34				
					35				
					36				
					37				
					38				
					39				
					40				



SOIL BORING/MONITORING WELL LOG: SB-21/MW-21

CVX #: 21-1577	DRILLER: Cascade Drilling	WELL DEPTH: 35 feet
ADDRESS: 631 Queen Anne Ave N	DRILL METHOD: Hollow-Stem Auger	CASING: 2-inch SCH 40 PVC
CITY: Seattle, WA	SAMPLE METHOD: Split Spoon	SCREEN INTERVAL: 15 - 35 feet
DATE: 8/9/04	HOLE DIAMETER: 8-inch	FILTER PACK: 2/12 Monterey Sand
LOGGED BY: Christopher Houck	BORING DEPTH: 41.5 feet	TOC ELEVATION: 94.76 feet

Analytical Sample	Sample Method	Blow Count	PID (ppm)	Sample Interval	Depth	Graphic Log	Description	Water Level	Well Construction Details
					0	Ground Surface			
					0	Asphalt			
					1	SAND (SW)	Dark brown SAND. Fine to coarse sand; some fine gravel; trace silt; loose; damp. No odor.		
					2				
					3				
					4				
					5				
					6				
					7	SAND (SP)	Light brown medium to fine SAND. Trace silt; minor to trace fine gravel; dense; moist. No odor. Air-knife to 8 feet below ground surface.		
					8				
					9				
					10				
-	SS	21 25 30	3.7	█	11				
					12				
-	SS	40 50 50	2.5	█	13				
					14	SILTY SAND (SM)	Dark brown SILTY SAND. Fine to very fine sand; dense; moist. No odor.		
					15				
-	SS	30 40 45	2.5	█	16				
					17				
-	SS	25 30 40	0	█	18				
					19				
					20				





SOIL BORING/MONITORING WELL LOG: SB-21/MW-21

CVX #: 21-1577

DRILLER: Cascade Drilling

WELL DEPTH: 35 feet

ADDRESS: 631 Queen Anne Ave N

DRILL METHOD: Hollow-Stem Auger

CASING: 2-inch SCH 40 PVC

CITY: Seattle, WA

SAMPLE METHOD: Split Spoon

SCREEN INTERVAL: 15 - 35 feet

DATE: 8/9/04

HOLE DIAMETER: 8-inch

FILTER PACK: 2/12 Monterey Sand

LOGGED BY: Christopher Houck

BORING DEPTH: 41.5 feet

TOC ELEVATION: 94.76 feet

Analytical Sample	Sample Method	Blow Count	PID (ppm)	Sample Interval	Depth	Graphic Log	Description	Water Level	Well Construction Details
-	SS	28 30 35	1.2		21		SAND (SP) Light brown fine to medium SAND. Minor to some coarse silt; dense; moist. No odor. Contains lenses of clean, medium to coarse sand with trace fine gravel.	 	
-	SS	30 40 45	0		23				
SB-21-25	SS	35 40 40	0		25				
-	SS	32 48 40	5.0		28				
-	SS	35 40 41	16.5		31				
SB-21-35	SS	30 35 38	26.7		35		SILT (ML) Gray to light gray, thinly laminated SILT. Trace to minor clay; very low plasticity, dense; moist. Weak hydrocarbon odor in the upper portion of the unit.	 Bentonite Backfill	
					36				
					37				
					38				
					39				
					40				



SOIL BORING/MONITORING WELL LOG: SB-21/MW-21

CVX #: 21-1577

DRILLER: Cascade Drilling

WELL DEPTH: 35 feet

ADDRESS: 631 Queen Anne Ave N

DRILL METHOD: Hollow-Stem Auger

CASING: 2-inch SCH 40 PVC

CITY: Seattle, WA

SAMPLE METHOD: Split Spoon

SCREEN INTERVAL: 15 - 35 feet

DATE: 8/9/04

HOLE DIAMETER: 8-inch

FILTER PACK: 2/12 Monterey Sand

LOGGED BY: Christopher Houck

BORING DEPTH: 41.5 feet

TOC ELEVATION: 94.76 feet

Analytical Sample	Sample Method	Blow Count	PID (ppm)	Sample Interval	Depth	Graphic Log	Description	Water Level	Well Construction Details
-	SS	32 40 40	0		41		Boring SB-21 completed at 41.5 feet and backfilled with bentonite to 35 feet.		
					42				
					43				
					44				
					45				
					46				
					47				
					48				
					49				
					50				
					51				
					52				
					53				
					54				
					55				
					56				
					57				
					58				
					59				
					60				

SITE No: 211577	DRILLER: Cascade	WELL DIAMETER: 0.75"
LOCATION: 631 Queen Ave, Seattle	DRILL METHOD: Limited-Access Geoprobe	SCREEN INTERVAL: 9.75-19.75'
CLIENT: Chevron	SAMPLE METHOD: Geoprobe	WELL CASING: Sch. 40 PVC
DATE: 10/04/04	HOLE DIAMETER: 2"	FILTER PACK: 10/20 Colorado Sand
LOGGED BY: G. Cisneros	HOLE DEPTH: 20	TOC ELEVATION: 104.83'

MOISTURE	PID (ppm)	DEPTH	GRAPHIC LOG	SAMPLE INTERVAL	DESCRIPTION	WELL COMPLETION DETAILS
		0			Ground Surface	<p>4" Casing</p> <p>Bentonite Chips</p> <p>PVC Riser</p> <p>Filter Pack Sand</p>
		0.5			Airknifed to 8' Top 6-inches is peagravel.	
		1			Thin Asphalt layer at 6"	
		2			Fill - Sand with little gravel; no silt.	
		3				
Dry to Moist	2.9	4			SAND (SP) Brownish gray, dense, medium to coarse SAND with 5% gravel; no odor; no sheen.	
		5				
Dry to Moist	4.2	6			SAND (SP-SM) Light brown to reddish in some areas, dense, fine to medium SAND with a 1-inch silty SAND layers with 10% silt, and 5% gravel; no odor; no sheen.	
		7				
Dry	4.2	8			Sandy SILT (ML) Light brown, very hard, sandy SILT with 5% clay and 15-20% sand; no odor; no sheen.	
Moist	5.5	9				
Moist	278	10			10-11' SAND (SP) Gray, very dense, fine to medium SAND with 5% silt; moderate hydrocarbon odor; slight sheen.	
Moist	30	11			11-12' SAND (SP) Same as above; moderate odor, slight sheen.	



BORING/MONITORING WELL LOG: SB-22/MW-22

SITE No: 211577	DRILLER: Cascade	WELL DIAMETER: 0.75"
LOCATION: 631 Queen Ave, Seattle	DRILL METHOD: Limited-Access Geoprobe	SCREEN INTERVAL: 9.75-19.75'
CLIENT: Chevron	SAMPLE METHOD: Geoprobe	WELL CASING: Sch. 40 PVC
DATE: 10/04/04	HOLE DIAMETER: 2"	FILTER PACK: 10/20 Colorado Sand
LOGGED BY: G. Cisneros	HOLE DEPTH: 20	TOC ELEVATION: 104.83'

MOISTURE	PID (ppm)	DEPTH	GRAPHIC LOG	SAMPLE INTERVAL	DESCRIPTION	WELL COMPLETION DETAILS
Damp	29.1	12			12-13' SAND (SP) Same as above; no silt; 5% gravel; strong odor; strong sheen.	<p>PVC Well Screen with Pre-Pack Sand</p>
Moist	8.6	13			13-14' SAND (SP) Same as above; no silt; no gravel; strong odor; strong sheen.	
Moist	78.9	14			14-15' SAND (SP) Same as above; strong odor; strong sheen.	
Wet						
Sat.	82	15			15-16' SAND (SP) Same as above; strong odor; strong sheen.	
Sat	5900	16			16-17' SAND (SW) Gray, dense, fine to coarse SAND with <5% silt, 5% gravel; strong odor; moderate sheen.	
Wet	6100	17			17-18' SAND (SW) Same as above; strong odor; moderate sheen.	
Wet	5836	18			18-19' SAND (SW) Same as above; strong odor; moderate sheen.	
Wet	2058	19			19' Clayey SILT (ML) Gray to brown, very hard clayey silt with 10% sand with moderate plasticity; slight odor; no sheen.	
Wet	257	20			CLAY (CL-ML) Brownish gray, CLAY with high plasticity; slight odor; no sheen.	
		21				
		22				
		23				

SITE No: 211577	DRILLER: Cascade	WELL DIAMETER: 0.75"
LOCATION: 631 Queen Ave, Seattle	DRILL METHOD: Limited-Access Geoprobe	SCREEN INTERVAL: 5.5-13.5'
CLIENT: Chevron	SAMPLE METHOD: Geoprobe	WELL CASING: Sch. 40 PVC
DATE: 10/04/04	HOLE DIAMETER: 2"	FILTER PACK: 10/20 Colorado Sand
LOGGED BY: G. Cisneros	HOLE DEPTH: 20	TOC ELEVATION: 107.82'

MOISTURE	PID (ppm)	DEPTH	GRAPHIC LOG	SAMPLE INTERVAL	DESCRIPTION	WELL COMPLETION DETAILS
		0			Ground Surface	<p>4" Casing</p> <p>Bentonite Chips</p> <p>PVC Riser</p> <p>Filter Pack Sand</p> <p>PVC Well Screen with Pre-pack Sand</p>
		1			Airknifed to 8' Fill - Sand with little gravel; no silt.	
Moist	0.0	4			SAND (SW) Dark brown, very dense, fine to coarse SAND with 10% gravel; no odor; no sheen. (Fill?)	
Moist	0.0	6			SAND (SW) Same as above; no odor; no sheen.	
Moist	1.9	7			SAND (SW) Same as above; no odor; no sheen.	
Moist	18.4	8			8-9' SAND (SW) Dark brown, very dense, fine to coarse SAND with 10% gravel; slight odor; no sheen.	
Wet	>10358	9			9-10' SAND (SP) Gray, very dense, fine to medium SAND; no silt; no gravel; strong odor; moderate sheen.	
Sat	>10358	10			10-10.5' SAND (SP) Same as above; strong hydrocarbon odor; strong sheen.	
Sat		11			10.5-11' SAND (SP-SM) Same as above except with three 2-inch interbedded layers of sandy silt with slight plasticity; strong odor; moderate sheen.	
Wet	1381	12			11-12' SAND (SP-SM) Gray, fine to medium SAND with interbedded silt layers; strong odor, moderate sheen.	

10/5/04

SITE No: 211577	DRILLER: Cascade	WELL DIAMETER: 0.75"
LOCATION: 631 Queen Ave, Seattle	DRILL METHOD: Limited-Access Geoprobe	SCREEN INTERVAL: 5.5-13.5'
CLIENT: Chevron	SAMPLE METHOD: Geoprobe	WELL CASING: Sch. 40 PVC
DATE: 10/04/04	HOLE DIAMETER: 2"	FILTER PACK: 10/20 Colorado Sand
LOGGED BY: G. Cisneros	HOLE DEPTH: 20	TOC ELEVATION: 107.82'

MOISTURE	PID (ppm)	DEPTH	GRAPHIC LOG	SAMPLE INTERVAL	DESCRIPTION	WELL COMPLETION DETAILS
Moist	9336	13			12-13' SAND (SP-SM) Same as above; strong odor; moderate sheen.	
Moist	14.1	14			13-14' SAND (SP-SM) Same as above; gray to reddish brown; slight odor; no sheen.	
Moist					14-14.5' SAND (SP-SM) Same as above; no odor; no sheen.	
Moist	29.3	15			14.5-15.75' SAND (SP) Brown, very dense, fine to medium SAND; no silt; no gravel; strong odor; moderate sheen.	
Moist	>10358	16			15.75-17' SAND (SP) Gray, fine to medium SAND; no silt; no gravel; strong odor; moderate sheen.	
Moist	4748	17			17-18' SAND (SP) Same as above; strong odor; moderate sheen.	
Moist	6012	18			18-19.25' SAND (SP) Same as above; strong odor; no sheen.	
Moist	252	19			19.25-19.75' Silty SAND (SM) Gray, very dense, silty fine to medium SAND with 20% silt; slight odor; no sheen.	
Moist	>10358	20			19.75-20' CLAY (CL) Brownish gray, CLAY with high plasticity; slight odor; no sheen.	
		21				
		22				
		23				
		24				
		25				

SITE No: 211577	DRILLER: Cascade	WELL DIAMETER: 0.75"
LOCATION: 631 Queen Ave, Seattle	DRILL METHOD: Limited-Access Geoprobe	SCREEN INTERVAL: 4.2-14.2
CLIENT: Chevron	SAMPLE METHOD: Geoprobe	WELL CASING: Sch. 40 PVC
DATE: 10/5/04	HOLE DIAMETER: 2"	FILTER PACK: 10/20 Colorado Sand
LOGGED BY: G. Cisneros	HOLE DEPTH: 20.5	TOC ELEVATION: 107.95'

MOISTURE	PID (ppm)	DEPTH	GRAPHIC LOG	SAMPLE INTERVAL	DESCRIPTION	WELL COMPLETION DETAILS
		0			Ground Surface	<p>4" Casing</p> <p>Bentonite Chips</p> <p>PVC Riser</p> <p>Filter Pack Sand</p> <p>PVC Well Screen with Pre-Packed Sand</p>
		0			Airknifed to 8' Layer of bricks at 6-inches.	
		1			Gravelly SAND	
		2				
		3				
Moist	0.4	4		4-5'	SAND (SW) Dark brown, gravelly SAND with 15-20% gravel and 5% silt; no odor; no sheen.	
		5				
Moist	0.0	6		6-8'	SAND (SP) Dark brown, fine to medium SAND with 5% gravel; no odor; no sheen.	
		7				
Wet	5.5	8		8-9'	8-9' SAND (SP) Brown to light gray, fine to medium SAND; no silt; no gravel; no odor; no sheen.	
Sat	1.5	9		9-10'	9-10' SAND (SP-SM) Light brown, very dense, fine to medium SAND with silt layers interbedded (15-20% silt); no odor; no sheen.	
Sat	7.1	10		10-11'	10-11' SAND (SP-SM) Same as above; no odor; no sheen.	
Wet	1.0	11		11-12'	11-12' Silty SAND (SM) Light brown, very dense, fine to medium SAND with 25% silt and 15% gravel; slight odor, no sheen.	
Moist	8.9	12		12-13'	12-13' Silty SAND (SM) Same as above; slight odor; no sheen.	

10/5/04

SITE No: 211577	DRILLER: Cascade	WELL DIAMETER: 0.75"
LOCATION: 631 Queen Ave, Seattle	DRILL METHOD: Limited-Access Geoprobe	SCREEN INTERVAL: 4.2-14.2
CLIENT: Chevron	SAMPLE METHOD: Geoprobe	WELL CASING: Sch. 40 PVC
DATE: 10/5/04	HOLE DIAMETER: 2"	FILTER PACK: 10/20 Colorado Sand
LOGGED BY: G. Cisneros	HOLE DEPTH: 20.5	TOC ELEVATION: 107.95'

MOISTURE	PID (ppm)	DEPTH	GRAPHIC LOG	SAMPLE INTERVAL	DESCRIPTION	WELL COMPLETION DETAILS
Moist	14.8	13			13-14' Silty SAND (SM) Same as above; slight odor; no sheen.	
Moist	16.4	14			14-15' SAND (SP-SM) Brown to gray, very dense, fine to medium SAND with 2-inch silty SAND layers; slight odor; no sheen.	
Moist	6.9	15			15-16' SAND (SP-SM) Same as above; no odor; no sheen.	
Wet	205.8	16			16-17' SAND (SP-SM) Gray, fine to medium SAND with a 1-inch silty sand layer at 16.5 feet; strong odor; moderate sheen.	
Moist	>4506	17			17-18' SAND (SP) Same as above; strong odor; moderate sheen.	
Moist	>4506	18			18-19.5' SAND (SP) Gray, dense, medium to coarse SAND; no silt; no gravel; strong odor; moderate sheen.	
Moist	177.8	19			19.5-20' Silty SAND (SM) Gray to brown, very dense SAND with 15% silt, no gravel; moderate odor; slight sheen.	
Moist	48.3	20			20-20.5' Clayey SILT (ML-CL) Very hard, clayey SILT with moderate plasticity; slight odor; no sheen.	
Moist	11.8	21				
		22				
		23				
		24				
		25				


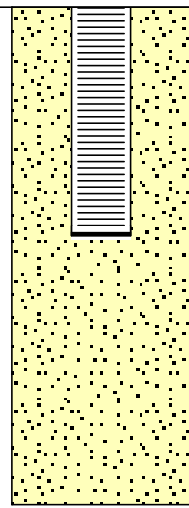






SITE No: 211577
 LOCATION: 631 Queen Ave, Seattle
 CLIENT: Chevron
 DATE: 10/25/04
 LOGGED BY: G. Cisneros

DRILLER: Cascade
 DRILL METHOD: Hollow-Stem Auger
 SAMPLE METHOD: Split-Spoon
 HOLE DIAMETER: 10"
 HOLE DEPTH: 26.5'

WELL DIAMETER: 4"
 SCREEN INTERVAL: 8-23'
 WELL CASING: Sch. 40 PVC
 FILTER PACK: 2/12 Monterey Sand
 TOC ELEVATION: 101.96'

MOISTURE	PID (ppm)	BLOWS / 6"	DEPTH	GRAPHIC LOG	SAMPLE INTERVAL	DESCRIPTION	WELL COMPLETION DETAILS
			0			Ground Surface	
			1			Airknifed to 8' Concrete 0-1' thick.	
			2			Brown, fine to medium SAND, no silt, <5% gravel.	
			3				
Dry to Moist	0		4			SAND (SP) Brown, fine to medium SAND with <5% silt and <5% gravel; no odor; no sheen.	
			5				
			6				
			7				
Moist	0	10 25 27	8			SAND (SP-SM) Brown, fine to medium SAND with thin layers of silt with moderate to high plasticity; no gravel; no silt in SAND and <10% sand in silt layers; no odor; no sheen.	
			9				
Moist	0	25 50	10			SAND (SP) Brown, fine to medium SAND with <5% silt and no gravel; no odor; no sheen.	
			11				
			12				
Wet	588	25 50	13			SAND (SP) Gray, poorly graded, fine to medium, SAND; no silt; no gravel; strong odor; slight sheen.	
			14				
			15			SAND (SP-SM) Gray, fine to medium SAND with 10% silt and a 3" silt layer at the bottom with moderate plasticity; no sheen; slight odor.	
Wet to Sat	28 59.3	8 25 20	16				
			17				
Sat	40.1	50	18			SAND (SP-SM) Gray to brown, fine to medium SAND with 2" thick interbedded silt layer; no gravel and <5% silt in sand; moderate odor; no sheen.	
			19				
			20				

SITE No: 211577	DRILLER: Cascade	WELL DIAMETER: 4"
LOCATION: 631 Queen Ave, Seattle	DRILL METHOD: Hollow-Stem Auger	SCREEN INTERVAL: 8-23'
CLIENT: Chevron	SAMPLE METHOD: Split-Spoon	WELL CASING: Sch. 40 PVC
DATE: 10/25/04	HOLE DIAMETER: 10"	FILTER PACK: 2/12 Monterey Sand
LOGGED BY: G. Cisneros	HOLE DEPTH: 26.5'	TOC ELEVATION: 101.96'

MOISTURE	PID (ppm)	BLOWS / 6"	DEPTH	GRAPHIC LOG	SAMPLE INTERVAL	DESCRIPTION	WELL COMPLETION DETAILS
Sat to Moist	149	6	21		[Sample Interval]	SILT (ML) Brown, very hard SILT with 5% sand and moderate plasticity; no gravel; slight odor; no sheen. (Sand heaving; added water to hole.)	
	170	24 50	22					SAND (SP) Gray-brown, fine to medium SAND; no silt; no gravel; no odor; no sheen.
Wet to Moist	121	6	23		[Sample Interval]	SILT (ML) Gray, very hard SILT with moderate plasticity; no odor; no sheen.	
	4	24 35	24				
Moist to Dry	0	14	25		[Sample Interval]	SILT/CLAY (ML/CL) Gray, very hard, clayey SILT/silty CLAY with moderate plasticity; no odor; no sheen.	
		21 25	26				
			27				
			28				
			29				
			30				
			31				
			32				
			33				
			34				
			35				
			36				
			37				
			38				
			39				
			40				



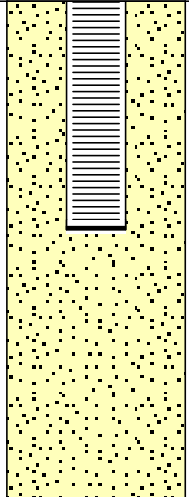
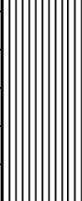

SITE No: 211577	DRILLER: Cascade	WELL DIAMETER: 4"
LOCATION: 631 Queen Ave, Seattle	DRILL METHOD: Hollow-Stem Auger	SCREEN INTERVAL: 7.75-22.75'
CLIENT: Chevron	SAMPLE METHOD: Split-Spoon	WELL CASING: Sch. 40 PVC
DATE: 10/27/04	HOLE DIAMETER: 10"	FILTER PACK: 2/12 Monterey Sand
LOGGED BY: G. Cisneros	HOLE DEPTH: 26.5'	TOC ELEVATION: 100.47'

MOISTURE	PID (ppm)	BLOWS / 6"	DEPTH	GRAPHIC LOG	SAMPLE INTERVAL	DESCRIPTION	WELL COMPLETION DETAILS
			0			Ground Surface	<p>4" Casing</p> <p>Bentonite Chips</p> <p>PVC Riser</p> <p>Filter Pack Sand</p> <p>PVC Well Screen</p>
			1			Airknifed to 8' Concrete 0-1' thick.	
Dry to Moist	0		2			SAND (SP-SM) Brown, fine to medium SAND with 10% silt, <5% gravel; no odor; no sheen.	
			3				
			4				
			5				
Moist	0	20	6			SAND (SP-SM) Brown, fine to medium SAND with 10% silt and <5% gravel; no odor; no sheen.	
		50	7				
		50	8				
			9				
Wet to Sat	117	50	10				
		50	11				
			12				
			13			SAND (SP) Brownish gray, very dense, fine to medium, SAND; no silt; no gravel; no odor; no sheen.	
Sat	310	17	14				
		50-3"	15			SAND (SP) Same as above, slight odor; no sheen.	
			16				
			17				
Sat	288	12	18			SAND (SP-SM) Same as above except 5% gravel and a 2" sandy silt layer at bottom with low plasticity; no odor; no sheen.	
		50-3"	19				
			20				

10/28/04

10/27/04

SITE No: 211577	DRILLER: Cascade	WELL DIAMETER: 4"
LOCATION: 631 Queen Ave, Seattle	DRILL METHOD: Hollow-Stem Auger	SCREEN INTERVAL: 7.75-22.75'
CLIENT: Chevron	SAMPLE METHOD: Split-Spoon	WELL CASING: Sch. 40 PVC
DATE: 10/27/04	HOLE DIAMETER: 10"	FILTER PACK: 2/12 Monterey Sand
LOGGED BY: G. Cisneros	HOLE DEPTH: 26.5'	TOC ELEVATION: 100.47'

MOISTURE	PID (ppm)	BLOWS / 6"	DEPTH	GRAPHIC LOG	SAMPLE INTERVAL	DESCRIPTION	WELL COMPLETION DETAILS
Sat	290	21 50-2"	21			SAND (SP) Same as above; no silt; no gravel; slight odor; no sheen.	
Sat		22	23			SAND (SP) Gray, very dense, fine to medium SAND; no silt; no gravel; no odor; no sheen.	
Moist to Dry	184	22 50-4"	24			Clayey SILT (ML-CL) Gray, very hard, clayey SILT with moderate plasticity; no odor; no sheen.		↑ Sloughed Sand ↓
		25	26				
	0.3	15 21 23	27				
			28				
			29				
			30				
			31				
			32				
			33				
			34				
			35				
			36				
			37				
			38				
			39				
			40				

BORING LOG

Boring No: MW-30

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle, WA

Date: 02/07/2005



Well Diameter: 2 inches

Well Depth: 34.68 ft

Well Screen: 19.68-34.68 ft

Filter Pack: 2/12 Monterey Sand

Driller: Cascade Drilling, Inc.

Method: AirPercussion, Hollow Stem

Consultant: Gabe Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 124.67 msl

Total Depth: 55.5 Ft

GW Depth: 25.0 Ft

Recov.	Depth Ft	Moist.	Blow Cnt	OVM	Soil Code	Soil Pattern	Soil Description	Well Construction
	0						Concrete top 4 inches	<p>Casing Sch 40 PVC</p> <p>Grout</p> <p>Concrete</p> <p>Seal Bentonite</p>
	5	Moist		9.6			Brown, loose, poorly sorted, fine to medium SAND with 10% gravel and 5% silt. No odor.	
	10	Wet	50/4	5.1	SP		Brown, very dense, poorly sorted, fine to medium SAND with 10% gravel. No odor, no sheen.	
	15	Moist	50	4.2			Same as above. Brown to dark brown in coloration. No odor, no sheen.	



BORING LOG

Boring No: MW-30

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle, WA

Date: 02/07/2005



Well Diameter: 2 inches

Well Depth: 34.68 ft

Well Screen: 19.68-34.68 ft

Filter Pack: 2/12 Monterey Sand

Driller: Cascade Drilling, Inc.

Method: AirPercussion, Hollow Stem

Consultant: Gabe Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 124.67 msl

Total Depth: 55.5 Ft

GW Depth: 25.0 Ft

Recov.	Depth Ft	Moist.	Blow Cnt	OVM	Soil Code	Soil Pattern	Soil Description	Well Construction
	15	Moist	50/4	5.8			Brown to light brown, very dense, fine-grained SAND with no gravel, no silt. No odor.	
		Moist	50/3	7.9			Brown to light brown, very dense, fine to medium-grained SAND with 10% gravel, no silt. No odor, no sheen.	
	20	Moist	50/3	3.7			Same as above. No odor, no sheen.	
		Moist	50/3	6.0	SP		Same as above. No odor, no sheen.	
	25	Wet	50/3	5.8			Brown to gray, very dense, fine to medium SAND with 10% silt and no gravel. No odor, no sheen.	
		Wet	50/5	5.9			Brown, very dense, fine to medium SAND with less than 5% silt, no gravel. No odor, no sheen.	
	30							



BORING LOG

Boring No: MW-30

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle, WA

Date: 02/07/2005



Well Diameter: 2 inches

Well Depth: 34.68 ft

Well Screen: 19.68-34.68 ft

Filter Pack: 2/12 Monterey Sand

Driller: Cascade Drilling, Inc.

Method: AirPercussion, Hollow Stem

Consultant: Gabe Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 124.67 msl

Total Depth: 55.5 Ft

GW Depth: 25.0 Ft

Recov.	Depth Ft	Moist.	Blow Cnt	OVM	Soil Code	Soil Pattern	Soil Description	Well Construction
	30	Wet	50/5	9.4			Brown to light gray, very dense, fine to medium SAND with 80% medium-grained sand, no silt, no gravel. No odor.	
			50/4	11.2			No recovery.	
	35	Moist	50/4	10.0			Brown to gray, very dense, fine to medium SAND with no silt, no gravel. No odor.	
		Moist	50/4	14.4	SP		Same as above. Brown to gray, very dense, fine to medium SAND with no silt, no gravel. No odor.	
	40	Moist	50/4	5.1			Same as above. Gray coloration. No odor.	
		Moist	50/4	4.7			Same as above. No odor.	
	45							



BORING LOG



Boring No: MW-30

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle, WA

Date: 02/07/2005

Well Diameter: 2 inches

Well Depth: 34.68 ft

Well Screen: 19.68-34.68 ft

Filter Pack: 2/12 Monterey Sand

Driller: Cascade Drilling, Inc.

Method: AirPercussion, Hollow Stem

Consultant: Gabe Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 124.67 msl

Total Depth: 55.5 Ft

GW Depth: 25.0 Ft

Recov.	Depth Ft	Moist.	Blow Cnt	OVM	Soil Code	Soil Pattern	Soil Description	Well Construction
	45	Moist	50/4	13	SP	| | | | |	Same as above. Gray in coloration.	
			50/4	13.9			Same as above. No odor.	
	50	Moist	70/60	14.8			Gray, very dense, fine to medium silty SAND with 25% silt and no gravel. No odor.	
		Moist	50/4	4.0			Same as above.	
	55	Moist			ML	| | | | |	Gray, clayey SILT with moderate plasticity.	
	55.5		50	3.2				



BORING LOG

Well No: MW-31

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave, Seattle, WA

Date: 02/07/2005 - 02/08/2005



Well Diameter: 2 inches

Well Depth: 30 ft

Well Screen: 15-30 ft 10-Slot

Filter Pack: 2/12 Monterey Sand

Driller: Cascade Drilling, Inc.

Method: AirPercussion, Hollow Stem

Consultant: Gabe Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 120.13 msl

Total Depth: 35.5 Ft

GW Depth: 23.0 Ft

Recov.	Depth Ft	Moist.	Blow Cnt	OVM	Soil Code	Soil Pattern	Soil Description	Well Construction
	0						Concrete top 4"	
				6.2	SW	Very dense, gravelly, silty SAND. Airknifed to 8'		
	5	Moist				Light brown to grayish brown, dense silty SAND. Mottled orange, fine to coarse sand, some gravel. No odor.		
					SP	Brown, very dense, fine to medium SAND with 5% gravel and no silt.		
	10	Moist	50/4	2.6		Light brown, very dense, fine to medium SAND with no silt and no gravel. No odor.		
	12							



BORING LOG

Well No: MW-31

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave, Seattle, WA

Date: 02/07/2005 - 02/08/2005



Well Diameter: 2 inches

Well Depth: 30 ft

Well Screen: 15-30 ft 10-Slot

Filter Pack: 2/12 Monterey Sand

Driller: Cascade Drilling, Inc.

Method: AirPercussion, Hollow Stem

Consultant: Gabe Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 120.13 msl

Total Depth: 35.5 Ft

GW Depth: 23.0 Ft

Recov.	Depth Ft	Moist.	Blow Cnt	OVM	Soil Code	Soil Pattern	Soil Description	Well Construction
	12	Moist					Light brown, very dense, fine to medium SAND with no silt and no gravel. No odor.	
	15	Moist	50/2	2.6	SP		Same as above. Olive brown in color. No odor, no sheen.	
	20	Moist	50/4	2.8			Olive gray with some iron oxide staining, very dense, fine to medium SAND with 15% silt and no gravel. No odor.	
	24							



BORING LOG



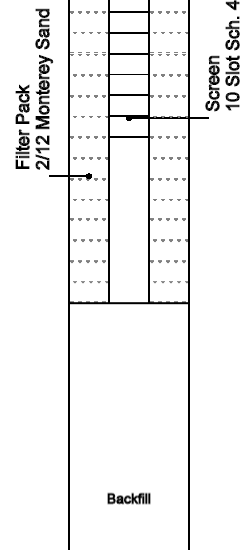
Well No: MW-31
 Chevron Site No: 211577
 Site Location: 631 Queen Anne Ave, Seattle, WA
 Date: 02/07/2005 - 02/08/2005

Well Diameter: 2 inches
 Well Depth: 30 ft
 Well Screen: 15-30 ft 10-Slot
 Filter Pack: 2/12 Monterey Sand

Driller: Cascade Drilling, Inc.
 Method: AirPercussion, Hollow Stem
 Consultant: Gabe Cisneros (SAIC, Bothell)
 Well Casing: Sch 40 PVC Elevation (TOC): 120.13 msl

Total Depth: 35.5 Ft
 GW Depth: 23.0 Ft

Recov.	Depth Ft	Moist.	Blow Cnt	OVM	Soil Code	Soil Pattern	Soil Description	Well Construction
	24	Moist						
	25		50/4	3.5				
		Sat.			SP		Brown, very dense, fine to medium SAND with no silt and no gravel. No odor.	
	30		50/4	4.2				
		Sat.					Same as above with 5% silt. No odor.	
	35	Sat.	50/5	3.1			Same as above with 5% silt and no gravel. No odor.	
	35.5							



BORING LOG

Well No: MW-32

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle WA

Date: 07/05/2005



Well Diameter: 2 in
 Well Depth: 28.6 ft
 Well Screen: 8.6-28.6 ft 10 Slot
 Filter Pack: 2/12 Monterey Sand

Driller: Cascade Drilling, Inc.
 Drilling Method: Hollow Stem
 Consultant: Gabriel Cisneros (SAIC, Bothell)
 Well Casing: Sch 40 PVC Elevation (TOC): 133.96 msl

Total Depth: 36.5 ft
 GW Depth: 11.19 ft

Recov.	Depth Ft	Moist.	Blow Cnt	PPM	Soil Code	Soil Pattern	Soil Description	Well Construction
	0							
	5	Damp		0	SW	.....	Airknife to 8 feet bgs. Brown, gravelly SAND with 20% gravel up to 1.5-inches in diameter and less than 5% silt; no odor; no sheen.	Casing Stainless Steel Casing GROUT Concrete/Quickset
	6	Damp		.6	ML	.....	Gray to brown, SILT with moderate plasticity and 10 to 20% fine to coarse sand; no odor; no sheen.	Seal Bentonite
	10	Damp			ML/SM	.....	Brown, sandy SILT with medium to coarse-grained sand.	Filter Pack 2/12 Monterey Sand Screen 10 Slot Sch. 40 PVC

BORING LOG

Well No: MW-32

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle WA

Date: 07/05/2005



Well Diameter: 2 in

Well Depth: 28.6 ft

Well Screen: 8.6-28.6 ft 10 Slot

Filter Pack: 2/12 Monterey Sand

Driller: Cascade Drilling, Inc.

Drilling Method: Hollow Stem

Consultant: Gabriel Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 133.96 msl

Total Depth: 36.5 ft

GW Depth: 11.19 ft

Recov.	Depth Ft	Moist.	Blow Cnt	PPM	Soil Code	Soil Pattern	Soil Description	Well Construction
	10	Damp			ML/SM		Brown, sandy SILT with medium to coarse-grained sand.	<p>Filter Pack 2/12 Monterey Sand</p> <p>Screen 10 Slot Sch. 40 PVC</p>
		Moist	50/5"	0			Brown, poorly sorted, dense, medium to coarse SAND with 10 to 20% silt; no odor; no sheen.	
		Wet	50/2	0			Same as above; no odor; no sheen.	
	15	Wet	50/6"	9.9	SM		Brown with gray coloration, dense, silty SAND; slight HC odor; no sheen.	
		Wet	50/6"	56.6			Same as above with gray coloration and 10% silt; no odor; no sheen.	
	20	Wet					Same as above; no odor; no sheen.	

BORING LOG



Well No: MW-32

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle WA

Date: 07/05/2005

Well Diameter: 2 in

Well Depth: 28.6 ft

Well Screen: 8.6-28.6 ft 10 Slot

Filter Pack: 2/12 Monterey Sand

Driller: Cascade Drilling, Inc.

Drilling Method: Hollow Stem

Consultant: Gabriel Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 133.96 msl

Total Depth: 36.5 ft

GW Depth: 11.19 ft

Recov.	Depth Ft	Moist.	Blow Cnt	PPM	Soil Code	Soil Pattern	Soil Description	Well Construction
	20		50/6"				Same as above; no odor; no sheen.	
		Wet					Same as above; slight HC odor; no sheen.	
			50/4"	125.0				
	25	Wet			SM		Gray, medium to coarse-grained, silty SAND with 10% silt and an interbedded silt lense with low plasticity; no odor; no sheen.	
			100/4"	70				
			75/6"	51.6			Gray, very dense, medium to coarse silty SAND with 20% gravel and 25% light brown silt clasts throughout the sample; no odor; no sheen.	
	30	Wet					Gray very dense, medium to coarse SAND with 15% gravel and small clasts of brown silt in lower 4-inches; no odor; no sheen.	

BORING LOG



Well No: MW-32

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle WA

Date: 07/05/2005

Well Diameter: 2 in

Well Depth: 28.6 ft

Well Screen: 8.6-28.6 ft 10 Slot

Filter Pack: 2/12 Monterey Sand

Driller: Cascade Drilling, Inc.

Drilling Method: Hollow Stem

Consultant: Gabriel Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 133.96 msl

Total Depth: 36.5 ft

GW Depth: 11.19 ft

Recov.	Depth Ft	Moist.	Blow Cnt	PPM	Soil Code	Soil Pattern	Soil Description	Well Construction
	30		50/4"	36.7	SW	.....	Gray very dense, medium to coarse SAND with 15% gravel and small clasts of brown silt in lower 4-inches; no odor; no sheen.	
		Wet						
					ML	.....	Gray, hard, SILT with low to moderate plasticity; no odor; no sheen.	
	35		16/50	34.8				Backfill
		Wet						
	36.5							

BORING LOG

Well No: MW-33

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle WA

Date: 07/05/2005 - 07/06/2005



Well Diameter: 2 in

Well Depth: 34.6 ft

Well Screen: 24.6-34.6 10-Slot

Filter Pack: 2/12 Monterey Sand

Driller: Cascade Drilling, Inc.

Drilling Method: Hollow Stem

Consultant: Gabriel Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 133.18 msl

Total Depth: 35.5 ft

GW Depth: 28.21 ft

Recov.	Depth Ft	Moist.	Blow Cnt	PPM	Soil Code	Soil Pattern	Soil Description	Well Construction
	0							<p>Casing Stainless Steel Casing</p> <p>Grout/Quickset</p> <p>Concrete/Quickset</p> <p>Seal Bentonite</p>
	5	Moist			SP	.....	Airknifed to 8 ft bgs. Brown, loose, fine SAND with 10% gravel and less than 5% silt; no odor; no sheen.	
	10	Moist			SP-SM	.....	Brown, dense, fine to medium SAND with 20% gravel and 15% silt; no odor; no sheen.	

BORING LOG



Well No: MW-33

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle WA

Date: 07/05/2005 - 07/06/2005

Well Diameter: 2 in

Well Depth: 34.6 ft

Well Screen: 24.6-34.6 10-Slot

Filter Pack: 2/12 Monterey Sand

Driller: Cascade Drilling, Inc.

Drilling Method: Hollow Stem

Consultant: Gabriel Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 133.18 msl

Total Depth: 35.5 ft

GW Depth: 28.21 ft

Recov.	Depth Ft	Moist.	Blow Cnt	PPM	Soil Code	Soil Pattern	Soil Description	Well Construction
	10	Moist	50	0	SP-SM		Brown, dense, fine to medium SAND with 20% gravel and 15% silt; no odor; no sheen.	
		Moist	50/4"	0			Brown, very dense, fine to medium, SAND with 5% gravel and no silt; no odor; no sheen.	
	15	Moist	50/4"	0.8	SP		Same as above; no odor; no sheen.	
		Moist	50/5"	1.2			Same as above; no odor; no sheen.	
	20	Moist					Same as above, brown to light brown; no odor; no sheen.	

BORING LOG

Well No: MW-33

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle WA

Date: 07/05/2005 - 07/06/2005



Well Diameter: 2 in Well Depth: 34.6 ft Well Screen: 24.6-34.6 10-Slot Filter Pack: 2/12 Monterey Sand	Driller: Cascade Drilling, Inc. Drilling Method: Hollow Stem Consultant: Gabriel Cisneros (SAIC, Bothell) Well Casing: Sch 40 PVC Elevation (TOC): 133.18 msl	Total Depth: 35.5 ft GW Depth: 28.21 ft
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Recov.	Depth Ft	Moist.	Blow Cnt	PPM	Soil Code	Soil Pattern	Soil Description	Well Construction
	20	Moist	50/5"	1.7	SP	| | | | |	Same as above, brown to light brown; no odor; no sheen.	
		Moist	50/5"	2.5			Same as above; no odor; no sheen.	
	25	Moist	50	0	SM	| | | | |	Same as above; no odor; no sheen.	
		Wet	50	3.4			Brown to gray, dense, fine silty SAND with 20% silt, no gravel; no odor; no gravel.	
	30	Wet			SM/ML	| | | | |	Gray, dense, to hard, fine silty SAND to sandy SILT with 40% silt; no odor; no sheen.	

BORING LOG



Well No: MW-33

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle WA

Date: 07/05/2005 - 07/06/2005

Well Diameter: 2 in

Well Depth: 34.6 ft

Well Screen: 24.6-34.6 10-Slot

Filter Pack: 2/12 Monterey Sand

Driller: Cascade Drilling, Inc.

Drilling Method: Hollow Stem

Consultant: Gabriel Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 133.18 msl

Total Depth: 35.5 ft

GW Depth: 28.21 ft

Recov.	Depth Ft	Moist.	Blow Cnt	PPM	Soil Code	Soil Pattern	Soil Description	Well Construction
	30		50	11.2	SM/ML	.....	Gray, dense, to hard, fine silty SAND to sandy SILT with 40% silt; no odor; no sheen.	
	35	Moist	50/4	101.3	ML	.....	Gray, hard, SILT with moderate plasticity; no odor; no sheen.	
	35.5							

BORING LOG

Well No: MW-34

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle, WA

Date: 11/21/2005



Well Diameter: 2 inches

Well Depth: 37 ft

Well Screen: 22-37 ft 10-Slot

Filter Pack: 16/30 Colorado Snd

Driller: Cascade Drilling, Inc.

Method: AirPercussion, Hollow Stem

Consultant: Gabriel Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 127.22 msl

Total Depth: 40.0 Ft

GW Depth: 27.5 Ft

Recov.	Depth Ft	Moist.	Blow Cnt	OVM	Soil Code	Soil Pattern	Soil Description	Well Construction
	0							
	5				SM		Concrete top 4-inches. Airknife to 8' bgs brown silty SAND (FILL)	
		Moist	13/18/32	1.7			Light brown to gray, fine to medium SAND with 20% silt and no gravel; no odor; no sheen.	
	10							



BORING LOG

Well No: MW-34

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle, WA

Date: 11/21/2005



Well Diameter: 2 inches

Well Depth: 37 ft

Well Screen: 22-37 ft 10-Slot

Filter Pack: 16/30 Colorado Sand

Driller: Cascade Drilling, Inc.

Method: AirPercussion, Hollow Stem

Consultant: Gabriel Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 127.22 msl

Total Depth: 40.0 Ft

GW Depth: 27.5 Ft

Recov.	Depth Ft	Moist.	Blow Cnt	OVM	Soil Code	Soil Pattern	Soil Description	Well Construction
	10	Moist	12/50	4.4	SP-SM	Light brown, fine to medium SAND with 10% silt and a 2-inch thick silt layer interbedded within the sand; no gravel; no odor.	<p>Seal Bentonite Chips</p>
		Moist	50	4.2	SP	.....	Brown to reddish brown, fine to medium SAND, no silt and no gravel; Fe oxidation coloring; no odor; no sheen.
	15	Moist	19/50	4.7	SP-SM	.....	Brown to reddish brown, fine to medium SAND with 10% silt; no grave; no odor; no sheen.
		Moist	50	4.0	SW	.....	Brown, fine to coarse SAND and gravel with 5% silt; no odor; no sheen.
	20	Moist			SP	.....	Brown to Fe oxidized red, fine to medium SAND with less than 5% silt and a thin silt layer interbedded; no odor; no sheen.



BORING LOG



Well No: MW-34

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle, WA

Date: 11/21/2005

Well Diameter: 2 inches

Well Depth: 37 ft

Well Screen: 22-37 ft 10-Slot

Filter Pack: 16/30 Colorado Snd

Driller: Cascade Drilling, Inc.

Method: AirPercussion, Hollow Stem

Consultant: Gabriel Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 127.22 msl

Total Depth: 40.0 Ft

GW Depth: 27.5 Ft

Recov.	Depth Ft	Moist.	Blow Cnt	OVM	Soil Code	Soil Pattern	Soil Description	Well Construction
	20	Moist	50	4.0			Brown to Fe oxidized red, fine to medium SAND with less than 5% silt and a thin silt layer interbedded; no odor; no sheen.	<p>Filter Pack 16/30 Colorado Sand</p> <p>Screen 10 Slot Sch. 40 PVC</p>
		Moist	50	6.0			Brown, fine to medium SAND with no gravel and no silt; no odor; no sheen.	
	25	Moist	23/50	4.5	SP		Same as above; no odor; no sheen.	
		Wet	50	3.7			Same as above; no odor; no sheen.	
	30	Sat.					Light brown to gray, fine to coarse SAND with less than 5% fine gravel; no odor; no sheen.	



BORING LOG

Well No: MW-34

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle, WA

Date: 11/21/2005



Well Diameter: 2 inches

Well Depth: 37 ft

Well Screen: 22-37 ft 10-Slot

Filter Pack: 16/30 Colorado Snd

Driller: Cascade Drilling, Inc.

Method: AirPercussion, Hollow Stem

Consultant: Gabriel Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 127.22 msl

Total Depth: 40.0 Ft

GW Depth: 27.5 Ft

Recov.	Depth Ft	Moist.	Blow Cnt	OVM	Soil Code	Soil Pattern	Soil Description	Well Construction
	30	Sat.	50-3"	4.3			Light brown to gray, fine to coarse SAND with less than 5% fine gravel; no odor; no sheen.	<p>Filter Pack 16/30 Colorado Sand</p> <p>Screen 10 Slot Sch. 40 PVC</p>
	35	Sat.			SP		No Recovery.	
	40							



BORING LOG

Well No: MW-35

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle WA

Date: 11/21/2005 - 11/22/2005



Well Diameter: 2 in

Well Depth: 40 ft

Well Screen: 22-37 ft 10-Slot

Filter Pack: 16/30 Colorado Snd

Driller: Cascade Drilling, Inc.

Drilling Method: Hollow Stem

Consultant: Gabriel Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 133.39 msl

Total Depth: 41.0 ft

GW Depth: 29.0 ft

Recov.	Depth Ft	Moist.	Blow Cnt	PPM	Soil Code	Soil Pattern	Soil Description	Well Construction
	0							<p>Casing Stainless Steel Well Box Grout Concrete Seal Bentonite Chips</p>
	5	Moist			SP	.....	Silty, gravelly SAND with large cobbles and concrete (FILL). Airknifed to 10 feet bgs.	
	10				SW	.....	Same as above; except larger cobbles.	
	10	Moist	15/17/21		SP	.....	Brown, fine to medium SAND with less than 5% silt, no gravel; no odor; no sheen.	
	12							

BORING LOG

Well No: MW-35

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle WA

Date: 11/21/2005 - 11/22/2005



Well Diameter: 2 in	Driller: Cascade Drilling, Inc.	Total Depth: 41.0 ft
Well Depth: 40 ft	Drilling Method: Hollow Stem	GW Depth: 29.0 ft
Well Screen: 22-37 ft 10-Slot	Consultant: Gabriel Cisneros (SAIC, Bothell)	
Filter Pack: 16/30 Colorado Snd	Well Casing: Sch 40 PVC Elevation (TOC): 133.39 msl	

Recov.	Depth Ft	Moist.	Blow Cnt	PPM	Soil Code	Soil Pattern	Soil Description	Well Construction
	12	Moist					Brown, fine to medium SAND with less than 5% silt, no gravel; no odor; no sheen.	
	15	Moist	15/18/23		SP		Light brown, fine to medium SAND with 5% silt and finer sand; no gravel; no odor; no sheen.	
		Moist	15/29/50				Same as above except with finer-grained sand; no odor; no sheen.	
	20	Moist	17/33/50				Same as above; no odor; no sheen.	
		Moist	16/30/50		SP-SM		Light brown, fine-grained SAND with 10% silt; no gravel; no odor; no sheen.	
	24							

BORING LOG

Well No: MW-35

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle WA

Date: 11/21/2005 - 11/22/2005



Well Diameter: 2 in

Well Depth: 40 ft

Well Screen: 22-37 ft 10-Slot

Filter Pack: 16/30 Colorado Sand

Driller: Cascade Drilling, Inc.

Drilling Method: Hollow Stem

Consultant: Gabriel Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 133.39 msl

Total Depth: 41.0 ft

GW Depth: 29.0 ft

Recov.	Depth Ft	Moist.	Blow Cnt	PPM	Soil Code	Soil Pattern	Soil Description	Well Construction
	24	Moist					Light brown, fine-grained SAND with 10% silt; no gravel; no odor; no sheen.	<p>Filter Pack 16/30 Colorado Sand</p> <p>Screen 10 Slot Sch. 40 PVC</p>
	25	Moist	30/50		SP-SM		Same as above except a 1-inch silt later interbedded at bottom 25.75 ft bgs; no odor; no sheen.	
		Moist	27/50				Light brown, fine to medium SAND with less than 5% silt, no odor, no sheen.	
	30	Wet	29/50		SP		Same as above; no odor; no sheen. (Wet to Saturated)	
		Sat.	34/50				Brown to gray, fine to coarse SAND with no silt and no gravel; no odor.	
	35	Wet	16/50		SM		Light brownish gray, fine, silty SAND with 15% silt; no odor; no sheen	
	36							

BORING LOG



Well No: MW-35

Chevron Site No: 211577

Site Location: 631 Queen Anne Ave N, Seattle WA

Date: 11/21/2005 - 11/22/2005

Well Diameter: 2 in

Well Depth: 40 ft

Well Screen: 22-37 ft 10-Slot

Filter Pack: 16/30 Colorado Snd

Driller: Cascade Drilling, Inc.

Drilling Method: Hollow Stem

Consultant: Gabriel Cisneros (SAIC, Bothell)

Well Casing: Sch 40 PVC

Elevation (TOC): 133.39 msl

Total Depth: 41.0 ft

GW Depth: 29.0 ft

Recov.	Depth Ft	Moist.	Blow Cnt	PPM	Soil Code	Soil Pattern	Soil Description	Well Construction
	36	Wet	16/50				Light brownish gray, fine, silty SAND with 15% silt; no odor; no sheen	
		Wet	16/35/50		SM		Gray, fine silty SAND with 30% silt; no odor; no sheen.	
	40	Moist	32/50		ML/CL		Gray, stiff, clayey SILT with moderate plasticity.	
	41.0							



SOIL BORING LOG

BORING No: NV-1

PAGE 1 of 1

PROJECT: 21-1577
 LOCATION: Queen Anne, Seattle, WA
 CLIENT: Chevron
 DATE: 07/06/05
 LOGGED BY: G. Cisneros, S. Kline

DRILLER: Cascade Drilling, Inc.
 DRILL METHOD: Air Knife
 SAMPLE METHOD: Hand Auger
 HOLE DIAMETER: 10-inch max.
 HOLE DEPTH: 9.0 feet

WELL DIAMETER: 10-inch
 WELL DEPTH: 9.0 feet
 WELL CASING: 1/4-inch outside diameter nylon tubing
 WELL SCREEN: 5.0-5.5 ft & 8.0-8.5 ft
 FILTER PACK: 2/12 Monterey Sand

GROUND ELEVATION: 134.33 msl

Analytical Sample Number	PID (ppm)	BLOWS/6"	Water Level	Sample		DEPTH (ft.)	SOIL TYPE	LITHOLOGY / DESCRIPTION	Well Completion Details
				Recovery	Interval				
	0.0					1 2 3 4 5	SP-SM	Brown, dense, fine to medium SAND with 15% gravel and 10% silt; no odor, no sheen	<p>The diagram illustrates the well's construction. It shows a 1-inch steel casing extending to the bottom. At the top, there is a concrete seal. Below the casing, there are bentonite seals at approximately 3.5 feet and 7.5 feet depths. A filter pack of 2/12 silica is located between 5.0 and 8.5 feet. The well is filled with sand and gravel, with a screen at the bottom.</p>
	0.0					6 7 8 9 10 11	SM	Brown to gray, dense, fine to medium SAND with 5% gravel and 15% silt; no odor, no sheen	

NOTES: Soil vapor sampling devices consist of a 3/8-inch diameter by six-inch-long fine mesh stainless-steel screen with the lower open end of the device sealed. The upper end of each sampler contains a barb type fitting, to which 1/4-inch outside diameter nylon tubing is attached which runs to the surface of the well for sample collection.



SOIL BORING LOG

BORING No: NV-2

PAGE 1 of 2

PROJECT: 21-1577
 LOCATION: Queen Anne, Seattle, WA
 CLIENT: Chevron
 DATE: 07/06/05
 LOGGED BY: G. Cisneros, S. Kline

DRILLER: Cascade Drilling, Inc.
 DRILL METHOD: Air Knife/Hollow Stem
 SAMPLE METHOD: Hand Auger/Split Spoon
 HOLE DIAMETER: 10-inch max.
 HOLE DEPTH: 21.0 feet

WELL DIAMETER: 10-inch
 WELL DEPTH: 15.5 feet
 WELL CASING: 1/4-inch outside diameter nylon tubing
 WELL SCREEN: 5.0-5.5 ft, 10.0-10.5 & 15.0-15.5 ft
 FILTER PACK: 2/12 Monterey Sand

GROUND ELEVATION: 133.60 msl

Analytical Sample Number	PID (ppm)	BLOWS/6"	Water Level	Sample		DEPTH (ft.)	SOIL TYPE	LITHOLOGY / DESCRIPTION	Well Completion Details
				Recovery	Interval				
						1			
						2			
						3			
						4	SP-SM	Airknifed to 8 feet bgs. Brown, dense, fine to coarse SAND with 5% gravel and 10% silt; no odor, no sheen.	
	4.7					5			
						6			
						7			
						8			
	0.8					9	SM	Brown, fine to coarse silty SAND with 20% gravel up to 1 inch in diameter.	
						10			
	0.2	50				11	SP-SM	Same as above with decreasing gravel content and interbedded silt layers 1- to 2-inches in thickness.	

NOTES: Soil vapor sampling devices consist of a 3/8-inch diameter by six-inch-long fine mesh stainless-steel screen with the lower open end of the device sealed. The upper end of each sampler contains a barb type fitting, to which 1/4-inch outside diameter nylon tubing is attached which runs to the surface of the well for sample collection.



SOIL BORING LOG

BORING No: NV-2

PAGE 2 of 2

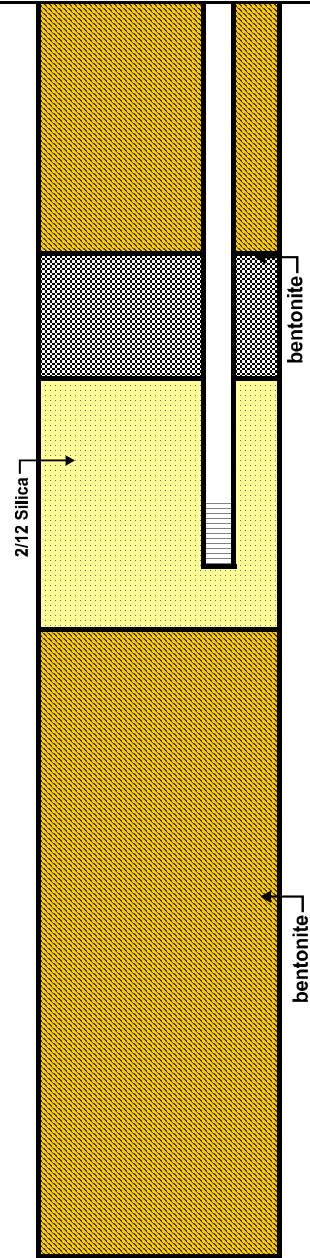
PROJECT: 21-1577
 LOCATION: Queen Anne, Seattle, WA
 CLIENT: Chevron
 DATE: 07/06/05
 LOGGED BY: G. Cisneros, S. Kline

DRILLER: Cascade Drilling, Inc.
 DRILL METHOD: Air Knife/Hollow Stem
 SAMPLE METHOD: Hand Auger/Split Spoon
 HOLE DIAMETER: 10-inch max.
 HOLE DEPTH: 21.0 feet

WELL DIAMETER: 10-inch
 WELL DEPTH: 15.5 feet
 WELL CASING: 1/4-inch outside diameter nylon tubing
 WELL SCREEN: 5.0-5.5 ft, 10.0-10.5 & 15.0-15.5 ft
 FILTER PACK: 2/12 Monterey Sand

GROUND ELEVATION: 133.60 msl

Analytical Sample Number	PID (ppm)	BLOWS/6"	Water Level	Sample		DEPTH (ft.)	SOIL TYPE	LITHOLOGY / DESCRIPTION	Well Completion Details
				Recovery	Interval				
						12			
						13	SP-SM	Same as above with decreasing gravel content and interbedded silt layers 1- to 2-inches in thickness.	
						14			
						15			
	0.1	50				16			
						17			
						18	SP-SM	Brown, dense, medium to coarse SAND with 5% gravel and 10% silt; no odor, no sheen.	
						19			
	1.2	50				20			
						21			
						22			



NOTES: Soil vapor sampling devices consist of a 3/8-inch diameter by six-inch-long fine mesh stainless-steel screen with the lower open end of the device sealed. The upper end of each sampler contains a barb type fitting, to which 1/4-inch outside diameter nylon tubing is attached which runs to the surface of the well for sample collection.

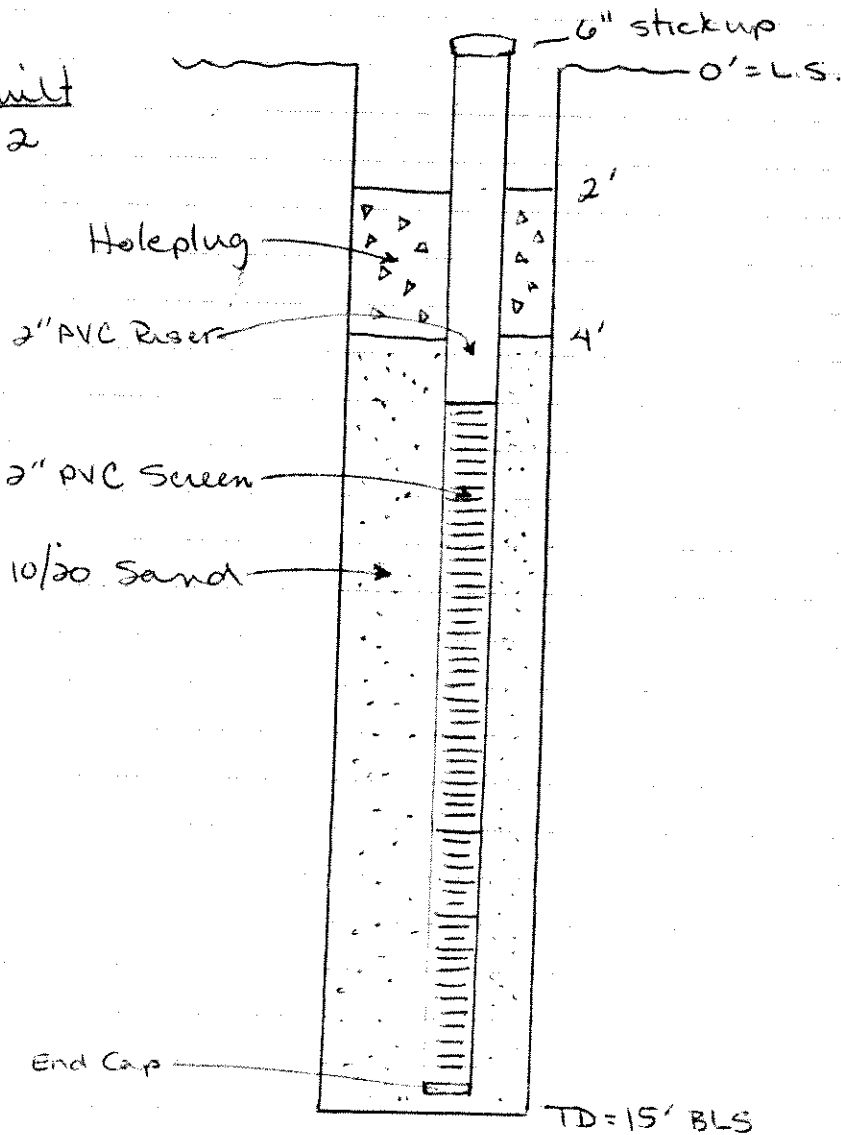
VP-2

1035 TD @ 15'. ~ 2-3" of water at the bottom

1050 Begin well install:

- 1 10' 2" PVC screen w/ end cap
- 1 5' 2" PVC blank
- 1 bags of hole plug (hydrated) @ 2'
- 11 bags of 10/20 sand @ 4'

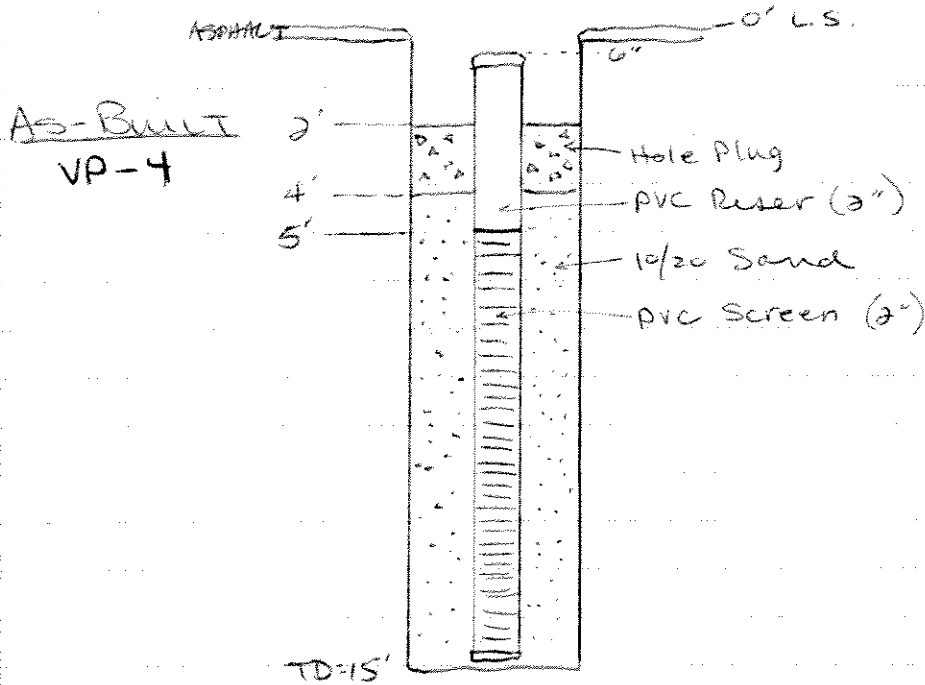
As-Built
VP-2



5-18-93

VP-4

17



0950: Slow auger pulling. Strong fuel smell

0957: Augers are out

1000: Folding Mast down. Pull off VP-4.

1019: Move to Decou

Run to Safeway to make copies

1030: Drillers Decouming. Go over to Deli & watch tank pull

1050: The tank (#1) is out!

5-18-93

VP-6

0815 Sample @ 12.5'

BC = 6/8/11

SY 4/1 dark gray

strong gasoline smell
wet

SAND - fine-med w/ little silt
SP-SM

Drill to 15'. 18" of H₂O at bottom

Doug Pearson on-site

0830 D. Pearson off-site

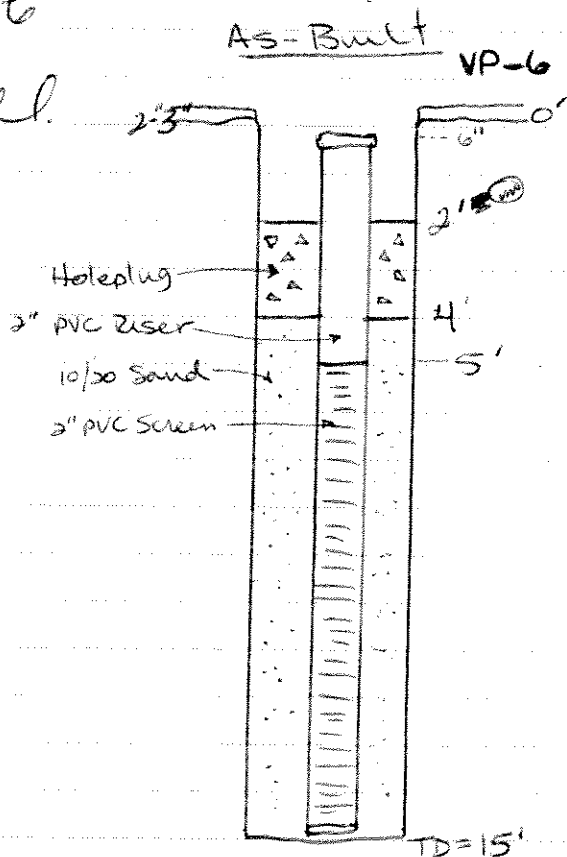
Begin well install.
Setting well at 15' but
only using 14.5' of
pipe so well is
6" below surface

1 10' 2" PVC Screen

1 4.5' 2" PVC Riser

1 1/2 Bags 10/20 Sand

1 1/2 Bag Hole Plug



5-17-93

11

As-Built

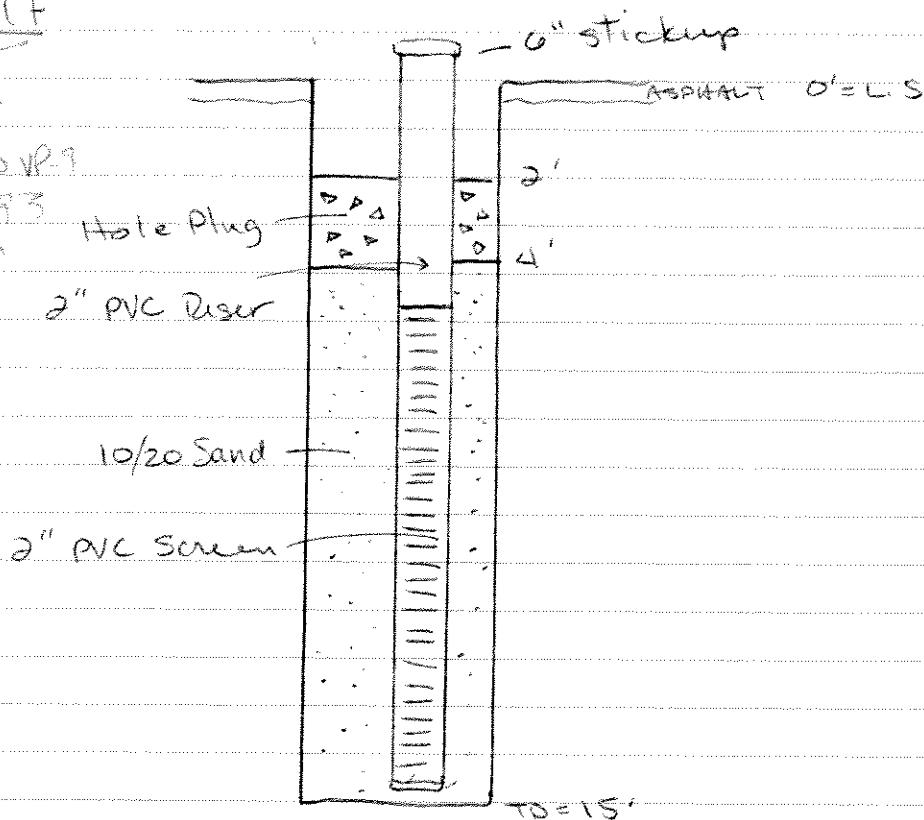
~~VP-8~~

VP-9

changed to VP-9

on 6/10/93

J. Walker



1445 Drillers decommissioning augers.

1530 Signed daily logs -
Drillers off site for the day

GES securing site

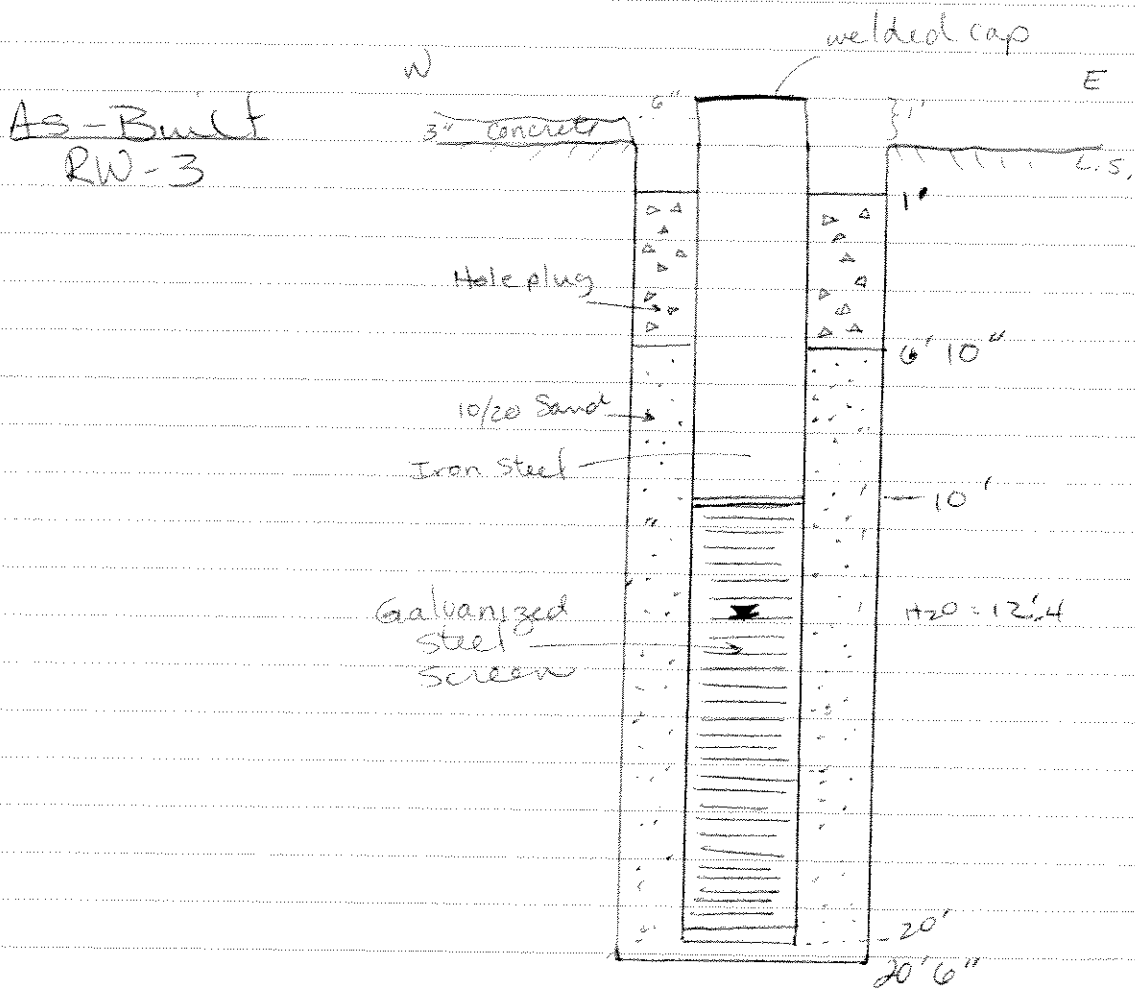
1535 Pouring dry ice down the UST

1350 Ecology folks off-site for the day

5-24-93

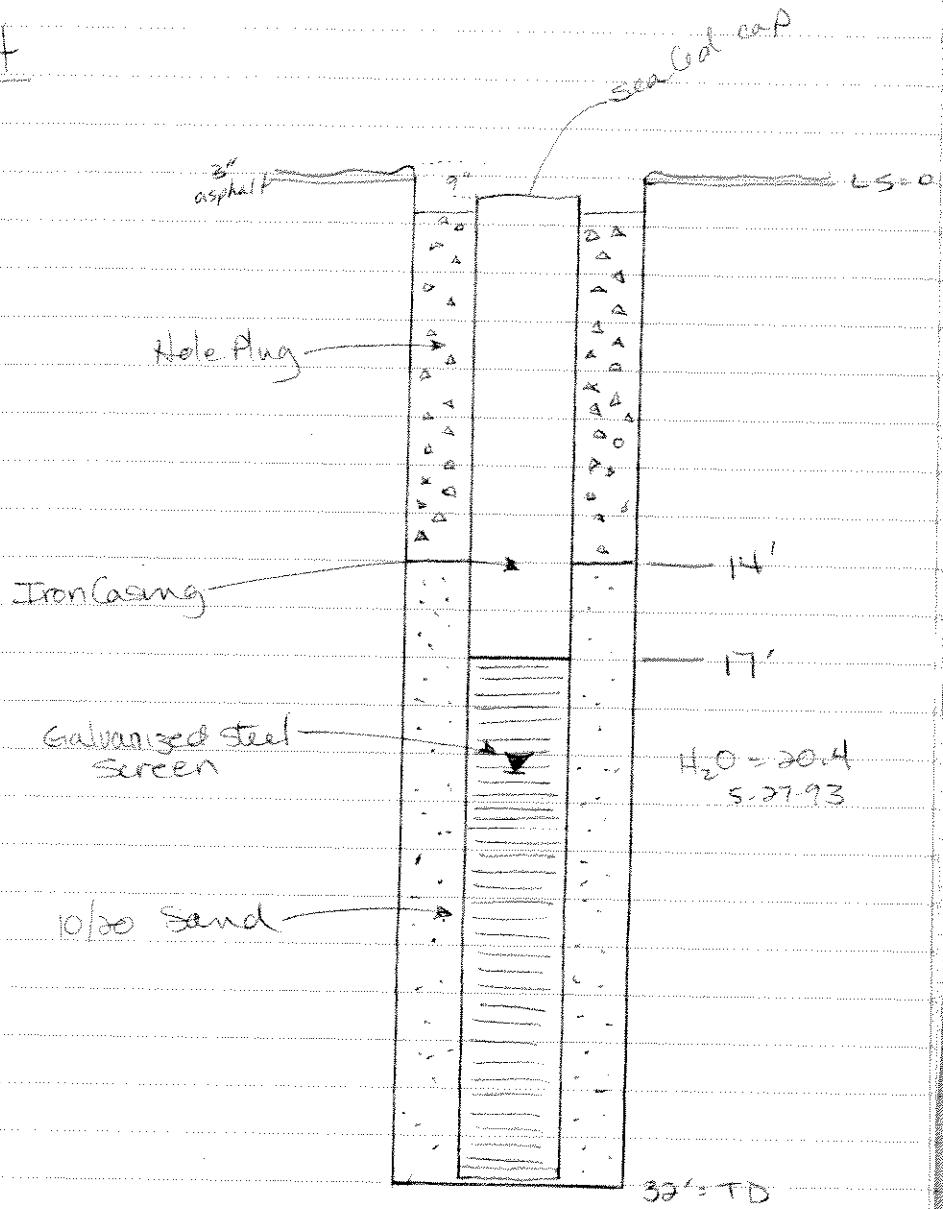
The plans show VES connecting to MW-2 (VP-3). MW-2 is not a monitoring well. Its a

Well connect up to MW-7 instead (H₂O @) & also the hand drilled well at the SE corner of Monterey Apt Bldg. Chung-Pi (Ecology) approved.



As-built

RW-4



1630 Clean up site. lower Mast.

Move Rig - to Dicron

5-25-93

nd. 70'

1007

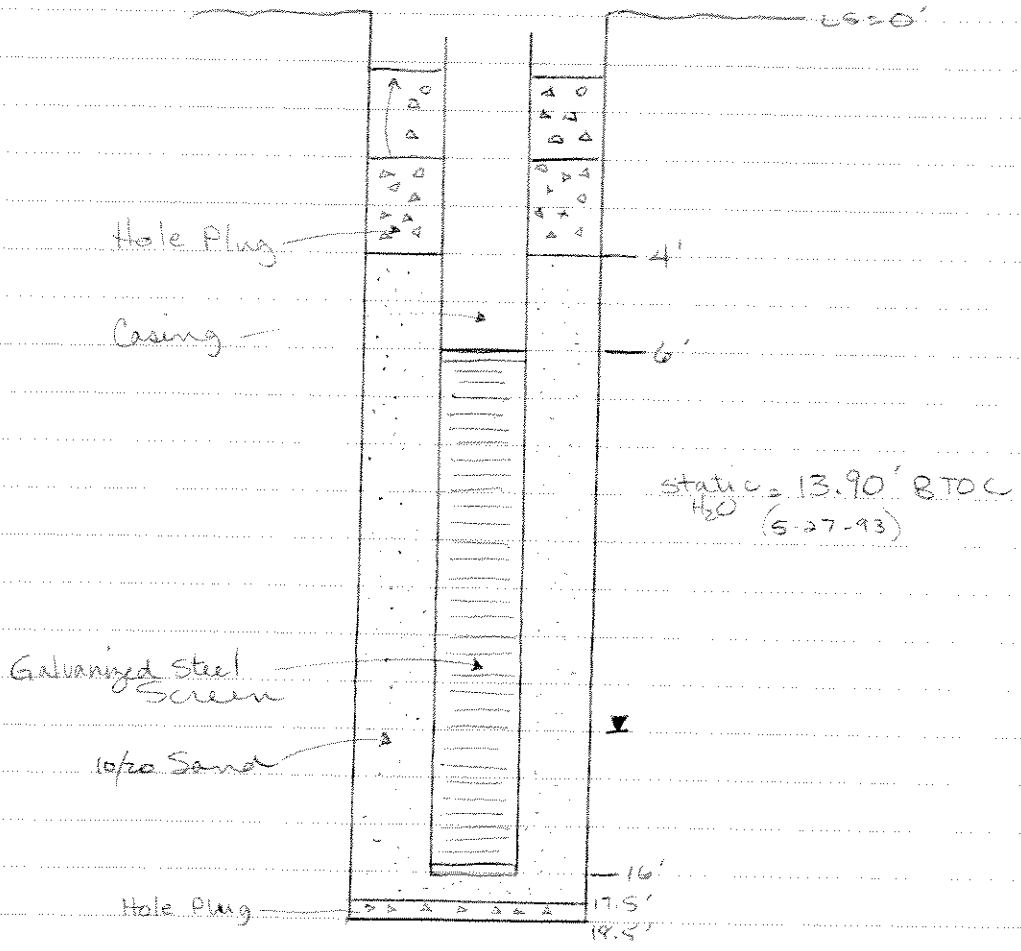
Lower Well

- ||||| bags 10/20 Sand (50 lbs)
- 4 bags 10/20 Sand (100 lbs)
- 4 bags Hole Plug

As-Built

RW-5

have





BORING LOG: SP-1

SITE No: 211577

DRILLER: Cascade

LOCATION: 631 Queen Anne Ave, Seattle

DRILL METHOD: Geoprobe

CLIENT: Chevron/Texaco

SAMPLE METHOD: Split-Spoon with Liner

DATE: 3/12/04

HOLE DIAMETER: 2"

LOGGED BY: GC

HOLE DEPTH: 22'

MOISTURE	PID (ppm)	DEPTH	GRAPHIC LOG	SAMPLE INTERVAL	DESCRIPTION
		0			Ground Surface
		0			Airknifed to 8' Asphalt from 0-3"
		1			
		2			
		3			
		4			
		5			SAND (SM) Dark brown, very dense, well-graded, gravelly, silty, SAND.
		6			
		7			
		8			SAND (SM) Dark brown, well-graded, very dense, medium to coarse sand with 15% gravel and 15% silt; slight hydrocarbon odor; no sheen.
Dry to Moist	0	9			
	0	10			
	0	11			SAND and SILT (SM) Dark gray to black SAND with thin silt layers; hydrocarbon odor; no sheen.
Moist	1553	12			
	1674	13			SAND (SP) Brownish gray to dark gray, poorly graded, very dense SAND with <5% silt.
	1569	14			
	>4040	15			
	850.2	16			
	>4040	17			SAND (SP) Brownish gray, poorly graded, very dense SAND; increasing silt content with depth.
Moist to Wet	238.0	18			
	1.4	19			Groundwater at 19.5'
Wet to Sat	2928	20			SAND (SP-SM) Same as above; more silty with depth; HC odor; no sheen.
	>4040	21			Silty SAND (SM) Brownish gray, well-graded, very dense, fine to medium silty SAND.
Sat	>4040	22			



BORING LOG: SP-2

SITE No: 211577

DRILLER: Cascade

LOCATION: 631 Queen Anne Ave, Seattle

DRILL METHOD: Geoprobe

CLIENT: Chevron/Texaco

SAMPLE METHOD: Split-Spoon with Liner

DATE: 3/12/04

HOLE DIAMETER: 2"

LOGGED BY: GC

HOLE DEPTH: 20'

MOISTURE	PID (ppm)	DEPTH	GRAPHIC LOG	SAMPLE INTERVAL	DESCRIPTION
		0			Ground Surface
		0			Airknifed to 8' Asphalt from 0-3"
		1			
		2			SAND (SP-SM) Dark brown, very dense, well-graded, gravelly, silty, SAND with 10% silt, no gravel.
		3			
		4			
		5			
		6			
		7			
	2025	8			SAND (SP) Dark gray, well-graded, very dense, medium to coarse SAND with <10% silt; HC odor; no sheen
Dry to Moist	28.6	9			SAND (SP) Dark gray, poorly graded, very dense, medium to coarse sand; hydrocarbon odor; no sheen.
	0	10			
Moist to Sat	44.7	11			Groundwater at 11'
	43.8	12			
	1941	13			SAND (SP) Same as above; strong odor; sheen.
	>4040	14			
	26.3	15			SAND (SP) Brown, poorly graded, very dense, medium to coarse clean SAND; no odor; no sheen.
	0	16			
	0	17			
Sat	0	18			
	0	19			
	0	20			



BORING LOG: SP-4

SITE No: 211577

DRILLER: Cascade

LOCATION: 631 Queen Anne Ave, Seattle

DRILL METHOD: Geoprobe

CLIENT: Chevron/Texaco

SAMPLE METHOD: Split-Spoon with Liner

DATE: 3/12/04

HOLE DIAMETER: 2"

LOGGED BY: GC

HOLE DEPTH: 22'

MOISTURE	PID (ppm)	DEPTH	GRAPHIC LOG	SAMPLE INTERVAL	DESCRIPTION
		0			Ground Surface
		0-3"			Airknifed to 8' Asphalt from 0-3"
		4-8'			SAND (SP-SM) Dark brown, very dense, medium to coarse SAND with minor silt; no odor; no sheen.
Moist to Wet	18.3	8'			SAND (SP-SM) Brown, very dense, poorly graded, fine to medium SAND with minor silt and thin interbedded layers of silt and clay; slight hydrocarbon odor; no sheen.
	2.3	9'			
Wet to Sat	1.7	10'			Groundwater at 9.5'
	3.6	11'			SAND (SP) Dark gray, poorly graded, very dense, medium to coarse SAND; strong hydrocarbon odor; sheen present.
	81.7	12'			
	58.6	13'			
	1801	14'			SAND (SP) Same as above; strong odor; strong sheen.
Sat	90.4	15'			
	287	16'			
	294	17'			
	181	18'			
	160	19'			SAND (SP) Brown, poorly graded, very dense, medium to coarse clean SAND; subtle hydrocarbon odor; no sheen.
Sat	176	20'			
	37.1	21'			Refusal at 22'
	12.3	22'			

DRAFT

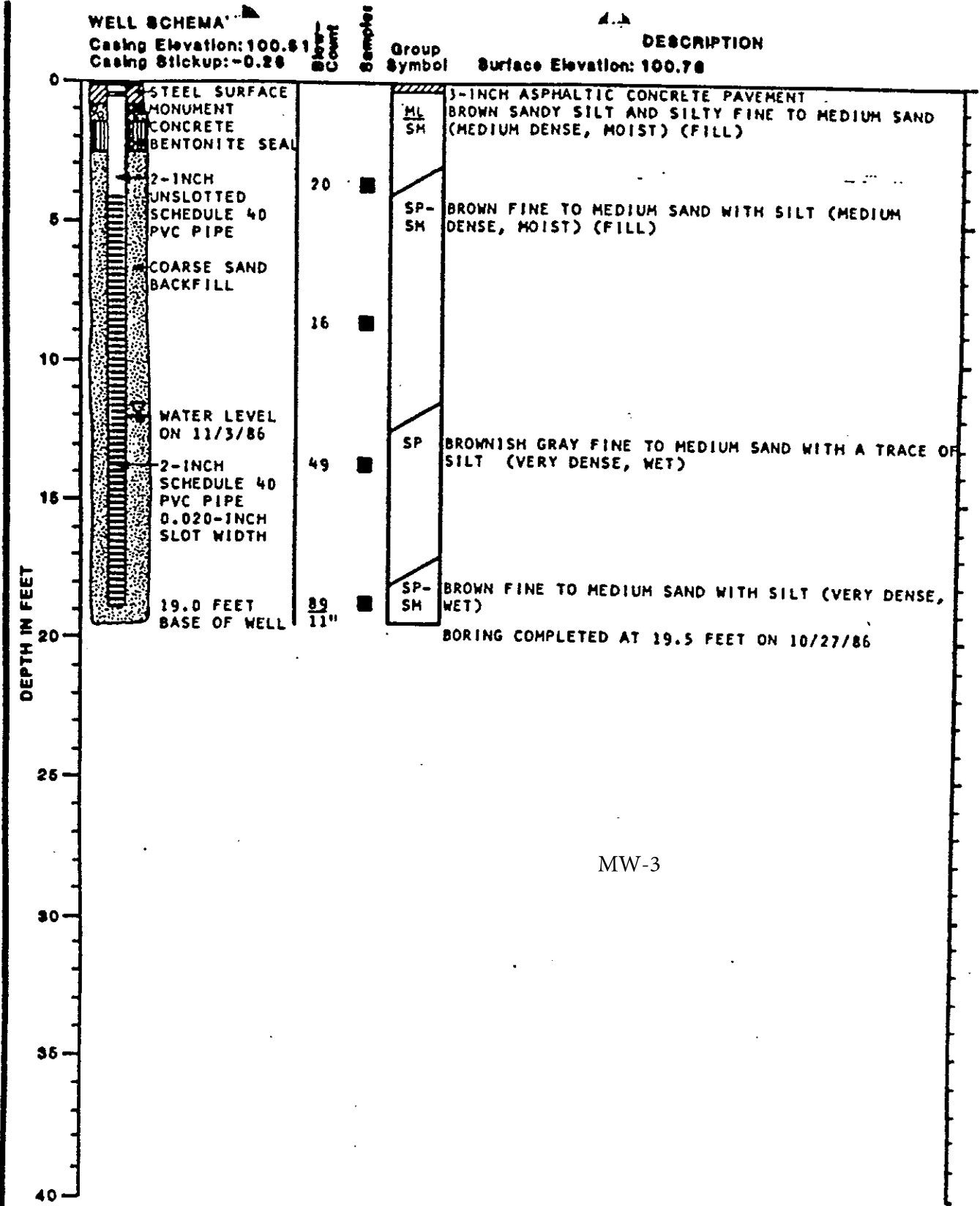
WELL SCHEMA

Casing Elevation: 100.81
Casing Stickup: -0.28



DESCRIPTION

Surface Elevation: 100.78



504-04 JAM:DMP 11-13-86

Note: See Figure 3 for Explanation of Symbols



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LOG OF MONITOR WELL

FIGURE 4

MW-3

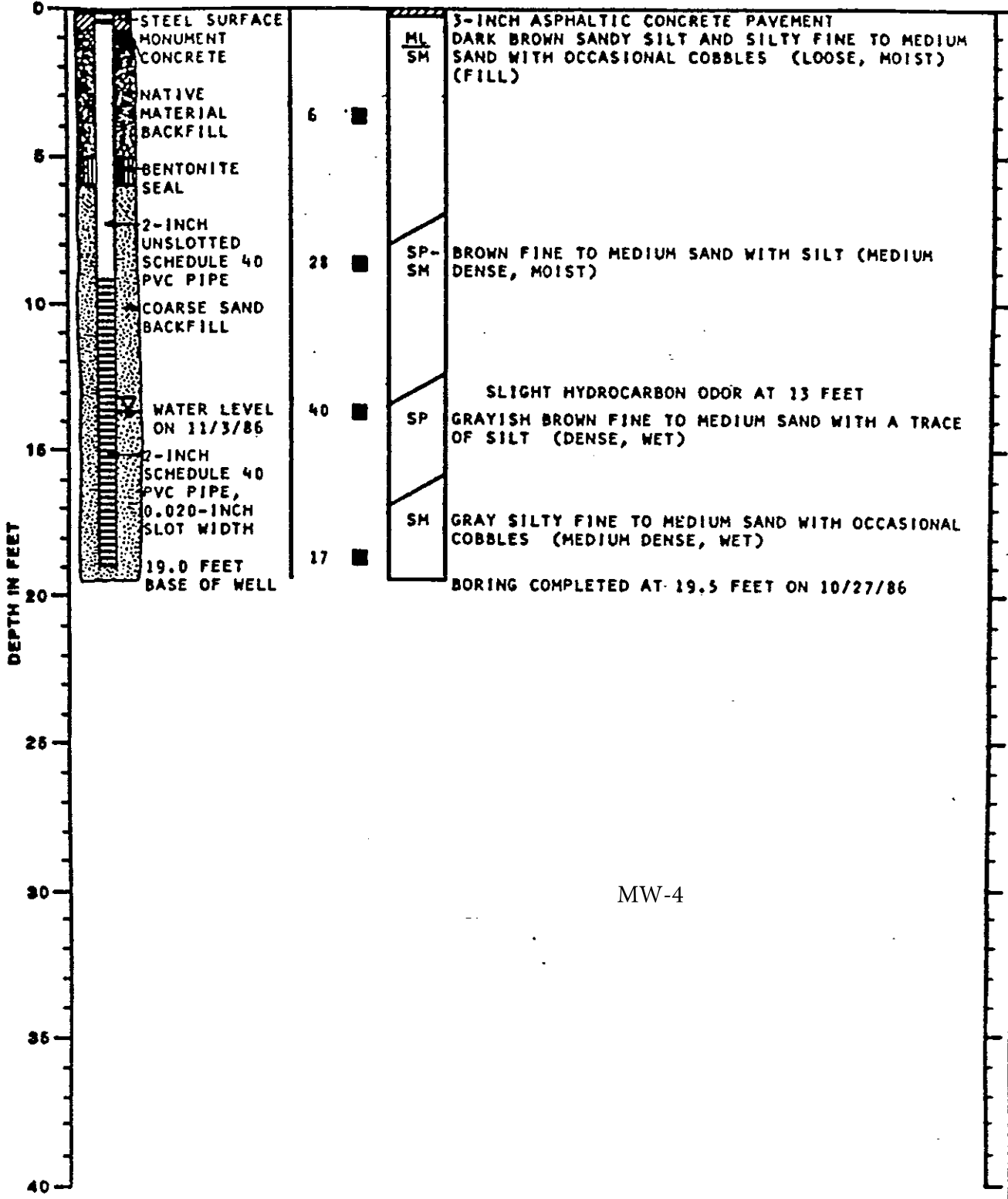
DRAFT

WELL SCHEMATIC

Casing Elevation: 102.08
Casing Slickup: -0.80

DESCRIPTION

Surface Elevation: 102.88



504-04 JAM:DMP 11-13-86

MW-4



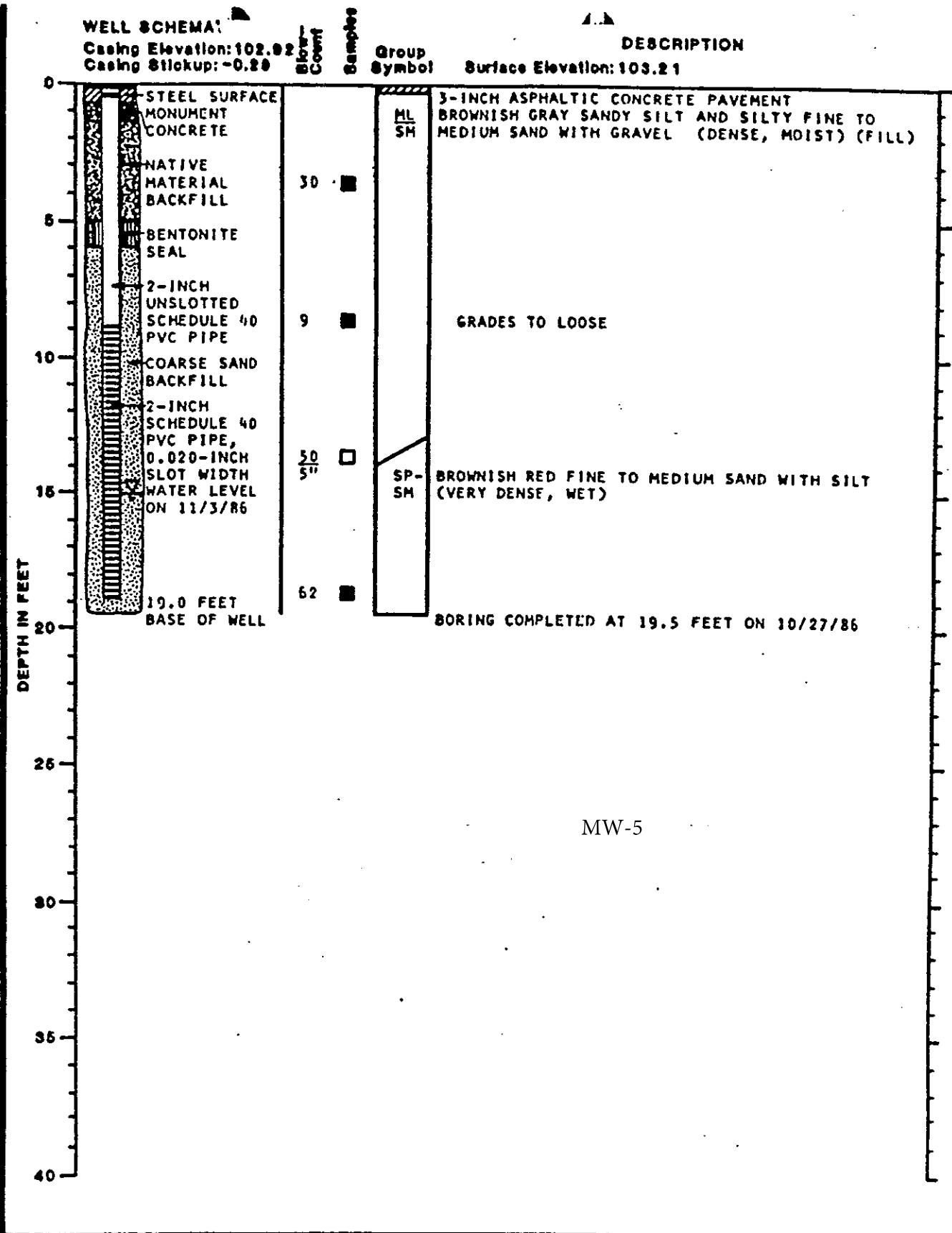
GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE 5

URAF

504-04 JAM:DMP 11-13-86



MW-5

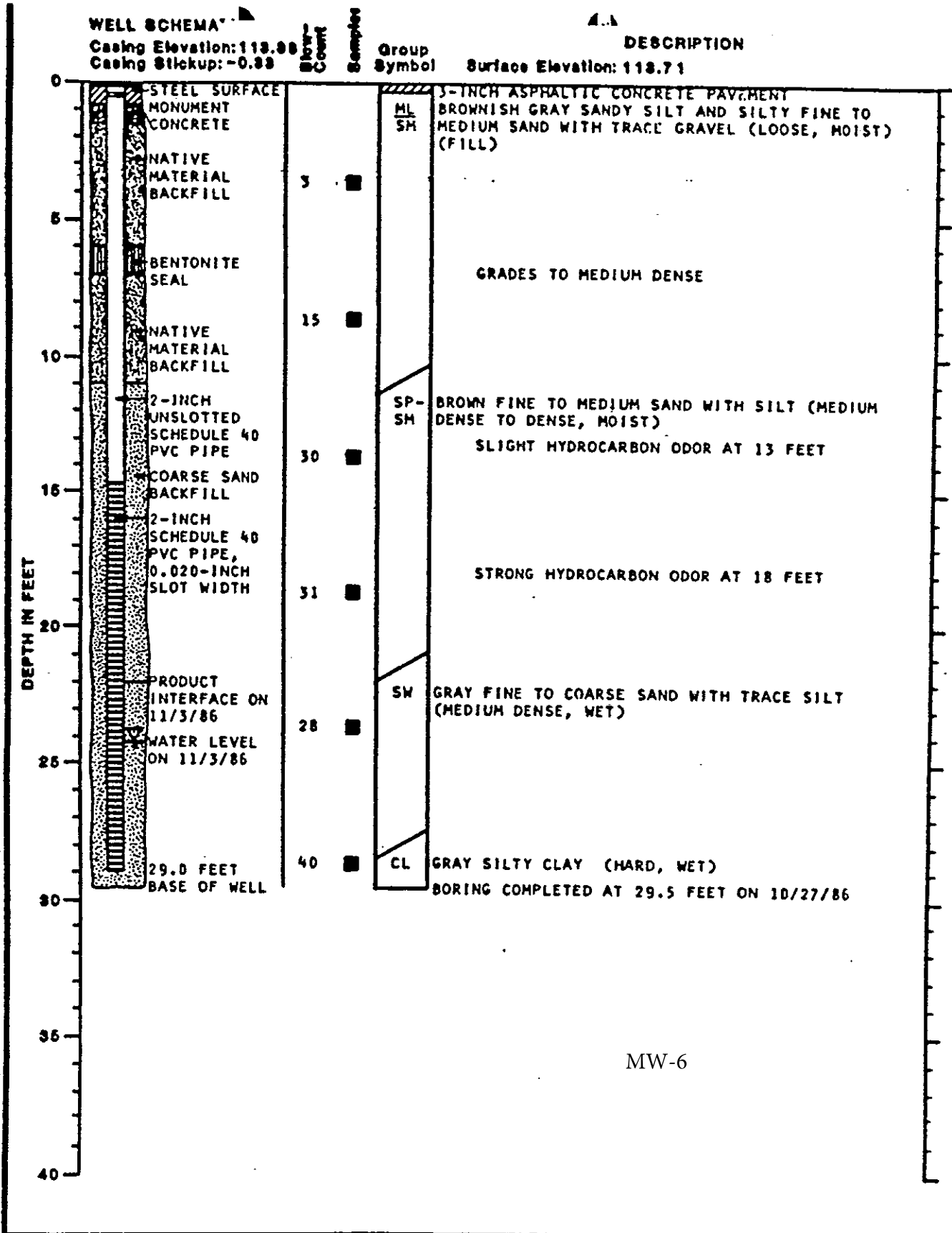


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LOG OF MONITOR WELL

FIGURE 6

DRAFT



504-04 JAM:DMP 11-13-86

MW-6



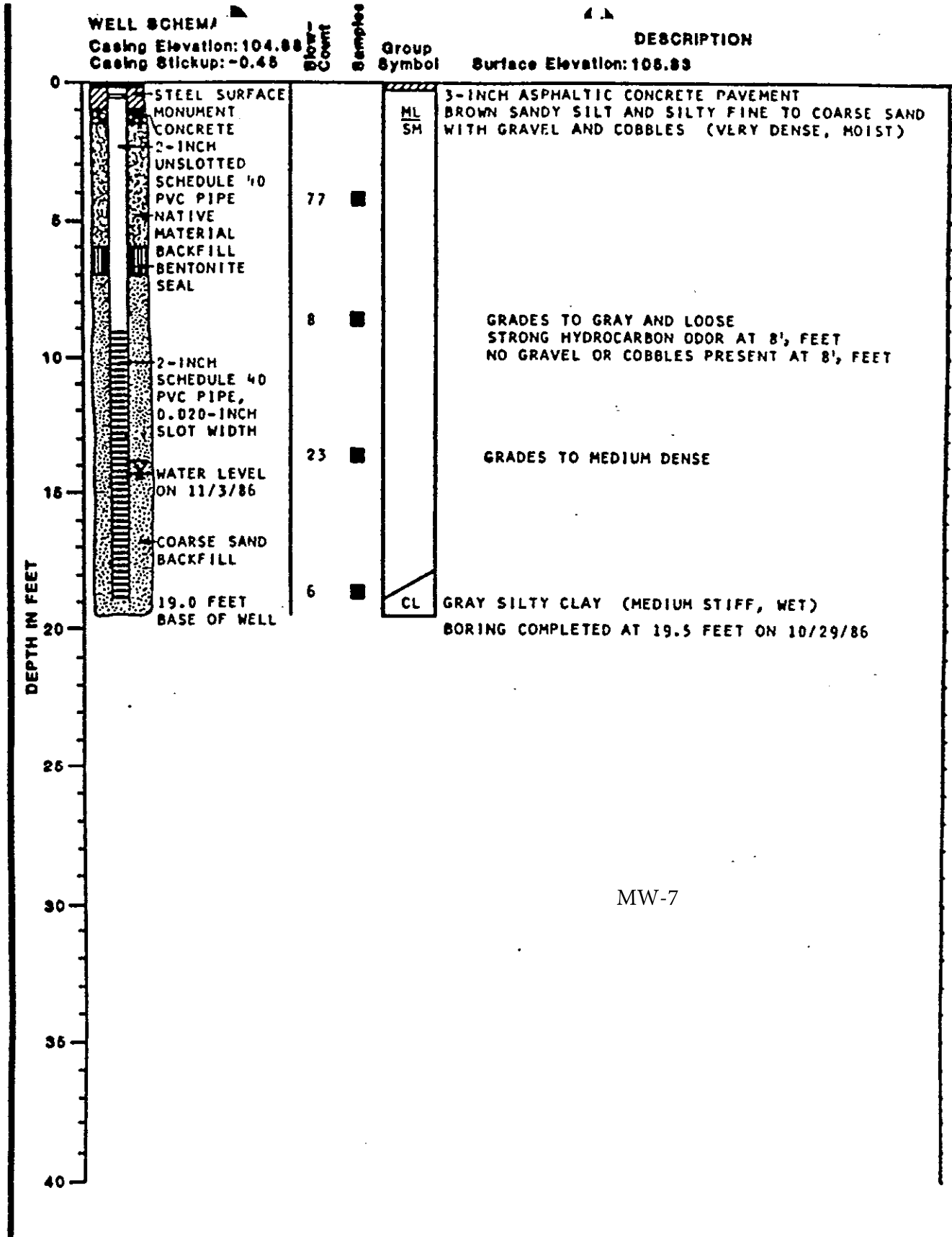
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LOG OF MONITOR WELL

FIGURE 7

DRAF

504-04 JAN:DMP 11-13-86



MW-7



LOG OF MONITOR WELL

FIGURE 8

DRAFT

WELL SCHEMATIC

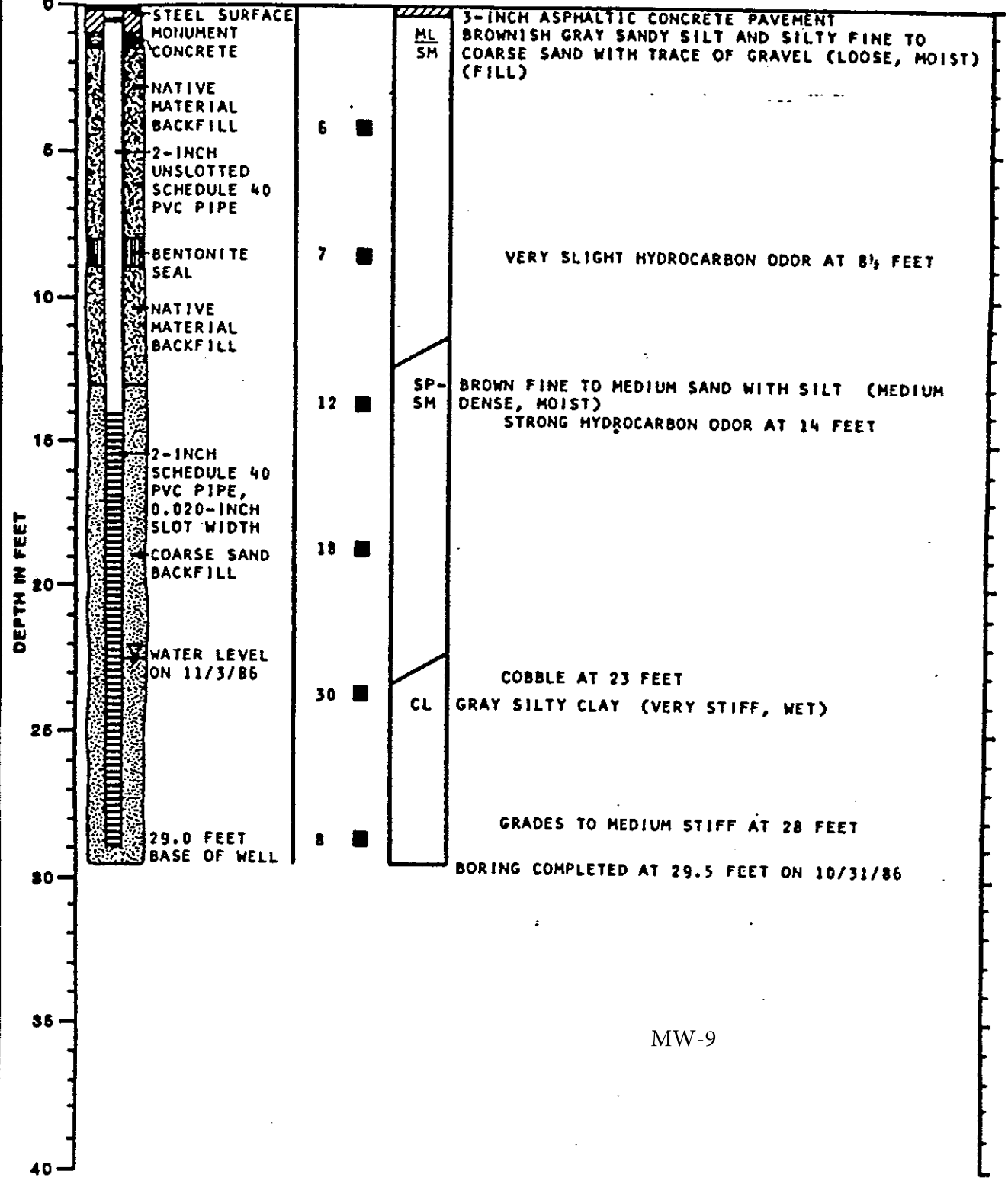
Casing Elevation: 114.40
Casing Stickup: -0.26

Flow-Count
Samples

Group Symbol

DESCRIPTION

Surface Elevation: 114.66



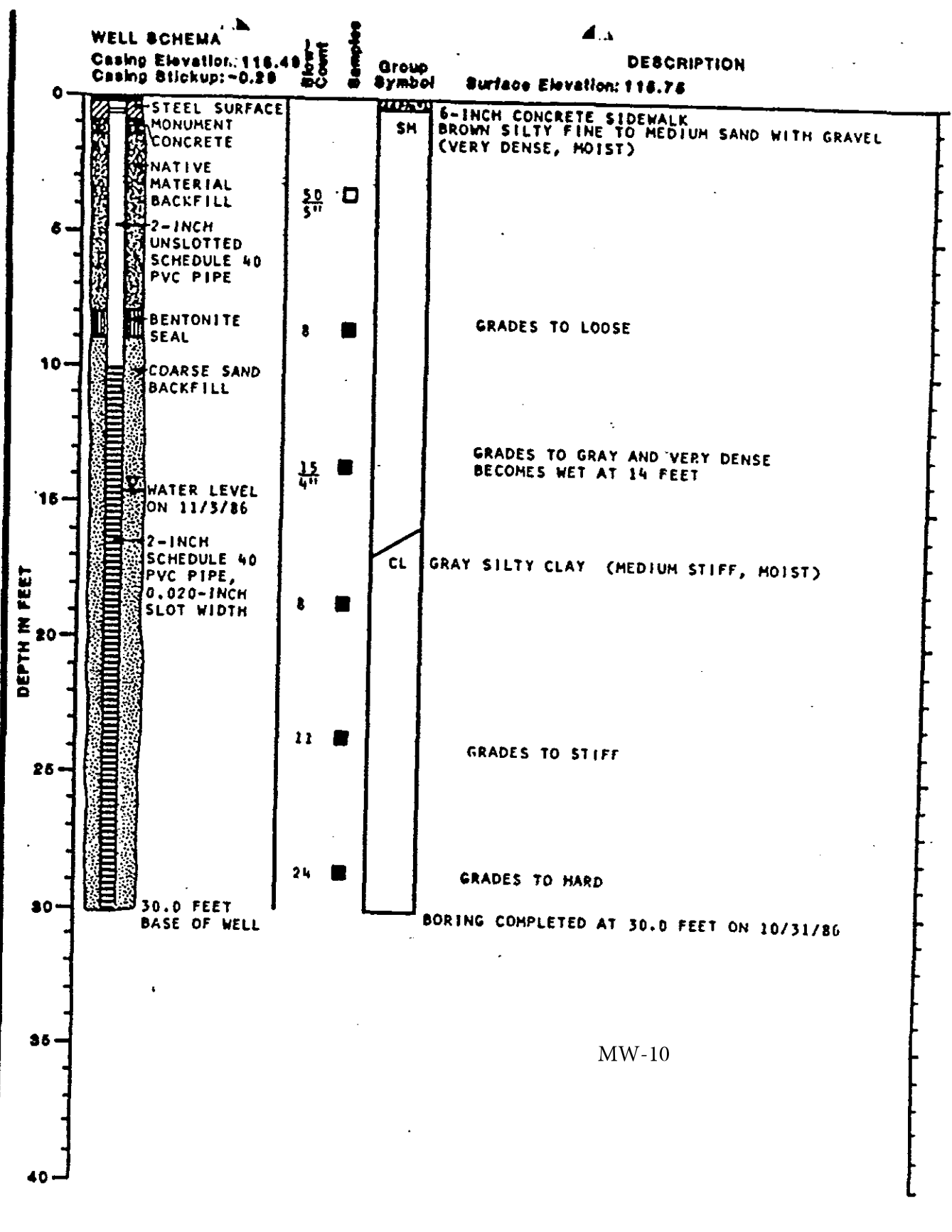
JAM:DMP 11-13-86 504-04



LOG OF MONITOR WELL

FIGURE 10

DRAFT



504-04 JAN:DMP 11-13-86



LOG OF MONITOR WELL

FIGURE 11

MW-10

Appendix C

Health and Safety Plan (HASP)



Site Specific Health and Safety Plan

Revision 16a

Project Name:	Site 211577 631 Queen Anne Ave, Seattle, WA 98109
Project Number:	3001258
Client Name:	Chevron
Date:	7/2/2019
HASP Expires	7/1/2020
Revision:	0

Approvals:

HASP Developer: _____ Daniel Sly Gilbert

Project Manager: _____ Christopher Dotson

HASP Reviewer: _____ Eric Epple

Arcadis Culture of Caring

Arcadis is committed to a Culture of Caring that ensures each Arcadis employee, part time as needed employee (PTAN), temporary agency employee under Arcadis day to day control, Inexperienced Workers and contractor (cumulatively referred to here as "field staff") goes home at the end of the day free from injury or illness. I certify that the following has been performed with all Arcadis field staff on this project either in person or by Skype:

- Reviewed the HASP including a discussion of hazard identification and controls.
 - If conducting activities deemed by Arcadis to be "High Risk", frontline management has reviewed applicable H&S standards (Job Safety Analysis [JSA] when authorized by H&S) for these activities with field staff.
 - If permit to work is required, frontline management has reviewed the permit(s) with field staff.
- Reviewed proactive H&S engagement expectations/injury prevention actions.
- Reviewed Stop Work Authority.
- Reviewed the incident reporting process and expectations including when WorkCare should be contacted by staff (WorkCare incident intervention for all minor, non-emergency injuries) and that the WorkCare phone number is programmed into field team cell phone.
- For Inexperienced Workers, a mentor has been assigned for the new task being performed.

For short service employees (SSEs), PTANS* and temporary agency employees* :

- Provided coaching and mentoring on Arcadis H&S expectations during project work. Reviewed in detail specific hazards and controls and provided a resource who can be contacted if individual has questions regarding planned or unplanned work tasks.

Mentor/Resource # _____
Name Phone Number

Signed:

* Upon hiring/contracting for the first time.

Emergency Information

Site Address:

Site 211577
631 Queen Anne Ave, Seattle, WA 98109

Emergency Phone Numbers:

Emergency (fire, police, ambulance)		911
Emergency (facility specific, if applicable):		
Emergency Other (specify):		
Primary Client Contact:	Tim Bishop	925-588-4662
WorkCare (non-life-threatening injury/illness):		1-888-449-7787
Project H&S:	Aaron Svitana	925-360-2313
Task Manager:	Ada Hamilton	206-413-6430
Project Manager:	Christopher Dotson	503-785-9383
Corporate H&S Specialist:	Greg Mason	859-806-0746
Corporate H&S Director:	Denis Balcer	614-778-9171

Hospital Name and Address:

Virginia Mason Emergency Department
1010 Spring St, Seattle, WA 98101

Hospital Phone Number:

206-583-6433

Supplemental Client Contact Information:

Chevron PM - Tim Bishop	925-588-4662
Chevron HES Lead - Jim Duke	713-432-2916

Other Important Phone Numbers:

Poison Control Center	1-800-222-1222
Nat. Response Ctr. (spills in reportable quantities)	1-800-424-8802
U.S. Coast Guard (spills to water)	1-800-424-8802

Incident Reporting Protocol Within Arcadis

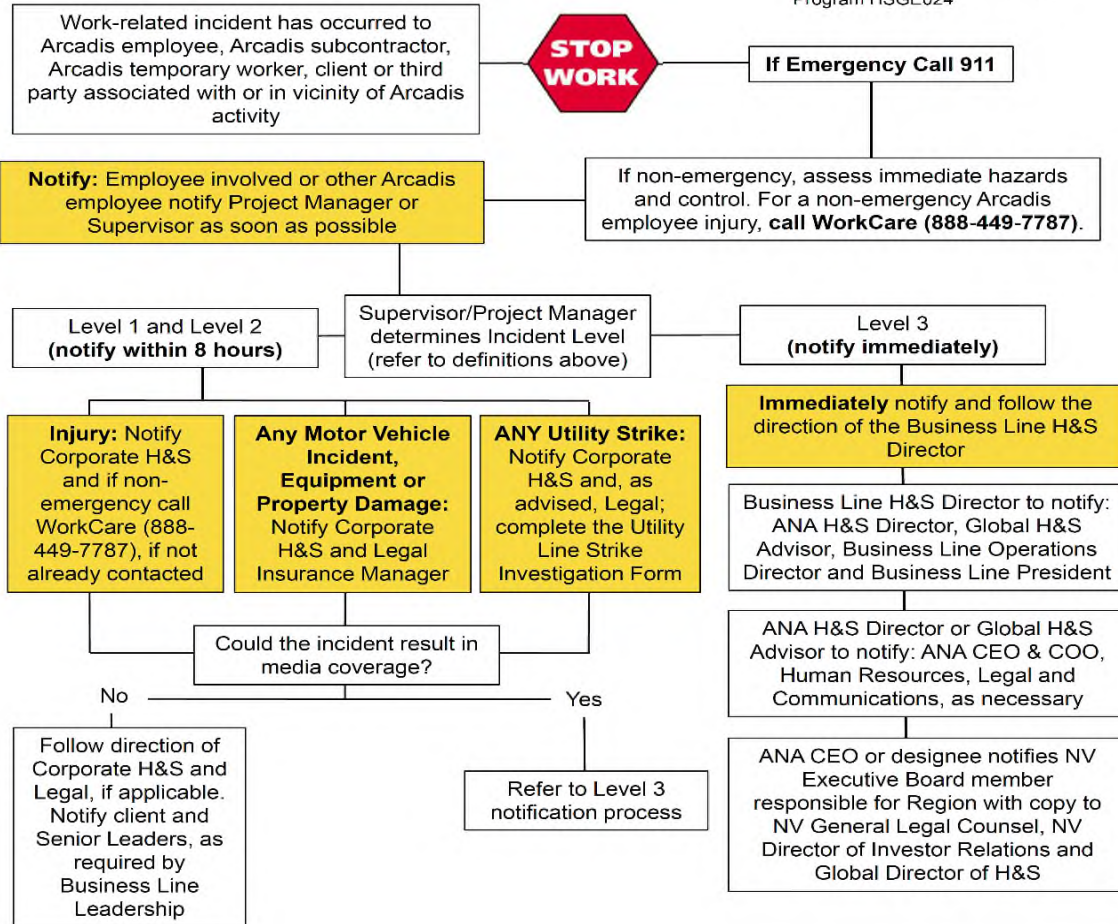
Incident Levels

Level 1: First aid/self-treated, work-related injury (contact WorkCare as soon as possible); minor property or equipment damage (less than or equal to \$100); vehicle loss event* (no injuries, no third-party involvement or other vehicle involvement).

Level 2: Professional Medical Treatment (if non-emergency injury or illness, employee must contact WorkCare as soon as possible); moderate property or equipment damage (greater than \$100 but less than or equal to \$5,000); ANY utility strike incident, any motor vehicle accident* (including injury or third-party involvement).

Level 3: Immediately report fatality, severe or catastrophic injury and/or overnight hospitalization required; significant property or equipment damage (greater than \$5,000); missing person or incident that generates media coverage.

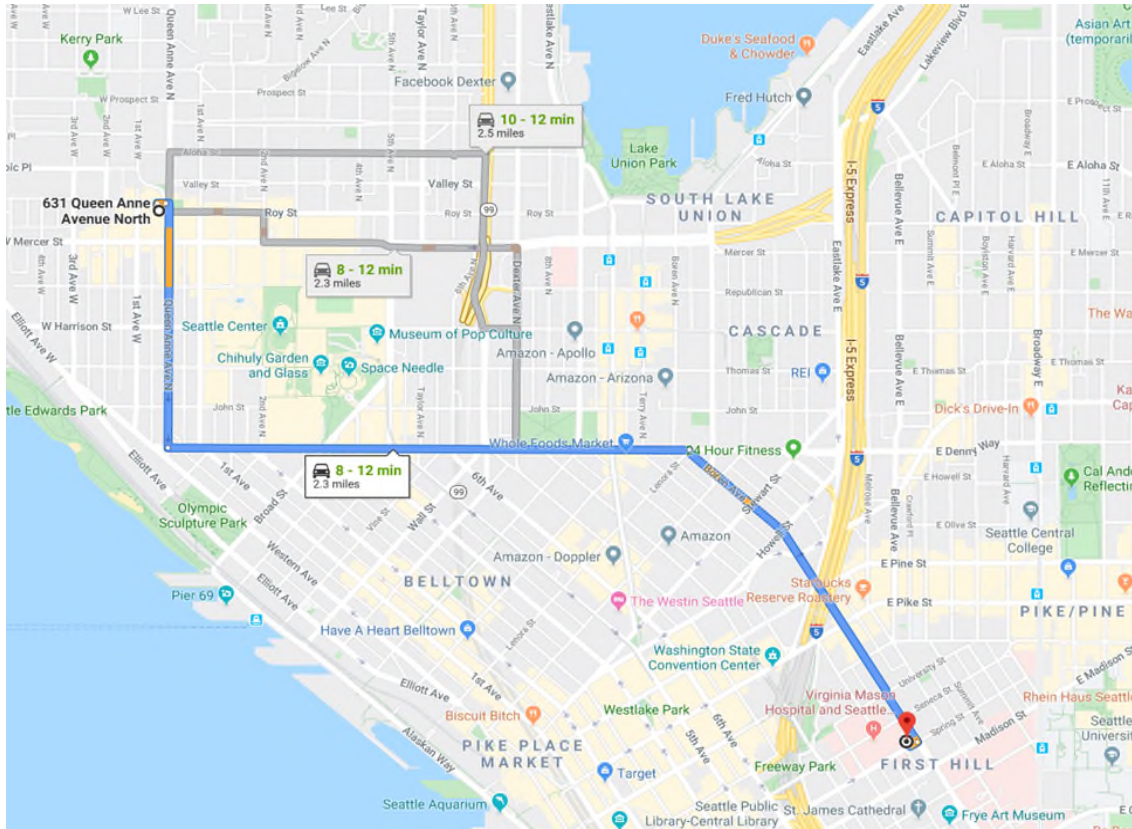
* Refer to Motor Vehicle Safety Program HSGE024



Client Incident Reporting Protocol

Project team must manually enter client incident protocol to client below

Route to the Hospital



Head south on Queen Anne Ave N
Use the left 2 lanes to turn left onto Denny Way
Turn right onto Spring St
Destination will be on the right

Site Type

The project site is an active facility with the following attributes:

Commercial	
Parking Lot/Private Drive (NON ROW)	

Work in parking lots will require preparation of a Non-ROW Traffic Safety Plan.

Surrounding Land Use and Topography

The site is located in an urban commercial area of the Queen Anne neighbourhood in Seattle. The site is on a corner, bounded by Queen Anne Ave N to the East and W Roy St to the North. W Mercer St is located on the southern end of the block. The area experiences high road traffic.

Simultaneous Operations (SimOps)

Planned Arcadis site work will not be in proximity to SimOps work activities performed by non Arcadis employees or subcontractors. Arcadis will initiate stop work and evaluate the work activities through the JSA process if during the course of work a SimOps activity is identified that could reasonably affect health and safety of Arcadis employees and subcontractors.

Site Background

The site and existing building are currently vacant, and the parking lot is utilized as a paid parking lot operated by Republic Parking. The exterior portions of the site outside the vacant building are asphalt paved. In general, the soils underlying the site consist of silty sands to depths of approximately 6 feet to 8 feet bgs, underlain by sand to depths of 17 feet bgs beneath the eastern portion of the Site, to 31 feet bgs beneath the western portion of the Site. Underlying the sand is the Lawton Clay, a hard to very hard, relatively impervious, clayey silt. The shallow water bearing zone, present across the site, is typically found perched above the Lawton Clay. Depth to this water bearing zone ranges from approximately 10 to 13.5 feet bgs, beneath the eastern portion of the site, to 18 to 24 feet bgs beneath the western portion. Groundwater flow direction has consistently been towards the west-southwest.

Project Tasks

The following tasks are identified for this project:

1	Decontamination - Small or hand-held objects using manual methods
2	Mobilization - Loading and unloading vehicles
3	Monitor well - Well installation, development, or purging contractor oversight
4	Monitor well - Well sounding, water level or product measurements using probes, tapes or downhole water parameter measurements
5	Monitoring - Air monitoring using hand held or stationary equipment - non-radiation
6	Sampling - Pressurized air sampling using sample cylinders or similar devices
7	Oversight - Oversight of contractors
8	Sampling - Free product - all media and all manual methods
9	Sampling - Well sampling using mechanical methods
10	Survey - Land surveying
11	Utilities - Clearance
12	Waste - Containment of IDW in small containment devices greater than 10 gallons but less than or equal to 119 gallons capacity
13	Waste - Liquid waste sampling using manual methods
14	Waste - Solid waste sampling using manual methods
15	Waste- Arcadis oversight of contractors performing IDW containment, segregation and/or sampling
16	Select
17	Select
18	Select
19	Select
20	Select

Supplemental requirements associated with the above task(s):
 A Washington Heat Illness Prevention Plan (HIPP) is attached.

The Arcadis Utility Clearance Checklist must be used for utility clearance activities.

Client H&S information is attached.

Site access agreements and/or a discussion of proper procedures for accessing off-site non-client owned private property must be

<input checked="" type="checkbox"/>	Required Checklists/Work Forms
	<i>Tailgate Safety Briefing Form</i>
	<i>Vehicle Inspection Checklist</i>
	<i>Utility and Structures Checklist</i>

<input type="checkbox"/>	Required Permits
	<i>Not Applicable</i>
<input type="checkbox"/>	Required H&S Standards
	<i>Not applicable</i>

Short Service Employees (SSEs)

SSEs (employees who are employed with Arcadis for less than 1 year or are Inexperienced Workers) have the potential to work on this project. If SSEs are utilized, the project team working in conjunction with the SSE's administrative supervisor will ensure requirements of ARC HSGE019 "Short Service Employees" are completed. SSE's will be identified on the project Tailgate Safety Meeting Form.

Roles and Responsibilities

Name	Role	Short Service Employee
1 Christopher Dotson	Project Manager (PM)	No
2 Ada Hammlton	Associate Project Manager (APM)	No
3 Eric Epple	Task Manager	No
4 Julia Vidonish	Field Technical Lead	No
5 Julia Vidonish	Site Safety Officer (SSO)	No
6 Ryan Brauchla	Field Technician	No
7 Daniel Gilbert	Field Technician	No
8		
9		
10		

Training

All Arcadis employees are required to have the following training to be on site:

Selected Arcadis employees are required to have the following additional training:

Defensive Driving - Smith On-Line
H&S Program Orientation (non-certifica
HAZCOM GHS/EAP (non-certificate)
Hazwoper 40-Hour
Hazwoper 8-Hour Annual Refresher
PPE (non-certificate)
None
None
None
None
None
None
None
Client specific:
Other:

BBP (Bloodborne Pathogens)	Julia Vidonish
Benzene - General Awareness	Ryan Brauchla
DOT HazMat #1	Daniel Gilbert
Electrical General Awareness	
Electrical NFPA 70E - includes Arc Flash	
Excavation General Awareness	
Fire Extinguisher (non-certificate)	
First Aid/CPR	
Hazwoper 8-Hour Supervisor	
Hearing Conservation/Protection	
Respirator	
None	
None	
None	
None	
Other:	

The Arcadis Fundamental H&S Principles

Staff working on any of the task(s) listed above must utilize the six Arcadis Fundamental H&S Principles to ensure work is conducted safely. These principles include: 1) Use of TRACK, 2) H&S Planning, 3) Stop Work Authority, 4) "If Not Me Then Who", 5) Stewardship, and 6) Incident Reporting. Every project team member plays an important role in project health and safety. This is more than just having a HASP, training, or PPE. Proactive staff engagement with these principles is critical to a safe work environment.



General Task Hazard Assessment and Risk Control (HARC)

General: Hazards Applicable to All Project Tasks

The 12 hazard category HARC ratings are not available in this General THA. The mitigated and unmitigated ratings for the hazards presented are based on the Risk Assessment Matrix below. Modify hazards and ratings as necessary to meet project needs.

Risk Assessment Matrix		Likelihood Ratings			
Consequences Ratings		A	B	C	D
People	Property	0 Almost Impossible	1 Possible but Unlikely	2 Likely to Happen	3 Almost Certain to Happen
1-Slight or No Health Effect	Slight or No Damage	0-Low	1-Low	2-Low	3-Low
2-Minor Health Effect	Minor Damage	0-Low	2-Low	4-Medium	6-Medium
3-Major Health Effect	Local Damage	0-Low	3-Low	6-Medium	9-High
4-Fatalities	Major Damage	0-Low	4-Medium	8-High	12-High

Hazard #1

Driving - On road - Injury or vehicle damage from motor vehicle accident or incident

Suggested FHSBH Ref: III V, W, U, AO To mitigate this hazard, use TRACK and the following:
 Overall Unmitigated Risk: **HIGH** Smith System (on line)
 Mitigated Risk: **MEDIUM** JSAs
 Comments: Use Smith System "5-Keys" when driving. See Driving JSA for details.

Hazard #2

Driving - Driver - Injury, death or property damage due to driver distraction, fatigue, etc.

Suggested FHSBH Ref: III V, AO To mitigate this hazard, use TRACK and the following:
 Overall Unmitigated Risk: **HIGH** Smith System (on line)
 Mitigated Risk: **LOW** Driver awareness and use of stop work authority
 Comments: Use route planning. Keep eyes moving while driving. See Driving JSA.

Hazard #3

Biological - skin/eye irritation or damage from poisonous plants

Suggested FHSBH Ref: III N, AE To mitigate this hazard, use TRACK and the following:
 Overall Unmitigated Risk: **LOW** Job Briefing/Site Awareness
 Mitigated Risk: **LOW** PPE (see HASP "PPE" section)
 Comments: Use skin pre-treatment lotions when available.

Hazard #4

Biological - bites or stings from exposure to insects or arachnids

Suggested FHSBH Ref: III N To mitigate this hazard, use TRACK and the following:
 Overall Unmitigated Risk: **LOW** Job Briefing/Site Awareness
 Mitigated Risk: **LOW** PPE (see HASP "PPE" section)
 Comments: Do body check daily.

Hazard #5

Biological - cuts, scrapes, skin/eye puncture from exposure to physically damaging plants

Suggested FHSBH Ref: III N, AE To mitigate this hazard, use TRACK and the following:
 Overall Unmitigated Risk: **MEDIUM** Job Briefing/Site Awareness
 Mitigated Risk: **LOW** PPE (see HASP "PPE" section)
 Comments:

General Task HARC (continued)

Hazard #6		
Environmental - Thermal stress - Injury or illness from heat or cold		
Suggested FHSB Ref:	III M	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	Field H&S Handbook (see ref. above)
Mitigated Risk:	LOW	JSAs
Comments:	Use job rotation or rest breaks. Stay hydrated and eat regularly.	
Hazard #7		
Environmental - Inclement weather - Injury or equipment damage from inclement weather		
Suggested FHSB Ref:	III I	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	Weather Monitoring
Mitigated Risk:	LOW	Cont./Emerg. Planning
Comments:	Use 30/30 rule for lightning. See FHSB for details.	
Hazard #8		
Motion - Musculoskeletal - Injury from lifting, twisting, stooping, or awkward body positions		
Suggested FHSB Ref:	III AF	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	Engineering Controls (specify in comments)
Mitigated Risk:	LOW	Admin. Controls (specify in comments)
Comments:	Use proper lifting techniques. Use job rotation when applicable. See FHSB for details.	
Hazard #9		
Motion - Musculoskeletal - Injury from repeated work activity or body motion		
Suggested FHSB Ref:	III AF	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	Engineering Controls (specify in comments)
Mitigated Risk:	LOW	Admin. Controls (specify in comments)
Comments:	Use proper lifting techniques. Use job rotation when applicable. See FHSB for details.	
Hazard #10		
Sound - Noise - Injury or illness due to noise exposure		
Suggested FHSB Ref:	III L	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	Engineering Controls (specify in comments)
Mitigated Risk:	LOW	PPE (see HASP "PPE" section)
Comments:	Increase distance from source if possible. Maintain equipment.	
Hazard #11		
Gravity - Falls - Injury due to slips and trips		
Suggested FHSB Ref:	III F	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	Site Awareness
Mitigated Risk:	LOW	Housekeeping
Comments:	Use footwear appropriate for site conditions, plan routes and do not hurry while walking.	
Hazard #12		
Radiation - Non-ionizing - Injury or illness due to exposure to non-ionizing radiation including sun exposure		
Suggested FHSB Ref:	NA	To mitigate this hazard, use TRACK and the following:
Overall Unmitigated Risk:	MEDIUM	PPE (see HASP "PPE" section)
Mitigated Risk:	LOW	H&S Standards
Comments:	Wear long-sleeve shirt, apply sunscreen	

Task Specific HARC

Task 1:		Decontamination - Small or hand-held objects using manual methods					
HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low):		FHSBH Ref:				III G	
Biological	L	Chemical	M	Driving	-	Electrical	-
Environmental	L	Gravity	L	Mechanical	-	Motion	L
Personal Safety	L	Pressure	L	Radiation	-	Sound	L
Hazard #1							
Chemical - liquids, skin or eye irritation/damage/allergy							
Suggested FHSBH Ref:		III C, F, G, K, S, AG		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		MEDIUM		PPE (see HASP "PPE" section)			
Mitigated Risk:		LOW		JSAs			
Comments:		Be aware of chemicals on site, wear appropriate PPE (eg nitrile gloves)					
Hazard #2							
Chemical - solids/particulates, skin or eye irritation/damage/allergy							
Suggested FHSBH Ref:		III C, F, G, K, S, AG		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		MEDIUM		HASP			
Mitigated Risk:		LOW		JSAs			
Comments:		Be aware of chemicals on site, wear appropriate PPE (eg nitrile gloves)					
Hazard #3							
None							
Suggested FHSBH Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							
Hazard #4							
None							
Suggested FHSBH Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							
Hazard #5							
None							
Suggested FHSBH Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							
Hazard #6							
None							
Suggested FHSBH Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							

Task Specific HARC (continued)

Task 2:		Mobilization - Loading and unloading vehicles					
HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low):		FHSBH Ref:		III F			
Biological	-	Chemical	L	Driving	-	Electrical	L
Environmental	L	Gravity	M	Mechanical	L	Motion	M
Personal Safety	L	Pressure	L	Radiation	L	Sound	L
Hazard #1							
Chemical - liquids, skin or eye irritation/damage/allergy							
Suggested FHSBH Ref:		III C, F, G, K, S, AG		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		MEDIUM		HASP			
Mitigated Risk:		LOW		JSAs			
Comments:		Be aware of moving parts, communicate with operator before approaching					
Hazard #2							
Chemical - solids/particulates, skin or eye irritation/damage/allergy							
Suggested FHSBH Ref:		III C, F, G, K, S, AG		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		MEDIUM		HASP			
Mitigated Risk:		LOW		JSAs			
Comments:		Be aware of chemicals on site, wear appropriate PPE (eg nitrile gloves)					
Hazard #3							
None							
Suggested FHSBH Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							
Hazard #4							
None							
Suggested FHSBH Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Job Briefing/Site Awareness			
Mitigated Risk:		Not Ranked		JSAs			
Comments:							
Hazard #5							
None							
Suggested FHSBH Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							
Hazard #6							
None							
Suggested FHSBH Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							

Task Specific HARC (continued)

Task 3:		Monitor well - Well installation, development, or purging contractor oversight					
HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low):		FHSB Ref:				III F	
Biological	L	Chemical	L	Driving	-	Electrical	-
Environmental	L	Gravity	M	Mechanical	L	Motion	L
Personal Safety	-	Pressure	L	Radiation	-	Sound	M
Hazard #1							
Mechanical - Pinch point - Injury by pinching of body part in mechanical process							
Suggested FHSB Ref:		III S IV, E, F, G, O		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		MEDIUM		PPE (see HASP "PPE" section)			
Mitigated Risk:		LOW		Machine Guarding			
Comments:		Be aware of moving parts, communicate with operator before approaching					
Hazard #2							
Motion - Struck by - Bodily injury from impact with moving object							
Suggested FHSB Ref:		III S		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		MEDIUM		Site Awareness			
Mitigated Risk:		LOW		Engineering Controls (specify in comments)			
Comments:		Be aware of moving parts, communicate with operator before approaching					
Hazard #3							
None							
Suggested FHSB Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							
Hazard #4							
None							
Suggested FHSB Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							
Hazard #5							
None							
Suggested FHSB Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							
Hazard #6							
None							
Suggested FHSB Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							

Task Specific HARC (continued)

Task 4:	Monitor well - Well sounding, water level or product measurements using probes, ta						
HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low):				FHSBH Ref:		III F	
Biological	L	Chemical	L	Driving	-	Electrical	-
Environmental	L	Gravity	M	Mechanical	-	Motion	L
Personal Safety	-	Pressure	L	Radiation	-	Sound	L
Hazard #1							
Motion - Struck by - Bodily injury from impact with moving object							
Suggested FHSBH Ref:	III S		To mitigate this hazard, use TRACK and the following:				
Overall Unmitigated Risk:	MEDIUM		JSAs				
Mitigated Risk:	LOW		Job Briefing/Site Awareness				
Comments:	Ensure packed items are stable and secure in vehicle, use straps when necessary						
Hazard #2							
None							
Suggested FHSBH Ref:	#N/A		To mitigate this hazard, use TRACK and the following:				
Overall Unmitigated Risk:	#N/A		Select				
Mitigated Risk:	#N/A		Select				
Comments:							
Hazard #3							
#N/A							
None							
Suggested FHSBH Ref:	None		To mitigate this hazard, use TRACK and the following:				
Overall Unmitigated Risk:	Not Ranked		Select				
Mitigated Risk:	Not Ranked		Select				
Comments:							
Hazard #4							
None							
Suggested FHSBH Ref:	None		To mitigate this hazard, use TRACK and the following:				
Overall Unmitigated Risk:	Not Ranked		Select				
Mitigated Risk:	Not Ranked		Select				
Comments:							
Hazard #5							
None							
Suggested FHSBH Ref:	None		To mitigate this hazard, use TRACK and the following:				
Overall Unmitigated Risk:	Not Ranked		Select				
Mitigated Risk:	Not Ranked		Select				
Comments:							
Hazard #6							
None							
Suggested FHSBH Ref:	None		To mitigate this hazard, use TRACK and the following:				
Overall Unmitigated Risk:	Not Ranked		Select				
Mitigated Risk:	Not Ranked		Select				
Comments:							

Task Specific HARC (continued)

Task 5:		Monitoring - Air monitoring using hand held or stationary equipment - non-radiation					
HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low):		FHSB Ref:			V I		
Biological	L	Chemical	M	Driving	-	Electrical	L
Environmental	L	Gravity	L	Mechanical	L	Motion	L
Personal Safety	L	Pressure	-	Radiation	-	Sound	L
Hazard #1							
Environmental - Utilities - Injury or property damage from utility strike/damage							
Suggested FHSB Ref:		III AN		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		HIGH		PPE (see HASP "PPE" section)			
Mitigated Risk:		MEDIUM		Job Briefing/Site Awareness			
Comments:		Use three lines of evidence to clear utilities					
Hazard #2							
Mechanical - Pinch point - Injury by pinching of body part in mechanical process							
Suggested FHSB Ref:		III S IV, E, F, G, O		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		MEDIUM		PPE (see HASP "PPE" section)			
Mitigated Risk:		LOW		Job Briefing/Site Awareness			
Comments:		Be aware of moving parts, communicate with operator					
Hazard #3							
Motion - Struck by - Bodily injury from impact with moving object							
Suggested FHSB Ref:		III S		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		MEDIUM		Select			
Mitigated Risk:		LOW		Select			
Comments:		Understand process, be aware of moving parts on and around the machine (eg					
Hazard #4							
None							
Suggested FHSB Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							
Hazard #5							
None							
Suggested FHSB Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							
Hazard #6							
None							
Suggested FHSB Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							

Task Specific HARC (continued)

Task 6:		Sampling - Pressurized air sampling using sample cylinders or similar devices					
HARC Unmitigated	Hazard Types (H-High, M-Medium, L-Low):			FHSBH Ref:		III F	
Biological	L	Chemical	L	Driving	-	Electrical	-
Environmental	-	Gravity	L	Mechanical	L	Motion	L
Personal Safety	-	Pressure	M	Radiation	-	Sound	L
Hazard #1							
Environmental - Utilities - Injury or property damage from utility strike/damage							
Suggested FHSBH Ref:	III AN		To mitigate this hazard, use TRACK and the following:				
Overall Unmitigated Risk:	HIGH		Smith System (on line)				
Mitigated Risk:	MEDIUM		JSAs				
Comments:	Use three lines of evidence to clear utilities						
Hazard #2							
Mechanical - Pinch point - Injury by pinching of body part in mechanical process							
Suggested FHSBH Ref:	III S IV, E, F, G, O		To mitigate this hazard, use TRACK and the following:				
Overall Unmitigated Risk:	MEDIUM		Inspections				
Mitigated Risk:	LOW		PPE (see HASP "PPE" section)				
Comments:	Be aware of moving parts, communicate with operator						
Hazard #3							
Motion - Struck by - Bodily injury from impact with moving object							
Suggested FHSBH Ref:	III S		To mitigate this hazard, use TRACK and the following:				
Overall Unmitigated Risk:	MEDIUM		Select				
Mitigated Risk:	LOW		Select				
Comments:	Understand process, be aware of moving parts on and around the machine (eg						
Hazard #4							
None							
Suggested FHSBH Ref:	None		To mitigate this hazard, use TRACK and the following:				
Overall Unmitigated Risk:	Not Ranked		Select				
Mitigated Risk:	Not Ranked		Select				
Comments:							
Hazard #5							
None							
Suggested FHSBH Ref:	None		To mitigate this hazard, use TRACK and the following:				
Overall Unmitigated Risk:	Not Ranked		Select				
Mitigated Risk:	Not Ranked		Select				
Comments:							
Hazard #6							
None							
Suggested FHSBH Ref:	None		To mitigate this hazard, use TRACK and the following:				
Overall Unmitigated Risk:	Not Ranked		Select				
Mitigated Risk:	Not Ranked		Select				
Comments:							

Task Specific HARC (continued)

Task 7:		Oversight - Oversight of contractors					
HARC Unmitigated	Hazard Types (H-High, M-Medium, L-Low):					FHSHB Ref:	II M
Biological	L	Chemical	L	Driving	L	Electrical	L
Environmental	L	Gravity	L	Mechanical	L	Motion	L
Personal Safety	L	Pressure	L	Radiation	L	Sound	L
Hazard #1							
Motion - Cuts and scrapes - Injury from moving object impacting skin or eye							
Suggested FHSHB Ref:	III S			To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:	MEDIUM			Site Awareness			
Mitigated Risk:	LOW			Engineering Controls (specify in comments)			
Comments:	Caution when opening the wells						
Hazard #2							
Pressure - Hydraulic - Injury from hydraulic process or device failure							
Suggested FHSHB Ref:	IV E			To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:	MEDIUM			Select			
Mitigated Risk:	LOW			Select			
Comments:	Caution when opening the wells						
Hazard #3							
None							
Suggested FHSHB Ref:	None			To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:	Not Ranked			Select			
Mitigated Risk:	Not Ranked			Select			
Comments:							
Hazard #4							
None							
Suggested FHSHB Ref:	None			To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:	Not Ranked			Select			
Mitigated Risk:	Not Ranked			Select			
Comments:							
Hazard #5							
None							
Suggested FHSHB Ref:	None			To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:	Not Ranked			Select			
Mitigated Risk:	Not Ranked			Select			
Comments:							
Hazard #6							
None							
Suggested FHSHB Ref:	None			To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:	Not Ranked			Select			
Mitigated Risk:	Not Ranked			Select			
Comments:							

Task Specific HARC (continued)

Task 8:		Sampling - Free product - all media and all manual methods					
HARC Unmitigated	Hazard Types (H-High, M-Medium, L-Low):					FHSHB Ref:	III F, S
Biological	L	Chemical	M	Driving	-	Electrical	L
Environmental	L	Gravity	L	Mechanical	L	Motion	L
Personal Safety	L	Pressure	L	Radiation	-	Sound	L
Hazard #1							
Chemical - liquids - injury or illness from vapor inhalation							
Suggested FHSHB Ref:	III C, F, G, K, S, AG			To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:	MEDIUM			See HASP "Monitoring" section			
Mitigated Risk:	LOW			Respiratory Protection Training			
Comments:	Be aware of action levels						
Hazard #2							
Suggested FHSHB Ref:	#N/A			To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:	#N/A			Site Awareness			
Mitigated Risk:	#N/A			Machine Guarding			
Comments:							
Hazard #3 #N/A							
Suggested FHSHB Ref:	#N/A			To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:	#N/A			JSAs			
Mitigated Risk:	#N/A			Job Briefing/Site Awareness			
Comments:							
Hazard #4 #N/A							
None							
Suggested FHSHB Ref:	None			To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:	Not Ranked			Select			
Mitigated Risk:	Not Ranked			Select			
Comments:							
Hazard #5							
None							
Suggested FHSHB Ref:	None			To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:	Not Ranked			Select			
Mitigated Risk:	Not Ranked			Select			
Comments:							
Hazard #6							
None							
Suggested FHSHB Ref:	None			To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:	Not Ranked			Select			
Mitigated Risk:	Not Ranked			Select			
Comments:							

Task Specific HARC (continued)

Task 9:		Sampling - Well sampling using mechanical methods					
HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low):		FHSB Ref:				III F	
Biological	L	Chemical	M	Driving	-	Electrical	L
Environmental	M	Gravity	M	Mechanical	L	Motion	M
Personal Safety	L	Pressure	L	Radiation	-	Sound	M
Hazard #1							
Chemical- liquids - injury or illness from skin absorption							
Suggested FHSB Ref:		III C, F, G, K, S, AG		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		MEDIUM		Specialized Checklist/Forms			
Mitigated Risk:		LOW		H&S Standards			
Comments:							
Hazard #2							
Electrical - Electrocutation or arc flash - Injury or death from electrocution or arc flash from electrical							
Suggested FHSB Ref:		III AA, AB		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		HIGH		Lockout/Tagout			
Mitigated Risk:		MEDIUM		Electrical (NFPA 70E) Training			
Comments:							
Hazard #3							
Mechanical - Pinch point - Injury by pinching of body part in mechanical process							
Suggested FHSB Ref:		III S IV, E, F, G, O		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		MEDIUM		Machine Guarding			
Mitigated Risk:		LOW		Inspections			
Comments:							
Hazard #4							
None							
Suggested FHSB Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							
Hazard #5							
None							
Suggested FHSB Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							
Hazard #6							
None							
Suggested FHSB Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							

Task Specific HARC (continued)

Task 10:		Survey - Land surveying					
HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low):		FHSB Ref:				III F	
Biological	M	Chemical	-	Driving	-	Electrical	-
Environmental	M	Gravity	M	Mechanical	-	Motion	M
Personal Safety	L	Pressure	-	Radiation	-	Sound	L
Hazard #1							
Motion - Struck by - Bodily injury from impact with moving object							
Suggested FHSB Ref:	III S	To mitigate this hazard, use TRACK and the following:					
Overall Unmitigated Risk:	MEDIUM	JSAs					
Mitigated Risk:	LOW	Site Awareness					
Comments:	Be aware of action levels						
Hazard #2							
Pressure - Hydraulic - Injury from hydraulic process or device failure							
Suggested FHSB Ref:	IV E	To mitigate this hazard, use TRACK and the following:					
Overall Unmitigated Risk:	MEDIUM	H&S Standards					
Mitigated Risk:	LOW	PPE (see HASP "PPE" section)					
Comments:							
Hazard #3							
None							
Suggested FHSB Ref:	None	To mitigate this hazard, use TRACK and the following:					
Overall Unmitigated Risk:	Not Ranked	Select					
Mitigated Risk:	Not Ranked	Select					
Comments:							
Hazard #4							
None							
Suggested FHSB Ref:	None	To mitigate this hazard, use TRACK and the following:					
Overall Unmitigated Risk:	Not Ranked	Select					
Mitigated Risk:	Not Ranked	Select					
Comments:							
Hazard #5							
None							
Suggested FHSB Ref:	None	To mitigate this hazard, use TRACK and the following:					
Overall Unmitigated Risk:	Not Ranked	Select					
Mitigated Risk:	Not Ranked	Select					
Comments:							
Hazard #6							
None							
Suggested FHSB Ref:	None	To mitigate this hazard, use TRACK and the following:					
Overall Unmitigated Risk:	Not Ranked	Select					
Mitigated Risk:	Not Ranked	Select					
Comments:							

Task Specific HARC (continued)

Task 11:		Utilities - Clearance					
HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low):		FHSBH Ref:				III AN	
Biological	L	Chemical	L	Driving	-	Electrical	M
Environmental	L	Gravity	L	Mechanical	M	Motion	M
Personal Safety	L	Pressure	L	Radiation	-	Sound	L
Hazard #1							
Chemical- liquids - injury or illness from skin absorption							
Suggested FHSBH Ref:		III C, F, G, K, S, AG		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		MEDIUM		PPE (see HASP "PPE" section)			
Mitigated Risk:		LOW		JSAs			
Comments:		Be aware of contaminants, wear appropriate gloves					
Hazard #2							
Gravity - Struck by - Injury from falling object							
Suggested FHSBH Ref:		III AC, IV A		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		MEDIUM		PPE (see HASP "PPE" section)			
Mitigated Risk:		LOW		Job Briefing/Site Awareness			
Comments:		Be aware of overhead objects					
Hazard #3							
None							
Suggested FHSBH Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							
Hazard #4							
None							
Suggested FHSBH Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							
Hazard #5							
None							
Suggested FHSBH Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							
Hazard #6							
None							
Suggested FHSBH Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							

Task Specific HARC (continued)

Task 12:	Waste - Containment of IDW in small containment devices greater than 10 gallons b						
HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low):		FHSBH Ref:		III AG			
Biological	L	Chemical	M	Driving	-	Electrical	-
Environmental	M	Gravity	M	Mechanical	L	Motion	M
Personal Safety	L	Pressure	L	Radiation	-	Sound	L
Hazard #1							
Chemical- solids/particulates - injury or illness from skin absorption							
Suggested FHSBH Ref:		III C, F, G, K, S, AG		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		MEDIUM		HASP			
Mitigated Risk:		LOW		PPE (see HASP "PPE" section)			
Comments:		Be aware of contaminants, wear appropriate gloves					
Hazard #2							
Chemical - solids/particulates, skin or eye irritation/damage/allergy							
Suggested FHSBH Ref:		III C, F, G, K, S, AG		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		MEDIUM		HASP			
Mitigated Risk:		LOW		PPE (see HASP "PPE" section)			
Comments:		Be aware of contaminants, wear appropriate gloves					
Hazard #3							
Environmental - Utilities - Injury or property damage from utility strike/damage							
Suggested FHSBH Ref:		III AN		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		HIGH		H&S Standards			
Mitigated Risk:		MEDIUM		Specialized Checklist/Forms			
Comments:		Use three lines of evidence to clear utilities when digging					
Hazard #4							
Mechanical - Pinch point - Injury by pinching of body part in mechanical process							
Suggested FHSBH Ref:		III S IV, E, F, G, O		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		MEDIUM		Site Awareness			
Mitigated Risk:		LOW		Machine Guarding			
Comments:		Communicate with machine operators before approaching, be aware of moving parts					
Hazard #5							
Pressure - Compressed gas - Injury or illness from damaged cylinder/ valve due improper use or handling							
Suggested FHSBH Ref:		III AI		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		HIGH		JSAs			
Mitigated Risk:		LOW		Specialized Training per Standard			
Comments:							
Hazard #6							
None							
Suggested FHSBH Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							

Task Specific HARC (continued)

Task 13:		Waste - Liquid waste sampling using manual methods					
HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low):		FHSB Ref:		III AG			
Biological	L	Chemical	M	Driving	-	Electrical	-
Environmental	M	Gravity	M	Mechanical	-	Motion	M
Personal Safety	L	Pressure	L	Radiation	-	Sound	L
Hazard #1							
Chemical- solids/particulates - injury or illness from skin absorption							
Suggested FHSB Ref:		III C, F, G, K, S, AG		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		MEDIUM		HASP			
Mitigated Risk:		LOW		PPE (see HASP "PPE" section)			
Comments:		Be aware of contaminants, wear appropriate gloves					
Hazard #2							
Chemical - solids/particulates, skin or eye irritation/damage/allergy							
Suggested FHSB Ref:		III C, F, G, K, S, AG		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		MEDIUM		HASP			
Mitigated Risk:		LOW		PPE (see HASP "PPE" section)			
Comments:		Be aware of contaminants, wear appropriate gloves					
Hazard #3							
Environmental - Utilities - Injury or property damage from utility strike/damage							
Suggested FHSB Ref:		III AN		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		HIGH		H&S Standards			
Mitigated Risk:		MEDIUM		Specialized Checklist/Forms			
Comments:							
Hazard #4							
Mechanical - Pinch point - Injury by pinching of body part in mechanical process							
Suggested FHSB Ref:		III S IV, E, F, G, O		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		MEDIUM		Site Awareness			
Mitigated Risk:		LOW		Machine Guarding			
Comments:		Communicate with machine operators before approaching, be aware of moving parts					
Hazard #5							
None							
Suggested FHSB Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							
Hazard #6							
None							
Suggested FHSB Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							

Task Specific HARC (continued)

Task 14:		Waste - Solid waste sampling using manual methods					
HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low):		FHSBH Ref:				III AG	
Biological	L	Chemical	L	Driving	-	Electrical	-
Environmental	M	Gravity	M	Mechanical	-	Motion	M
Personal Safety	L	Pressure	L	Radiation	-	Sound	L
Hazard #1							
Chemical - liquids, skin or eye irritation/damage/allergy							
Suggested FHSBH Ref:		III C, F, G, K, S, AG		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		MEDIUM		PPE (see HASP "PPE" section)			
Mitigated Risk:		LOW		JSAs			
Comments: Be aware of contaminants, wear appropriate gloves							
Gravity - Struck by - Injury from falling object							
Suggested FHSBH Ref:		III AC, IV A		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		MEDIUM		PPE (see HASP "PPE" section)			
Mitigated Risk:		LOW		Job Briefing/Site Awareness			
Comments: Be aware of overhead objects							
Hazard #3							
None							
Suggested FHSBH Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							
Hazard #4							
None							
Suggested FHSBH Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							
Hazard #5							
None							
Suggested FHSBH Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							
Hazard #6							
None							
Suggested FHSBH Ref:		None		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		Not Ranked		Select			
Mitigated Risk:		Not Ranked		Select			
Comments:							

Task Specific HARC (continued)

Task 15:	Waste- Arcadis oversight of contractors performing IDW containment, segregation a						
HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low):		FHSBH Ref:			II M		
Biological	L	Chemical	L	Driving	-	Electrical	-
Environmental	M	Gravity	L	Mechanical	-	Motion	L
Personal Safety	L	Pressure	L	Radiation	-	Sound	L
Hazard #1							
Environmental - Utilities - Injury or property damage from utility strike/damage							
Suggested FHSBH Ref:	III AN		To mitigate this hazard, use TRACK and the following:				
Overall Unmitigated Risk:	HIGH		Specialized Checklist/Forms				
Mitigated Risk:	MEDIUM		PPE (see HASP "PPE" section)				
Comments:	Be careful exposing utilities when clearing via hand auger or vacuum truck						
Hazard #2							
Environmental - Wind -Skin injury from sun or wind exposure							
Suggested FHSBH Ref:	III M		To mitigate this hazard, use TRACK and the following:				
Overall Unmitigated Risk:	MEDIUM		JSAs				
Mitigated Risk:	LOW		PPE (see HASP "PPE" section)				
Comments:							
Hazard #3							
None							
Suggested FHSBH Ref:	None		To mitigate this hazard, use TRACK and the following:				
Overall Unmitigated Risk:	Not Ranked		Select				
Mitigated Risk:	Not Ranked		Select				
Comments:							
Hazard #4							
None							
Suggested FHSBH Ref:	None		To mitigate this hazard, use TRACK and the following:				
Overall Unmitigated Risk:	Not Ranked		Select				
Mitigated Risk:	Not Ranked		Select				
Comments:							
Hazard #5							
None							
Suggested FHSBH Ref:	None		To mitigate this hazard, use TRACK and the following:				
Overall Unmitigated Risk:	Not Ranked		Select				
Mitigated Risk:	Not Ranked		Select				
Comments:							
Hazard #6							
None							
Suggested FHSBH Ref:	None		To mitigate this hazard, use TRACK and the following:				
Overall Unmitigated Risk:	Not Ranked		Select				
Mitigated Risk:	Not Ranked		Select				
Comments:							

Task Specific HARC (continued)

Task 16:	Select						
HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low):				FHSB Ref:		NA	
Biological	-	Chemical	-	Driving	-	Electrical	-
Environmental	-	Gravity	-	Mechanical	-	Motion	-
Personal Safety	-	Pressure	-	Radiation	-	Sound	-
Hazard #1							
Environmental - Utilities - Injury or property damage from utility strike/damage							
Suggested FHSB Ref:	III AN			To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:	HIGH			Specialized Checklist/Forms			
Mitigated Risk:	MEDIUM			PPE (see HASP "PPE" section)			
Comments:	Be careful exposing utilities when clearing via hand auger or vacuum truck						
Hazard #2							
Suggested FHSB Ref:	#N/A			To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:	#N/A			Select			
Mitigated Risk:	#N/A			Select			
Comments:							
Hazard #3 #N/A							
Suggested FHSB Ref:	#N/A			To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:	#N/A			PPE (see HASP "PPE" section)			
Mitigated Risk:	#N/A			H&S Standards			
Comments:	When moving barrels, use dolly to prevent barrels tipping over						
Hazard #4 #N/A							
None							
Suggested FHSB Ref:	None			To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:	Not Ranked			Select			
Mitigated Risk:	Not Ranked			Select			
Comments:							
Hazard #5							
None							
Suggested FHSB Ref:	None			To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:	Not Ranked			Select			
Mitigated Risk:	Not Ranked			Select			
Comments:							
Hazard #6							
None							
Suggested FHSB Ref:	None			To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:	Not Ranked			Select			
Mitigated Risk:	Not Ranked			Select			
Comments:							

Task Specific HARC (continued)

Task 17:	Select		
HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low):	FHSBH Ref:		NA
Biological	-	Chemical	-
Environmental	-	Gravity	-
Personal Safety	-	Pressure	-
		Driving	-
		Mechanical	-
		Radiation	-
		Electrical	-
		Motion	-
		Sound	-
Hazard #1			
Chemical - solids/particulates, skin or eye irritation/damage/allergy			
Suggested FHSBH Ref:	III C, F, G, K, S, AG	To mitigate this hazard, use TRACK and the following:	
Overall Unmitigated Risk:	MEDIUM	PPE (see HASP "PPE" section)	
Mitigated Risk:	LOW	Job Briefing/Site Awareness	
Comments:	Be aware of contaminants, wear appropriate gloves		
Hazard #2			
Chemical - liquids, skin or eye irritation/damage/allergy			
Suggested FHSBH Ref:	III C, F, G, K, S, AG	To mitigate this hazard, use TRACK and the following:	
Overall Unmitigated Risk:	MEDIUM	PPE (see HASP "PPE" section)	
Mitigated Risk:	LOW	Job Briefing/Site Awareness	
Comments:	Be aware of contaminants, wear appropriate gloves		
Hazard #3			
None			
Suggested FHSBH Ref:	None	To mitigate this hazard, use TRACK and the following:	
Overall Unmitigated Risk:	Not Ranked	Select	
Mitigated Risk:	Not Ranked	Select	
Comments:			
Hazard #4			
None			
Suggested FHSBH Ref:	None	To mitigate this hazard, use TRACK and the following:	
Overall Unmitigated Risk:	Not Ranked	Select	
Mitigated Risk:	Not Ranked	Select	
Comments:			
Hazard #5			
None			
Suggested FHSBH Ref:	None	To mitigate this hazard, use TRACK and the following:	
Overall Unmitigated Risk:	Not Ranked	Select	
Mitigated Risk:	Not Ranked	Select	
Comments:			
Hazard #6			
None			
Suggested FHSBH Ref:	None	To mitigate this hazard, use TRACK and the following:	
Overall Unmitigated Risk:	Not Ranked	Select	
Mitigated Risk:	Not Ranked	Select	
Comments:			

Task Specific HARC (continued)

Task 18:	Select		
HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low):	FHSBH Ref:		NA
Biological	-	Chemical	-
Environmental	-	Gravity	-
Personal Safety	-	Pressure	-
		Driving	-
		Mechanical	-
		Radiation	-
		Electrical	-
		Motion	-
		Sound	-
Hazard #1			
Chemical - solids/particulates, skin or eye irritation/damage/allergy			
Suggested FHSBH Ref:	III C, F, G, K, S, AG	To mitigate this hazard, use TRACK and the following:	
Overall Unmitigated Risk:	MEDIUM	PPE (see HASP "PPE" section)	
Mitigated Risk:	LOW	Job Briefing/Site Awareness	
Comments:	Be aware of contaminants, wear appropriate gloves		
Hazard #2			
Chemical - liquids, skin or eye irritation/damage/allergy			
Suggested FHSBH Ref:	III C, F, G, K, S, AG	To mitigate this hazard, use TRACK and the following:	
Overall Unmitigated Risk:	MEDIUM	PPE (see HASP "PPE" section)	
Mitigated Risk:	LOW	Job Briefing/Site Awareness	
Comments:	Be aware of contaminants, wear appropriate gloves		
Hazard #3			
None			
Suggested FHSBH Ref:	None	To mitigate this hazard, use TRACK and the following:	
Overall Unmitigated Risk:	Not Ranked	Select	
Mitigated Risk:	Not Ranked	Select	
Comments:			
Hazard #4			
None			
Suggested FHSBH Ref:	None	To mitigate this hazard, use TRACK and the following:	
Overall Unmitigated Risk:	Not Ranked	Select	
Mitigated Risk:	Not Ranked	Select	
Comments:			
Hazard #5			
None			
Suggested FHSBH Ref:	None	To mitigate this hazard, use TRACK and the following:	
Overall Unmitigated Risk:	Not Ranked	Select	
Mitigated Risk:	Not Ranked	Select	
Comments:			
Hazard #6			
None			
Suggested FHSBH Ref:	None	To mitigate this hazard, use TRACK and the following:	
Overall Unmitigated Risk:	Not Ranked	Select	
Mitigated Risk:	Not Ranked	Select	
Comments:			

Task Specific HARC (continued)

Task 19:		Select					
HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low):				FHSB Ref:		NA	
Biological	<input type="text" value="-"/>	Chemical	<input type="text" value="-"/>	Driving	<input type="text" value="-"/>	Electrical	<input type="text" value="-"/>
Environmental	<input type="text" value="-"/>	Gravity	<input type="text" value="-"/>	Mechanical	<input type="text" value="-"/>	Motion	<input type="text" value="-"/>
Personal Safety	<input type="text" value="-"/>	Pressure	<input type="text" value="-"/>	Radiation	<input type="text" value="-"/>	Sound	<input type="text" value="-"/>
Hazard #1							
Chemical - solids/particulates, skin or eye irritation/damage/allergy							
Suggested FHSB Ref:		III C, F, G, K, S, AG		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		<input type="text" value="MEDIUM"/>		PPE (see HASP "PPE" section)			
Mitigated Risk:		<input type="text" value="LOW"/>		Job Briefing/Site Awareness			
Comments:		Be aware of contaminants, wear appropriate gloves					
Hazard #2							
Chemical - liquids, skin or eye irritation/damage/allergy							
Suggested FHSB Ref:		III C, F, G, K, S, AG		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		<input type="text" value="MEDIUM"/>		PPE (see HASP "PPE" section)			
Mitigated Risk:		<input type="text" value="LOW"/>		Job Briefing/Site Awareness			
Comments:		Be aware of contaminants, wear appropriate gloves					
Hazard #3							
None							
Suggested FHSB Ref:		<input type="text" value="None"/>		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		<input type="text" value="Not Ranked"/>		Select			
Mitigated Risk:		<input type="text" value="Not Ranked"/>		Select			
Comments:							
Hazard #4							
None							
Suggested FHSB Ref:		<input type="text" value="None"/>		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		<input type="text" value="Not Ranked"/>		Select			
Mitigated Risk:		<input type="text" value="Not Ranked"/>		Select			
Comments:							
Hazard #5							
None							
Suggested FHSB Ref:		<input type="text" value="None"/>		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		<input type="text" value="Not Ranked"/>		Select			
Mitigated Risk:		<input type="text" value="Not Ranked"/>		Select			
Comments:							
Hazard #6							
None							
Suggested FHSB Ref:		<input type="text" value="None"/>		To mitigate this hazard, use TRACK and the following:			
Overall Unmitigated Risk:		<input type="text" value="Not Ranked"/>		Select			
Mitigated Risk:		<input type="text" value="Not Ranked"/>		Select			
Comments:							

Task Specific HARC (continued)

Task 20:	Select		
HARC Unmitigated Hazard Types (H-High, M-Medium, L-Low):		FHSBH Ref: NA	
Biological	<input type="checkbox"/>	Chemical	<input type="checkbox"/>
Environmental	<input type="checkbox"/>	Gravity	<input type="checkbox"/>
Personal Safety	<input type="checkbox"/>	Pressure	<input type="checkbox"/>
		Driving	<input type="checkbox"/>
		Mechanical	<input type="checkbox"/>
		Radiation	<input type="checkbox"/>
		Electrical	<input type="checkbox"/>
		Motion	<input type="checkbox"/>
		Sound	<input type="checkbox"/>
Hazard #1			
Chemical - solids/particulates, skin or eye irritation/damage/allergy			
Suggested FHSBH Ref:	III C, F, G, K, S, AG	To mitigate this hazard, use TRACK and the following:	
Overall Unmitigated Risk:	MEDIUM	PPE (see HASP "PPE" section)	
Mitigated Risk:	LOW	Job Briefing/Site Awareness	
Comments:	Be aware of contaminants, wear appropriate gloves		
Hazard #2			
Chemical - liquids, skin or eye irritation/damage/allergy			
Suggested FHSBH Ref:	III C, F, G, K, S, AG	To mitigate this hazard, use TRACK and the following:	
Overall Unmitigated Risk:	MEDIUM	PPE (see HASP "PPE" section)	
Mitigated Risk:	LOW	Job Briefing/Site Awareness	
Comments:	Be aware of contaminants, wear appropriate gloves		
Hazard #3			
None			
Suggested FHSBH Ref:	None	To mitigate this hazard, use TRACK and the following:	
Overall Unmitigated Risk:	<input type="text" value="Not Ranked"/>	Select	
Mitigated Risk:	<input type="text" value="Not Ranked"/>	Select	
Comments:			
Hazard #4			
None			
Suggested FHSBH Ref:	None	To mitigate this hazard, use TRACK and the following:	
Overall Unmitigated Risk:	<input type="text" value="Not Ranked"/>	Select	
Mitigated Risk:	<input type="text" value="Not Ranked"/>	Select	
Comments:			
Hazard #5			
None			
Suggested FHSBH Ref:	None	To mitigate this hazard, use TRACK and the following:	
Overall Unmitigated Risk:	<input type="text" value="Not Ranked"/>	Select	
Mitigated Risk:	<input type="text" value="Not Ranked"/>	Select	
Comments:			
Hazard #6			
None			
Suggested FHSBH Ref:	None	To mitigate this hazard, use TRACK and the following:	
Overall Unmitigated Risk:	<input type="text" value="Not Ranked"/>	Select	
Mitigated Risk:	<input type="text" value="Not Ranked"/>	Select	
Comments:			

Hazard Communication (HAZCOM)/Global Harmonization System (GHS)

HAZCOM/GHS for this project is managed by the client or general contractor

List the chemicals anticipated to be used by Arcadis on this project per HAZCOM/GHS requirements.
(Modify quantities as needed)

Preservatives		Qty	Decontamination		Qty	Calibration		Qty.
<input type="checkbox"/>	Not applicable		<input type="checkbox"/>	Not applicable		<input type="checkbox"/>	Not applicable	
<input checked="" type="checkbox"/>	Hydrochloric acid	<500 ml	<input checked="" type="checkbox"/>	Alconox	≤ 5 lbs	<input checked="" type="checkbox"/>	Isobutylene/air	1 cyl
<input checked="" type="checkbox"/>	Nitric acid	<500 ml	<input type="checkbox"/>	Liquinox	≤ 1 gal	<input checked="" type="checkbox"/>	Methane/air	1 cyl
<input checked="" type="checkbox"/>	Sulfuric acid	<500 ml	<input checked="" type="checkbox"/>	Acetone	≤ 1 gal	<input type="checkbox"/>	Pentane/air	1 cyl
<input checked="" type="checkbox"/>	Sodium hydroxide	<500 ml	<input checked="" type="checkbox"/>	Methanol	≤ 1 gal	<input type="checkbox"/>	Hydrogen/air	1 cyl
<input type="checkbox"/>	Zinc acetate	<500 ml	<input type="checkbox"/>	Hexane	≤ 1 gal	<input type="checkbox"/>	Propane/air	1 cyl
<input type="checkbox"/>	Ascorbic acid	<500 ml	<input type="checkbox"/>	Isopropyl alcohol	≤ 4 gal	<input checked="" type="checkbox"/>	Hydrogen sulfide/air	1 cyl
<input type="checkbox"/>	Acetic acid	<500 ml	<input type="checkbox"/>	Nitric acid	≤ 1 L	<input type="checkbox"/>	Carbon monoxide/air	1 cyl
<input type="checkbox"/>	Isopropyl alcohol	< 4 gal.	<input type="checkbox"/>	Other:		<input checked="" type="checkbox"/>	pH standards (4,7,10)	≤ 1 gal
<input type="checkbox"/>	Formalin (<10%)	< 4 gal.				<input checked="" type="checkbox"/>	Conductivity standards	≤ 1 gal
<input type="checkbox"/>	Methanol	<500 ml				<input checked="" type="checkbox"/>	Other:	
<input type="checkbox"/>	Sodium bisulfate	<500 ml					<u>Multi-Gas Calibration Gas</u>	

Fuels		Qty.	Kits		Qty.
<input type="checkbox"/>	Not applicable		<input checked="" type="checkbox"/>	Not applicable	
<input checked="" type="checkbox"/>	Gasoline	≤ 5 gal	<input type="checkbox"/>	Hach (specify):	1 kit
<input checked="" type="checkbox"/>	Diesel	≤ 5 gal	<input type="checkbox"/>	DTECH (specify):	1 kit
<input type="checkbox"/>	Kerosene	≤ 5 gal	<input type="checkbox"/>	Other:	1 kit
<input type="checkbox"/>	Propane	1 cyl			
<input type="checkbox"/>	Other:				

Remediation		Qty.	Other:		Qty.	DOT(1):		Qty.
<input type="checkbox"/>	Not applicable		<input checked="" type="checkbox"/>	Helium	1 cyl	<input type="checkbox"/>	MOT eligible soils	
<input type="checkbox"/>			<input checked="" type="checkbox"/>	Spray paint	≤ 6 cans	<input type="checkbox"/>	MOT eligible water	
<input type="checkbox"/>			<input type="checkbox"/>	WD-40	≤ 1 can	<input type="checkbox"/>	MOT eligible solids	
<input type="checkbox"/>			<input type="checkbox"/>	Pipe cement	≤ 1 can	<input type="checkbox"/>	MOT eligible liquids	
<input type="checkbox"/>			<input type="checkbox"/>	Pipe primer	≤ 1 can			
<input type="checkbox"/>			<input type="checkbox"/>	Mineral spirits	≤ 1 gal			

(1) Attach applicable Materials of Trade (MOT) generic shipping determination. SDS not generally applicable to this category.

SDSs for this project will be available electronically on a designated project field computer. All project workers will be notified of the SDS location in their initial safety briefing.

Contractor SDSs will be submitted to Arcadis in advance of work and will be filed with Arcadis SDSs as indicated above.

Air Monitoring

- There are no atmospheric chemical, radiological, or particulate hazards on this project requiring air monitoring.
 Air monitoring is the responsibility of the client or subcontractor.

Constituents of Interest:

Time Weighted Averages (TWAs) are ACGIH 8-Hr Threshold Limit Values (TLVs) unless noted.

Gasoline

TWA	30 ppm, Arcadis administrative limit	LEL/UEL (%)	1.4/7.6
STEL	500 ppm	VD (Air = 1)	NA
IDLH	NA	VP (mmHg)	38-300

Benzene

TWA	0.5 ppm, OSHA Reg. See Notes	LEL/UEL (%)	1.2/7.8
STEL	2.5 ppm	VD (Air = 1)	NA
IDLH	500 ppm, NIOSH	VP (mmHg)	75

Toluene

TWA	20 ppm	LEL/UEL (%)	1.1/7.1
STEL	150 ppm, NIOSH	VD (Air = 1)	NA
IDLH	500 ppm, NIOSH	VP (mmHg)	21

Ethylbenzene

TWA	20 ppm	LEL/UEL (%)	0.8/6.7
STEL	125 ppm	VD (Air = 1)	NA
IDLH	800 ppm, NIOSH	VP (mmHg)	7

Xylene

TWA	100 ppm	LEL/UEL (%)	1.1/7.0
STEL	150 ppm	VD (Air = 1)	NA
IDLH	900 ppm, NIOSH	VP (mmHg)	9

Diesel

Anticipated Breathing Zone Concentration <= 10 mg/m3

TWA	100 mg/m3, skin, (15 ppm Arcadis limit-see PID warning)	LEL/UEL (%)	NA
STEL	NA	RGD (Air = 1)	NA
IDLH	NA	VP (mmHg)	NA

TWA - Time Weighted Average (ACGIH TLV unless noted) LEL/UEL - Lower /Upper Explosive Limit
STEL - Short Term Exposure Limit RGD - Relative Gas Density
IDLH - Immediately Dangerous to Life and Health VP - Vapor Pressure

Notes:

One or more constituents above is listed with a skin notation. Avoid conditions where dusts, mists, or aerosols are created. Avoid skin contact with impacted media.

As noted, one or more of the above constituents is an OSHA regulated substance. If exposure is expected to be above the TWA or STEL, contact a CIH or CSP for assistance unless otherwise permitted by a substance specific plan template identified in this section.

Required Monitoring Instruments, Action Levels and Monitoring Frequency

Gray fields below are not automated. Make necessary selections from drop down menus.

Photoionization Detector

Select Lamp: 10.6 eV

Diesel/Fuel Oil: The 15 ppm Arcadis recommended exposure limit for diesel/fuel oil is not included in the computation below. Manual action level adjustment may be required. The PID may provide a slow response to diesel fuel/fuel oil.

Computed action levels (PID units) (1):		Computed action levels have been manually adjusted.
<	2.1	Continue working
	2.1 - 4.2	Levels sustained > 5 minutes, monitor continuously and review engineering controls and PPE. Proceed with caution.
>	4.2	Stop work and contact SSO

(1) Computed action levels are for PIDs which have not been programmed to correct TLVs for specific constituents or mixtures.

Particulate/aerosol monitoring is not required. Re-evaluate if visible dusts or aerosols cannot be controlled.

Action levels are in mg/m3		Computed action levels have been manually adjusted.
<	NA	Continue working
	NA	Levels sustained > 5 minutes, monitor continuously and review engineering controls and PPE. Proceed with caution.
>	NA	Stop work and contact SSO

Breathing zone air monitoring using the above instruments will be performed at the following frequency:

Hourly

If manually logging air monitoring results, all results must be documented, including non-detects.

Standard 4 Gas Monitoring (LEL,O2,H2S,CO) with a multigas meter is required

LEL/O2 Meter Monitoring Required	0-5% LEL	Continue work
	>5-10% LEL	Continually monitor, review engineering controls, proceed with caution
	>10% LEL	Stop work, evacuate, contact SSO
	19.5%-23.5% O2	Normal, continue work
	<19.5% O2	O2 deficient, stop work, evacuate, contact SSO
	>23.5% O2	O2 enriched, stop work, evacuate, contact SSO

Checked gases require monitoring:

		1/2 TLV	Stop Work Action Level	Comments
<input type="checkbox"/>	Ammonia	12.5 ppm	25 ppm	Use a multigas meter equipped with a sensor(s) capable of detecting checked gases identified to the right. Review engineering controls and perform continuous monitoring with data logging at concentrations >1/2 TLV. Stop work action levels are based on Level D protection.
X	Carbon dioxide	2500 ppm	5000 ppm	
X	Carbon monoxide	12.5 ppm	25 ppm	
<input type="checkbox"/>	Chlorine	0.05 ppm	0.1 ppm	
<input type="checkbox"/>	Hydrogen cyanide	2.35 ppm (skin)	4.7 ppm* (skin)	
X	Hydrogen sulfide	0.5 ppm	1 ppm	
<input type="checkbox"/>	Nitrogen dioxide	0.1 ppm	0.2 ppm	
<input type="checkbox"/>	Phosphine	0.025 ppm	0.05 ppm	
<input type="checkbox"/>	Sulfur dioxide	0.125 ppm	0.25* ppm	
<input type="checkbox"/>	Mercury vapor	0.0125 mg/m3	0.025 mg/m3	

* Ceiling or STEL value

All air-monitoring instruments must be calibration checked daily, if used, per manufacturer's instructions. Calibration checks, including calibration gases used, must be documented.

Compound specific monitoring using indicator tubes or chips is not required.

Indicator:		≤TWA	Continue work
<input type="checkbox"/> Tube	<input type="checkbox"/> Chip	>TWA	Stop work, review engineering controls and PPE, contact SSO
Compound(s):			

Indicator tube/chip monitoring frequency: Not applicable

Air Monitoring

Task or Area of Concern: _____

Constituents of Interest:

Time Weighted Averages (TWAs) are ACGIH 8 Hr Threshold Limit Values (TLVs) unless noted.

Methyl tert-butyl ether			
TWA	50 ppm	LEL/UEL (%)	NA/NA
STEL	NA	VD (Air = 1)	NA
IDLH	NA	VP (mmHg)	NA
Lead			
		Anticipated Breathing Zone Concentration <=	10 mg/m3
TWA	0.05 mg/m3, OSHA Reg. See Notes	LEL/UEL (%)	NA/NA
STEL	NA	VD (Air = 1)	NA
IDLH	100 mg/m3	VP (mmHg)	NA
Ethanol			
TWA	1000 ppm, NIOSH	LEL/UEL (%)	3.3/19
STEL	1000 ppm	VD (Air = 1)	NA
IDLH	3300 ppm, NIOSH	VP (mmHg)	44
None			
TWA	NA	LEL/UEL (%)	NA
STEL	NA	VD (Air = 1)	NA
IDLH	NA	VP (mmHg)	NA
None			
TWA	NA	LEL/UEL (%)	NA
STEL	NA	VD (Air = 1)	NA
IDLH	NA	VP (mmHg)	NA
None			
TWA	NA	LEL/UEL (%)	NA
STEL	NA	RGD (Air = 1)	NA
IDLH	NA	VP (mmHg)	NA
None			
TWA	NA	LEL/UEL (%)	NA
STEL	NA	RGD (Air = 1)	NA
IDLH	NA	VP (mmHg)	NA
None			
TWA	NA	LEL/UEL (%)	NA
STEL	NA	RGD (Air = 1)	NA
IDLH	NA	VP (mmHg)	NA

None

TWA NA
STEL NA
IDLH NA

LEL/UEL (%): NA
RGD (Air = 1): NA
VP (mmHg): NA

None

TWA NA
STEL NA
IDLH NA

LEL/UEL (%): NA
RGD (Air = 1): NA
VP (mmHg): NA

None

TWA NA
STEL NA
IDLH NA

LEL/UEL (%): NA
RGD (Air = 1): NA
VP (mmHg): NA

None

TWA NA
STEL NA
IDLH NA

LEL/UEL (%): NA
RGD (Air = 1): NA
VP (mmHg): NA

None

TWA NA
STEL NA
IDLH NA

LEL/UEL (%): NA
RGD (Air = 1): NA
VP (mmHg): NA

None

TWA NA
STEL NA
IDLH NA

LEL/UEL (%): NA
RGD (Air = 1): NA
VP (mmHg): NA

None

TWA NA
STEL NA
IDLH NA

LEL/UEL (%): NA
RGD (Air = 1): NA
VP (mmHg): NA

None

TWA NA
STEL NA
IDLH NA

LEL/UEL (%): NA
RGD (Air = 1): NA
VP (mmHg): NA

None

TWA NA
STEL NA
IDLH NA

LEL/UEL (%): NA
RGD (Air = 1): NA
VP (mmHg): NA

None

TWA NA
STEL NA
IDLH NA

LEL/UEL (%): NA
RGD (Air = 1): NA
VP (mmHg): NA

None

TWA NA
STEL NA
IDLH NA

LEL/UEL (%): NA
RGD (Air = 1): NA
VP (mmHg): NA

None

TWA NA
STEL NA
IDLH NA

LEL/UEL (%): NA
RGD (Air = 1): NA
VP (mmHg): NA

TWA - Time Weighted Average (ACGIH TLV unless noted)

STEL - Short Term Exposure Limit

IDLH - Immediately Dangerous to Life and Health

Notes:

LEL/UEL - Lower/Upper Explosive Limit

RGD - Relative Gas Density

VP - Vapor Pressure

As noted, one or more of the above constituents is an OSHA regulated substance. If exposure is expected to be above the TWA, contact a CIH or CSP for assistance unless otherwise permitted by a substance specific plan template identified in this section.

Required Monitoring Instruments, Action Levels and Monitoring Frequency

Gray fields below are not automated. Make necessary selections from drop down menus.

Air monitoring for volatile organics is not required.

		Computed action levels have been manually adjusted.
<	NA	Continue working
>	NA - NA	Levels sustained > 5 minutes, monitor continuously and review engineering controls and PPE. Proceed with caution.
>	NA	Stop work and contact SSO

Particulate/aerosol monitoring is not required. Re-evaluate if visible dusts or aerosols cannot be controlled.

Action levels are in mg/m3		Computed action levels have been manually adjusted.
<	NA	Continue working
>	NA	Levels sustained > 5 minutes, monitor continuously and review engineering controls and PPE. Proceed with caution.
>	NA	Stop work and contact SSO

Breathing zone air monitoring using the above instruments will be performed at the following frequency:

Select

Multigas (including LEL/O2 and Hg vapor) monitoring is not required.

LEL/O2 Meter	0-5% LEL	Continue work
	>5-10% LEL	Continually monitor, review engineering controls, proceed with caution
	>10% LEL	Stop work, evacuate, contact SSO
LEL/O2 Monitoring Not Required	19.5%-23.5% O2	Normal, continue work
	<19.5% O2	O2 deficient, stop work, evacuate, contact SSO
	>23.5% O2	O2 enriched, stop work, evacuate, contact SSO

Additional Gas/Vapor Monitoring is Not Required

	1/2 TLV	Stop Work Action Level	Comments
<input type="checkbox"/> Ammonia	12.5 ppm	25 ppm	
<input type="checkbox"/> Carbon dioxide	2500 ppm	5000 ppm	
<input type="checkbox"/> Carbon monoxide	12.5 ppm	25 ppm	
<input type="checkbox"/> Chlorine	0.05 ppm	0.1 ppm	
<input type="checkbox"/> Hydrogen cyanide	2.35 ppm (skin)	4.7 ppm* (skin)	
<input type="checkbox"/> Hydrogen sulfide	0.5 ppm	1 ppm	
<input type="checkbox"/> Nitrogen dioxide	0.1 ppm	0.2 ppm	
<input type="checkbox"/> Phosphine	0.025 ppm	0.05 ppm	
<input type="checkbox"/> Sulfur dioxide	0.125 ppm	0.25 ppm	
<input type="checkbox"/> Mercury vapor	0.0125 mg/m3	0.025 mg/m3	

* Ceiling or STEL value

All air-monitoring instruments must be calibration checked daily, if used, per manufacturer's instructions. Calibration checks, including calibration gases used, must be documented.

Compound specific monitoring using indicator tubes or chips is not required.

Indicator:	<input type="checkbox"/> Tube <input type="checkbox"/> Chip	≤TWA	Continue work
		>TWA	Stop work, review engineering controls and PPE, contact SSO
Compound(s):			

Indicator tube/chip monitoring frequency: Not applicable

Air Monitoring Acronyms and Definitions

Arcadis Acronym	Meaning	Definition
<u>Action Levels</u>		
A	Arcadis Specific TWA	An Arcadis administrative TWA.
c	Ceiling (TLV-C)	The concentration that shall not be exceeded during any part of the working exposure.
i	Inhalable	Particles that enter the respiratory system via the nose or mouth.
IDLH	Immediately Dangerous to Life and Health	The exposure concentration which is likely to cause significant injury/illness or death.
PEL	Permissible Exposure Limit (OSHA)	OSHA exposure limit and is legally enforceable in the United States.
r	Respirable	The portion of inhalable particles that enter the deepest part of the lung, the nonciliated alveoli.
REL	Recommended Exposure Limit (NIOSH)	The NIOSH TWA for an exposure up to a 10-hour workday during a 40-hour work week.
s	Skin	Potential for dermal absorption
se	Sensitizer	Potential for dermal or respirable sensitization resulting from the interaction of an absorbed agent.
STEL	Short Term Exposure Limit (TLV-STEL)	Usually a 15-minute TWA exposure that should not be exceeded at any time during the workday, even if the 8-hour TWA is within the TLV, PEL, or REL TWAs.
TLV	Threshold Limit Value (ACGIH)	The ACGIH TWA for an exposure up to a 8-hour workday during a 40-hour work week.
TWA	Time Weighted Average (TLV-TWA)	Time-weighted average exposure concentration for a conventional 8-hour (TLV, PEL) or up to 10-hour (REL) workday and a 40-hour week.
<u>Chemical and Physical Properties</u>		
IP	Ionization Potential	Ionization potential, eV (electron volts) [Ionization potentials are given as a guideline for the selection of photoionization detector lamps used in some direct-reading instruments.]
LEL	Lower Explosive Limit	The minimum concentration of a vapor in air below which propagation of a flame will not occur in the presence of an ignition source.
UEL	Upper Explosive Limit	The maximum concentration of a vapor in air below which propagation of a flame will not occur in the presence of an ignition source.
RGD	Relative Gas Density	Weight of a vapor or gas compared to an equal volume of air (air = 1). If greater than 1.0, the vapor or gas is heavier than air and will concentrate in the low places. If less than 1.0, the vapor or gas will rise.

<u>Units</u>		
eV	Electron volt	A unit of energy equal to the energy acquired by an electron falling through a potential difference of one volt.
m	mg/m ³	Milligrams per cubic meter
p	ppm	Parts per million
<u>Organizations/Agencies</u>		
ACGIH	American Conference of Governmental Industrial Hygienists	
NIOSH	National Institute for Occupational Safety and Health	
OSHA	Occupational Safety and Health Administration	

Personal Protective Equipment (PPE)

See JSA or Permit for the task being performed for required PPE. If work is not conducted under a JSA or Permit, refer to the governing document for PPE requirements. At a minimum, the following checked PPE is required for all tasks during field work (outside of field office trailers and vehicles) not covered by a JSA or Permit on this project:

Minimum PPE required to be worn by all staff on project:				Specify Type:		
<input checked="" type="checkbox"/>	Hard hat	<input type="checkbox"/>	Snake chaps/guards	<input type="checkbox"/>	Coveralls:	
<input checked="" type="checkbox"/>	Safety glasses	<input type="checkbox"/>	Briar chaps	<input type="checkbox"/>	Apron:	
<input type="checkbox"/>	Safety goggles	<input type="checkbox"/>	Chainsaw chaps	<input checked="" type="checkbox"/>	Chem. resistant gloves:	
<input type="checkbox"/>	Face shield	<input type="checkbox"/>	Sturdy boot	<input type="checkbox"/>	Gloves other:	
<input type="checkbox"/>	Hearing protection	<input checked="" type="checkbox"/>	Steel or comp. toe boot	<input type="checkbox"/>	Chemical boot:	
<input type="checkbox"/>	Rain suit	<input type="checkbox"/>	Metatarsal boot	<input type="checkbox"/>	Boot other:	
<input type="checkbox"/>	Other:	<input type="checkbox"/>		<input checked="" type="checkbox"/>	Traffic vest, shirt or coat:	Class II
				<input type="checkbox"/>	Life vest:	

Task specific PPE: Hearing Protection, Chemical Resistant Gloves and Work Gloves
 Comments:

Task specific PPE to be used if applicable hazards (Sound, Chemical and Motion)

Medical Surveillance

All Arcadis employees and subcontractors performing field work will be required to be current in HAZWOPER medical surveillance.

Client drug and/or alcohol testing will be required for all workers on this project. The project or task manager will instruct project participants on testing protocols.

Hazardous Materials Shipping and Transportation

A shipping determination package has been prepared, reviewed and provided to Arcadis field staff for this project.

Traffic Safety and Traffic Safety Plans (TSPs)

All or portions of the project work will be conducted in both a public right of way (ROW) and parking lot/private roadway and a TSP addressing ROW and Non-ROW traffic safety controls is attached to this HASP.

Arcadis Commercial Motor Vehicles (CMVs)

CMVs operated by Arcadis employees on public roadways will not be utilized on this project. Arcadis defines a CMV as any single vehicle with a gross vehicle weight rating (GVWR) ≥10,001 pounds or a truck and trailer combination with a combined GVWR ≥10,001 pounds (GVWR of truck + GVWR of trailer = ≥10,001 pounds).

Site Control

Site control requirements are integrated into the TSP for this project.

Decontamination

Decontamination protocols are addressed in the applicable task JSA(s) for this project. The applicable JSAs are attached to this HASP.

Sanitation

NA

Safety Briefings

Arcadis will lead all safety briefings on this project and will document the safety briefing on a Tailgate Safety Briefing form or logbook. Safety briefings will be conducted once at the beginning of each work day unless the Site Safety Officer deems more frequent safety briefings will be required based on work being conducted. All project workers, including Arcadis subcontractors, will be required to attend the safety briefing. Site visitors and project workers not on duty during the morning safety briefing will receive the safety briefing upon their arrival onto the project site for the day.

Behavior Based Safety (BBS) Program

The CPM or APM is responsible for reviewing and establishing BBS goals for the project. These goals are summarized below.

TIP required at the following frequency on this project:

1 per event

Near Miss reporting goals for this project:

For each occurrence

Other (specify):

Safety Equipment and Supplies

Safety equipment/supply requirements are addressed in the JSA or Permit for the task being performed. If work is not performed under a JSA or Permit, the following safety equipment is required to be present on site in good condition (Check all that apply):

- First aid kit
- Bloodborne pathogens kit
- Fire extinguisher
- Eyewash (ANSI compliant)
- Eyewash (bottle)
- Drinking water
- Other:

- Insect repellent: _____
- Sunscreen
- Air horn
- Traffic cones
- 2-way radios
- Heat stress monitor
- Poisonous plant pre/post exposure lotion/soap

Control of Ticks and Poisonous Plants

Work on this project has a low tick exposure hazard. Use of insect repellent (DEET and/or permethrin) is recommended. Wear light colored clothing to help identify presence of ticks on staff. Keep shirt tails inside pants.

Work on this project has a low poisonous plant exposure hazard. First aid kits should be equipped with post exposure soap as a precaution. Inspect work area for presence of hazard prior to initiating work at the location. Wear disposable gloves during work and while removing outer footwear.

International Travel

International travel is not required for this project.

Signatures

I have read, understand and agree to abide by the requirements presented in this health and safety plan. I understand that I have the absolute right to stop work if I recognize an unsafe condition affecting my work until corrected.

Printed Name	Signature	Date
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____
_____	_____	_____

Add additional sheets if necessary

You have an absolute right to STOP WORK if unsafe conditions exist!

Job Safety Analysis

General

JSA ID	HASP 1	Status	Complete
Job Name	General Industry-Driving - passenger vehicles	Created Date	7/2/2019
Task Description	Driving a car, van, or truck on public roadways.	Completed Date	07/02/2019

Client / Project

Client	Chevron
Project Number	3001258
Project Name	Site 211577
Project Manager	#REF!

User Roles

Role	Employee	Due Date	Completed Date
Developer	Daniel Sly Gilbert	7/2/2019	7/2/2019
HASP Reviewer	Dotson, Christopher	7/2/2019	7/2/2019
Quality Reviewer			

Job Steps

Job Step No.	Job Step Description		Potential Hazard	Critical Action	H&S Reference
1	Pre-Trip Inspection	1	Failing to perform pre-trip inspections may cause mechanical failure, accident or injury.	Perform walk around of vehicle with particular attention to tire inflation and condition. Check lights, wipers, seatbelts for proper operating condition. Properly adjust seat and mirrors prior to vehicle operation. Use or review vehicle inspection checklist as required under the MVSP.	ARC HSGE024 Motor Vehicle Safety Standard (MVSP)
		2	Scrapes, cuts, burns to hand if inspecting engine fluids and/or tires. Eye splash hazard if inspecting engine fluids. Pinch or crush hazards when opening or closing hood, trunk, or tailgate.	Wear protective gloves and safety glasses as described below when checking under hood or tires. Use TRACK and keep hands clear when opening/closing hood, trunk, or tailgate to avoid crush or pinch hazard.	
		3	Struck by other vehicles while walking around vehicle performing inspections.	Wear high visibility vest, shirt, or coat while performing inspections in parking lots or other areas with a traffic hazard. Remain vigilant of moving vehicles or equipment in area, face oncoming vehicles to extent practical.	
		4	Improperly secured cargo may dislodge creating injury, property damage, or road hazard.	Ensure all cargo is properly secured to prevent movement while the vehicle is in operation. This includes cargo in the cab of the vehicle.	
2	Driving a motor vehicle on public streets	1	Failing to observe traffic flow ahead increases risk of hard braking resulting in potential impact of vehicle ahead, being struck by another vehicle from behind, and decreases decision making time.	Use Smith System Key #1, "Aim High in Steering". Look ahead (15 seconds if possible) to observe traffic flow and traffic signals. Adjust speed accordingly to keep vehicle moving and avoid frequent braking. Select lane of least traffic and adjust speed based on observed signal timing when possible. Avoid following directly behind large vehicles that obscure view ahead.	Smith System "5-Keys" is a registered trademark of Smith System Driver Improvement Institute, Inc.

		2	Failing to observe vehicles, pedestrians, bicyclists, and other relevant objects in vicinity of your vehicle increases risk of side swipes, rear ending, and third party injury.	Use Smith System Key #2, "Get the Big Picture". Maintain 360 degrees of awareness around vehicle. Check a mirror every 6-8 seconds, maintain space around the vehicle, choose a lane that avoids being boxed in. Look for pedestrian activity ahead in crosswalks or sidewalks. Watch for construction zone approach signs and act early by executing lane changes and reducing speed.	
		3	Failing to keep your eyes moving increases risk of not seeing relevant vehicles, pedestrians, and objects in your vicinity that may impair your ability to make timely and appropriate driving decisions and also increases risk of accident.	Use Smith System Key #3, "Keep Your Eyes Moving". Move your eyes every 2 seconds and avoid staring while evaluating relevant objects. Scan major and minor intersections prior to entering them. Check mirrors.	
		4	Failing to maintain space around and in front of your vehicle increases risk of striking another vehicle or being struck by another vehicle. Insufficient space shortens time for effective driving decision making resulting in increased accident risk.	Use Smith System #4, "Leave Yourself an Out". Use 4 second rule when following a vehicle. Avoid driving in vehicle clusters by adjusting speed and using lanes that permit maximum space and visibility. When stopped, keep one car length space in front of vehicle ahead or white line.	
		5	Failing to communicate with other drivers and pedestrians increases risk of striking vehicles, pedestrians, or being struck by other vehicles, especially from the rear.	Use Smith System Key #5, "Make Sure They See You". Brake early and gradually when stopping to reduce potential of being rear ended. Keep foot on brake while stopped. Use turn signals and horn effectively. Establish eye contact with other drivers and pedestrians to extent practical. Use vehicle positioning that promotes being seen.	
		6	Distractions within the vehicle takes focus off driving, increases risk of accident decreases time for making effective driving decisions.	Cell phone use (any type or configuration) is prohibited while the vehicle is in motion. Familiarize yourself with vehicle layout and controls (radio, temperature controls, etc.) prior to operating unfamiliar vehicles. Set controls prior to operating vehicle. Use GPS in unfamiliar areas to avoid use of paper maps/directions while driving. Set GPS prior to vehicle operation. Pull over and stop to modify GPS functions. Avoid consuming food or drink while driving.	
3	Parking	1	Parking vehicle in areas of clustered parked vehicles or near facility entrance may impair visibility to oncoming traffic in lot and increase exposure to pedestrian traffic.	Use pull through parking or back into parking space when permitted or practical. When practical and safe to do so, park away from other vehicles and avoid parking near the facility entrance or loading docks. If available, use a spotter to aid in backing activity. Back no further than necessary and back slowly. Get out and look (GOAL) if uncertain of immediate surroundings. Tap horn prior to backing.	

PPE Personal Protective Equipment

Type	Personal Protective Equipment	Description	Required
Eye Protection	safety glasses	While checking engine or tires	Required
Hand Protection	work gloves (specify type)	Leather or equivalent checking engine or	Required

Supplies

Type	Supply	Description	Required
Communication Devices	mobile phone		Required
	other	Vehicle kit (applies to company trucks)	Required
Miscellaneous	fire extinguisher	Applies to company trucks	Required
	first aid kit	Applies to company trucks	Required

Task Improvement Process

General

Observed Company: _____

Observation Type: _____

TIP Form: H&S Field Multi-Task (General)

Task Observed: _____

Observee Name: _____

Observer Name: _____

Observation Date: _____

Project Number: 3001258

Project Name: Site 211577631 Queen Anne Ave, Seattle, WA 98109

Supervisor: _____

Equipment On Site: _____

Pertinent Information: _____

Observation

Task	Correct	Questionable	Comments
General			
PPE worn according to HASP/JLA specifications and inspected before use?			
STOP work authority used where appropriate?			
Body Use/Positioning			
Proper lifting/pushing/pulling techniques used (no awkward positions/posture; no twisting or excessive reaching; no straining; no excessive weight; load under control/stable; etc.)?			
Body parts away from pinch points (clear or protected from being caught between objects/equipment or from contacting sharp objects/edges, etc.)?			
Body parts not in the Line of Fire (protected from being struck by traffic, equipment, falling/flying objects, etc.)?			
Work Procedures/Environment			
Correct type and number of barricades/warning devices/cones?			

Communication with others when necessary (hand signals, flags, etc.)?			
Right tools and equipment selected for the job and inspected before use?			
Tools and equipment used properly?			
Housekeeping performed (work areas and pathways clear of hazards, uneven surfaces addressed, etc.)?			
Slip/trip/fall hazards addressed (path selected and cleared, eyes on path, speed footing, etc.)?			
Proper energy control (electrical systems grounded, lock out/tag out performed, isolated, cords/fixtures in good condition, GFCI inspected and utilized when appropriate and used properly, etc.)?			
Protected from overhead/underground utilities (proper clearance, properly marked, spotters as necessary, etc.)?			
Safe work on/near water (appropriate flotation device, appropriate boat for body of water and operation of boat, etc.)?			
Chemical/Radiation protection (decontamination zones set up properly, air monitoring, completed, and logged, etc.)?			
Fall from elevated height prevention (maintains 3-points of contact, appropriate ladder, mounting/dismounting vehicle/equipment, fall arrest system, etc.)?			
Any additional safety issues identified:			

Tip Summary Enter details of the TIP and follow up discussion provide details on how any questionable items were resolved.

Discussion following the TIP led by: _____

Date of follow-up discussion: _____

Positive Comments:

Discussion Summary Completed:

- Supervisor Led
- Peer to Peer
- Arcadis Employee to Subcontractor

Summary of Questionable Items

Action Items (Optional) Assign appropriate action items based on the observations made. You can add more than one action item if needed.

Item #	Action Item	Responsible Person	Due Date	Comp. Date
1				
2				
3				

Standard Review

Reviews to be performed after entry of this TIP into 4-Sight.

Quality Review

Quality Reviews to be performed after entry of this TIP into 4-Sight.

Field Validation and Verification

Use the 4-Sight generated copy of this TIP to perform field V&V activities.

Air Monitoring Documentation Form



PID Model: _____

Monitor Frequency: _____

LEL/O₂ Model: _____

CIT Model: _____

Dust Mon. Model: _____

Air Monitoring Results

Date	Time	PID (units)	O ₂ (%)	LEL (% LEL)	CIT (ppm)	Dusts (mg/m ³)	Location
_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____
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_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____

CIT = Colorimetric Indicator Tube
LEL = Lower Explosive Limit
mg/m³ = Milligram per cubic meter
O₂ = Oxygen

ppm = Part per million
% = Percent
PID = Photoionization Detector



Traffic Safety Plan (TSP)

Notes: ROW - Right of Way (Public) formerly known as "TCP"

Non-ROW - Not in the ROW (parking lots, etc.) formerly known as "STAR"

1.0 General

Plan type	Non-Right of Way (Non-ROW)
Project Name:	211577 Seattle Queen Anne Ave N
Project Number:	3001258
Developer Name:	Daniel Sly Gilbert
Duration of Project (in hours or days):	10
Time Restrictions (Y/N, if Y describe below):	N
Not Applicable	
Not Applicable	
Not Applicable	NA
Not Applicable	
Not Applicable	NA
<input type="checkbox"/> Working on multiple roads?	

Comments:

2.0 Work Description

Provide a brief description of scope of work:

Groundwater sampling

Soil vapor sampling

Subcontractor oversight

3.0 Type and Duration

Work locations on this project will be:

Intermediate work (1-8 hours per location)

Non-ROW work will be performed in:

Active parking lot

Special traffic conditions may include (select most prevalent):

Not applicable

4.0 Traffic Control Layout, Number of Devices Required, and Phasing

The following Non-ROW requirements in the Traffic Safety Handbook applies:

Section 7.3 Intermediate Duration Work in Parking Areas (1 to 8 Hours) (DOT Facts-302b)

The menu below will be blank and is not applicable.

The menu below will be blank and is not applicable.

Non-ROW configuration:

An example non-ROW traffic control configuration for this project is illustrated below. The actual type and number of devices required are specified below. Don't leave vehicle doors open. Don't establish controls within 25 ft of the front or rear of parked large vehicles/rolling equipment without coordinating with the vehicle/equipment operator.

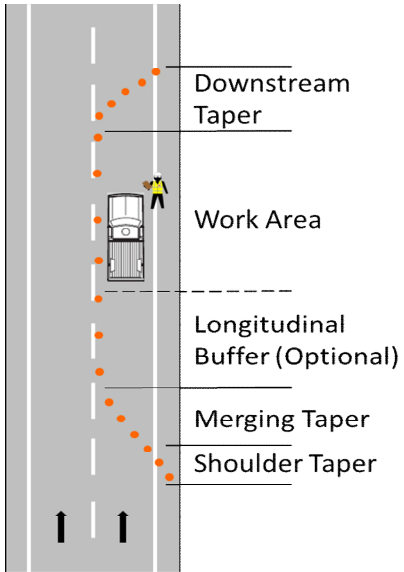
ROW minimum sign spacing distances for "A", "B" and "C" (as applicable) in referenced DOT Facts.			ROW oncoming traffic minimum site distance required to see Flagger and properly decelerate and stop.
A	NA	ft.	
B	NA	ft.	
C	NA	ft.	

ROW Cone Calculation (Values are default. Light grey fields may be modified based on actual road conditions)

<input type="checkbox"/>	Active work area length (feet)	200
<input type="checkbox"/>	Apply Optional Longitudinal Buffer (ft)?	0
	Lane width of offset (feet)	12
	Shoulder width of offset (feet)	8
	Posted speed limit	NA

<input type="checkbox"/>	Shoulder Taper	
	Taper Length (feet)	NA
	Cones Required	NA
	Cones Spacing (max., ft)	NA

<input type="checkbox"/>	Merging Taper	
	Taper Length (feet)	NA
	Cones Required	NA
	Cones Spacing (max., ft)	NA



Work Area


Cone Spacing (max., ft) NA
 Cones Required NA

Downstream Taper

Taper Length (feet) NA
 Cones Required NA
 Cone Spacing (max., ft) NA

Note: Review taper configuration and cone spacing after ROW implementation to ensure traffic is moving efficiently without motorist confusion in the RWZ.

Cones Required (minimum) NA

Select the traffic control devices to be used and enter number each required:			Non-ROW Phasing:
Check all that apply:	Wording or Pictogram	Number:	
<input type="checkbox"/>	Warning signs		1) Position truck as shield, if practical 2) Deploy traffic control devices 3) Affix flags, caution tape or fencing 4) Unload project equipment 5) Commence work 6) SSO to maintain controls 7) Remove controls in reverse order
<input type="checkbox"/>	Warning signs		
<input type="checkbox"/>	Warning signs		
<input type="checkbox"/>	Stop/Slow paddle		
<input type="checkbox"/>	Red flag		
<input type="checkbox"/>	Drums		
<input checked="" type="checkbox"/>	Channelizer cone (42 inch height, 10 lb base)	6.00	
<input type="checkbox"/>	Channelizer cone (42 inch height, 30 lb base)		
<input type="checkbox"/>	Traffic cones (≥ 18 inches tall)	NA	
<input type="checkbox"/>	Barricade: 		
<input type="checkbox"/>	Flags for cones		
<input type="checkbox"/>	Lights (for night work)		
<input type="checkbox"/>	Plastic fencing (rolls)		
<input checked="" type="checkbox"/>	Caution tape (rolls)	1	
<input type="checkbox"/>	Other (specify):		

Reviewed By:

HASP Reviewer:

THIS FORM MUST BE COMPLETED IN ENTIRETY PRIOR TO BEGINNING ANY INTRUSIVE WORK

Project: Site 211577631 Queen Anne Ave, Seattle, WA 98109
 Project Number: 3001258
 Form Completion Date: _____ Form Expiration Date: _____
 (15 business days post form completion date)

Pre-Field Work

Required: One Call or "811" notified 48-72 hours in advance of work? #: _____
 Ticket Expiration Date _____ (Review State Requirements)
 Utility companies notified during the One Call process See attached ticket

 List any other utilities requiring notification:
 None _____

Private Locator Contacted Yes No
 Plan private utility clearance subcontractor assignments, areas, required clearance equipment, depth of clearance needed, types of utilities. When possible re-clear 811 markings to confirm utility locations.
 Client provided utility maps or "as built" drawings showing utilities? Yes No

Field Work - This must be completed on site, by staff who have a minimum of one year of field experience in identifying utilities. Review check list with PM or designee prior to beginning intrusive work.

List Soil Boring / Well IDs or Excavation Locations applicable to this clearance checklist:

3 Reliable Lines of Evidence Required Prior to Starting any Subsurface Intrusive Work
 One Call/"811" (Reliable as a line of evidence when working in public right of way or easement)
 Utility Markings Present: Paint Pin flags/stakes Other None
 Client Provided Maps/Drawings **OR** Maps/Drawings requested but not provided
 Client Clearance Name(s)/Affiliation(s) _____
 Interview(s): Name(s)/Affiliation(s) _____
 Did person(s) interviewed indicate depths of any utilities in the subsurface?
 Yes, depths provided: _____ Did not know or refused to answer
 Additional Comments: _____

Site Inspection (**Complete Page 2 & Photo Document Marked Utilities & Utility Structures**)
 Public Records / Maps / Asbuilts
 Private Locator: (Name and Company) _____
 Ground Penetrating Radar (GPR)
 Radiofrequency (RFLoc)
 Electromagnetic (EM)
 Metal Detector

- Tips for Successful Utility Location:**
1. Don't forget to look up
 2. Be on site with Private Utility Locators
 3. Ask Private Locators to "confirm" other's markings
 4. Select alternate/backup locations during clearance process
 5. Mark out all known utilities. Leave nothing to question
 6. No hammering - no pickaxes - no digging bars - no shortcutting
 7. No excessive turning or downward force of hand augers/shovels
 8. Utilities may run in or directly under asphalt/concrete

Soft Dig Methods

Termination Depth _____ ft. bgs
 Potholing / Vacuum Extraction
 Air-Knife or Hydro-Knife
 Probing
 Hand Auguring

Other: _____
 Marine Locator: (Name and Company) _____

During the site inspection look for the following: ("**YES**" requires additional investigation and the utility must be marked properly prior to beginning subsurface intrusive work):

Site Inspection	Utility Color Codes	Present			
a) Natural gas line present (evidence of a gas meter)?	Yellow	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
i) Feeder Lines to buildings or homes?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
b) Evidence of electric lines:	Red				
i) Conduits to ground from electric meter or along wall?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
iii) Conduits from power poles running into ground?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
ii) Light poles, electric devices with no overhead lines?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
iii) Overhead electric lines present? (See Section I)		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
c) Evidence of sewer drains:	Green				
i) Restrooms or kitchen on site?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
ii) Sewer cleanouts present?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
iii) Combined sewer/storm lines or multiple sewer lines?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
d) Evidence of water lines:	Blue				
i) Water meter on site or multiple water lines?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
ii) Fire hydrants in vicinity of work?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
iii) Irrigation systems? (Sprinkler heads, valve boxes, controls in building)		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
e) Evidence of storm drains:	Green				
i) Open curbside or slotted grate storm drains		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
ii) Gutter down spouts going into ground		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
f) Evidence of telecommunication lines:	Orange				
i) Fiber optic warning signs in areas?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
iv) Aboveground cable boxes or housings or wires in work area?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
g) Underground storage tanks:					
i) Tank pit present, tank vent present?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
ii) Product lines running to dispensers/buildings?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
h) Do utilities enter or exit existing structures/buildings?					
If Yes, confirm the utility markings outside of structure/building match up.		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
i) Proposed excavation marked in white?	White	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
j) Unclassed utilities / anomalies marked in pink?	Pink	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
k) Overhead Utilities/Communication Lines - Look Up:					
i) Overhead electrical conduit, pipe chases, cable trays, product lines?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
ii) Overhead fire sprinkler system?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
l) Overhead Power lines in or near the work area:					
i) < 50 kV within 10 ft. of work area?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
ii) >50 - 200 kV within 15 ft. of work area?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
iii) >200-350 kV within 20 ft. of work area?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
iv) >350-500 kV within 25 ft. of work area?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
v) >500-750 kV within 35 ft. or work area?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
vi) >750-1000 kV within 45 ft. of work area?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
m) Other:					
i) Evidence of linear asphalt or concrete repair?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
ii) Evidence of linear ground subsidence or change in vegetation?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
iii) Unmarked manholes or valve covers in work area?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
iv) Warning signs ("Call Before you Dig", etc.) on or adjacent to site?		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
v) Utility color markings not illustrated in this checklist?	Purple	<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
n) Has the Utilities & Structures Checklist been reviewed by the PM or Designee		<input type="checkbox"/>	Yes	<input type="checkbox"/>	No
PM or Designee Name: _____					

Name and Signature of person completing the checklist: _____
 Date: _____

Do not perform **mechanized** intrusive work within 30 inches of a utility marking without receiving pre-approval by Corporate H&S .

Control Number: TSM- 3001258



TSM + project number plus date as follows: xxxxxxxx.xxxx.xxxx - dd/mm/year

TAILGATE HEALTH & SAFETY MEETING FORM

Project Name: _____ **Project Location:** _____

Date: _____ **Time:** _____ **Conducted by:** _____ **Signature/Title:** _____

Issues or concerns from previous day's activities:

Task anticipated to be performed today:
 Additional permits/checklists attached

USE TRACK! Evaluate the hazards (h) for the tasks being performed today and rank as Low (L), Medium (M) or High (H). Use relevant JSAs, FHSB, permit or other work standard to communicate controls (c) to be used to eliminate or mitigate identified hazards.

<input type="checkbox"/> Gravity (i.e., ladder, trips) (L M H) h: _____ c: _____	<input type="checkbox"/> Motion (i.e., traffic, machinery) (L M H) h: _____ c: _____	<input type="checkbox"/> Mechanical (i.e., augers, motors) (L M H) h: _____ c: _____
<input type="checkbox"/> Electrical (i.e., utilities) (L M H) h: _____ c: _____	<input type="checkbox"/> Pressure (i.e., gas cyl., wells) (L M H) h: _____ c: _____	<input type="checkbox"/> Environment (i.e., heat, cold) (L M H) h: _____ c: _____
<input type="checkbox"/> Chemical (i.e., fuel, acid, paint) (L M H) h: _____ c: _____	<input type="checkbox"/> Biological (i.e., ticks, poison ivy) (L M H) h: _____ c: _____	<input type="checkbox"/> Radiation (i.e., alpha, sun, laser) (L M H) h: _____ c: _____
<input type="checkbox"/> Sound (i.e., machinery) (L M H) h: _____ c: _____	<input type="checkbox"/> Personal (i.e. alone, night) (L M H) h: _____ c: _____	<input type="checkbox"/> Driving (i.e. car, ATV, boat) (L M H) h: _____ c: _____

Refer to the attached Hazard Analysis Sheet(s) or JSA

Comments:

Signature and Certification: I have read and understand the project specific HASP for this project.

SSE Employee*	Non-Life Threatening Injury or Illness Call WorkCare 1-888-449-7787			<p>I will STOP the job any time anyone is concerned or uncertain about health & safety or if anyone identifies a hazard or additional mitigation not recorded in the site, project, job or task hazard assessment.</p> <p>I will be alert to any changes in personnel, conditions at the work site or hazards not covered by the original hazard assessments.</p> <p>If it is necessary to STOP THE JOB, I will perform TRACK; and then amend the hazard assessments or the HASP as needed.</p> <p>I will not assist a subcontractor or other party with their work unless it is absolutely necessary and then only after I have done TRACK and I have thoroughly controlled the hazard.</p> <p>All site staff should arrive fit for work. If not, they should report to the supervisor any restrictions or concerns.</p> <p>In the event of an injury, employees will call WorkCare at 1.888.449-7787 and then notify the field supervisor.</p> <p>Utility strike, motor vehicle accident or 3rd party property damage - field supervisor will immediately notify the Project or Task Manager</p>
	Printed Name/Signature/Company	Sign In Time	Sign Out Time	

*Short Service Employee (SSE) working for Arcadis <1 year.

Arcadis Weekly Vehicle Inspection Form

 Vehicle # / License Plate #

 Lease Plan # / Last 6 of Vin #

Inspection Date													
Odometer reading													
Driver / Inspector Name													
Check the appropriate box and enter repair date for identified repairs:													
		OK	Needs Repair	Repair Date	OK	Needs Repair	Repair Date	OK	Needs Repair	Repair Date	OK	Needs Repair	Repair Date
Interior	Horn operational												
	Door Locks operational												
	Seat Belts in good repair												
	Seats and Seating Controls												
	Steering Wheel - No Excessive Play												
	Interior Lights and Light Controls												
	Instrument Panel/Gauges												
	Wiper Controls operational												
	Heat/Defrost/Air Conditioning working												
	Rear View Mirror present												
	Backup Camera/Sensors working												
	Jack and Lug Wrench present												
Exterior¹	Lights and Signals operational												
	Tires properly inflated/good tread depth												
	Spare Tire properly inflated												
	Doors operational												
	Windows Not Cracked/Damaged												
	Side View Mirrors												
Engine & Brakes	Body Panels and Bumpers												
	Engine Start & Running Smoothly												
	Fluid Levels, No Noticeable Leaks												
	Belts tight, no cracks												
Emergency Equipment²	Brakes operational, no squeaking												
	First Aid Kit, inspected weekly												
	Fire Extinguisher properly secured												
	Fire Extinguisher inspected weekly												
	Orange/Yellow emergency warning light												
	Roadside Assistance Information												
Cargo	Recommend spotter cones available												
	Cargo Secure and Properly Distributed												
Registration	Securing Devices in Good Condition												
	License Plate /Tags												
	Registration and Insurance												
	City/State Inspection Decal												
	Lease Plan information/Fuel Card												

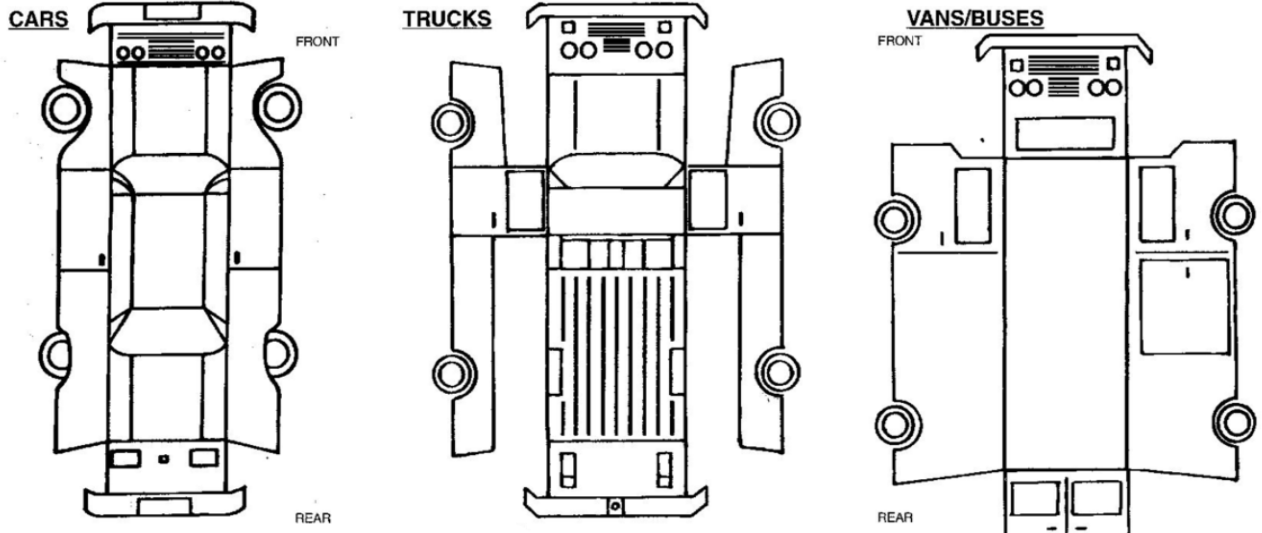
¹ Note all damages to the vehicle on the back of this page

² Emergency Equipment required per Motor Vehicle Standard ARC HSGE024

Note All Vehicle Damage Below

All Vehicle Damage must be reported to Sue Berndt (Corporate Legal), Andrew McDonald (Corporate H&S), and Roger Elliot (Corporate Fleet Manger)

- CODES:**
- B-BENT
 - BR-BROKEN
 - BU-BULGE
 - C-CHAFED
 - CH-CHIPPED
 - CPM-COVERED WITH PROTECTIVE MATERIAL-UNABLE TO DETERMINE DEFECTS IF ANY
 - CSA-CHAFED AND SCRATCHED ALL OVER
 - CR-CRACKED
 - D-DENTED
 - DMC-DUST AND MUD COVERED UNABLE TO DETERMINE OTHER DEFECTS IF ANY
 - G-GOUGED OR CUT
 - GC-GLASS CRACKED
 - HS-HAIRLINE SCRATCH
 - M-MISSING
 - P-PUNCTURED
 - R-RUSTY
 - S-SCRATCHED
 - SC-SCRAPED
 - SM-SMASHED
 - ST-STAINED AND/OR SOILED
 - T-TORN



-INDICATE ON DIAGRAM-
-GIVE DIMENSIONS-
-CIRCLE WHERE APPLICABLE-

Notes:

Tread guide: If a tread gauge is not available coins may be used to determine remaining tread. 2/32" is the minimum by law in most states (top of Lincoln's head on penny), 4/32" is minimum recommended for wet surfaces (top of Washington's head on quarter), 6/32" is minimum recommended for snowy surfaces (top of Lincoln Memorial on penny). Vehicle tires should be replaced if the tread depth is less than 6/32".



2/32" remaining 4/32" remaining 6/32" remaining

Reference JSA 10907 For Weekly Vehicle Inspection

HEAT ILLNESS PREVENTION PLAN



Purpose and Scope

Date Completed

The purpose of this document is to serve as a planning tool and implementation guide to assist the project team, onsite personnel, and the Site Safety Officer (SSO) or other designated responsible party to comply with the requirements set forth by **Cal/OSHA Title 8 CCR 3395 Heat Illness Prevention Standard** and the **Washington State Outdoor Heat Exposure Regulations 296-62-09510 thru 09560**.

NOTE: This HASP Supplement is required to be used in California and Washington states. The Arcadis Health and Safety Standards ARC HSIH013 Heat Stress Prevention, and ARC HSGE008 Injury and Illness Prevention Program (IIPP) must accompany this HASP Supplement. To completely address the regulatory requirements for work in CA and WA states these standards are required to be used in association with the project-specific HASP and this supplement.

The scope of this HIPP applies to Arcadis projects which include, but are not limited to: outdoor operations such as contractor oversight, construction, refining, oil and gas extraction, asbestos removal, and hazardous waste site activities and interior work particularly tasks which require employees to wear PPE which can increase the risk for heat stress for the wearer. This HIPP provides guidance to prevent or reduce the risk of work-related heat illness. This HASP Supplement provides site specific instructions for actions to be completed at the project site.

Project sites in other states and provinces are expected to use this HASP Supplement as a Best Management Practice to prevent heat related illness injuries.

Project Site Name

631 Queen Anne Ave, Seattle, WA 98109

Authority and Implementation

The following designated individuals have authority and responsibility for implementing the provisions of this program at the project work site indicated above.

Project Manager

Christopher Dotson

Site Safety Officer (SSO)

Julia Vidonish

SSO Designated Alternate

Acclimatization of Personnel for Heat Stress Prevention

The degree to which personnel have been able to physiologically adjust or acclimatize to working under hot conditions affects ability to safely do work. Acclimatized individuals generally have lower heart rates and body temperatures than unacclimated individuals, and sweat sooner and more profusely. This enables them to maintain lower skin and body temperatures at a given level of environmental heat and work loads than unacclimated workers. Acclimatization can occur after a few days of exposure to the hot work environment. OSHA/NIOSH suggests an acclimatization period of 2-3 days for fit personnel. On the 1st day personnel should spend 50% of the day exposed to / working in the hot environment and increasing the amount of work 10-20% based on personnel response to the hot environment and work load.

Procedures for Provisions for Potable Water

The SSO or designee will be responsible for implementing the following when conditions at the site are anticipated to exceed 80 degrees (°) Fahrenheit (F) / 26.6° Celsius (C)

1. Proper hydration is critical to preventing heat related illness and injury. Project sites will maintain an adequate supply of suitably cool, fresh and pure potable water on site/readily accessible to allow each employee to consume 1 quart (1 L) of water per hour, ideally at a rate of four 8-oz (250 mL) cups per hour.

NOTE: Fresh and pure water is defined as being "odor free and suitably cool". Where suitably cool means water being cooler than the ambient temperature but not so cold as to cause discomfort or prevent drinking.

NOTE: Electrolyte replacement drinks or "Sports Drinks" should be used to replace essential minerals lost during sweating. Sports drinks should supplement water intake e.g. one "sport drink" to every three bottles of water (3 waters : 1 sport drink)

2. During the Tailgate Safety Meeting and site briefings identify and communicate the type and location of the water source. The water source must provide suitably cool, fresh, and pure water in sufficient quantity for all employees at the site. Water shall be provided free of charge or expenses will be reimbursed for employees. If the source is potable plumbed water do not complete Item 6 of this Section.

3. Communicate to staff whether all water for the day will be provided at the start of the shift (e.g., 2 gallons / 8 L per employee for an 8-hour shift), or how and when water will be replenished.

NOTE: A sufficient quantity of water must always be present and readily accessible to allow every employee to consume at least 1 quart (1L) of water per hour. It is suggested to have a minimum of three hours supply of water per employee on hand.

4. Water supplies must be positioned as close as reasonable possible to site workers. Placing water only in shaded areas or by toilet facilities is not sufficient, particularly at large work sites or at multi-story construction sites. Drinking water sources need to be close enough to workers to allow for routine consumption per the rate noted above.

5. Inspect the coolers / water dispensers for cleanliness and replenishment of water and cooling ice routinely based on temperatures and staff size. Cooling ice will be stored in clean coolers if added directly to water dispensers.

NOTE: If the site temperature exceeds 90° F / 32° C the frequency of the cooler inspection will increase to verify water remains cool and the water supply is maintained.

6. Oversee the daily inspection and maintenance of coolers to ensure they are kept clean and in good condition.

Potable Water Source & Location

<input type="checkbox"/>	Potable plumbed source	Location:	
<input checked="" type="checkbox"/>	Bottled water in chilled cooler	Location:	
<input type="checkbox"/>	Drinking water dispenser & cups	Location:	

Procedures for Provisions for Potable Water Continued

Check which applies. Must check at least one box, or provide additional detail.

<input checked="" type="checkbox"/>	Ice will be purchased at the start of each day.
<input type="checkbox"/>	Ice will be provided by an onsite source or vendor service. Ice to be potable
<input type="checkbox"/>	Alternative potable ice source: _____
<input type="checkbox"/>	Food safe cleaning product for water cooler.
<input type="checkbox"/>	Sufficient amount of drinking water cups for each employee per dispenser.
<input type="checkbox"/>	Other items needed: _____

Access to Shade

The SSO or designee is responsible for implementing the following for how shade will be coordinated and provided **when temperatures exceed 80° F / 26° C.**

1. Access to shade must be allowed at all times. Before the start of work, the location of the shade areas, the importance of taking shade breaks, recognizing the signs and symptoms of heat illness, the schedule of shade breaks, and the location of shade break locations (if not portable) will be addressed during each Tailgate Safety Meeting and site briefing.

NOTE: Where required by regulation, shade breaks will be taken at a minimum rate of 10 minutes of shade for every two hour work period. As temperature increases shade breaks will increase in frequency. See the Heat Index table below for Heat Index specific Action Levels defining shade break frequency and duration.

2. The amount of shaded area must be able to accommodate all employees taking a recovery or rest break including employees on meal breaks. The shaded area(s) don't need to provide shade to accommodate **all employees** on a site or working a shift at the same time. An example includes rotating routine breaks among employees. Also, additional portable shade structures can be erected on an "as-needed" basis.

Employees must have enough shaded space so they can sit in a normal posture fully in the shade with enough space to allow for sitting without being in physical contact with each other. Employees who desire access to shade must not be deprived of it due to lack of space.

3. Employees who take a preventative cool-down rest;

(1) shall be monitored and asked if they are experiencing symptoms of heat related illness. (2) shall be encouraged to remain in the shade. (3) shall not be ordered back to work until signs or symptoms of heat illness have abated, but in no event less than 5 minutes in addition to the time needed to access the shade.

If an employee exhibits signs or symptoms of heat illness while taking a preventative cool-down rest the SSO will provide appropriate support (e.g. additional hydration and/or call to WorkCare) or emergency response support as needed based on symptoms.

4. Shade structures will be relocated to follow the crew for moving tasks. Shade structures will be placed within 50 feet of the work area, if practical. Shade structures must be no further than a short walk away (e.g. 2-3 minutes) from the work area. This consideration becomes more critical as the temperature rises above 80° F (26 C).

Access to Shade Continued

5. In situations where it is not safe or feasible to provide shade, the SSO will document in the HASP Supplement the unsafe or unfeasible conditions, and include the steps taken to provide alternative cooling measures equivalent to shade.

Unsafe/unfeasible conditions: _____

Alternative Cooling Measures Implemented:

<input checked="" type="checkbox"/>	Provide vehicles with working air conditioner to all employees for rest breaks / recovery breaks / meal breaks.
<input type="checkbox"/>	Provide temporary or mobile shade structure(s) that are either ventilated or open to air movement (Secure against wind.)
<input type="checkbox"/>	Provide a building / permanent structure(s) in close proximity to the work area with a cooling environment via mechanical ventilation or open to air movement which will be used for shade. (Job trailer, pavilion, manufacturing building, etc.)
<input type="checkbox"/>	Other: _____

Monitoring of Weather and Heat Index Table

1. The SSO or designee must check the extended weather forecast in advance of the upcoming work on a weekly basis. Work schedules will be adjusted in advance, taking into consideration whether high temperatures or a heat wave is expected.

Accepted weather forecasting resources include webpages "NOAA.gov" or "weather.com" or see the NIOSH Heat Tool (formerly the OSHA Heat Tool app)

<https://www.cdc.gov/niosh/topics/heatstress/heatapp.html>

2. Before work starts for the day or shift, the SSO will review the forecasted temperature and humidity for the (exterior) work site and compare conditions against the National Weather Service Heat Index (below) to evaluate the risk level for heat illness. Determination will be made of whether or not workers will be exposed to a combination of temperature and humidity characterized as "Caution", "Extreme Caution", "Danger" or "Extreme Danger" for heat illnesses.

NOTE: It is important to know the temperature at which these warnings occur. When working outdoors see the Heat Index Table in this supplement for Action Level specific instructions for hazard controls.


3. Where state regulations indicate a thermometer or similar on-site monitoring device will be used at the job site to monitor for sudden increases in temperature. The SSO will be responsible for obtaining a thermometer/weather station prior to the start of work and make it readily visible / accessible where it can easily be monitored throughout the course of the day.

NOTE: If the temperature is **> 80°F (26 C)** shade structures will be opened and made available to workers. If temperature is **≥ 95° F (35 C)** additional preventive measures will be implemented.

Monitoring of Weather and Heat Index Table

		Relative Humidity (%)																			
		5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85	90	95	100
Temperature (°F)	80	77	78	78	79	79	79	80	80	80	81	81	82	82	83	84	84	85	86	86	87
	81	78	79	79	79	80	80	81	81	82	82	83	84	85	86	86	87	88	90	91	93
	82	79	79	80	80	80	81	81	82	83	84	84	85	86	88	89	90	91	93	95	99
	83	79	80	80	81	81	81	82	82	83	84	85	86	87	88	90	91	93	95	97	99
	84	80	81	81	81	82	82	83	83	84	85	86	88	89	90	92	94	96	98	100	103
	85	81	81	82	82	82	83	84	84	85	86	88	89	91	93	95	97	99	102	104	107
	86	81	82	83	83	83	84	85	85	87	88	89	91	93	95	97	100	102	105	108	112
	87	82	83	83	84	84	85	86	87	88	89	91	93	95	98	100	103	106	109	113	116
	88	83	84	84	85	85	86	87	88	89	91	93	95	98	100	103	106	110	113	117	121
	89	84	84	85	85	86	87	88	89	91	93	95	97	100	103	106	110	113	117	122	
	90	84	85	86	86	87	88	89	91	92	95	97	100	103	106	109	113	117	122	127	
	91	85	86	87	87	88	89	90	92	94	97	99	102	105	109	113	117	122	126	132	
	92	86	87	88	88	89	90	92	94	96	99	101	105	108	112	116	121	126	131		
	93	87	88	89	89	90	92	93	95	98	101	104	107	111	116	120	125	130	136		
	94	87	89	90	90	91	93	95	97	100	103	106	110	114	119	124	129	135	141		
	95	88	89	91	91	93	94	96	99	102	105	109	113	118	123	128	134	140			
	96	89	90	92	93	94	96	98	101	104	108	112	116	121	126	132	138	145			
	97	90	91	93	94	95	97	100	103	106	110	114	119	125	130	136	143	150			
	98	91	92	94	95	97	99	102	105	109	113	117	123	128	134	141	148				
	99	92	93	95	96	98	101	104	107	111	115	120	126	132	138	145	153				
	100	93	94	96	97	100	102	106	109	114	118	124	129	136	143	150	158				
	101	93	95	97	99	101	104	108	112	116	121	127	133	140	147	155					
	102	94	96	98	100	103	106	110	114	119	124	130	137	144	152	160					
	103	95	97	99	101	104	108	112	116	122	127	134	141	148	157	165					
	104	96	98	100	103	106	110	114	119	124	131	137	145	153	161						
105	97	99	102	104	108	112	116	121	127	134	141	149	157	166							
106	98	100	103	106	109	114	119	124	130	137	145	153	162	172							
107	99	101	104	107	111	116	121	127	134	141	149	157	167								
108	100	102	105	109	113	118	123	130	137	144	153	162	172								
109	100	103	107	110	115	120	126	133	140	148	157	167	177								
110	101	104	108	112	117	122	129	136	143	152	161	171									
111	102	106	109	114	119	125	131	139	147	156	166	176									
112	104	107	111	115	121	127	134	142	150	160	170	181									
113	104	108	112	117	123	129	137	145	154	164	175										
114	105	109	113	119	125	132	140	148	158	168	179										
115	106	110	115	121	127	134	143	152	162	173	184										
116	107	111	116	122	129	137	146	155	166	177											
117	108	112	118	124	132	140	149	159	170	181											
118	108	113	119	126	134	142	152	162	174	186											
119	109	114	121	128	136	145	155	166	178												
120	110	116	122	130	138	148	158	170	182												
121	111	117	124	132	141	151	162	174	187												
122	111	118	125	134	143	154	165	178													
123	112	119	127	136	146	157	169	182													
124	113	120	129	138	148	160	172														
125	114	121	130	140	151	163	176														

Heat Index



Extreme Danger	Heat stroke likely.
Danger	Sunstroke, muscle cramps, and/or heat exhaustion likely. Heatstroke possible with prolonged exposure and/or physical activity.
Extreme Caution	Sunstroke, muscle cramps, and/or heat exhaustion possible with prolonged exposure and/or physical activity.
Caution	Fatigue possible with prolonged exposure and/or physical activity.

Note: The Heat Index table was developed with an expectation of partial shade & light wind conditions present. Work conducted in direct / full sunlight (e.g. no partial shade) and no wind adds up to 15° F (8° C) to the Heat Index evaluation.

Monitoring of Weather and Heat Index Table Continued

Heat Index Action Levels. Below are recommended additional controls. Each level of additional controls is additive as the temperature increases.

	<p>CAUTION 80° - 89° F (26° - 32° C). Implement one or more of the following measures: Provide and direct hydration, schedule breaks, ensure lightweight clothing is worn, provide break areas with shade / ventilation / air conditioning.</p>
	<p>EXTREME CAUTION 90° - 97° F (32° - 39° C). Implement all the previous and add one or more of the following: Provide light duty PPE, cooled break areas, shaded work areas. NOTE: "Light Duty PPE" includes hard hat sun shades, sun hats, dry or wet evaporative cooling vests, microfiber cooling towels / scarves / headbands / hard hat suspension inserts or sweatbands, hard hat neck shades.</p>
	<p>DANGER 98° - 107° F (39° - 43° C). Implement all the previous and add one or more of the following: cooled work areas, modified work schedule, heavy duty PPE, and personnel physiological monitoring. NOTE: "Heavy Duty PPE" phase-change cooling vests, gel pack or ice pack equipped cooling vests. Consider engineering controls such as forced ventilation.</p>
	<p>EXTREME DANGER $\geq 108^\circ$ F ($\geq 44^\circ$ C). If working at this temperature or greater Stop Work until conditions change or hazards are effectively controlled via the items listed above. At this range of temperatures it is critical to implement personnel vital sign monitoring for determining the appropriate frequency and duration of Work / Rest cycles.</p>

Work / Rest Cycle Duration and Frequency Process

Because the incidence for heat stress depends on a variety of factors, all workers regardless if they are wearing permeable or semi-permeable clothing, should be monitored. If semi-permeable clothing is worn (e.g. **not** standard cotton or synthetic work clothing) begin monitoring those workers when temps exceed 70° F in the work area. This becomes of particular importance when work is conducted indoors, includes strenuous tasks, and additional PPE is worn such as Level C respiratory protection or chemical protective clothing (CPC) is worn.

NOTE: Warning signs include when a persons sustained heart rate exceeds 180 beats per minute minus their age (e.g., 180 - age = X) for individuals with normal cardiac performance per their physician; or a body core temperature exceeding 101.3° F / 38.5° C for acclimatized workers or 100° F / 38° C for unacclimated workers.

Suggested Frequency and Duration of Work / Rest Cycles Applying Physiological Monitoring of Acclimatized Personnel

Adjusted Temp. (1)	Permeable PPE (2)	Impermeable PPE
≥ 90° F / 32° C	After ea. 45 mins. of work	After ea. 15 mins. working
87.5-90° F / 30.8-32.2° C	After ea. 60 mins. of work	After ea. 30 mins. Working
82.5-87.5° F / 28.1-30.8° C	After ea. 90 mins. of work	After ea. 60 mins. Working
77.5-82.5° F / 25.3-28.1° C	After ea. 120 mins. of work	After ea. 90 mins. Working
72.5-77.5° F / 22.5-25.3° C	After ea. 150 mins. of work	After ea. 120 mins. Working

NOTES:

(1) Adjusted air temp (ta adj) calculation: $ta\ adj\ F = ta\ F + (13 \times \% \text{ sunshine})$. Measure the air temperature (ta) with a thermometer (shielded from radiant heat). Estimate the percent sunshine by judging what percent time the sun is not covered by clouds that are thick enough to produce a shadow. (100 percent sunshine = no cloud cover and a sharp, distinct shadow; 0 percent sunshine = no shadows.)

(2) Permeable PPE consists of cotton clothing with long sleeves and pants or breathable coveralls.

Heart Rate Monitoring

Count the radial pulse (located on the inside of the wrist below the thumb) during a 30 second interval before the start of work to establish a baseline heart rate. During rest cycles count the heart rate as early as possible at the beginning of the rest cycle.

- If the heart rate exceeds 110 beats per minute at the beginning of the rest period, shorten the next work cycle by one-third and keep the rest period the same.
- If the heart rate still exceeds 110 beats per minute at the next rest period, shorten the following work cycle by one-third.

Body Temperature Monitoring

Oral temperature. Use a clinical thermometer (3 minutes under the tongue) or a forehead infrared type device to measure the body temperature at the end of the work period (If using an oral thermometer record temperature before drinking liquids).

- If oral temperature exceeds 99.6°F (37.6°C), shorten the next work cycle by one-third without changing the rest period.
- If oral temperature still exceeds 99.6°F (37.6°C) at the beginning of the next rest period, shorten the following work cycle by one-third.
- Do not permit a worker to wear a semi-permeable or impermeable garment when his/her oral temperature exceeds 100.6 °F (38.1 °C).

Procedures for High Heat Conditions and Heat Waves

These procedures are additional preventative measures to be implemented when the temperature is > 95° F (35° C). The SSO or designee is responsible for ensuring effective observation and monitoring of employees during periods of high heat by implementing one or more of the following procedures:

1. SSO or designee will supervise 20 or fewer employees.
2. The "Buddy System" is mandatory. Conduct routine checks for early signs of Heat Illness. Set and verify routine consumption of water & sports drinks in a 3:1 ratio.
3. Maintain regular communication between Project Manager or SSO / designee and field staff (e.g. via mobile phone, radio or another effective means) for observation of early signs of heat illness.
4. Designate one or more employees as authorized to contact emergency medical services and communicating that if no designate is identified and the SSO is unavailable that any employee can call for emergency medical assistance.
5. Modify work schedule to avoid hottest parts of the day (e.g. start work earlier in the AM, stop work for the hottest hours of the day, conduct work during the evening).

Additionally, tailgate Safety Meetings will include a review the high heat procedures, encourage employees to drink plenty of water, and remind employees of the importance to take a preventative or recovery cool-down rest when necessary.

Employees will be observed for alertness and signs and symptoms of heat illness at regular intervals to be documented in the field book or field log.

The "Buddy System" must be implemented. Particular attention needs to be paid to new employees or employees who have yet to acclimate to high heat conditions. Additionally, frequent communication will be maintained with employees working by themselves (via cell phone or two-way radio), to evaluate early warning signs and symptoms of heat illness.

When the SSO is not available, an alternate responsible person must be assigned to look for signs and symptoms of heat illness. Such a designated observer will be trained and know what steps to take if heat illness occurs.

"Heat Wave" Procedures

A "heat wave" as defined by NOAA, is a period of abnormally and uncomfortably hot and unusually humid weather." Typically, a heat wave lasts 2 or more days. A "Heat Wave" as defined for the purposes of this Standard is when temperatures are sustained above 80° F (26° C). During a heat wave or if site conditions indicate the potential for "Extreme Caution", "Danger" or "Extreme Danger" per the NOAA Heat Index Table the following steps will be taken:

Work schedules will be modified to protect workers from heat illnesses. The SSO or designee in coordination with the project team, will use their Stop Work Authority and evaluate the following actions and document the action in the daily field log

1. Modify work hours to exclude the hottest parts of the day.
2. Reschedule work or specific tasks that require strenuous exertion or Stop Work.

If schedule modifications are not possible, the Heat Illness Prevention Plan will be reviewed before work resumes. At a minimum, procedures for heat illness prevention, the provisions of the high heat procedures, the weather forecast and emergency response protocols will be reviewed.

Employees will be provided with additional water and rest breaks and will be observed more frequently. During work activities and rest breaks, employees will be observed for signs and symptoms of heat illness.

All employees will maintain frequent communication with the SSO or designee, who will be monitoring workers for possible symptoms of heat illness. In the event of large project sites where the SSO may be unable to be near the workers (to directly observe or communicate with them), then communication via a cell phone or radio may be used for this purpose provided reception in the area is reliable.

Procedure for Emergency Response

Emergency procedures include recognizing the symptoms of heat related illness. A critical step also involves ensuring that effective communication is established either through voice, direct observation or electronic means such as via mobile phones or 2-way radios. In an emergency situation it is critical that employees understand the process and contact information for requesting emergency medical support. The reception coverage for the site must be evaluated and understood to ensure adequate communication is in place across the project site. During a heat wave or hot temperatures, workers will be reminded and encouraged to immediately report to the SSO any signs or symptoms of the onset of heat stress they are experiencing.

Procedure for Emergency Response Continued

The SSO or designee is responsible for implementing the following procedures for emergency response. These procedures include, but are not limited to, the following:

- 1.** Prior to assigning staff to a particular work site, during the Tailgate H&S Safety Meeting all site workers will review the HASP along with the identified Hospital precise directions (such as streets or road names, distinguishing features, and distances to major roads), to avoid a delay of emergency medical services.
- 2.** Prior to work, efforts will be made to ensure that a qualified, appropriately trained and equipped personnel are consistently available to render first aid.
- 3.** Prior to the morning Tailgate Safety Meeting, an evaluation of whether or not a language barrier is present at the site for understanding the necessary preventative measures and emergency notifications procedures can be completed. Necessary steps will be taken (such as assigning the responsibility to call emergency medical services to the SSO or an English speaking worker) to ensure that emergency medical services can be immediately called in the event of an emergency.
- 4.** All SSOs and supervisors will carry cell phones or other means of communication to ensure that emergency medical services can be called. Routine checks will be made to ensure the devices are allowed on site, have adequate reception across the site, and are functional prior to each shift.
- 5.** When an employee reports symptoms, or displaying symptoms of possible heat illness, steps will be taken immediately to keep the affected employee cool and comfortable. Evaluate whether 1st aid is to be administered or emergency services are to be contacted or the employee is to be taken to an emergency facility for care.

Procedure for Handling a Sick Employee

Signs of Heat Stress: Excessive fatigue, heavy sweating, headaches, abdominal and/or upper thigh cramps, mild dizziness, elevated pulse.

Signs of Heat Exhaustion: Cool, moist, pale or flushed skin, nausea or vomiting, disorientation or confusion.

Signs of Heat Stroke: Hot, red skin which can feel dry to the touch, or moist from overexertion, changes in consciousness, rapid or weak pulse, shallow rapid breathing.

The SSO or designee is responsible for implementing the following procedures for evaluating and providing care for a sick employee:

- 1.** When an employee displays signs or symptoms consistent with the heat related illness, the SSO or designee will check the sick employee and determine whether resting in the shade and drinking cool water will suffice or if emergency service providers will need to be called.

If determined to be a **non-emergency (e.g. heat cramps or heat stress)** the SSO will contact WorkCare Injury Assistance Hotline 1-888-449-7787 for non-emergency 1st aid level medical assistance. In the event of the injury being an **emergency**, or potentially (**e.g. Heat Exhaustion or Heat Stroke**) contact emergency support services.

Appendix A: Site-Specific Health & Safety Plan Supplement

(copy Emergency Contact List and Hospital/Clinic directions after the HASP cover page)



Site Name/Address: Site 211577 – 631 Queen Anne Ave, Seattle, WA 98109



HASP Approver: Aaron Svitana

Date: January 24, 2020

STOP WORK AUTHORITY – As an employee or contractor for Arcadis, you are responsible and authorized to stop any work that is not safe!

There will be NO repercussions for initiating Stop Work Authority.

Emergency Contact List

Emergency Agency	
 Police	911
 Ambulance	911
 Fire	911
Other Important Contacts	
Poison Control	800.222.1222
National Response Center (all spills in reportable quantities)	800.424.8802
United States Coast Guard (spills to water)	800.424.8802
WorkCare	888 449 7787
Arcadis	
Arcadis Region Manager – Christopher Dotson	503.785.9383
Arcadis Alternate Contacts – Ada Hamilton	206.413.6430
Arcadis OE/HES Manager – Aaron Svitana	925.360.2313 (cell)
Arcadis – Principal in Charge – Kathleen Abbott	415.491.4530 Ext.18 (o) 925.323.5861 (m)
Chevron	
Chevron Project Manager – Eric Hetrick	916.715.4782 (cell)
Chevron HES Lead – Jim Duke	713.432.2916 (office)

DIRECTIONS TO HOSPITAL (FOR EMERGENCY SCENARIOS)



Hospital Name: Virginia Mason Emergency Department

Address: 1010 Spring St, Seattle, WA 98101

Emergency Room Number: (206) 583-6433

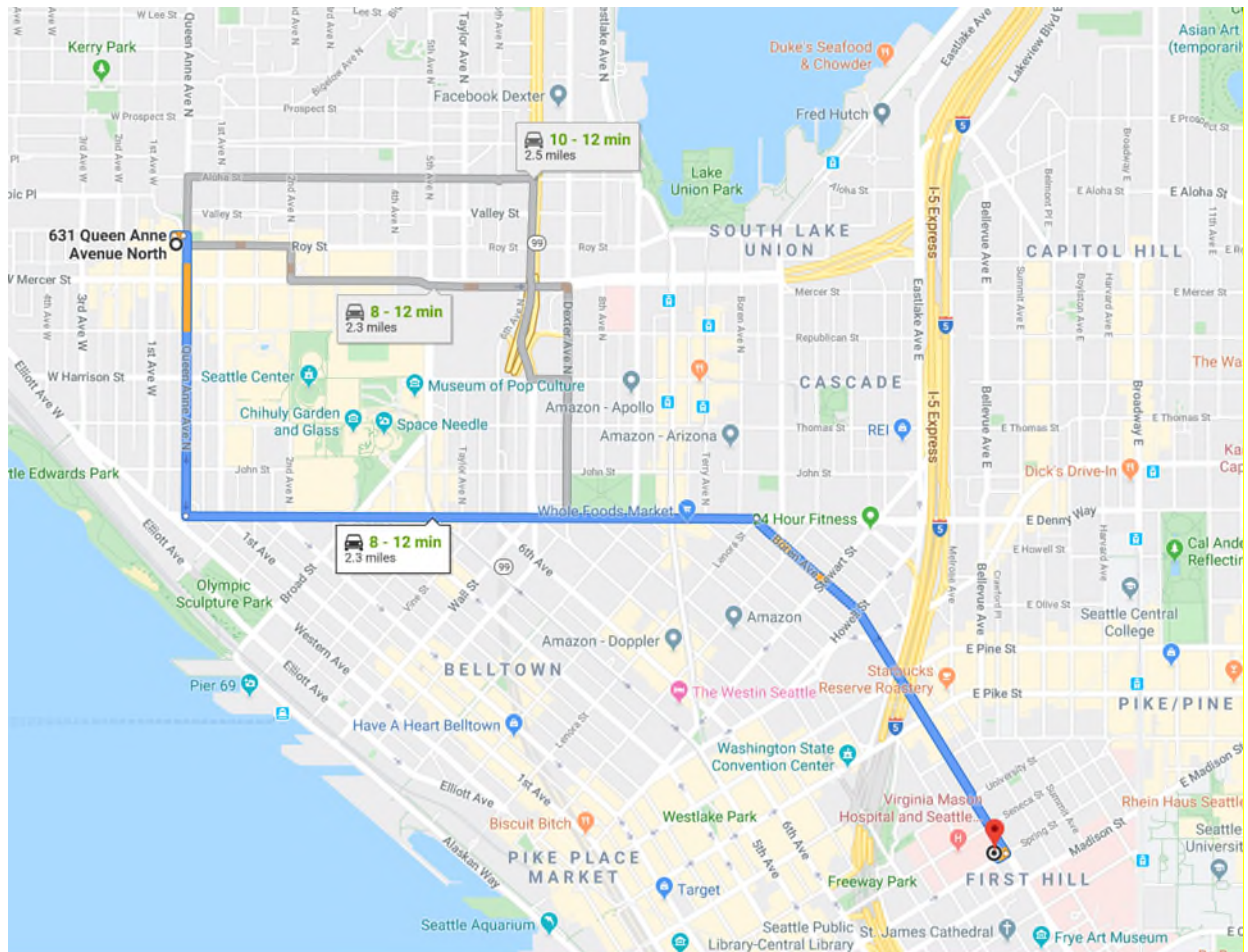
Hours of Operation: 24 hours a day, 7 days a week

- Head south on Queen Anne Ave N
- Use the left 2 lanes to turn left onto Denny Way
- Turn right onto Spring St
- Destination will be on the right

SUMMARY

Driving Distance: 2.3 miles

Trip Duration: 8-12 minutes



DIRECTIONS TO OCCUPATIONAL HEALTH CLINIC (FOR NON – EMERGENCY, WORKCARE SCENARIOS)



Clinic Name: Concentra Urgent Care

Address: 140 4th Ave N Suite 150, Seattle, WA 98109

Clinic Phone Number: (206) 682-7418

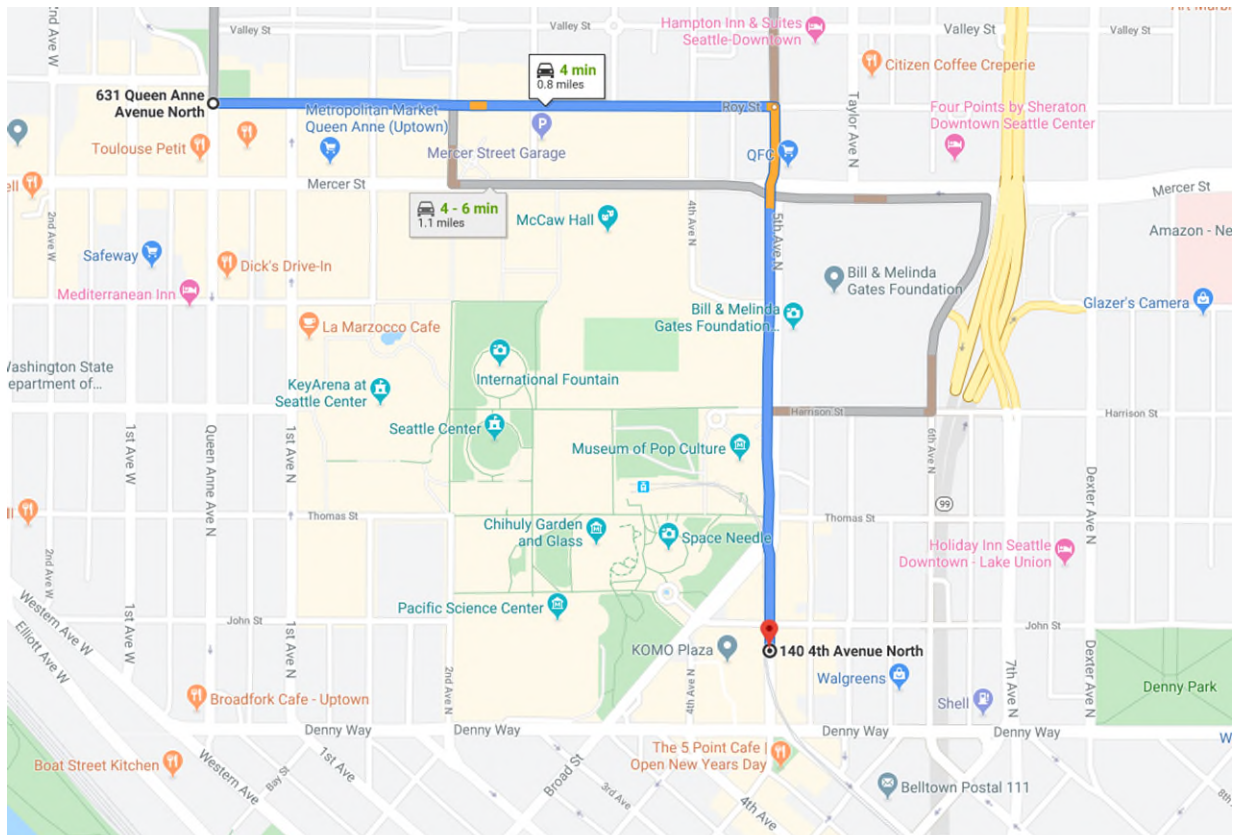
Hours of Operation: Monday through Friday 7am to 4pm
Saturday and Sunday Closed

- Head east on Roy St toward 1st Ave N
- Turn right onto 5th Ave N
- Destination will be on the right

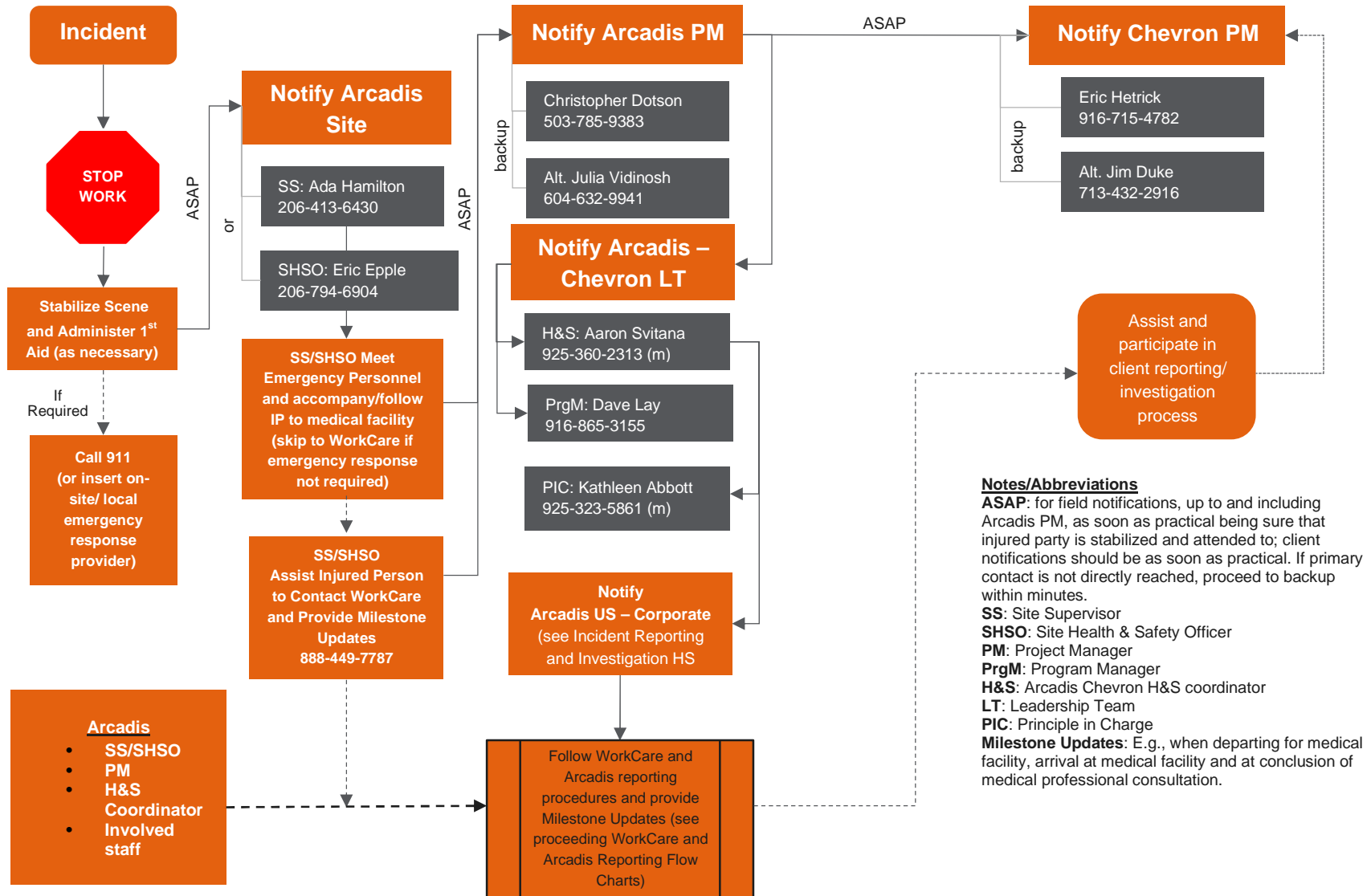
SUMMARY

Driving Distance: 0.8 miles

Trip Duration: 4 minutes



Loss/Near Loss Reporting Plan



Site Background

The site is situated in the lower Queen Anne area, which includes commercial and residential areas. The site is surrounded by apartment complexes, restaurants, and retail businesses. The site and existing building are currently vacant, and the parking lot is utilized as a paid parking lot operated by Republic Parking. The exterior portions of the site outside the vacant building are asphalt paved. In general, the soils underlying the site consist of silty sands to depths of approximately 6 feet to 8 feet bgs, underlain by sand to depths of 17 feet bgs beneath the eastern portion of the Site, to 31 feet bgs beneath the western portion of the Site. Underlying the sand is the Lawton Clay, a hard to very hard, relatively impervious, clayey silt. The shallow water bearing zone, present across the site, is typically found perched above the Lawton Clay. Depth to this water bearing zone ranges from approximately 10 to 13.5 feet bgs, beneath the eastern portion of the site, to 18 to 24 feet bgs beneath the western portion. Groundwater flow direction has consistently been towards the west-southwest.

From 1927 to 1954, the southern portion of the Property was historically occupied by a service station, and the Acme Cleaners, a possible dry-cleaning facility, occupied the southeast portion of the property for a period of up to nine years during this time. In 1954, Texaco purchased the site and demolished the first-generation service station and constructed a new service station on the southern portion of the site. In 1967, the service station was remodeled but continued to operate as a Texaco-branded gasoline service station until 1993, when it was decommissioned. The site operated as a convenience store from 1993 to 2018 and a parking lot from 2018 to 2020. The current plan is to redevelop the site as a multi-use residential building with one level of underground parking and to remediate all contaminated soil and groundwater in conjunction with the redevelopment.

During a 1978 Seattle Fire Department investigation of an odor complaint, gasoline was identified in a basement sump. This finding prompted the investigation of the site as a potential source of this contamination. In 1986, during a subsurface investigation requested by Ecology, what was described as a concrete tank was encountered and punctured. A strong gasoline odor was noted after breaking through the concrete. Groundwater monitoring wells installed on the site exhibited evidence of LNAPL. Analytical results from a 1991 remedial investigation indicated widespread petroleum hydrocarbon groundwater contamination extended from the site to the west beyond 1st Avenue with an estimated volume of 4,800 gallons of LNAPL present beneath the site.

In 1993, UST closure activities were conducted on the site. Significant soil contamination was encountered at the eastern dispenser island and in the UST excavations and this contaminated soil was used as backfill for the excavation and was not transported offsite for proper disposal. Remediation systems were also installed on site, including a soil vapor extraction system and a groundwater recovery system with a spray aeration vacuum extraction treatment system connected to horizontal extraction piping situated 8 to 10 feet deep in the former UST excavation area. In April 1996, the spray aeration vacuum extraction system was replaced with a catalytic oxidizer in conjunction with the installation of vapor extraction wells. The system reportedly operated intermittently between September 1996 and December 1997 but was largely ineffective at removing contamination. Some LNAPL was recovered using absorbent socks between December 1999 and June 2000. In 2003, the non-operational vapor extraction system was upgraded to create a negative pressure in soils beneath the southwest-adjointing Monterrey Apartments property. The system did remove a limited amount of soil vapor between 2003 and 2005. In 2007 a dual-phase extraction system was installed on site and during its five months of operation, it was able to remove approximately 45,000 pounds of hydrocarbon mass.

Site Type

Site Status	Type	Permitting Authority	Site Security	Area (within ¼ mile of site)
Active	X Mixed Use	Chevron	Secure (fenced)	Industrial
X Inactive		X Arcadis	X Unsecure	X Commercial
			X Access controlled	X Residential

Major Site Chemicals of Concern

Known Compounds	Source (e.g. soil/water/drum)	Location	Depth Range (feet)	Maximum Concentration (ppm, mg/kg, µg/L)
LNAPL	Groundwater	MW6	24	2.26 feet
Dissolved lead	Groundwater	MW6	24	61.9 µg/L
Dissolved arsenic	Groundwater	RW4	24	6.1 µg/L
PCE	Groundwater	MW6	24	1.6 µg/L
TCE	Groundwater	MW6	24	2.3 µg/L
cis-1,2-DCE	Groundwater	DPE6	24	8 µg/L
GRO	Soil	PIT-7	11	11,000 mg/kg
DRO	Soil	PIT-11	6	4,000 mg/kg
HRO	Soil	P05	4	360 mg/kg
Benzene	Soil	DP-6	22	52.2 mg/kg
Toluene	Soil	DP-6	22	448 mg/kg
Ethylbenzene	Soil	DP-6	22	112 mg/kg
Xylenes	Soil	DP-6	22	629 mg/kg
Lead	Soil	DP-7	33.5	10.5 mg/kg
Chromium	Soil	DP-2	14	48.6 mg/kg
Arsenic	Soil	DP-2	14	4.53 mg/kg
Naphthalene	Soil	DB-6	22	42.7 mg/kg

Spill Prevention and Containment

The table below summarizes the activities that will be conducted on site that might result in an unwanted release, including steps to prevent and contain releases.

Spill Prevention and Containment

Specific Activity	Potentially Released Material	Steps to Prevent Release	Steps to Contain Release
Drilling	Impacted soil	Plastic sheeting	Place plastic sheeting over ground around boring
Excavation	Impacted soil	Plastic sheeting	Place plastic sheeting over ground before starting stockpile
Groundwater Monitoring	Impacted groundwater	Purge water buckets, secondary containment	Place absorbent pads beneath water buckets, and place on stable surface

Hazard Communication

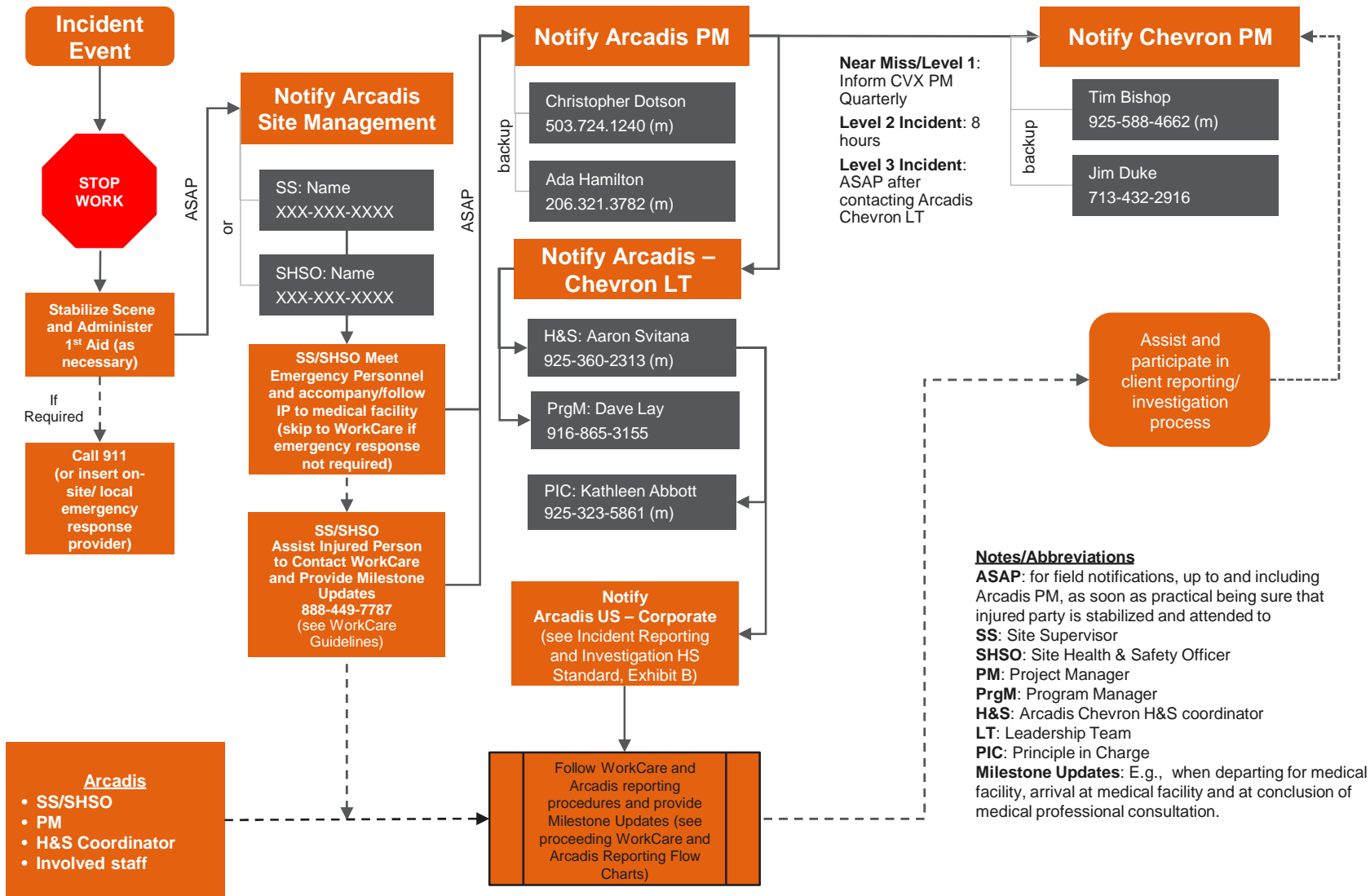
All project required chemicals must be handled in accordance with the Arcadis HazCom Standard (ARC HSGE007) and the requirements outlined in the FHSB. Table 4.5 lists all chemicals that will be brought, used, and/or stored on site by Arcadis or its subcontractors. Safety Data Sheets (SDSs) for chemicals brought on site are included in Appendix C.

Master Chemical/Waste Storage List

Type	Estimated Quantity	Storage Location	Labelling Requirement
Spray Paint	12 oz	Work Vehicle	Manufacturer's Label
Fire Extinguisher	20 lbs	Work Vehicle	Manufacturer's Label
Eyewash saline	32 oz	In support zone	Manufacturer's Label
Liquinox (detergent)		Decon kit in truck bed	Manufacturer's Label
Alconox (detergent)	<1.0 L	Decon kit in truck bed	Manufacturer's Label
WD-40	15 oz	Work Vehicle	Manufacturer's Label
Hydrochloric acid (preservative)		40-milliliter sample containers	N/A
55-gallon drums of soil/ groundwater		Behind building	Pending analysis sticker Non-hazardous waste sticker
Isobutane, air (PID calibration gas)	35 L	PID case	Manufacturer's Label

Incident and Near Miss Reporting Plan – Chevron Team (Outsourced)

Project Name
Project Location



Notes/Abbreviations
ASAP: for field notifications, up to and including Arcadis PM, as soon as practical being sure that injured party is stabilized and attended to
SS: Site Supervisor
SHSO: Site Health & Safety Officer
PM: Project Manager
PrgM: Program Manager
H&S: Arcadis Chevron H&S coordinator
LT: Leadership Team
PIC: Principle in Charge
Milestone Updates: E.g., when departing for medical facility, arrival at medical facility and at conclusion of medical professional consultation.

Reporting Plan Roles and Responsibilities

Role	Responsibility
Site Worker (all including SS, SHSO, PM, etc.)	<ul style="list-style-type: none"> Recognize hazards/unsafe conditions Use Stop Work Authority Report near losses (NL)/incidents/injuries immediately to SS or SHSO
Site Supervisor (SS) and Site Health & Safety Officer (SSHO)	<ul style="list-style-type: none"> Review and understand this procedure Verify and validate site worker(s) review and understand this procedure Assure appropriate Stop Work Authority has been utilized and secure incident site/equipment/site workers Respond to reports of NL/incidents/injuries and initiate reporting and care management actions Verify that emergency medical services (e.g. 911) has been notified, as necessary Assist injured person (IP) to contact WorkCare Gather appropriate initial facts regarding event and contact Arcadis PM or backups as soon as possible (must have live conversation) Accompany IP to medical facilities and report milestone updates to Arcadis PM and Arcadis Chevron Leadership Team (LT). E.g. milestone updates include when departing for medical facility, arrival at medical facility and at conclusion of medical professional consultation. Coordinate gathering of facts, timelines and information to support Arcadis and Chevron incident investigation and reporting process (IIR) Test this procedure by conducting credible mock person-down drill at least annually
Arcadis PM or backup	<ul style="list-style-type: none"> Report facts regarding the event ASAP (i.e. within 1-2 hours and absolutely no later than end of shift Arcadis Chevron LT and Arcadis Corporate H&S; and according to timelines to CVX PM per Level 1/2/3 requirements noted. <ul style="list-style-type: none"> To the extent practical, given event circumstances, Arcadis Chevron LT notification should be done by Arcadis PM (for consistent transfer of facts) but may be delegated (preferably SS or SHSO) Assist SS/SHSO in gathering of facts, timelines and information to support Arcadis and Chevron incident investigation and reporting process Act as primary point of contact with Chevron PM throughout this process Verify that project team has conducted mock person-down drills at least annually
Arcadis Chevron H&S Coordinator	<ul style="list-style-type: none"> Coordinate with Arcadis PM, SS and SHSO to verify that appropriate facts, timelines and information are gathered to support Arcadis and Chevron incident investigation and reporting process Participate in Arcadis and Chevron incident reporting process and review documentation Assist Arcadis PM as point of contact with Chevron PM and Chevron H&S management Coordinate with WorkCare and Corporate H&S to ensure appropriate care management

Safety Data Sheet



SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

Diesel Fuel No. 1

Product Use: Fuel

Product Number(s): 203409990, 203414990, 203421990, 203422990, 203425, 270093, 270193, 270293, 271005, 271493, 271593, 271693, 272133, 272134

Synonyms: Calco Conv Dyed DF 1, CALCO LS Diesel 1, Calco ULS Conv DF 1, CHEVRON HS Heating Fuel 1, CHEVRON LS Diesel 1, CHEVRON LS Heating Fuel 1, CHEVRON ULSD Diesel 1, CT ULS Conv DF 1, CT ULS Conv Dyed DF 1, ULS Conv DF 1

Company Identification

Chevron Products Company
6001 Bollinger Canyon Rd., T3325/B10
San Ramon, CA 94583
United States of America

Transportation Emergency Response

CHEMTREC: (800) 424-9300 or (703) 527-3887

Health Emergency

Chevron Emergency Information Center: Located in the USA. International collect calls accepted. (800) 231-0623 or (510) 231-0623

Product Information

Product Information: (800) 582-3835
SDS Requests: (800) 414-6737

SPECIAL NOTES: This MSDS covers all Chevron and Calco non-CARB Diesel No. 1 Fuels. The sulfur content is less than 0.5% (mass). (MSDS 7980)

SECTION 2 HAZARDS IDENTIFICATION

CLASSIFICATION: Flammable liquid: Category 3. Aspiration toxicant: Category 1. Skin irritation: Category 2. Target organ toxicant (central nervous system): Category 3. Target organ toxicant (respiratory irritant): Category 3. Acute aquatic toxicant: Category 2. Chronic aquatic toxicant: Category 2.



Signal Word: Danger

Physical Hazards: Flammable liquid and vapor.

Health Hazards: May be fatal if swallowed and enters airways. Causes skin irritation. May cause respiratory irritation. May cause drowsiness or dizziness.

Environmental Hazards: Toxic to aquatic life with long lasting effects.

PRECAUTIONARY STATEMENTS:

General: Keep out of reach of children. Read label before use.

Prevention: Keep away from heat/sparks/open flames/hot surfaces. -- No smoking. Ground/bond container and receiving equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Keep container tightly closed. Use explosion-proof electrical/ventilating/lighting/equipment. Avoid breathing dust/fume/gas/mist/vapours/spray. Use only outdoors or in a well-ventilated area. Wear protective gloves/protective clothing/eye protection/face protection. Wash thoroughly after handling. Avoid release to the environment.

Response: IF INHALED: Remove person to fresh air and keep comfortable for breathing. IF ON SKIN: Wash with plenty of soap and water. If skin irritation occurs: Get medical advice/attention. Take off contaminated clothing and wash it before reuse. IF ON SKIN (or hair): Take off immediately all contaminated clothing and wash it before reuse. Rinse skin with water/shower. IF SWALLOWED: Immediately call a poison center or doctor/physician. Do NOT induce vomiting. Call a poison center or doctor/physician if you feel unwell. In case of fire: Use media specified in the SDS to extinguish. Specific treatment (see Notes to Physician on this label). Collect spillage.

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

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

HAZARDS NOT OTHERWISE CLASSIFIED: Not Applicable

SECTION 3 COMPOSITION/ INFORMATION ON INGREDIENTS

COMPONENTS	CAS NUMBER	AMOUNT
Gas oils	68334-30-5	100 %wt/wt
Kerosine	8008-20-6	0 - 99 %wt/wt
Kerosine, hydrodesulfurized	64742-81-0	0 - 99 %wt/wt

Distillates, hydrodesulfurized, middle	64742-80-9	0 - 99 %wt/wt
Distillates, straight run middle (gas oil, light)	64741-44-2	0 - 99 %wt/wt
Naphthalene	91-20-3	0.02 - 0.2 %wt/wt
Total sulfur	Other	0 - 0.04 %wt/wt

SECTION 4 FIRST AID MEASURES

Description of first aid measures

Eye: No specific first aid measures are required. As a precaution, remove contact lenses, if worn, and flush eyes with water.

Skin: Wash skin with water immediately and remove contaminated clothing and shoes. Get medical attention if any symptoms develop. To remove the material from skin, use soap and water. Discard contaminated clothing and shoes or thoroughly clean before reuse.

Ingestion: If swallowed, get immediate medical attention. Do not induce vomiting. Never give anything by mouth to an unconscious person.

Inhalation: Move the exposed person to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if breathing difficulties continue or if any other symptoms develop.

Most important symptoms and effects, both acute and delayed

IMMEDIATE HEALTH EFFECTS

Eye: Not expected to cause prolonged or significant eye irritation.

Skin: Contact with the skin causes irritation. Contains a material that causes defatting of the skin. Contact with the skin is not expected to cause an allergic skin response. Symptoms may include pain, itching, discoloration, swelling, and blistering.

Ingestion: Highly toxic; may be fatal if swallowed. Because of its low viscosity, this material can directly enter the lungs, if swallowed, or if subsequently vomited. Once in the lungs it is very difficult to remove and can cause severe injury or death. May be irritating to mouth, throat, and stomach. Symptoms may include pain, nausea, vomiting, and diarrhea.

Inhalation: The vapor or fumes from this material may cause respiratory irritation. Symptoms of respiratory irritation may include coughing and difficulty breathing. Excessive or prolonged breathing of this material may cause central nervous system effects. Central nervous system effects may include headache, dizziness, nausea, vomiting, weakness, loss of coordination, blurred vision, drowsiness, confusion, or disorientation. At extreme exposures, central nervous system effects may include respiratory depression, tremors or convulsions, loss of consciousness, coma or death.

DELAYED OR OTHER HEALTH EFFECTS:

Cancer: Whole diesel engine exhaust has been classified as a Group 2A carcinogen (probably carcinogenic to humans) by the International Agency for Research on Cancer (IARC). Contains naphthalene, which has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC). Risk depends on duration and level of exposure. See Section 11 for additional information.

Indication of any immediate medical attention and special treatment needed

Note to Physicians: Ingestion of this product or subsequent vomiting may result in aspiration of light hydrocarbon liquid, which may cause pneumonitis.

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA: Use water fog, foam, dry chemical or carbon dioxide (CO₂) to extinguish flames.

Unusual Fire Hazards: See Section 7 for proper handling and storage.

PROTECTION OF FIRE FIGHTERS:

Fire Fighting Instructions: For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus.

Combustion Products: Highly dependent on combustion conditions. A complex mixture of airborne solids, liquids, and gases including carbon monoxide, carbon dioxide, and unidentified organic compounds will be evolved when this material undergoes combustion.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Protective Measures: Eliminate all sources of ignition in the vicinity of the spill or released vapor. If this material is released into the work area, evacuate the area immediately. Monitor area with combustible gas indicator.

Spill Management: Stop the source of the release if you can do it without risk. Contain release to prevent further contamination of soil, surface water or groundwater. Clean up spill as soon as possible, observing precautions in Exposure Controls/Personal Protection. Use appropriate techniques such as applying non-combustible absorbent materials or pumping. All equipment used when handling the product must be grounded. A vapor suppressing foam may be used to reduce vapors. Use clean non-sparking tools to collect absorbed material. Where feasible and appropriate, remove contaminated soil. Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations.

Reporting: Report spills to local authorities and/or the U.S. Coast Guard's National Response Center at (800) 424-8802 as appropriate or required.

SECTION 7 HANDLING AND STORAGE

General Handling Information: Avoid contaminating soil or releasing this material into sewage and drainage systems and bodies of water.

Precautionary Measures: Liquid evaporates and forms vapor (fumes) which can catch fire and burn with explosive force. Invisible vapor spreads easily and can be set on fire by many sources such as pilot lights, welding equipment, and electrical motors and switches. Fire hazard is greater as liquid temperature rises above 29C (85F).

Do not get in eyes, on skin, or on clothing. Do not taste or swallow. Do not breathe vapor or fumes. Wash thoroughly after handling. Keep out of the reach of children.

Static Hazard: Electrostatic charge may accumulate and create a hazardous condition when handling this

material. To minimize this hazard, bonding and grounding may be necessary but may not, by themselves, be sufficient. Review all operations which have the potential of generating and accumulating an electrostatic charge and/or a flammable atmosphere (including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation, and vacuum truck operations) and use appropriate mitigating procedures.

Container Warnings: Container is not designed to contain pressure. Do not use pressure to empty container or it may rupture with explosive force. Empty containers retain product residue (solid, liquid, and/or vapor) and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, static electricity, or other sources of ignition. They may explode and cause injury or death. Empty containers should be completely drained, properly closed, and promptly returned to a drum reconditioner or disposed of properly.

General Storage Information: DO NOT USE OR STORE near heat, sparks, flames, or hot surfaces . USE AND STORE ONLY IN WELL VENTILATED AREA. Keep container closed when not in use.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION
--

GENERAL CONSIDERATIONS:

Consider the potential hazards of this material (see Section 2), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

ENGINEERING CONTROLS:

Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below the recommended exposure limits.

PERSONAL PROTECTIVE EQUIPMENT

Eye/Face Protection: No special eye protection is normally required. Where splashing is possible, wear safety glasses with side shields as a good safety practice.

Skin Protection: Wear protective clothing to prevent skin contact. Selection of protective clothing may include gloves, apron, boots, and complete facial protection depending on operations conducted.

Suggested materials for protective gloves include: Nitrile Rubber, Polyurethane, Polyvinyl Alcohol (PVA) (Note: Avoid contact with water. PVA deteriorates in water.), Viton.

Respiratory Protection: Determine if airborne concentrations are below the recommended occupational exposure limits for jurisdiction of use. If airborne concentrations are above the acceptable limits, wear an approved respirator that provides adequate protection from this material, such as: Air-Purifying Respirator for Organic Vapors.

When used as a fuel, this material can produce carbon monoxide in the exhaust. Determine if airborne concentrations are below the occupational exposure limit for carbon monoxide. If not, wear an approved positive-pressure air-supplying respirator.

Use a positive pressure air-supplying respirator in circumstances where air-purifying respirators may not provide adequate protection.

Occupational Exposure Limits:

Component	Agency	TWA	STEL	Ceiling	Notation
Gas oils	ACGIH	100 mg/m3	--	--	Skin A3 total hydrocarbon
Gas oils	CVX	--	1000 mg/m3	--	--
Kerosine	ACGIH	200 mg/m3	--	--	Skin A3 Total hydrocarbon vapor
Kerosine	CVX	--	1000 mg/m3	--	--
Kerosine, hydrodesulfurized	ACGIH	200 mg/m3	--	--	Skin A3 Total hydrocarbon vapor
Kerosine, hydrodesulfurized	CVX	--	1000 mg/m3	--	--
Distillates, hydrodesulfurized, middle	Not Applicable	--	--	--	--
Distillates, straight run middle (gas oil, light)	Not Applicable	--	--	--	--
Naphthalene	ACGIH	10 ppm (weight)	15 ppm (weight)	--	Skin
Naphthalene	OSHA Z-1	50 mg/m3	--	--	--
Total sulfur	Not Applicable	--	--	--	--

Consult local authorities for appropriate values.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Attention: the data below are typical values and do not constitute a specification.

- Color:** Varies depending on specification
- Physical State:** Liquid
- Odor:** Hydrocarbon odor
- Odor Threshold:** No data available
- pH:** Not Applicable
- Vapor Pressure:** 0.40 kPa @ 40 °C (104 °F)
- Vapor Density (Air = 1):** >1
- Initial Boiling Point:** 204°C (399.2°F) - 300°C (572°F)
- Solubility:** Soluble in hydrocarbon solvents; insoluble in water.
- Freezing Point:** Not Applicable
- Melting Point:** No data available
- Specific Gravity:** 0.85 @ 15.6°C (60.1°F) (Typical)

Density: No data available
Viscosity: 1.30 - 2.40 cSt @ 40°C (104°F)
Evaporation Rate: No data available
Decomposition temperature: No data available
Octanol/Water Partition Coefficient: No data available

FLAMMABLE PROPERTIES:

Flammability (solid, gas): No Data Available

Flashpoint: 38 °C (100 °F)

Autoignition: 210 °C (410 °F)

Flammability (Explosive) Limits (% by volume in air): Lower: 0.6 Upper: 4.7

SECTION 10 STABILITY AND REACTIVITY

Reactivity: May react with strong acids or strong oxidizing agents, such as chlorates, nitrates, peroxides, etc.

Chemical Stability: This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.

Incompatibility With Other Materials: Not applicable

Hazardous Decomposition Products: None known (None expected)

Hazardous Polymerization: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects

Serious Eye Damage/Irritation: The eye irritation hazard is based on evaluation of data for product components.

Skin Corrosion/Irritation:

Skin Sensitization: This material did not cause skin sensitization reactions in a Buehler guinea pig test.

Acute Dermal Toxicity: ERROR: Symbol QUALFIER_DESC is an unknown variable name. The acute dermal toxicity is based on data for a similar material.

Acute Oral Toxicity: The acute oral toxicity is based on data for a similar material.

Acute Inhalation Toxicity: The acute respiratory toxicity is based on data for a similar material.

Acute Toxicity Estimate: Not Determined

Germ Cell Mutagenicity: The hazard evaluation is based on data for components or a similar material.

Carcinogenicity: Refer to ADDITIONAL TOXICOLOGY INFORMATION below. Whole diesel engine exhaust has been classified as a Group 2A carcinogen (probably carcinogenic to humans) by the International Agency for Research on Cancer (IARC). Contains naphthalene, which has been classified as

a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC).

Reproductive Toxicity: The hazard evaluation is based on data for components or a similar material.

Specific Target Organ Toxicity - Single Exposure: The hazard evaluation is based on data for components or a similar material.

Specific Target Organ Toxicity - Repeated Exposure: The hazard evaluation is based on data for components or a similar material.

ADDITIONAL TOXICOLOGY INFORMATION:

The National Institute of Occupational Safety and Health (NIOSH) has recommended that whole diesel exhaust be regarded as potentially causing cancer. This recommendation was based on test results showing increased lung cancer in laboratory animals exposed to whole diesel exhaust.

This product contains kerosene. CONCAWE (product dossier 94/106) has summarized current health, safety and environmental data available for a number of kerosenes (typically straight-run kerosene, CAS 8008-20-6, or hydrodesulfurized kerosene, CAS 64742-81-0). ACUTE/SUBCHRONIC: Following acute exposure to kerosene, signs observed in rats and rabbits were of a low order of toxicity: central nervous system depression occurred following oral exposure, skin irritation (ranging from slight to severe irritation) occurred with dermal exposure, and respiratory tract irritation occurred with inhalation exposure. None of the kerosenes tested produced more than slight eye irritation and none were skin sensitizers. However, intratracheal administration or artificial aspiration of small volumes (0.1 to 0.2 ml) of kerosene into the lungs of rats, chickens and primates resulted in lung damage and/or death. In a study in which rats, mice, rabbits and cats were exposed to kerosene aerosol concentrations in the range 0.05 to 120 mg/l for up to four weeks, reductions in respiratory rate, pulmonary hyperaemia, leucocytosis, monocytosis and decreased erythrocyte sedimentation rate were observed, and histological examination revealed inflammatory changes in the respiratory tract (tracheitis, bronchitis and pneumonia).

CANCER: Chronic (3 to 24 months) mouse dermal toxicity studies of kerosenes and jet fuels produced mild to moderate skin irritation, while long-term (2+ years) studies showed moderate to severe skin damage as well as an increased incidence of tumors after long latency periods (probably due to a secondary mechanism related to skin irritancy). DEVELOPMENTAL/REPRODUCTION: Hydrodesulfurized kerosene was tested by the Petroleum Product Stewardship Council in a OECD Guideline 421 Reproductive/Developmental Toxicity Study. The kerosene sample was diluted to 494 (60%), 330 (40%), and 165 (20%) mg/kg/day in food grade mineral oil and applied daily during pre-mating and mating to day 19 of gestation. There was no apparent maternal, reproductive, or developmental toxicity at any dose. Males treated for eight weeks had increased relative kidney weights in the high dose group but no microscopic changes in testes or epididymides. No gross anomalies were observed in the pups.

This product contains naphthalene.

GENERAL TOXICITY: Exposure to naphthalene has been reported to cause methemoglobinemia and/or hemolytic anemia, especially in humans deficient in the enzyme glucose-6-phosphate dehydrogenase. Laboratory animals given repeated oral doses of naphthalene have developed cataracts.

REPRODUCTIVE TOXICITY AND BIRTH DEFECTS: Naphthalene did not cause birth defects when

administered orally to rabbits, rats, and mice during pregnancy, but slightly reduced litter size in mice at dose levels that were lethal to the pregnant females. Naphthalene has been reported to cross the human placenta. GENETIC TOXICITY: Naphthalene caused chromosome aberrations and sister chromatid exchanges in Chinese hamster ovary cells, but was not a mutagen in several other in-vitro tests. CARCINOGENICITY: In a study conducted by the National Toxicology Program (NTP), mice exposed to 10 or 30 ppm of naphthalene by inhalation daily for two years had chronic inflammation of the nose and lungs and increased incidences of metaplasia in those tissues. The incidence of benign lung tumors (alveolar/bronchiolar adenomas) was significantly increased in the high-dose female group but not in the male groups. In another two-year inhalation study conducted by NTP, exposure of rats to 10, 30, and 60 ppm naphthalene caused increases in the incidences of a variety of nonneoplastic lesions in the nose. Increases in nasal tumors were seen in both sexes, including olfactory neuroblastomas in females at 60 ppm and adenomas of the respiratory epithelium in males at all exposure levels. The relevance of these effects to humans has not been established. No carcinogenic effect was reported in a 2-year feeding study in rats receiving naphthalene at 41 mg/kg/day.

This product contains gas oils.

CONCAWE (product dossier 95/107) has summarized current health, safety and environmental data available for a number of gas oils, typically hydrodesulfurized middle distillates, CAS 64742-80-9, straight-run middle distillates, CAS 64741-44-2, and/or light cat-cracked distillate CAS 64741-59-9.

CARCINOGENICITY: All materials tested have caused the development of skin tumors in mice, but all featured severe skin irritation and sometimes a long latency period before tumors developed. Straight-run and cracked gas oil samples were studied to determine the influence of dermal irritation on the carcinogenic activity of middle distillates. At non-irritant doses the straight-run gas oil was not carcinogenic, but at irritant doses, weak activity was demonstrated. Cracked gas oils, when diluted with mineral oil, demonstrated carcinogenic activity irrespective of the occurrence of skin irritation. Gas oils were tested on male mice to study tumor initiating/promoting activity. The results demonstrated that while a straight-run gas oil sample was neither an initiator or promoter, a blend of straight-run and FCC stock was both a tumor initiator and a promoter.

GENOTOXICITY: Hydrotreated & hydrodesulfurized gas oils range in activity from inactive to weakly positive in in-vitro bacterial mutagenicity assays. Mouse lymphoma assays on straight-run gas oils without subsequent hydrodesulphurization gave positive results in the presence of S9 metabolic activation. In-vivo bone marrow cytogenetics and sister chromatic exchange assay exhibited no activity for straight-run components with or without hydrodesulphurization. Thermally or catalytically cracked gas oils tested with in-vitro bacterial mutagenicity assays in the presence of S9 metabolic activation were shown to be mutagenic. In-vitro sister chromatic exchange assays on cracked gas oil gave equivocal results both with and without S9 metabolic activation. In-vivo bone marrow cytogenetics assay was inactive for two cracked gas oil samples. Three hydrocracked gas oils were tested with in-vitro bacterial mutagenicity assays with S9, and one of the three gave positive results. Twelve distillate fuel samples were tested with in-vitro bacterial mutagenicity assays & with S9 metabolic activation and showed negative to weakly positive results. In one series, activity was shown to be related to the PCA content of samples tested. Two in-vivo studies were also conducted. A mouse dominant lethal assay was negative for a sample of diesel fuel. In the other study, 9 samples of No 2 heating oil containing 50% cracked stocks caused a slight increase in the number of chromosomal aberrations in bone marrow cytogenetics assays. DEVELOPMENTAL TOXICITY: Diesel fuel vapor did not cause fetotoxic or teratogenic effects when pregnant rats were exposed on days 6-15 of pregnancy. Gas oils were applied to the skin of pregnant rats daily on days 0-19

of gestation. All but one (coker light gas oil) caused fetotoxicity (increased resorptions, reduced litter weight, reduced litter size) at dose levels that were also maternally toxic.

SECTION 12 ECOLOGICAL INFORMATION

ECOTOXICITY

This material is expected to be toxic to aquatic organisms and may cause long-term adverse effects in the aquatic environment. A series of studies on the acute toxicity of 4 diesel fuel samples were conducted by one laboratory using water accommodated fractions. The range of effective (EC50) or lethal concentrations (LC50) expressed as loading rates were:

- 48 hour(s) LC50: 20 - 210 mg/l (Daphnia magna)
- 96 hour(s) LC50: 21 - 210 mg/l (Salmo gairdneri)
- 72 hour(s) EC50: 2.6 - 25 mg/l (Selenastrum capricornutum)

MOBILITY

No data available.

PERSISTENCE AND DEGRADABILITY

This material is not expected to be readily biodegradable. On release to the environment the lighter components of diesel fuel will generally evaporate but depending on local environmental conditions (temperature, wind, mixing or wave action, soil type, etc.) the remainder may become dispersed in the water column or absorbed to soil or sediment. Diesel fuel would not be expected to be readily biodegradable. In a modified Strum test (OECD method 301B) approximately 40% biodegradation was recorded over 28 days. However, it has been shown that most hydrocarbon components of diesel fuel are degraded in soil in the presence of oxygen. Under anaerobic conditions, such as in anoxic sediments, rates of biodegradation are negligible. The biodegradability of this material is based on an evaluation of data for the components or a similar material.

The product has not been tested. The statement has been derived from products of a similar structure and composition.

POTENTIAL TO BIOACCUMULATE

Bioconcentration Factor: No data available.

Octanol/Water Partition Coefficient: No data available

SECTION 13 DISPOSAL CONSIDERATIONS

Use material for its intended purpose or recycle if possible. This material, if it must be discarded, may meet the criteria of a hazardous waste as defined by international, country, or local laws and regulations.

SECTION 14 TRANSPORT INFORMATION

The description shown may not apply to all shipping situations. Consult 49CFR, or appropriate Dangerous Goods Regulations, for additional description requirements (e.g., technical name) and mode-specific or quantity-specific shipping requirements.

DOT Shipping Description: UN1202, GAS OIL, 3, III OR UN1223, KEROSENE, 3, III ; OPTIONAL DISCLOSURES AS COMBUSTIBLE LIQUID PER 49 CFR 173.150 (F) OR AS A MARINE POLLUTANT (PETROLEUM DISTILLATES, KEROSENE, GAS OIL)

IMO/IMDG Shipping Description: UN1268, PETROLEUM DISTILLATES, N.O.S. (KEROSENE, GASOIL), 3, III, FLASH POINT SEE SECTION 5 OR 9, MARINE POLLUTANT (KEROSENE, GASOIL)

ICAO/IATA Shipping Description: UN1202, GAS OIL, 3, III; OR UN1223, KEROSENE, 3, III; OR UN1268, PETROLEUM DISTILLATES, N.O.S., 3, III

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC code:
Not applicable

SECTION 15 REGULATORY INFORMATION

EPCRA 311/312 CATEGORIES:	1. Immediate (Acute) Health Effects:	YES
	2. Delayed (Chronic) Health Effects:	NO
	3. Fire Hazard:	YES
	4. Sudden Release of Pressure Hazard:	NO
	5. Reactivity Hazard:	NO

REGULATORY LISTS SEARCHED:

01-1=IARC Group 1	03=EPCRA 313
01-2A=IARC Group 2A	04=CA Proposition 65
01-2B=IARC Group 2B	05=MA RTK
02=NTP Carcinogen	06=NJ RTK
	07=PA RTK

The following components of this material are found on the regulatory lists indicated.

Kerosine, hydrodesulfurized	05, 06, 07
Gas oils	07
Kerosine	05, 06, 07
Distillates, straight run middle (gas oil, light)	06
Naphthalene	01-2B, 02, 03, 04, 05, 06, 07

CERCLA REPORTABLE QUANTITIES(RQ)/EPCRA 302 THRESHOLD PLANNING QUANTITIES(TPQ):

Component	Component RQ	Component TPQ	Product RQ
Naphthalene	100 lbs	None	55556 lbs

CHEMICAL INVENTORIES:

All components comply with the following chemical inventory requirements: AICS (Australia), DSL (Canada), EINECS (European Union), IECSC (China), KECI (Korea), PICCS (Philippines), TSCA (United States).

NEW JERSEY RTK CLASSIFICATION:

Under the New Jersey Right-to-Know Act L. 1983 Chapter 315 N.J.S.A. 34:5A-1 et. seq., the product is to be identified as follows: DIESEL FUEL

SECTION 16 OTHER INFORMATION

NFPA RATINGS: Health: 1 Flammability: 2 Reactivity: 0

HMIS RATINGS: Health: 2 Flammability: 2 Reactivity: 0

(0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme, PPE:- Personal Protection Equipment Index recommendation, *- Chronic Effect Indicator). These values are obtained using the guidelines or published evaluations prepared by the National Fire Protection Association (NFPA) or the National Paint and Coating Association (for HMIS ratings).

REVISION STATEMENT: This revision updates the following sections of this Safety Data Sheet: 1,16

Revision Date: DECEMBER 02, 2015

ABBREVIATIONS THAT MAY HAVE BEEN USED IN THIS DOCUMENT:

TLV - Threshold Limit Value	TWA - Time Weighted Average
STEL - Short-term Exposure Limit	PEL - Permissible Exposure Limit
GHS - Globally Harmonized System	CAS - Chemical Abstract Service Number
ACGIH - American Conference of Governmental Industrial Hygienists	IMO/IMDG - International Maritime Dangerous Goods Code
API - American Petroleum Institute	SDS - Safety Data Sheet
HMIS - Hazardous Materials Information System	NFPA - National Fire Protection Association (USA)
DOT - Department of Transportation (USA)	NTP - National Toxicology Program (USA)
IARC - International Agency for Research on Cancer	OSHA - Occupational Safety and Health Administration
NCEL - New Chemical Exposure Limit	EPA - Environmental Protection Agency
SCBA - Self-Contained Breathing Apparatus	

Prepared according to the 29 CFR 1910.1200 (2012) by Chevron Energy Technology Company, 6001

Bollinger Canyon Road San Ramon, CA 94583.

The above information is based on the data of which we are aware and is believed to be correct as of the date hereof. Since this information may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modifications of the information, we do not assume any responsibility for the results of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.

Safety Data Sheet



SECTION 1 PRODUCT AND COMPANY IDENTIFICATION

CHEVRON and TEXACO PREMIUM UNLEADED GASOLINES

Product Use: Fuel

Product Number(s): 204257, 204259, 204280 [See Section 16 for Additional Product Numbers]

Synonyms: Calco Premium Gasoline; Chevron Premium Unleaded Gasoline; Chevron Supreme Plus Unleaded Gasoline; Chevron Supreme Unleaded Gasoline; Gasolines, Automotive; Texaco Power Premium Unleaded Gasoline

Company Identification

Chevron Products Company
6001 Bollinger Canyon Rd.
San Ramon, CA 94583
United States of America

Transportation Emergency Response

CHEMTREC: (800) 424-9300 or (703) 527-3887

Health Emergency

Chevron Emergency Information Center: Located in the USA. International collect calls accepted. (800) 231-0623 or (510) 231-0623

Product Information

Product Information: (800) 582-3835
SDS Requests: lubemsds@chevron.com

SECTION 2 HAZARDS IDENTIFICATION

CLASSIFICATION: Flammable liquid: Category 1. Aspiration toxicant: Category 1. Carcinogen: Category 1A. Target organ toxicant (repeated exposure): Category 1. Eye irritation: Category 2A. Germ Cell Mutagen: Category 1B. Skin irritation: Category 2. Reproductive toxicant (developmental): Category 2. Target organ toxicant (central nervous system): Category 3. Acute aquatic toxicant: Category 2. Chronic aquatic toxicant: Category 2.



Signal Word: Danger

Physical Hazards: Extremely flammable liquid and vapor.

Health Hazards: May be fatal if swallowed and enters airways. May cause genetic defects. May cause cancer.

Causes skin irritation. Causes serious eye irritation. Suspected of damaging the unborn child. May cause drowsiness or dizziness.

Target Organs: Causes damage to organs (Blood/Blood Forming Organs) through prolonged or repeated exposure.

Environmental Hazards: Toxic to aquatic life with long lasting effects.

PRECAUTIONARY STATEMENTS:

General: Keep out of reach of children. Read label before use.

Prevention: Obtain special instructions before use. Do not handle until all safety precautions have been read and understood. Keep away from heat/sparks/open flames/hot surfaces. -- No smoking. Ground/bond container and receiving equipment. Use only non-sparking tools. Take precautionary measures against static discharge. Keep container tightly closed. Use explosion-proof electrical/ventilating/lighting/equipment. Do not breathe dust/fume/gas/mist/vapours/spray. Use only outdoors or in a well-ventilated area. Wear protective gloves/protective clothing/eye protection/face protection. Use personal protective equipment as required. Do not eat, drink or smoke when using this product. Wash thoroughly after handling. Avoid release to the environment.

Response: In case of fire: Use media specified in the SDS to extinguish. IF exposed or concerned: Get medical advice/attention. IF INHALED: Call a poison center or doctor/physician if you feel unwell. Remove person to fresh air and keep comfortable for breathing. IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing. If eye irritation persists: Get medical advice/attention. IF ON SKIN (or hair): Take off immediately all contaminated clothing and wash it before reuse. Rinse skin with water/shower. If skin irritation occurs: Get medical advice/attention. IF SWALLOWED: Immediately call a POISON CENTER or doctor/physician. Do NOT induce vomiting. Specific treatment (see Notes to Physician on this label). Collect spillage.

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

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

HAZARDS NOT OTHERWISE CLASSIFIED: Not Applicable

SECTION 3 COMPOSITION/ INFORMATION ON INGREDIENTS

Hazardous Substance(s) or Complex Substance(s) required for disclosure

COMPONENTS	CAS NUMBER	AMOUNT
Gasoline	86290-81-5	100 %volume

Hazardous Constituent(s) Contained in Complex Substance(s) required for disclosure

COMPONENTS	CAS NUMBER	AMOUNT
Toluene	108-88-3	1 - 35 %volume
Xylene	1330-20-7	1 - 15 %volume
Pentane isomers (pentanes)	MIXTURE	1 - 13 %volume
Butane	106-97-8	1 - 12 %volume
Ethanol	64-17-5	0 - 10 %volume
Hexane	110-54-3	1 - 5 %volume
Benzene	71-43-2	0.1 - 5 %volume
Heptane	142-82-5	1 - 4 %volume
Ethylbenzene	100-41-4	0.1 - 3 %volume
Cyclohexane	110-82-7	1 - 3 %volume
Methylcyclohexane	108-87-2	1 - 2 %volume
Naphthalene	91-20-3	0.1 - 2 %volume

Motor gasoline is considered a mixture by EPA under the Toxic Substances Control Act (TSCA). The refinery

streams used to blend motor gasoline are all on the TSCA Chemical Substances Inventory. The appropriate CAS number for refinery blended motor gasoline is 86290-81-5. The product specifications of motor gasoline sold in your area will depend on applicable Federal and State regulations.

SECTION 4 FIRST AID MEASURES

Description of first aid measures

Eye: Flush eyes with water immediately while holding the eyelids open. Remove contact lenses, if worn, after initial flushing, and continue flushing for at least 15 minutes. Get immediate medical attention.

Skin: Wash skin with water immediately and remove contaminated clothing and shoes. Get medical attention if any symptoms develop. To remove the material from skin, use soap and water. Discard contaminated clothing and shoes or thoroughly clean before reuse.

Ingestion: If swallowed, get immediate medical attention. Do not induce vomiting. Never give anything by mouth to an unconscious person.

Inhalation: Move the exposed person to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Get medical attention if breathing difficulties continue or if any other symptoms develop.

Most important symptoms and effects, both acute and delayed

IMMEDIATE HEALTH EFFECTS

Eye: Contact with the eyes causes severe irritation. Symptoms may include pain, tearing, reddening, swelling and impaired vision.

Skin: Contact with the skin causes irritation. Skin contact may cause drying or defatting of the skin. Symptoms may include pain, itching, discoloration, swelling, and blistering. Contact with the skin is not expected to cause an allergic skin response.

Ingestion: Highly toxic; may be fatal if swallowed. Because of its low viscosity, this material can directly enter the lungs, if swallowed, or if subsequently vomited. Once in the lungs it is very difficult to remove and can cause severe injury or death. May be irritating to mouth, throat, and stomach. Symptoms may include pain, nausea, vomiting, and diarrhea.

Inhalation: Excessive or prolonged breathing of this material may cause central nervous system effects. Central nervous system effects may include headache, dizziness, nausea, vomiting, weakness, loss of coordination, blurred vision, drowsiness, confusion, or disorientation. At extreme exposures, central nervous system effects may include respiratory depression, tremors or convulsions, loss of consciousness, coma or death.

DELAYED OR OTHER HEALTH EFFECTS:

Reproduction and Birth Defects: Contains material that may cause harm to the unborn child if inhaled above the recommended exposure limit.

Cancer: Prolonged or repeated exposure to this material may cause cancer. Gasoline has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC).

Whole gasoline exhaust has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC).

Contains benzene, which has been classified as a carcinogen by the National Toxicology Program (NTP) and a Group 1 carcinogen (carcinogenic to humans) by the International Agency for Research on Cancer (IARC).

Contains naphthalene, which has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC). Contains ethylbenzene which has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC).

Genetic Toxicity: Contains material that may cause heritable genetic damage based on animal data.
Target Organs: Contains material that may cause damage to the following organ(s) following repeated inhalation at concentrations above the recommended exposure limit: Blood/Blood Forming Organs See Section 11 for additional information. Risk depends on duration and level of exposure.

Indication of any immediate medical attention and special treatment needed

Note to Physicians: Ingestion of this product or subsequent vomiting may result in aspiration of light hydrocarbon liquid, which may cause pneumonitis.

SECTION 5 FIRE FIGHTING MEASURES

EXTINGUISHING MEDIA: Dry Chemical, CO₂, Aqueous Film Forming Foam (AFFF) or alcohol resistant foam.
Unusual Fire Hazards: See Section 7 for proper handling and storage.

PROTECTION OF FIRE FIGHTERS:

Fire Fighting Instructions: For fires involving this material, do not enter any enclosed or confined fire space without proper protective equipment, including self-contained breathing apparatus.

Combustion Products: Highly dependent on combustion conditions. A complex mixture of airborne solids, liquids, and gases including carbon monoxide, carbon dioxide, and unidentified organic compounds will be evolved when this material undergoes combustion.

SECTION 6 ACCIDENTAL RELEASE MEASURES

Protective Measures: Eliminate all sources of ignition in the vicinity of the spill or released vapor. If this material is released into the work area, evacuate the area immediately. Monitor area with combustible gas indicator.

Spill Management: Stop the source of the release if you can do it without risk. Contain release to prevent further contamination of soil, surface water or groundwater. Clean up spill as soon as possible, observing precautions in Exposure Controls/Personal Protection. Use appropriate techniques such as applying non-combustible absorbent materials or pumping. All equipment used when handling the product must be grounded. A vapor suppressing foam may be used to reduce vapors. Use clean non-sparking tools to collect absorbed material. Where feasible and appropriate, remove contaminated soil. Place contaminated materials in disposable containers and dispose of in a manner consistent with applicable regulations.

Reporting: Report spills to local authorities and/or the U.S. Coast Guard's National Response Center at (800) 424-8802 as appropriate or required.

SECTION 7 HANDLING AND STORAGE

General Handling Information: Avoid contaminating soil or releasing this material into sewage and drainage systems and bodies of water.

Precautionary Measures: This product presents an extreme fire hazard. Liquid very quickly evaporates, even at low temperatures, and forms vapor (fumes) which can catch fire and burn with explosive violence. Invisible vapor spreads easily and can be set on fire by many sources such as pilot lights, welding equipment, and electrical motors and switches. Never siphon gasoline by mouth.

Do not store in open or unlabeled containers. READ AND OBSERVE ALL PRECAUTIONS ON PRODUCT LABEL. Use only as a motor fuel. Do not use for cleaning, pressure appliance fuel, or any other such use. Do not get in eyes, on skin, or on clothing. Do not taste or swallow. Do not breathe vapor or fumes. Wash thoroughly after handling. Keep out of the reach of children.

Static Hazard: Improper filling of portable gasoline containers creates danger of fire. Only dispense gasoline into approved and properly labeled gasoline containers. Always place portable containers on the ground. Be sure pump nozzle is in contact with the container while filling. Do not use a nozzle's lock-open device. Do not fill portable containers that are inside a vehicle or truck/trailer bed.

Electrostatic charge may accumulate and create a hazardous condition when handling this material. To minimize this hazard, bonding and grounding may be necessary but may not, by themselves, be sufficient. Review all operations which have the potential of generating and accumulating an electrostatic charge and/or a flammable atmosphere (including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation, and vacuum truck operations) and use appropriate mitigating procedures.

Container Warnings: Container is not designed to contain pressure. Do not use pressure to empty container or it may rupture with explosive force. Empty containers retain product residue (solid, liquid, and/or vapor) and can be dangerous. Do not pressurize, cut, weld, braze, solder, drill, grind, or expose such containers to heat, flame, sparks, static electricity, or other sources of ignition. They may explode and cause injury or death. Empty containers should be completely drained, properly closed, and promptly returned to a drum reconditioner or disposed of properly.

General Storage Information: DO NOT USE OR STORE near heat, sparks, flames, or hot surfaces. USE AND STORE ONLY IN WELL VENTILATED AREA. Keep container closed when not in use.

SECTION 8 EXPOSURE CONTROLS/PERSONAL PROTECTION

GENERAL CONSIDERATIONS:

Consider the potential hazards of this material (see Section 2), applicable exposure limits, job activities, and other substances in the work place when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment since protection is usually provided for a limited time or under certain circumstances.

ENGINEERING CONTROLS:

Use process enclosures, local exhaust ventilation, or other engineering controls to control airborne levels below the recommended exposure limits.

PERSONAL PROTECTIVE EQUIPMENT

Eye/Face Protection: Wear protective equipment to prevent eye contact. Selection of protective equipment may include safety glasses, chemical goggles, face shields, or a combination depending on the work operations conducted.

Skin Protection: Wear protective clothing to prevent skin contact. Selection of protective clothing may include gloves, apron, boots, and complete facial protection depending on operations conducted. Suggested materials for protective gloves include: Chlorinated Polyethylene (or Chlorosulfonated Polyethylene), Nitrile Rubber, Polyurethane, Viton.

Respiratory Protection: Determine if airborne concentrations are below the recommended occupational exposure limits for jurisdiction of use. If airborne concentrations are above the acceptable limits, wear an approved respirator that provides adequate protection from this material, such as: Air-Purifying Respirator for Organic Vapors.

When used as a fuel, this material can produce carbon monoxide in the exhaust. Determine if airborne concentrations are below the occupational exposure limit for carbon monoxide. If not, wear an approved positive-pressure air-supplying respirator.

Use a positive pressure air-supplying respirator in circumstances where air-purifying respirators may not provide adequate protection.

Occupational Exposure Limits:

Component	Agency	TWA	STEL	Ceiling	Notation
Gasoline	ACGIH	300 ppm (weight)	500 ppm (weight)	--	A3
Toluene	ACGIH	20 ppm (weight)	--	--	--

Toluene	OSHA Z-2	200 ppm (weight)	--	300 ppm (weight)	--
Xylene	ACGIH	100 ppm (weight)	150 ppm (weight)	--	--
Xylene	OSHA Z-1	435 mg/m3	--	--	--
Pentane isomers (pentanes)	Not Applicable	--	--	--	--
Butane	ACGIH	--	1000 ppm (weight)	--	--
Ethanol	ACGIH	1000 ppm (weight)	--	--	A4 A3
Ethanol	OSHA Z-1	1900 mg/m3	--	--	--
Benzene	ACGIH	.5 ppm (weight)	2.5 ppm (weight)	--	Skin A1 Skin
Hexane	ACGIH	50 ppm (weight)	--	--	Skin
Benzene	CVX	1 ppm (weight)	5 ppm (weight)	--	--
Benzene	OSHA SRS	1 ppm (weight)	5 ppm (weight)	--	--
Hexane	OSHA Z-1	1800 mg/m3	--	--	--
Benzene	OSHA Z-2	10 ppm (weight)	--	25 ppm (weight)	--
Heptane	ACGIH	400 ppm (weight)	500 ppm (weight)	--	--
Heptane	OSHA Z-1	2000 mg/m3	--	--	--
Cyclohexane	ACGIH	100 ppm (weight)	--	--	--
Ethylbenzene	ACGIH	20 ppm (weight)	--	--	A3
Ethylbenzene	OSHA Z-1	435 mg/m3	--	--	--
Cyclohexane	OSHA Z-1	1050 mg/m3	--	--	--
Methylcyclohexane	ACGIH	400 ppm (weight)	--	--	--
Naphthalene	ACGIH	10 ppm (weight)	15 ppm	--	Skin A3
Naphthalene	OSHA Z-1	50 mg/m3	--	--	--
Methylcyclohexane	OSHA Z-1	2000 mg/m3	--	--	--

Consult local authorities for appropriate values.

SECTION 9 PHYSICAL AND CHEMICAL PROPERTIES

Attention: the data below are typical values and do not constitute a specification.

Color: Colorless to yellow

Physical State: Liquid

Odor: Petroleum odor

Odor Threshold: No data available

pH: Not Applicable

Vapor Pressure: 5 psi - 15.50 psi (Typical) @ 37.8 °C (100 °F)

Vapor Density (Air = 1): 3 - 4 (Typical)

Initial Boiling Point: 27.2°C (81°F) - 52.8°C (127°F) (Typical)

Solubility: Negligible

Freezing Point: Not Applicable

Melting Point: Not Applicable

Specific Gravity: 0.70 g/ml - 0.80 g/ml @ 15.6°C (60.1°F) (Typical)

Viscosity: <1 SUS @ 37.8°C (100°F)

Evaporation Rate: No data available

Decomposition temperature: No data available

Octanol/Water Partition Coefficient: 2 - 7

FLAMMABLE PROPERTIES:

Flammability (solid, gas): No Data Available

Flashpoint: (Tagliabue Closed Cup ASTM D56) < -45 °C (< -49 °F)

Autoignition: > 280 °C (> 536 °F)

Flammability (Explosive) Limits (% by volume in air): Lower: 1.4 Upper: 7.6

SECTION 10 STABILITY AND REACTIVITY

Reactivity: May react with strong acids or strong oxidizing agents, such as chlorates, nitrates, peroxides, etc.

Chemical Stability: This material is considered stable under normal ambient and anticipated storage and handling conditions of temperature and pressure.

Incompatibility With Other Materials: Not applicable

Hazardous Decomposition Products: None known (None expected)

Hazardous Polymerization: Hazardous polymerization will not occur.

SECTION 11 TOXICOLOGICAL INFORMATION

Information on toxicological effects

Serious Eye Damage/Irritation: The eye irritation hazard is based on evaluation of data for product components.

Skin Corrosion/Irritation: For a 4-hour exposure, the Primary Irritation Index (PII) in rabbits is: 4.8/8.0.

Skin Sensitization: This material did not cause skin sensitization reactions in a Buehler guinea pig test.

Acute Dermal Toxicity: LD50: >3.75 g/kg (rabbit).

Acute Oral Toxicity: LD50: >5 ml/kg (rat).

Acute Inhalation Toxicity: 4 hour(s) LD50: >20000 mg/m³ (rat).

Acute Toxicity Estimate: Not Determined

Germ Cell Mutagenicity: The hazard evaluation is based on data for components or a similar material.

Carcinogenicity: The hazard evaluation is based on data for components or a similar material. Gasoline has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC).

Whole gasoline exhaust has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC).

Contains benzene, which has been classified as a carcinogen by the National Toxicology Program (NTP) and a Group 1 carcinogen (carcinogenic to humans) by the International Agency for Research on Cancer (IARC).

Contains naphthalene, which has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC). Contains ethylbenzene which has been classified as a Group 2B carcinogen (possibly carcinogenic to humans) by the International Agency for Research on Cancer (IARC).

Reproductive Toxicity: The hazard evaluation is based on data for components or a similar material.

Specific Target Organ Toxicity - Single Exposure: The hazard evaluation is based on data for components or a similar material.

Specific Target Organ Toxicity - Repeated Exposure: The hazard evaluation is based on data for components or a similar material.

ADDITIONAL TOXICOLOGY INFORMATION:

Gasolines are highly volatile and can produce significant concentrations of vapor at ambient temperatures. Gasoline vapor is heavier than air and at high concentrations may accumulate in confined spaces to present both safety and health hazards. When vapor exposures are low, or short duration and infrequent, such as during refueling and tanker loading/unloading, neither total hydrocarbon nor components such as benzene are likely to result in any adverse health effects. In situations such as accidents or spills where exposure to gasoline vapor is potentially high, attention should be paid to potential toxic effects of specific components. Information about specific components in gasoline can be found in Sections 2/3, 8 and 15 of this MSDS. More detailed information on the health hazards of specific gasoline components can be obtained calling the Chevron Emergency Information Center (see Section 1 for phone numbers).

Pathological misuse of solvents and gasoline, involving repeated and prolonged exposure to high concentrations of vapor is a significant exposure on which there are many reports in the medical literature. As with other solvents, persistent abuse involving repeated and prolonged exposures to high concentrations of vapor has been reported to result in central nervous system damage and eventually, death. In a study in which ten human volunteers were exposed for 30 minutes to approximately 200, 500 or 1000 ppm concentrations of gasoline vapor, irritation of the eyes was the only significant effect observed, based on both subjective and objective assessments.

Lifetime inhalation of wholly vaporized unleaded gasoline at 2056 ppm has caused increased liver tumors in female mice and kidney cancer in male rats. In their 1988 review of carcinogenic risk from gasoline, The International Agency for Research on Cancer (IARC) noted that, because published epidemiology studies did not include any exposure data, only occupations where gasoline exposure may have occurred were reviewed. These included gasoline service station attendants and automobile mechanics. IARC also noted that there was no opportunity to separate effects of combustion products from those of gasoline itself. Although IARC allocated gasoline a final overall classification of Group 2B, i.e. possibly carcinogenic to humans, this was based on limited evidence in experimental animals plus supporting evidence including the presence in gasoline of benzene. The actual evidence for carcinogenicity in humans was considered inadequate.

MUTAGENICITY: Gasoline was not mutagenic, with or without activation, in the Ames assay (Salmonella typhimurium), Saccharomyces cerevisiae, or mouse lymphoma assays. In addition, point mutations were not induced in human lymphocytes. Gasoline was not mutagenic when tested in the mouse dominant lethal assay. Administration of gasoline to rats did not cause chromosomal aberrations in their bone marrow cells.

EPIDEMIOLOGY: To explore the health effects of workers potentially exposed to gasoline vapors in the marketing and distribution sectors of the petroleum industry, the American Petroleum Institute sponsored a cohort mortality study (Publication 4555), a nested case-control study (Publication 4551), and an exposure assessment study (Publication 4552). Histories of exposure to gasoline were reconstructed for cohort of more than 18,000 employees from four companies for the time period between 1946 and 1985. The results of the cohort mortality study indicated that there was no increased mortality from either kidney cancer or leukemia among marketing and marine distribution employees who were exposed to gasoline in the petroleum industry, when compared to the general population. More importantly, based on internal comparisons, there was no association between mortality from kidney cancer or leukemia and various indices of gasoline exposure. In particular, neither duration of employment, duration of exposure, age at first exposure, year of first exposure, job category, cumulative exposure, frequency of peak exposure, nor average intensity of exposure had any effect on kidney cancer or leukemia mortality. The results of the nested case-control study confirmed the findings of the original cohort study. That is, exposure to gasoline at the levels experienced by this cohort of distribution workers is not a significant risk factor for leukemia (all cell types), acute myeloid leukemia, kidney cancer or multiple myeloma.

This product contains ethylbenzene.

BIRTH DEFECTS AND REPRODUCTION: Ethylbenzene is not expected to cause birth defects or other developmental effects based on well-conducted studies in rabbits and rats sponsored by NIOSH. Other studies in rats and mice which reported urinary tract malformations have many deficiencies and have limited usefulness in evaluating human risk. Reproductive effects are not expected based on a NIOSH study of fertility, and lack of effects observed for sperm counts and motility, estrous cycle and pathology of reproductive organs following repeated exposures. **HEARING:** Statistically significant losses in outer hair cells (OHCs) were observed in rats

exposed to ≥ 200 ppm ethylbenzene, 6 hours/day, 6 days/week for 13 weeks, after an 8-week recovery period. Following longer exposure, inner hair cells losses were also observed in rats exposed to ≥ 600 ppm ethylbenzene, but only occasionally in rats exposed to 400 ppm. The Lowest Observed Adverse Effect Level in rats (LOAEL) was 200 ppm for losses of OHCs. Guinea pigs exposed to ethylbenzene at 2,500 ppm, 6 hours/day for 5 days did not show auditory deficits or losses in OHCs. The concentration of ethylbenzene used in the JP-8 study was approximately 10 ppm. GENETIC TOXICITY: Ethylbenzene tested negative in the bacterial mutation test, Chinese Hamster Ovary (CHO) cell in vitro assay, sister chromatid exchange assay and an unscheduled DNA synthesis assay. Conflicting results have been reported for the mouse lymphoma cell assay. Increased micronuclei were reported in an in vitro Syrian hamster embryo cell assay; however, two in vivo micronuclei studies in mice were negative. In Syrian hamster embryo cells in vitro, cell transformation was observed at 7 days of incubation but not at 24 hours. Based on these results, ethylbenzene is not expected to be mutagenic or clastogenic. CARCINOGENICITY: In studies conducted by the National Toxicology Program, rats and mice were exposed to ethylbenzene at 25, 250 and 750 ppm for six hours per day, five days per week for 103 weeks. In rats exposed to 750 ppm, the incidence of kidney tubule hyperplasia and tumors was increased. Testicular tumors develop spontaneously in nearly all rats if allowed to complete their natural life span; in this study, the development of these tumors appeared to be enhanced in male rats exposed to 750 ppm. In mice, the incidences of lung tumors in males and liver tumors in females exposed to 750 ppm were increased as compared to control mice but were within the range of incidences observed historically in control mice. Other liver effects were observed in male mice exposed to 250 and 750 ppm. The incidences of hyperplasia were increased in the pituitary gland in female mice at 250 and 750 ppm and in the thyroid in male and female mice at 750 ppm.

This product contains toluene.

GENERAL TOXICITY: The primary effects of exposure to toluene in animals and humans are on the central nervous system. Solvent abusers, who typically inhale high concentrations (thousands of ppm) for brief periods of time, in addition to experiencing respiratory tract irritation, often suffer permanent central nervous system effects that include tremors, staggered gait, impaired speech, hearing and vision loss, and changes in brain tissue. Death in some solvent abusers has been attributed to cardiac arrhythmias, which appear to have been triggered by epinephrine acting on solvent sensitized cardiac tissue. Although liver and kidney effects have been seen in some solvent abusers, results of animal testing with toluene do not support these as primary target organs.

HEARING: Humans who were occupationally exposed to concentrations of toluene as low as 100 ppm for long periods of time have experienced hearing deficits. Hearing loss, as demonstrated using behavioral and electrophysiological testing as well as by observation of structural damage to cochlear hair cells, occurred in experimental animals exposed to toluene. It also appears that toluene exposure and noise may interact to produce hearing deficits.

COLOR VISION: In a single study of workers exposed to toluene at levels under 50 ppm, small decreases in the ability to discriminate colors in the blue-yellow range have been reported for female workers. This effect, which should be investigated further, is very subtle and would not likely have been noticed by the people tested.

REPRODUCTIVE/DEVELOPMENTAL TOXICITY: Toluene may also cause mental and/or growth retardation in the children of female solvent abusers who directly inhale toluene (usually at thousands of ppm) when they are pregnant. Toluene caused growth retardation in rats and rabbits when administered at doses that were toxic to the mothers. In rats, concentrations of up to 5000 ppm did not cause birth defects. No effects were observed in the offspring at doses that did not intoxicate the pregnant animals. The exposure level at which no effects were seen (No Observed Effect Level, NOEL) is 750 ppm in the rat and 500 ppm in the rabbit.

This product contains xylene.

ACUTE TOXICITY: The primary effects of exposure to xylene in animals and humans are on the central nervous system. In addition, in some individuals, xylene exposure can sensitize cardiac tissue to epinephrine which may precipitate fatal ventricular fibrillation. DEVELOPMENTAL TOXICITY: Xylene has been reported to cause developmental toxicity in rats and mice exposed by inhalation during pregnancy. The effects noted consisted of delayed development and minor skeletal variations. In addition, when pregnant mice were exposed by ingestion to a level that killed nearly one-third of the test group, lethality (resorptions) and malformations (primarily cleft palate) occurred. Since xylene can cross the placenta, it may be appropriate to prevent exposure during pregnancy.

GENETIC TOXICITY/CARCINOGENICITY: Xylene was not genotoxic in several mutagenicity testing assays including the Ames test. In a cancer study sponsored by the National Toxicology Program (NTP), technical grade

xylene gave no evidence of carcinogenicity in rats or mice dosed daily for two years. HEARING: Mixed xylenes have been shown to cause measurable hearing loss in rats exposed to 800 ppm in the air for 14 hours per day for six weeks. Exposure to 1450 ppm xylene for 8 hours caused hearing loss while exposure to 1700 ppm for 4 hours did not. Although no information is available for lower concentrations, other chemicals that cause hearing loss in rats at relatively high concentrations do not cause hearing loss in rats at low concentrations. Worker exposure to xylenes at the permissible exposure limit (100 ppm, time-weighted average) is not expected to cause hearing loss.

This product contains naphthalene.

GENERAL TOXICITY: Exposure to naphthalene has been reported to cause methemoglobinemia and/or hemolytic anemia, especially in humans deficient in the enzyme glucose-6-phosphate dehydrogenase. Laboratory animals given repeated oral doses of naphthalene have developed cataracts. **REPRODUCTIVE TOXICITY AND BIRTH DEFECTS:** Naphthalene did not cause birth defects when administered orally to rabbits, rats, and mice during pregnancy, but slightly reduced litter size in mice at dose levels that were lethal to the pregnant females. Naphthalene has been reported to cross the human placenta. **GENETIC TOXICITY:** Naphthalene caused chromosome aberrations and sister chromatid exchanges in Chinese hamster ovary cells, but was not a mutagen in several other in-vitro tests. **CARCINOGENICITY:** In a study conducted by the National Toxicology Program (NTP), mice exposed to 10 or 30 ppm of naphthalene by inhalation daily for two years had chronic inflammation of the nose and lungs and increased incidences of metaplasia in those tissues. The incidence of benign lung tumors (alveolar/bronchiolar adenomas) was significantly increased in the high-dose female group but not in the male groups. In another two-year inhalation study conducted by NTP, exposure of rats to 10, 30, and 60 ppm naphthalene caused increases in the incidences of a variety of nonneoplastic lesions in the nose. Increases in nasal tumors were seen in both sexes, including olfactory neuroblastomas in females at 60 ppm and adenomas of the respiratory epithelium in males at all exposure levels. The relevance of these effects to humans has not been established. No carcinogenic effect was reported in a 2-year feeding study in rats receiving naphthalene at 41 mg/kg/day.

This product contains cyclohexane.

Cyclohexane primarily affects the central nervous systems of laboratory animals and humans. Acute or prolonged inhalation of cyclohexane at levels below the recommended exposure limits does not result in toxic effects while acute exposures to levels above these recommended limits can cause reversible central nervous system depression. Prolonged exposures of laboratory animals to high levels (up to low thousands of parts per million) have also caused reversible effects which included hyperactivity, diminished response to stimuli, and adaptive liver changes while very high levels (high thousands of parts per million) were fatal. No developmental effects were seen in rats or rabbits following exposures of up to 7000 ppm cyclohexane. No reproductive effects occurred in rats, although postnatal pup growth was reduced at 7000 ppm in a similar manner as observed in the parental animals. Cyclohexane has not been shown to be mutagenic in several in vitro and in vivo assays and has not produced tumors in several dermal application long-term bioassays. Based on these results and the lack of any mutagenic or genotoxic metabolites, cyclohexane is not expected to be mutagenic or genotoxic. Following dermal exposure, cyclohexane is rapidly absorbed, metabolized, and excreted.

This product contains ethanol (ethyl alcohol).

Chronic ingestion of ethanol can damage the liver, nervous system and heart. Chronic heavy consumption of alcoholic beverages has been associated with an increased risk of cancer. Ingestion of ethanol during pregnancy can cause human birth defects such as fetal alcohol syndrome.

This product contains butane.

An atmospheric concentration of 100,000 ppm (10%) butane is not noticeably irritating to the eyes, nose or respiratory tract, but will produce slight dizziness in a few minutes of exposure. No chronic systemic effect has been reported from occupational exposure.

This product contains benzene.

GENETIC TOXICITY/CANCER: Repeated or prolonged breathing of benzene vapor has been associated with the development of chromosomal damage in experimental animals and various blood diseases in humans ranging from aplastic anemia to leukemia (a form of cancer). All of these diseases can be fatal. In some individuals, benzene exposure can sensitize cardiac tissue to epinephrine which may precipitate fatal ventricular fibrillation. **REPRODUCTIVE/DEVELOPMENTAL TOXICITY:** No birth defects have been shown to occur in pregnant

laboratory animals exposed to doses not toxic to the mother. However, some evidence of fetal toxicity such as delayed physical development has been seen at such levels. The available information on the effects of benzene on human pregnancies is inadequate but it has been established that benzene can cross the human placenta. OCCUPATIONAL: The OSHA Benzene Standard (29 CFR 1910.1028) contains detailed requirements for training, exposure monitoring, respiratory protection and medical surveillance triggered by the exposure level. Refer to the OSHA Standard before using this product.

This product contains n-hexane.
TARGET ORGAN TOXICITY: Prolonged or repeated ingestion, skin contact or breathing of vapors of n-hexane has been shown to cause peripheral neuropathy. Recovery ranges from no recovery to complete recovery depending upon the severity of the nerve damage. Exposure to 1000 ppm n-hexane for 18 hr/day for 61 days has been shown to cause testicular damage in rats. However, when rats were exposed to higher concentrations for shorter daily periods (10,000 ppm for 6 h/day, 5 days/wk for 13 weeks), no testicular lesions were seen.
CARCINOGENICITY: Chronic exposure to commercial hexane (52% n-hexane) at a concentration of 9000ppm was not carcinogenic to rats or to male mice, but did result in an increased incidence of liver tumors in female mice. No carcinogenic effects were observed in female mice exposed to 900 or 3000 ppm hexane or in male mice. The relevance for humans of these hexane-induced mouse liver tumors is questionable.
GENETIC TOXICITY: n-Hexane caused chromosome aberrations in bone marrow of rats, but was negative in the AMES and mouse lymphoma tests.

SECTION 12 ECOLOGICAL INFORMATION
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ECOTOXICITY

Gasoline studies have been conducted in the laboratory under a variety of test conditions with a range of fish and invertebrate species. An even more extensive database is available on the aquatic toxicity of individual aromatic constituents. The majority of published studies do not identify the type of gasoline evaluated, or even provide distinguishing characteristics such as aromatic content or presence of lead alkyls. As a result, comparison of results among studies using open and closed vessels, different ages and species of test animals and different gasoline types, is difficult.

The bulk of the available literature on gasoline relates to the environmental impact of monoaromatic (BTEX) and diaromatic (naphthalene, methyl-naphthalenes) constituents. In general, non-oxygenated gasoline exhibits some short-term toxicity to freshwater and marine organisms, especially under closed vessel or flow-through exposure conditions in the laboratory. The components which are the most prominent in the water soluble fraction and cause aquatic toxicity, are also highly volatile and can be readily biodegraded by microorganisms.

This material is expected to be toxic to aquatic organisms and may cause long-term adverse effects in the aquatic environment.

- 48 hour(s) LC50: 3.0 mg/l (Daphnia magna)
- 96 hour(s) LC50: 1.8 mg/l (Mysidopsis bahia)
- 96 hour(s) LC50: 8.3 mg/l (Cyprinodon variegatus)
- 96 hour(s) LC50: 2.7 mg/l (Oncorhynchus mykiss)

MOBILITY

No data available.

PERSISTENCE AND DEGRADABILITY

This material is expected to be readily biodegradable. Following spillage, the more volatile components of gasoline will be rapidly lost, with concurrent dissolution of these and other constituents into the water. Factors such as local environmental conditions (temperature, wind, mixing or wave action, soil type, etc), photo-oxidation, biodegradation and adsorption onto suspended sediments, can contribute to the weathering of spilled gasoline.

The aqueous solubility of non-oxygenated unleaded gasoline, based on analysis of benzene, toluene, ethylbenzene+xylenes and naphthalene, is reported to be 112 mg/l. Solubility data on individual gasoline constituents also available.

POTENTIAL TO BIOACCUMULATE

Bioconcentration Factor: No data available.

Octanol/Water Partition Coefficient: 2 - 7

SECTION 13 DISPOSAL CONSIDERATIONS

Use material for its intended purpose or recycle if possible. This material, if it must be discarded, may meet the criteria of a hazardous waste as defined by international, country, or local laws and regulations.

SECTION 14 TRANSPORT INFORMATION

The description shown may not apply to all shipping situations. Consult 49CFR, or appropriate Dangerous Goods Regulations, for additional description requirements (e.g., technical name) and mode-specific or quantity-specific shipping requirements.

DOT Shipping Description: UN1203, GASOLINE, 3, II; OPTIONAL DISCLOSURE: UN1203, GASOLINE, 3, II, MARINE POLLUTANT (GASOLINE)

IMO/IMDG Shipping Description: UN1203, GASOLINE, 3, II, FLASH POINT SEE SECTION 5 OR 9, MARINE POLLUTANT (GASOLINE)

ICAO/IATA Shipping Description: UN1203, GASOLINE, 3, II

Transport in bulk according to Annex II of MARPOL 73/78 and the IBC code:
Not applicable

SECTION 15 REGULATORY INFORMATION

EPCRA 311/312 CATEGORIES:	1. Immediate (Acute) Health Effects:	YES	
	2. Delayed (Chronic) Health Effects:		YES
	3. Fire Hazard:		YES
	4. Sudden Release of Pressure Hazard:	NO	
	5. Reactivity Hazard:		NO

REGULATORY LISTS SEARCHED:

- | | |
|---------------------|----------------------|
| 01-1=IARC Group 1 | 03=EPCRA 313 |
| 01-2A=IARC Group 2A | 04=CA Proposition 65 |
| 01-2B=IARC Group 2B | 05=MA RTK |
| 02=NTP Carcinogen | 06=NJ RTK |
| | 07=PA RTK |

The following components of this material are found on the regulatory lists indicated.

Gasoline	01-2B, 07
Toluene	04, 05, 06, 07
Xylene	03, 05, 06, 07
Butane	05, 06, 07
Ethanol	01-1, 02, 04, 05, 06, 07
Benzene	01-1, 02, 03, 04, 05, 06, 07
Hexane	05, 06, 07
Heptane	05, 06, 07
Ethylbenzene	01-2B, 03, 04, 05, 06, 07
Cyclohexane	05, 06, 07
Naphthalene	01-2B, 02, 04, 05, 06, 07
Methylcyclohexane	05, 06

CERCLA REPORTABLE QUANTITIES(RQ)/EPCRA 302 THRESHOLD PLANNING QUANTITIES(TPQ):

Component	Component RQ	Component TPQ	Product RQ
Benzene	10 lbs	None	186 lbs
Cyclohexane	1000 lbs	None	34188 lbs
Ethylbenzene	1000 lbs	None	34964 lbs
Hexane	5000 lbs	None	129149 lbs
Naphthalene	100 lbs	None	4000 lbs
Toluene	1000 lbs	None	2627 lbs
Xylene (contains o-, m-, & p- xylene isomers in varying amounts)	100 lbs	None	649 lbs

CHEMICAL INVENTORIES:

All components comply with the following chemical inventory requirements: AICS (Australia), DSL (Canada), EINECS (European Union), ENCS (Japan), IECSC (China), KECI (Korea), PICCS (Philippines), TSCA (United States).

SECTION 16 OTHER INFORMATION

NFPA RATINGS: Health: 1 Flammability: 3 Reactivity: 0

HMIS RATINGS: Health: 2* Flammability: 3 Reactivity: 0
(0-Least, 1-Slight, 2-Moderate, 3-High, 4-Extreme, PPE:- Personal Protection Equipment Index recommendation, *-Chronic Effect Indicator). These values are obtained using the guidelines or published evaluations prepared by the National Fire Protection Association (NFPA) or the National Paint and Coating Association (for HMIS ratings).

Additional Product Number(s): 201019, 201024, 201050, 201051, 201058, 201060, 201061, 201066, 201068, 201069, 201071, 201072, 201078, 201081, 201084, 201085, 201088, 201091, 201092, 201094, 201096, 201097, 201098, 201101, 201103, 201114, 201117, 201193, 201213, 201214, 201215, 201233, 201234, 201235, 201263, 201264, 201265, 201274, 201275, 201276, 201283, 201284, 201285, 201293, 201294, 201295, 201853, 201854, 201861, 201862, 201863, 204006, 204007, 204008, 204009, 204014, 204015, 204026, 204027, 204043, 204050, 204051, 204052, 204059, 204074, 204075, 204092, 204093, 204108, 204109, 204120, 204121, 204144, 204145, 204168, 204169, 204192, 204193, 204204, 204205, 204211, 204216, 204217, 204228, 204229, 204252, 204253, 204276, 204277, 204294, 204295, 204327, 204328, 204329, 204351, 204353, 204355, 204357, 204362, 204363, 204368, 204369, 204374, 204375, 204380, 204381, 204386, 204387, 204392, 204393, 204398, 204399, 204404, 204405, 204410, 204411, 204416, 204417, 204422, 204423, 204428, 204429, 204434, 204435, 204440, 204441, 204443, 204447, 204451, 204455, 204459, 204463, 204470, 204471, 204488, 204489, 204506, 204507, 204524, 204525, 204542, 204543, 204560, 204561, 204578, 204579, 204591, 204596, 204597, 204614, 204615, 204632, 204633, 204650, 204651, 204668, 204669, 204683, 204694, 204695, 204700, 204701, 204706, 204707, 204712,

204713, 204725, 204726, 204731, 204732, 204741, 204754, 204755, 241766

REVISION STATEMENT: SECTION 02 - Precautionary Statements information was modified.

SECTION 03 - Composition information was added.

SECTION 03 - Composition information was modified.

SECTION 05 - Extinguishing Media information was modified.

SECTION 07 - Precautionary Measures information was modified.

SECTION 07 - Static Hazards information was modified.

SECTION 08 - Occupational Exposure Limit Table information was modified.

SECTION 09 - Physical/Chemical Properties information was modified.

SECTION 11 - Additional Toxicology Information information was modified.

SECTION 12 - Ecological Information information was modified.

SECTION 13 - Disposal Considerations information was modified.

SECTION 14 - DOT Classification information was added.

SECTION 14 - DOT Classification information was deleted.

SECTION 14 - ICAO Classification information was added.

SECTION 14 - ICAO Classification information was deleted.

SECTION 14 - IMO Classification information was added.

SECTION 14 - IMO Classification information was deleted.

SECTION 15 - Regulatory Information information was modified.

Revision Date: December 10, 2018

ABBREVIATIONS THAT MAY HAVE BEEN USED IN THIS DOCUMENT:

TLV - Threshold Limit Value	TWA - Time Weighted Average
STEL - Short-term Exposure Limit	PEL - Permissible Exposure Limit
GHS - Globally Harmonized System	CAS - Chemical Abstract Service Number
ACGIH - American Conference of Governmental Industrial Hygienists	IMO/IMDG - International Maritime Dangerous Goods Code
API - American Petroleum Institute	SDS - Safety Data Sheet
HMIS - Hazardous Materials Information System	NFPA - National Fire Protection Association (USA)
DOT - Department of Transportation (USA)	NTP - National Toxicology Program (USA)
IARC - International Agency for Research on Cancer	OSHA - Occupational Safety and Health Administration
NCEL - New Chemical Exposure Limit	EPA - Environmental Protection Agency
SCBA - Self-Contained Breathing Apparatus	

Prepared according to the 29 CFR 1910.1200 (2012) by Chevron Energy Technology Company, 6001 Bollinger Canyon Road, San Ramon, CA 94583.

The above information is based on the data of which we are aware and is believed to be correct as of the date hereof. Since this information may be applied under conditions beyond our control and with which we may be unfamiliar and since data made available subsequent to the date hereof may suggest modifications of the information, we do not assume any responsibility for the results of its use. This information is furnished upon condition that the person receiving it shall make his own determination of the suitability of the material for his particular purpose.

SAFETY DATA SHEET

Creation Date 24-Aug-2009

Revision Date 18-Jan-2018

Revision Number 5

1. Identification

Product Name Hydrochloric acid

Cat No. : A481-212; A481-212LC; S71942SC; S71943; S71943ND; S80036; S80038; SA49

Synonyms Muriatic acid; Hydrogen chloride; HCl (Technical/Certified ACS Plus/Optima/NF/FCC)

Recommended Use Laboratory chemicals.

Uses advised against Not for food, drug, pesticide or biocidal product use

Details of the supplier of the safety data sheet

Company

Fisher Scientific
One Reagent Lane
Fair Lawn, NJ 07410
Tel: (201) 796-7100

Emergency Telephone Number

CHEMTREC®, Inside the USA: 800-424-9300
CHEMTREC®, Outside the USA: 001-703-527-3887

2. Hazard(s) identification

Classification

This chemical is considered hazardous by the 2012 OSHA Hazard Communication Standard (29 CFR 1910.1200)

Corrosive to metals	Category 1
Skin Corrosion/Irritation	Category 1 B
Serious Eye Damage/Eye Irritation	Category 1
Specific target organ toxicity (single exposure)	Category 3
Target Organs - Respiratory system.	

Label Elements

Signal Word

Danger

Hazard Statements

May be corrosive to metals
Causes severe skin burns and eye damage
May cause respiratory irritation

**Precautionary Statements****Prevention**

Do not breathe dust/fume/gas/mist/vapors/spray
 Wash face, hands and any exposed skin thoroughly after handling
 Wear protective gloves/protective clothing/eye protection/face protection
 Use only outdoors or in a well-ventilated area
 Keep only in original container

Response

Immediately call a POISON CENTER or doctor/physician

Inhalation

IF INHALED: Remove victim to fresh air and keep at rest in a position comfortable for breathing

Skin

IF ON SKIN (or hair): Take off immediately all contaminated clothing. Rinse skin with water/shower
 Wash contaminated clothing before reuse

Eyes

IF IN EYES: Rinse cautiously with water for several minutes. Remove contact lenses, if present and easy to do. Continue rinsing

Ingestion

IF SWALLOWED: Rinse mouth. DO NOT induce vomiting

Spills

Absorb spillage to prevent material damage

Storage

Store locked up
 Store in a well-ventilated place. Keep container tightly closed
 Store in corrosive resistant polypropylene container with a resistant inliner
 Store in a dry place

Disposal

Dispose of contents/container to an approved waste disposal plant

Hazards not otherwise classified (HNOC)

None identified

3. Composition/Information on Ingredients

Component	CAS-No	Weight %
Water	7732-18-5	62-65
Hydrochloric acid	7647-01-0	35-38

4. First-aid measures

Eye Contact

Rinse immediately with plenty of water, also under the eyelids, for at least 15 minutes. Immediate medical attention is required.

Skin Contact

Wash off immediately with plenty of water for at least 15 minutes. Immediate medical attention is required.

Inhalation

Move to fresh air. If breathing is difficult, give oxygen. Do not use mouth-to-mouth method if victim ingested or inhaled the substance; give artificial respiration with the aid of a pocket mask equipped with a one-way valve or other proper respiratory medical device. Immediate medical attention is required.

Ingestion	Do not induce vomiting. Call a physician or Poison Control Center immediately.
Most important symptoms and effects	Causes burns by all exposure routes. Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated: Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation
Notes to Physician	Treat symptomatically

5. Fire-fighting measures

Suitable Extinguishing Media	Substance is nonflammable; use agent most appropriate to extinguish surrounding fire.
Unsuitable Extinguishing Media	No information available
Flash Point	No information available
Method -	No information available
Autoignition Temperature	No information available
Explosion Limits	
Upper	No data available
Lower	No data available
Sensitivity to Mechanical Impact	No information available
Sensitivity to Static Discharge	No information available

Specific Hazards Arising from the Chemical

Corrosive Material. Causes burns by all exposure routes. Thermal decomposition can lead to release of irritating gases and vapors.

Hazardous Combustion Products

Hydrogen chloride gas

Protective Equipment and Precautions for Firefighters

As in any fire, wear self-contained breathing apparatus pressure-demand, MSHA/NIOSH (approved or equivalent) and full protective gear.

NFPA

Health	Flammability	Instability	Physical hazards
3	0	0	N/A

6. Accidental release measures

Personal Precautions	Use personal protective equipment. Ensure adequate ventilation. Evacuate personnel to safe areas. Keep people away from and upwind of spill/leak. Do not get in eyes, on skin, or on clothing.
Environmental Precautions	Should not be released into the environment. See Section 12 for additional ecological information.
Methods for Containment and Clean Up	Soak up with inert absorbent material. Keep in suitable, closed containers for disposal.

7. Handling and storage

Handling	Wear personal protective equipment. Do not breathe vapors or spray mist. Do not get in eyes, on skin, or on clothing. Do not ingest.
Storage	Keep containers tightly closed in a dry, cool and well-ventilated place. Corrosives area.

8. Exposure controls / personal protection

Exposure Guidelines

Component	ACGIH TLV	OSHA PEL	NIOSH IDLH	Mexico OEL (TWA)
Hydrochloric acid	Ceiling: 2 ppm	Ceiling: 5 ppm Ceiling: 7 mg/m ³ (Vacated) Ceiling: 5 ppm (Vacated) Ceiling: 7 mg/m ³	IDLH: 50 ppm Ceiling: 5 ppm Ceiling: 7 mg/m ³	Ceiling: 5 ppm Ceiling: 7 mg/m ³

Legend

ACGIH - American Conference of Governmental Industrial Hygienists

OSHA - Occupational Safety and Health Administration

NIOSH IDLH: The National Institute for Occupational Safety and Health Immediately Dangerous to Life or Health

Engineering Measures Ensure that eyewash stations and safety showers are close to the workstation location.

Personal Protective Equipment

Eye/face Protection Wear appropriate protective eyeglasses or chemical safety goggles as described by OSHA's eye and face protection regulations in 29 CFR 1910.133 or European Standard EN166.

Skin and body protection Wear appropriate protective gloves and clothing to prevent skin exposure.

Respiratory Protection Follow the OSHA respirator regulations found in 29 CFR 1910.134 or European Standard EN 149. Use a NIOSH/MSHA or European Standard EN 149 approved respirator if exposure limits are exceeded or if irritation or other symptoms are experienced.

Hygiene Measures Handle in accordance with good industrial hygiene and safety practice.

9. Physical and chemical properties

Physical State	Liquid
Appearance	Colorless
Odor	pungent
Odor Threshold	No information available
pH	< 1
Melting Point/Range	-35 °C / -31 °F
Boiling Point/Range	57 °C / 135 °F @ 760 mmHg
Flash Point	No information available
Evaporation Rate	No information available
Flammability (solid,gas)	Not applicable
Flammability or explosive limits	
Upper	No data available
Lower	No data available
Vapor Pressure	125 mbar @ 20 °C
Vapor Density	1.27
Specific Gravity	1.18
Solubility	Soluble in water
Partition coefficient; n-octanol/water	No data available
Autoignition Temperature	No information available
Decomposition Temperature	No information available
Viscosity	1.8 mPa.s @ 15°C
Molecular Formula	HCl.H ₂ O
Molecular Weight	55.55

10. Stability and reactivity

Reactive Hazard None known, based on information available

Stability	Stable under normal conditions.
Conditions to Avoid	Incompatible products. Excess heat.
Incompatible Materials	Metals, Strong oxidizing agents, Bases, sodium hypochlorite, Amines, Fluorine, Cyanides, Alkaline
Hazardous Decomposition Products	Hydrogen chloride gas
Hazardous Polymerization	Hazardous polymerization does not occur.
Hazardous Reactions	Contact with metals may evolve flammable hydrogen gas.

11. Toxicological information

Acute Toxicity

Product Information

Oral LD50

Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.

Dermal LD50

Based on ATE data, the classification criteria are not met. ATE > 2000 mg/kg.

Vapor LC50

Based on ATE data, the classification criteria are not met. ATE > 20 mg/l.

Component Information

Component	LD50 Oral	LD50 Dermal	LC50 Inhalation
Water	-	Not listed	Not listed
Hydrochloric acid	238 - 277 mg/kg (Rat)	> 5010 mg/kg (Rabbit)	1.68 mg/L (Rat) 1 h

Toxicologically Synergistic Products No information available

Delayed and immediate effects as well as chronic effects from short and long-term exposure

Irritation Causes burns by all exposure routes

Sensitization No information available

Carcinogenicity The table below indicates whether each agency has listed any ingredient as a carcinogen.

Component	CAS-No	IARC	NTP	ACGIH	OSHA	Mexico
Water	7732-18-5	Not listed	Not listed	Not listed	Not listed	Not listed
Hydrochloric acid	7647-01-0	Not listed	Not listed	Not listed	Not listed	Not listed

IARC: (International Agency for Research on Cancer)

IARC: (International Agency for Research on Cancer)

Group 1 - Carcinogenic to Humans

Group 2A - Probably Carcinogenic to Humans

Group 2B - Possibly Carcinogenic to Humans

Mutagenic Effects No information available

Reproductive Effects No information available.

Developmental Effects No information available.

Teratogenicity No information available.

STOT - single exposure Respiratory system

STOT - repeated exposure None known

Aspiration hazard No information available

Symptoms / effects, both acute and delayed Product is a corrosive material. Use of gastric lavage or emesis is contraindicated. Possible perforation of stomach or esophagus should be investigated: Ingestion causes severe swelling, severe damage to the delicate tissue and danger of perforation

Endocrine Disruptor Information No information available

Other Adverse Effects The toxicological properties have not been fully investigated.

12. Ecological information

Ecotoxicity

Do not empty into drains. Large amounts will affect pH and harm aquatic organisms.

Component	Freshwater Algae	Freshwater Fish	Microtox	Water Flea
Hydrochloric acid	-	282 mg/L LC50 96 h Gambusia affinis mg/L LC50 48 h Leuciscus idus	-	56mg/L EC50 72h Daphnia

Persistence and Degradability Persistence is unlikely based on information available.

Bioaccumulation/ Accumulation No information available.

Mobility Will likely be mobile in the environment due to its water solubility.

13. Disposal considerations

Waste Disposal Methods Chemical waste generators must determine whether a discarded chemical is classified as a hazardous waste. Chemical waste generators must also consult local, regional, and national hazardous waste regulations to ensure complete and accurate classification.

14. Transport information

DOT

UN-No UN1789
 Proper Shipping Name HYDROCHLORIC ACID
 Hazard Class 8
 Packing Group II

TDG

UN-No UN1789
 Proper Shipping Name HYDROCHLORIC ACID
 Hazard Class 8
 Packing Group II

IATA

UN-No UN1789
 Proper Shipping Name Hydrochloric acid
 Hazard Class 8
 Packing Group II

IMDG/IMO

UN-No UN1789
 Proper Shipping Name Hydrochloric acid
 Hazard Class 8
 Packing Group II

15. Regulatory information

International Inventories

Component	TSCA	DSL	NDSL	EINECS	ELINCS	NLP	PICCS	ENCS	AICS	IECSC	KECL
Water	X	X	-	231-791-2	-		X	-	X	X	X
Hydrochloric acid	X	X	-	231-595-7	-		X	X	X	X	X

Legend:

X - Listed

E - Indicates a substance that is the subject of a Section 5(e) Consent order under TSCA.

F - Indicates a substance that is the subject of a Section 5(f) Rule under TSCA.

N - Indicates a polymeric substance containing no free-radical initiator in its inventory name but is considered to cover the designated polymer made with any free-radical initiator regardless of the amount used.

P - Indicates a commenced PMN substance

R - Indicates a substance that is the subject of a Section 6 risk management rule under TSCA.

S - Indicates a substance that is identified in a proposed or final Significant New Use Rule

T - Indicates a substance that is the subject of a Section 4 test rule under TSCA.

XU - Indicates a substance exempt from reporting under the Inventory Update Rule, i.e. Partial Updating of the TSCA Inventory Data Base Production and Site Reports (40 CFR 710(B)).

Y1 - Indicates an exempt polymer that has a number-average molecular weight of 1,000 or greater.

Y2 - Indicates an exempt polymer that is a polyester and is made only from reactants included in a specified list of low concern reactants that comprises one of the eligibility criteria for the exemption rule.

U.S. Federal Regulations

TSCA 12(b) Not applicable

SARA 313

Component	CAS-No	Weight %	SARA 313 - Threshold Values %
Hydrochloric acid	7647-01-0	35-38	1.0

SARA 311/312 Hazard Categories See section 2 for more information

CWA (Clean Water Act)

Component	CWA - Hazardous Substances	CWA - Reportable Quantities	CWA - Toxic Pollutants	CWA - Priority Pollutants
Hydrochloric acid	X	5000 lb	-	-

Clean Air Act

Component	HAPS Data	Class 1 Ozone Depletors	Class 2 Ozone Depletors
Hydrochloric acid	X		-

OSHA Occupational Safety and Health Administration

Not applicable

Component	Specifically Regulated Chemicals	Highly Hazardous Chemicals
Hydrochloric acid	-	TQ: 5000 lb

CERCLA This material, as supplied, contains one or more substances regulated as a hazardous substance under the Comprehensive Environmental Response Compensation and Liability Act (CERCLA) (40 CFR 302)

Component	Hazardous Substances RQs	CERCLA EHS RQs
Hydrochloric acid	5000 lb	5000 lb

California Proposition 65 This product does not contain any Proposition 65 chemicals

U.S. State Right-to-Know Regulations

Component	Massachusetts	New Jersey	Pennsylvania	Illinois	Rhode Island
Water	-	-	X	-	-
Hydrochloric acid	X	X	X	X	X

U.S. Department of Transportation

Reportable Quantity (RQ): Y
 DOT Marine Pollutant N
 DOT Severe Marine Pollutant N

U.S. Department of Homeland Security

This product contains the following DHS chemicals:

Component	DHS Chemical Facility Anti-Terrorism Standard
Hydrochloric acid	0 lb STQ (anhydrous); 11250 lb STQ (37% concentration or greater)

Other International Regulations

Mexico - Grade No information available

16. Other information

Prepared By Regulatory Affairs
Thermo Fisher Scientific
Email: EMSDS.RA@thermofisher.com

Creation Date 24-Aug-2009
Revision Date 18-Jan-2018
Print Date 18-Jan-2018
Revision Summary SDS sections updated. 2. 3. 11.

Disclaimer

The information provided in this Safety Data Sheet is correct to the best of our knowledge, information and belief at the date of its publication. The information given is designed only as a guidance for safe handling, use, processing, storage, transportation, disposal and release and is not to be considered a warranty or quality specification. The information relates only to the specific material designated and may not be valid for such material used in combination with any other materials or in any process, unless specified in the text

End of SDS

SAFETY DATA SHEET

Isobutylene

Section 1. Identification

GHS product identifier	: Isobutylene
Chemical name	: 2-methylpropene
Other means of identification	: 1-Propene, 2-methyl-; Isobutene; Isobutylene; 1-Propene, 2-methyl- (isobutene); 1, 1-Dimethylethylene; Isopropylidenemethylene; iso-Butene; i-Butene; 2-Methylpropylene; 2-Methyl-2-propene; 2-Methyl-1-propene
Product type	: Gas.
Product use	: Synthetic/Analytical chemistry.
Synonym	: 1-Propene, 2-methyl-; Isobutene; Isobutylene; 1-Propene, 2-methyl- (isobutene); 1, 1-Dimethylethylene; Isopropylidenemethylene; iso-Butene; i-Butene; 2-Methylpropylene; 2-Methyl-2-propene; 2-Methyl-1-propene
SDS #	: 001031
Supplier's details	: Airgas USA, LLC and its affiliates 259 North Radnor-Chester Road Suite 100 Radnor, PA 19087-5283 1-610-687-5253
24-hour telephone	: 1-866-734-3438

Section 2. Hazards identification

OSHA/HCS status	: This material is considered hazardous by the OSHA Hazard Communication Standard (29 CFR 1910.1200).
Classification of the substance or mixture	: FLAMMABLE GASES - Category 1 GASES UNDER PRESSURE - Liquefied gas

GHS label elements

Hazard pictograms



Signal word : Danger

Hazard statements : Extremely flammable gas.
May form explosive mixtures with air.
Contains gas under pressure; may explode if heated.
May displace oxygen and cause rapid suffocation.

Precautionary statements

General

: Read and follow all Safety Data Sheets (SDS'S) before use. Read label before use. Keep out of reach of children. If medical advice is needed, have product container or label at hand. Close valve after each use and when empty. Use equipment rated for cylinder pressure. Do not open valve until connected to equipment prepared for use. Use a back flow preventative device in the piping. Use only equipment of compatible materials of construction. Always keep container in upright position. Approach suspected leak area with caution.

Prevention

: Keep away from heat, hot surfaces, sparks, open flames and other ignition sources. No smoking.

Response

: Leaking gas fire: Do not extinguish, unless leak can be stopped safely. Eliminate all ignition sources if safe to do so.

Storage

: Protect from sunlight. Store in a well-ventilated place.

Disposal

: Not applicable.

Hazards not otherwise classified

: In addition to any other important health or physical hazards, this product may displace oxygen and cause rapid suffocation.

Section 3. Composition/information on ingredients

Substance/mixture	: Substance
Chemical name	: 2-methylpropene
Other means of identification	: 1-Propene, 2-methyl-; Isobutene; Isobutylene; 1-Propene, 2-methyl- (isobutene); 1, 1-Dimethylethylene; Isopropylidenemethylene; iso-Butene; i-Butene; 2-Methylpropylene; 2-Methyl-2-propene; 2-Methyl-1-propene
Product code	: 001031

CAS number/other identifiers

CAS number : 115-11-7

Ingredient name	%	CAS number
Isobutylene	100	115-11-7

Any concentration shown as a range is to protect confidentiality or is due to batch variation.

There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

Occupational exposure limits, if available, are listed in Section 8.

Section 4. First aid measures

Description of necessary first aid measures

Eye contact	: Immediately flush eyes with plenty of water, occasionally lifting the upper and lower eyelids. Check for and remove any contact lenses. Continue to rinse for at least 10 minutes. Get medical attention if irritation occurs.
Inhalation	: Remove victim to fresh air and keep at rest in a position comfortable for breathing. If not breathing, if breathing is irregular or if respiratory arrest occurs, provide artificial respiration or oxygen by trained personnel. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation. Get medical attention if adverse health effects persist or are severe. If unconscious, place in recovery position and get medical attention immediately. Maintain an open airway. Loosen tight clothing such as a collar, tie, belt or waistband.
Skin contact	: Flush contaminated skin with plenty of water. Remove contaminated clothing and shoes. To avoid the risk of static discharges and gas ignition, soak contaminated clothing thoroughly with water before removing it. Get medical attention if symptoms occur. Wash clothing before reuse. Clean shoes thoroughly before reuse.
Ingestion	: As this product is a gas, refer to the inhalation section.

Most important symptoms/effects, acute and delayed

Potential acute health effects

Eye contact	: No known significant effects or critical hazards.
Inhalation	: No known significant effects or critical hazards.
Skin contact	: No known significant effects or critical hazards.
Frostbite	: Try to warm up the frozen tissues and seek medical attention.
Ingestion	: As this product is a gas, refer to the inhalation section.

Over-exposure signs/symptoms

Eye contact	: No specific data.
Inhalation	: No specific data.
Skin contact	: No specific data.
Ingestion	: No specific data.

Indication of immediate medical attention and special treatment needed, if necessary

Notes to physician	: Treat symptomatically. Contact poison treatment specialist immediately if large quantities have been ingested or inhaled.
Specific treatments	: No specific treatment.

Section 4. First aid measures

- Protection of first-aiders** : No action shall be taken involving any personal risk or without suitable training. It may be dangerous to the person providing aid to give mouth-to-mouth resuscitation.

See toxicological information (Section 11)

Section 5. Fire-fighting measures

Extinguishing media

- Suitable extinguishing media** : Use an extinguishing agent suitable for the surrounding fire.
- Unsuitable extinguishing media** : None known.

- Specific hazards arising from the chemical** : Contains gas under pressure. Extremely 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.

- Hazardous thermal decomposition products** : Decomposition products may include the following materials:
carbon dioxide
carbon monoxide

- Special protective actions for fire-fighters** : Promptly isolate the scene by removing all persons from the vicinity of the incident if there is a fire. No action shall be taken involving any personal risk or without suitable training. Contact supplier immediately for specialist advice. Move containers from fire area if this can be done without risk. Use water spray to keep fire-exposed containers cool. If involved in fire, shut off flow immediately if it can be done without risk. If this is impossible, withdraw from area and allow fire to burn. Fight fire from protected location or maximum possible distance. Eliminate all ignition sources if safe to do so.

- 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, protective equipment and emergency procedures

- For non-emergency personnel** : Accidental releases pose a serious fire or explosion hazard. No action shall be taken involving any personal risk or without suitable training. Evacuate surrounding areas. Keep unnecessary and unprotected personnel from entering. Shut off all ignition sources. No flares, smoking or flames in hazard area. Avoid breathing gas. Provide adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Put on appropriate personal protective equipment.

- For emergency responders** : If specialized clothing is required to deal with the spillage, take note of any information in Section 8 on suitable and unsuitable materials. See also the information in "For non-emergency personnel".

- Environmental precautions** : Ensure emergency procedures to deal with accidental gas releases are in place to avoid contamination of the environment. Inform the relevant authorities if the product has caused environmental pollution (sewers, waterways, soil or air).

Methods and materials for containment and cleaning up

- Small spill** : Immediately contact emergency personnel. Stop leak if without risk. Use spark-proof tools and explosion-proof equipment.
- Large spill** : 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

Precautions for safe handling

Protective measures : Put on appropriate personal protective equipment (see Section 8). Contains gas under pressure. Avoid breathing gas. Use only with adequate ventilation. Wear appropriate respirator when ventilation is inadequate. Do not enter storage areas and confined spaces unless adequately ventilated. Do not puncture or incinerate container. Use equipment rated for cylinder pressure. Close valve after each use and when empty. Protect cylinders from physical damage; do not drag, roll, slide, or drop. Use a suitable hand truck for cylinder movement.

Use only non-sparking tools. Avoid contact with eyes, skin and clothing. Empty containers retain product residue and can be hazardous. Store and use away from heat, sparks, open flame or any other ignition source. Use explosion-proof electrical (ventilating, lighting and material handling) equipment.

Advice on general occupational hygiene : Eating, drinking and smoking should be prohibited in areas where this material is handled, stored and processed. Workers should wash hands and face before eating, drinking and smoking. Remove contaminated clothing and protective equipment before entering eating areas. See also Section 8 for additional information on hygiene measures.

Conditions for safe storage, including any incompatibilities : Store in accordance with local regulations. Store in a segregated and approved area. Store away from direct sunlight in a dry, cool and well-ventilated area, away from incompatible materials (see Section 10). Eliminate all ignition sources. 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). Keep container tightly closed and sealed until ready for use. See Section 10 for incompatible materials before handling or use.

Section 8. Exposure controls/personal protection

Control parameters

Occupational exposure limits

Ingredient name	Exposure limits
Isobutylene	ACGIH TLV (United States, 3/2017). TWA: 250 ppm 8 hours.

Appropriate 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.

Environmental exposure controls : Emissions from ventilation or work process equipment should be checked to ensure they comply with the requirements of environmental protection legislation. In some cases, fume scrubbers, filters or engineering modifications to the process equipment will be necessary to reduce emissions to acceptable levels.

Individual protection measures

Hygiene measures : Wash hands, forearms and face thoroughly after handling chemical products, before eating, smoking and using the lavatory and at the end of the working period. Appropriate techniques should be used to remove potentially contaminated clothing. Wash contaminated clothing before reusing. Ensure that eyewash stations and safety showers are close to the workstation location.

Eye/face protection : 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, gases or dusts. If contact is possible, the following protection should be worn, unless the assessment indicates a higher degree of protection: safety glasses with side-shields.

Skin protection

Section 8. Exposure controls/personal protection

- Hand protection** : 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. Considering the parameters specified by the glove manufacturer, check during use that the gloves are still retaining their protective properties. It should be noted that the time to breakthrough for any glove material may be different for different glove manufacturers. In the case of mixtures, consisting of several substances, the protection time of the gloves cannot be accurately estimated.
- Body protection** : 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. When there is a risk of ignition from static electricity, wear anti-static protective clothing. For the greatest protection from static discharges, clothing should include anti-static overalls, boots and gloves.
- Other skin protection** : Appropriate footwear and any additional skin protection measures 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 protection** : Based on the hazard and potential for exposure, select a respirator that meets the appropriate standard or certification. Respirators must be used according to a respiratory protection program to ensure proper fitting, training, and other important aspects of use. 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.

Section 9. Physical and chemical properties

Appearance

- Physical state** : Gas. [Compressed gas.]
- Color** : Colorless.
- Odor** : Characteristic.
- Odor threshold** : Not available.
- pH** : Not available.
- Melting point** : -140.7°C (-221.3°F)
- Boiling point** : -6.9°C (19.6°F)
- Critical temperature** : 144.75°C (292.6°F)
- Flash point** : Closed cup: -76.1°C (-105°F)
- Evaporation rate** : Not available.
- Flammability (solid, gas)** : Extremely flammable in the presence of the following materials or conditions: open flames, sparks and static discharge and oxidizing materials.
- Lower and upper explosive (flammable) limits** : Lower: 1.8%
Upper: 9.6%
- Vapor pressure** : 24.3 (psig)
- Vapor density** : 1.94 (Air = 1)
- Specific Volume (ft³/lb)** : 6.6845
- Gas Density (lb/ft³)** : 0.1496 (25°C / 77 to °F)
- Relative density** : Not applicable.
- Solubility** : Not available.
- Solubility in water** : 0.26 g/l
- Partition coefficient: n-octanol/water** : 2.34
- Auto-ignition temperature** : 465°C (869°F)
- Decomposition temperature** : Not available.
- Viscosity** : Not applicable.
- Flow time (ISO 2431)** : Not available.
- Molecular weight** : 56.12 g/mole
- Aerosol product**
- Heat of combustion** : -45029034 J/kg

Section 10. Stability and reactivity

- Reactivity** : No specific test data related to reactivity available for this product or its ingredients.
- Chemical stability** : The product is stable.
- Possibility of hazardous reactions** : Under normal conditions of storage and use, hazardous reactions will not occur.
- Conditions to avoid** : Avoid all possible sources of ignition (spark or flame). Do not pressurize, cut, weld, braze, solder, drill, grind or expose containers to heat or sources of ignition.
- Incompatible materials** : Oxidizers
- 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

Information on toxicological effects

Acute toxicity

Product/ingredient name	Result	Species	Dose	Exposure
Isobutylene	LC50 Inhalation Vapor	Rat	550000 mg/m ³	4 hours

Irritation/Corrosion

Not available.

Sensitization

Not available.

Mutagenicity

Not available.

Carcinogenicity

Not available.

Reproductive toxicity

Not available.

Teratogenicity

Not available.

Specific target organ toxicity (single exposure)

Not available.

Specific target organ toxicity (repeated exposure)

Not available.

Aspiration hazard

Not available.

Information on the likely routes of exposure : Not available.

Potential acute health effects

Eye contact : No known significant effects or critical hazards.

Section 11. Toxicological information

- Inhalation** : No known significant effects or critical hazards.
Skin contact : No known significant effects or critical hazards.
Ingestion : As this product is a gas, refer to the inhalation section.

Symptoms related to the physical, chemical and toxicological characteristics

- Eye contact** : No specific data.
Inhalation : No specific data.
Skin contact : No specific data.
Ingestion : No specific data.

Delayed and immediate effects and also chronic effects from short and long term exposure

Short term exposure

- Potential immediate effects** : Not available.
Potential delayed effects : Not available.

Long term exposure

- Potential immediate effects** : Not available.
Potential delayed effects : Not available.

Potential chronic health effects

Not available.

- General** : No known significant effects or critical hazards.
Carcinogenicity : No known significant effects or critical hazards.
Mutagenicity : No known significant effects or critical hazards.
Teratogenicity : No known significant effects or critical hazards.
Developmental effects : No known significant effects or critical hazards.
Fertility effects : No known significant effects or critical hazards.

Numerical measures of toxicity

Acute toxicity estimates

Not available.

Section 12. Ecological information

Toxicity

Not available.

Persistence and degradability

Not available.

Bioaccumulative potential

Product/ingredient name	LogP _{ow}	BCF	Potential
Isobutylene	2.34	-	low

Mobility in soil

- Soil/water partition coefficient (K_{oc})** : Not available.






Section 12. Ecological information

Other adverse effects : No known significant effects or critical hazards.

Section 13. Disposal considerations

Disposal methods : The generation of waste should be avoided or minimized wherever possible. Disposal of this product, solutions and any by-products should at all times comply with the requirements of environmental protection and waste disposal legislation and any regional local authority requirements. Dispose of surplus and non-recyclable products via a licensed waste disposal contractor. Waste should not be disposed of untreated to the sewer unless fully compliant with the requirements of all authorities with jurisdiction. Empty Airgas-owned pressure vessels should be returned to Airgas. Waste packaging should be recycled. Incineration or landfill should only be considered when recycling is not feasible. This material and its container must be disposed of in a safe way. Empty containers or liners may retain some product residues. Do not puncture or incinerate container.

Section 14. Transport information

	DOT	TDG	Mexico	IMDG	IATA
UN number	UN1055	UN1055	UN1055	UN1055	UN1055
UN proper shipping name	ISOBUTYLENE	ISOBUTYLENE	ISOBUTYLENE	ISOBUTYLENE	ISOBUTYLENE
Transport hazard class(es)	2.1 	2.1 	2.1 	2.1 	2.1 
Packing group	-	-	-	-	-
Environmental hazards	No.	No.	No.	No.	No.

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

Additional information

- DOT Classification** : **Limited quantity** Yes.
Quantity limitation Passenger aircraft/rail: Forbidden. Cargo aircraft: 150 kg.
Special provisions 19, T50
- TDG Classification** : Product classified as per the following sections of the Transportation of Dangerous Goods Regulations: 2.13-2.17 (Class 2).
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
- IATA** : **Quantity limitation** Passenger and Cargo Aircraft: Forbidden. Cargo Aircraft Only: 150 kg.

Special precautions for user : **Transport within user's premises:** always transport in closed containers that are upright and secure. Ensure that persons transporting the product know what to do in the event of an accident or spillage.

Transport in bulk according to Annex II of MARPOL and the IBC Code : Not available.

Section 15. Regulatory information

U.S. Federal regulations : TSCA 8(a) CDR Exempt/Partial exemption: Not determined
Clean Air Act (CAA) 112 regulated flammable substances: Isobutylene

Clean Air Act Section 112 (b) Hazardous Air Pollutants (HAPs) : Not listed

Clean Air Act Section 602 Class I Substances : Not listed

Clean Air Act Section 602 Class II Substances : Not listed

DEA List I Chemicals (Precursor Chemicals) : Not listed

DEA List II Chemicals (Essential Chemicals) : Not listed

SARA 302/304

Composition/information on ingredients

No products were found.

SARA 304 RQ : Not applicable.

SARA 311/312

Classification : Refer to Section 2: Hazards Identification of this SDS for classification of substance.

State regulations

Massachusetts : This material is listed.

New York : This material is not listed.

New Jersey : This material is listed.

Pennsylvania : This material is listed.

International regulations

Chemical Weapon Convention List Schedules I, II & III Chemicals

Not listed.

Montreal Protocol (Annexes A, B, C, E)

Not listed.

Stockholm Convention on Persistent Organic Pollutants

Not listed.

Rotterdam Convention on Prior Informed Consent (PIC)

Not listed.

UNECE Aarhus Protocol on POPs and Heavy Metals

Not listed.

Inventory list

Australia : This material is listed or exempted.

Canada : This material is listed or exempted.

China : This material is listed or exempted.

Europe : This material is listed or exempted.

Japan : **Japan inventory (ENCS):** This material is listed or exempted.
Japan inventory (ISHL): Not determined.

Malaysia : Not determined.

New Zealand : This material is listed or exempted.

Philippines : This material is listed or exempted.

Republic of Korea : This material is listed or exempted.

Section 15. Regulatory information

Taiwan	: This material is listed or exempted.
Thailand	: Not determined.
Turkey	: Not determined.
United States	: This material is listed or exempted.
Viet Nam	: Not determined.

Section 16. Other information

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

Health	/	1
Flammability		4
Physical hazards		3

Caution: HMIS® ratings are based on a 0-4 rating scale, with 0 representing minimal hazards or risks, and 4 representing significant hazards or risks. Although HMIS® ratings and the associated label are not required on SDSs or products leaving a facility under 29 CFR 1910.1200, the preparer may choose to provide them. HMIS® ratings are to be used with a fully implemented HMIS® program. HMIS® is a registered trademark and service mark of the American Coatings Association, Inc.

The customer is responsible for determining the PPE code for this material. For more information on HMIS® Personal Protective Equipment (PPE) codes, consult the HMIS® Implementation Manual.

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



Reprinted with permission from NFPA 704-2001, Identification of the Hazards of Materials for Emergency Response Copyright ©1997, National Fire Protection Association, Quincy, MA 02269. This reprinted material is not the complete and official position of the National Fire Protection Association, on the referenced subject which is represented only by the standard in its entirety.

Copyright ©2001, National Fire Protection Association, Quincy, MA 02269. This warning system is intended to be interpreted and applied only by properly trained individuals to identify fire, health and reactivity hazards of chemicals. The user is referred to certain limited number of chemicals with recommended classifications in NFPA 49 and NFPA 325, which would be used as a guideline only. Whether the chemicals are classified by NFPA or not, anyone using the 704 systems to classify chemicals does so at their own risk.

Procedure used to derive the classification

Classification	Justification
FLAMMABLE GASES - Category 1	Expert judgment
GASES UNDER PRESSURE - Liquefied gas	Expert judgment

History

Date of printing	: 5/10/2018
Date of issue/Date of revision	: 5/10/2018
Date of previous issue	: 7/11/2016
Version	: 0.02

Key to abbreviations

: ATE = Acute Toxicity Estimate
: BCF = Bioconcentration Factor
: GHS = Globally Harmonized System of Classification and Labelling of Chemicals
: IATA = International Air Transport Association
: IBC = Intermediate Bulk Container
: IMDG = International Maritime Dangerous Goods
: LogPow = logarithm of the octanol/water partition coefficient
: MARPOL = International Convention for the Prevention of Pollution From Ships, 1973

Section 16. Other information

as modified by the Protocol of 1978. ("Marpol" = marine pollution)
UN = United Nations

References

: Not available.

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.

Smith System® Five Keys (Forward Driving)

1. **Aim High in Steering®** - Avoid Collisions by seeing, evaluating, and acting upon all information available.
2. **Get the Big Picture®** - Fewer mistakes are made when you have the complete traffic picture.
3. **Keep Your Eyes Moving®** - Proper scanning techniques separate safe drivers from people who make costly errors.
4. **Leave Yourself an Out®** - All that separates drivers from a collision is space. Use it to your advantage. *This also applies to parking—to ensure safe and easy exit in case of emergency, choose pull through spaces or back into parking spaces when possible.*
5. **Make Sure They See You®** - Seek eye contact and use your warning devices at the same time

Smith System® Five Keys (Backing-Up Driving)

AVOID BACKING WHENEVER POSSIBLE - But When It's Unavoidable:

1. Check The Backing Area First
2. Back Slowly And Carefully – Use A Spotter If Necessary
3. Remain Aware Of The Blind Areas
4. Look Front, Sides, And Rear As You Back
5. Back No Further Than You Must

PRE-TRIP VEHICLE INSPECTION CHECKLIST

Date: _____ **Beginning Mileage:** _____ **Ending Mileage:** _____

Unit: _____
Operator: _____

NR = Needs Repair

CHECK BEFORE OPERATING	OK	NR	COMMENTS
Driver's License on Hand			
ARCADIS Insurance Card in Vehicle			
Back-up Alarm Operational (if installed)			
Tires (tread, pressure, cracking)			
Taillights Operational			
Turn Signals Operational			
Brake Lights Operational			
Back-Up Lights Operational			
Headlights Operational			
Parking Lights Operational			
Mirrors Adjusted to Minimize Blind Spots			
Under the Vehicle (nothing hanging or leaking)			
Windshield Wipers and Fluid all Functional			
Cargo Secured or in Trunk			
Doors are Fully Closed and Locked			
Seat Adjusted, Head Restraint to Match Height of Head			
Driver and All Passengers Must Fasten Safety Belt			
Scan the Gauges to Make Sure Everything is Normal			
Adjust the Vents, Windows, and Heater or Air Conditioner for Comfort			
Review Driving JSA			
Driver is Mentally and Physically Prepared to Drive			
DOT Materials of Trade are Properly Stowed (ie. Compressed gas)			
Perform a Driving-Related Safety Moment (record in comments)			



2/32" remaining 4/32" remaining 6/32" remaining

Tread guide: If a tread gauge is not available coins may be used to determine remaining tread. 2/32" is the minimum by law in most states (top of Lincoln's head on penny), 4/32" is minimum recommended for wet surfaces (top of Washington's head on quarter), 6/32" is minimum recommended for snowy surfaces (top of Lincoln Memorial on penny). Our vehicle tires must be replaced if the tread depth is less than 6/32"

ARCADIS Insurance Card:



If renting from Enterprise or National be sure the Enterprise/National ID (XZ12140) is on the rental agreement.

Coverage:

Auto Physical Damage – ACV or 250K,
whichever is less

Comprehensive	\$2,000 Deductible
Collision:	\$2,000 Deductible
Liability:	\$10,000 Deductible

XL Speciality Insurance Company

Policy No:	AEC0010758-17 (AOS)
Policy Period:	01/01/2019 to 10/01/2019

In the event of a claim, contact:

Arcadis
Susan Berndt: (720) 344-3756

If unable to reach, contact:

Aon Risk Services South, Inc.
Janice Letson: (615) 771-8160

If unable to reach, contact:

XL Speciality Insurance Company
(800) 823-7351



TEAM Chevron

Job Safety Analysis

JSA Description: General Oversight		
Project Name:	Site Address:	Field Leader:
Date of JSA Development: 1/6/2015	Project No:	
Development Team Please include the team members employer and email if not employed by ARCADIS:	Position/Title:	Phone Number
Reviewed By Please include the reviewers employer and email if not employed by ARCADIS:	Position/Title:	Review Date (MM/DD/YYYY)
Jay White	H&S Administrator	01/06/2014
Permits Required (general, hi-risk, etc.):	General PTW	
Specialized tools/equipment:		
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT		
<input checked="" type="checkbox"/> (Class II) High-visibility vest or appropriate high-visibility clothing. <input checked="" type="checkbox"/> Long pants/Long shirt <input checked="" type="checkbox"/> Safety glasses, wraparound or with side shields labeled with ANSI Z87.1 rating, or a certification card for lenses and frames <input checked="" type="checkbox"/> Safety footwear meeting ASTM F2413-05 standard with chemical or oil resistant soles <input checked="" type="checkbox"/> Long-sleeved shirts <input checked="" type="checkbox"/> High visibility work gloves (when high visibility glove options exist for a particular glove type) <input checked="" type="checkbox"/> Hard hat that complies with ANSI Z89.1		
Personal Protective Equipment (PPE) Determination		
Check all that apply <input checked="" type="checkbox"/> and follow requirements associated with selection in PPE Hazard Assessment (App. H in HASP)		

Eye Protection

- Chemical protective goggles that comply with ANSI Z87.1
- Impact goggles that comply with ANSI Z87.1
- Flexible goggles that comply with ANSI Z87.1
- Welding goggles /helmet or face shield. Tinted lenses required. PPE must comply with Z87.1
- Laser safety glasses that comply with ANSI

Hazardous Atmosphere

- Photoionization detector (PID)
- Flame Ionization Detector (FID)
- Dust monitor
- LEL / O₂ meter
- H₂S meter

Head Protection

- Type E Hardhat (Electrical)
- Hard hat with chin strap, miner's helmet with chin strap or mountaineering helmet with chin strap

Body Protection

- Chemical resistant clothing recommended on SDS
- Chain saw chaps
- Snake chaps OR boots marketed as "snake proof"³
- DOT Class III vest (low light conditions or traffic flow at 50 mph or more)
- DOT Class II or III tear away vest when working around rotating or moving parts
- Sunscreen lotion >= SPF 30
- Insect repellent
- US Coast Guard approved personal flotation device (PFD) – Type I, II or III

Foot Protection

- Safety shoes or boots with metatarsal guards
- Safety boots with puncture-resistant midsoles or that have built-in puncture resistance (PR rated)
- Safety boots with electric hazard (EH) protection (standard in most footwear)
- Rubber-sole boots or grips
- Chemical resistant boot covers
- Lace-up safety boots conforming to ASTM F2413-05 or equivalent in non-US jurisdictions

Face Protection

- chemical protective goggles that comply with ANSI Z87.1
- Face Shield

Hearing Protection

- Ear Plugs (noise 80 db)
- Ear Muffs with Ear Plugs (noise 105 db)

Respiratory Protection

- Half-face respirator
- Full-face respirator
- SCBA

Fall Protection

- Personal fall arrest system designed or approved by a qualified person OR other means of fall protection determined by qualified person

Heat, Flame, Flash Fire or Arc Hazard

- cooling vest
- Fire retardant clothing (FRC)

Hand Protection

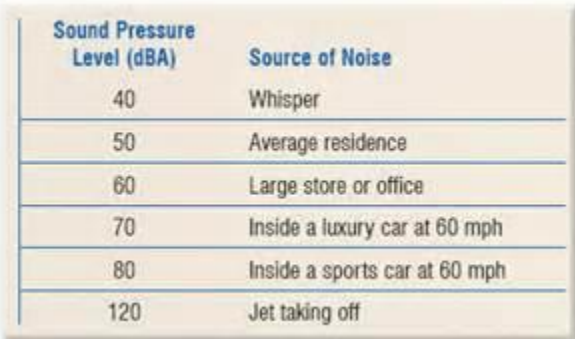
- chemical resistant gloves per SDS
- cut-resistant gloves or liners
- Leather/work gloves
- welding gloves
- leather gloves, insulated
- nitrile gloves
- Impact Resistant Gloves



Job Safety Analysis



JSA Description: General Oversight		Site ID:		Date: 1/6/2015																					
<table border="1" style="width:100%; text-align:center;"> <tr> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> <td></td> </tr> <tr> <td>Biological</td> <td>Chemical</td> <td>Electrical</td> <td>Gravity</td> <td>Mechanical</td> <td>Motion</td> <td>Pressure</td> <td>Radiation</td> <td>Sound</td> <td>Temperature</td> </tr> </table>																Biological	Chemical	Electrical	Gravity	Mechanical	Motion	Pressure	Radiation	Sound	Temperature
Biological	Chemical	Electrical	Gravity	Mechanical	Motion	Pressure	Radiation	Sound	Temperature																
Job Steps	Potential Hazard(s)	Critical Action(s)	Responsible Person(s) - Initials	Mitigation Steps Verified ¹																					
1. Site access and work area walk	MOTION - Broken bones, sprains, lacerations, or death from being struck by motor vehicle	<ol style="list-style-type: none"> 1. Observe vehicle traffic and pedestrian traffic in or around potential work zones. When setting up cones and barricades scan work zone and surrounding area for traffic. Make eye contact with drivers and give right-of-way to all motor vehicles present. 2. Establish traffic control for exclusion zone per requirements; use 42.0" high-visibility delineator post with flags; and park vehicle as barrier, if feasible. 3. Wear DOT Class II or higher hi-visibility traffic vests to make personnel more visible to on and off site traffic 																							
	MECHANICAL - Lacerations, abrasions to hands when carrying A-frame barricades	<ol style="list-style-type: none"> 1. Identify pinch points with tape or highly visible marking ink to increase awareness. 2. Wear Level 2 cut-resistant gloves prevent soft tissue injuries 																							
	MOTION - Nails or other sharp objects piercing the bottoms of boot and feet	<ol style="list-style-type: none"> 1. Perform a site walks to clear area of nails and other sharp objects on the ground using broom to push the objects out of the work area 2. Wearing puncture resistant boots or steel sole inserts to prevent sharp objects from piercing the bottom of boots 																							
2. Observing General Oversight	Motion – Broken bones, lacerations or sprains when walking in inclement weather conditions.	<ol style="list-style-type: none"> 1. Watch for black ice. 2. Use caution when walking. 3. Rain/Mud: Plan walking path to avoid muddy areas when available; avoid flooded areas. 4. Fog: Stay alert for equipment and hard-to-see hazards. 																							

	<p>Biological – Bites or stings from ticks/ mosquitoes and poison oak/ivy/sumac, etc.</p>	<ol style="list-style-type: none"> 1. Have insect spray available to kill wasps/bees. 2. Inspect work area for insects and avoid if observed. 3. Inspect clothing for ticks after being onsite. 4. Wear gloves, long sleeves, and pants to prevent insect bites. 5. Wear light colored clothing to prevent attracting insects. 																
	<p>Motion – Serious injury or death from contact with heavy equipment or truck traffic.</p>	<ol style="list-style-type: none"> 1. Keep 20 feet from reach of equipment and out of the swing radius or line of fire. 2. Do not approach heavy equipment until it has been de-energized and communication has been established with the equipment operator. 																
	<p>Chemical – Skin or respiratory irritation from exposure to contaminants of concern [Benzene; Ethyl benzene; Ammonia; Chlorobenzene; Coal Tar Pitch; and Lead].</p>	<ol style="list-style-type: none"> 1. Monitor DUST onsite with CAMP monitoring. 2. Don respiratory protection or stop work if necessary. 3. Maintain safe distance from open excavation 4. Wear nitrile gloves if handling potentially impacted soil. Decon any boots and equipment that may have come in contact of impacted materials. 																
	<p>Temperature – Heat Stroke or heat stress from high temperatures and level of work load.</p>	<ol style="list-style-type: none"> 1. Take shelter in vehicle/trailer to keep cool or in shaded area as necessary. 2. Drink water to stay hydrated and cool. 3. Wear appropriate clothing for weather conditions. 4. Watch coworkers for signs of heat stroke. <table border="1"> <thead> <tr> <th>Temperature (°F)</th> <th>Maximum Allowable Work Time</th> <th>Minimum Mandatory Rest Time</th> </tr> </thead> <tbody> <tr> <td>95+</td> <td>8 minutes</td> <td>15 minutes</td> </tr> <tr> <td>85-95</td> <td>13 minutes</td> <td>10 minutes</td> </tr> <tr> <td>75-85</td> <td>20 minutes</td> <td>10 minutes</td> </tr> </tbody> </table>	Temperature (°F)	Maximum Allowable Work Time	Minimum Mandatory Rest Time	95+	8 minutes	15 minutes	85-95	13 minutes	10 minutes	75-85	20 minutes	10 minutes				
Temperature (°F)	Maximum Allowable Work Time	Minimum Mandatory Rest Time																
95+	8 minutes	15 minutes																
85-95	13 minutes	10 minutes																
75-85	20 minutes	10 minutes																
	<p>Sound – Hearing damage from equipment noise</p>	<ol style="list-style-type: none"> 1. Stay out of the exclusion zone to maintain a safe distance to limit noise exposure. 2. Wear hearing protection when necessary. Generally when you need to raise your voice to converse with a person standing next to you.  <table border="1"> <thead> <tr> <th>Sound Pressure Level (dBA)</th> <th>Source of Noise</th> </tr> </thead> <tbody> <tr> <td>40</td> <td>Whisper</td> </tr> <tr> <td>50</td> <td>Average residence</td> </tr> <tr> <td>60</td> <td>Large store or office</td> </tr> <tr> <td>70</td> <td>Inside a luxury car at 60 mph</td> </tr> <tr> <td>80</td> <td>Inside a sports car at 60 mph</td> </tr> <tr> <td>120</td> <td>Jet taking off</td> </tr> </tbody> </table>	Sound Pressure Level (dBA)	Source of Noise	40	Whisper	50	Average residence	60	Large store or office	70	Inside a luxury car at 60 mph	80	Inside a sports car at 60 mph	120	Jet taking off		
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80	Inside a sports car at 60 mph																	
120	Jet taking off																	

	Motion – Broken bones, lacerations or sprains from tripping over debris while taking photographs	<ol style="list-style-type: none"> 1. Take photographs and field notes from a stationary position. Do not walk and talk while in the work area and on the phone. 2. Plan route before walking. Conduct TRACK all of the time. 		
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Notes:

1 – Verifier may be any ARCADIS employee or Subcontractor under direct contract by ARCADIS. The Verifier may be the Responsible Person, Site H&S Officer, Construction Manager, Project Manager, Subcontractor, etc.



TEAM Chevron

Job Safety Analysis

JSA Description: Groundwater Monitoring		
Project Name:	Site Address:	Field Leader:
Date of JSA Development: 1/6/2015	Project No:	
Development Team Please include the team members employer and email if not employed by ARCADIS:	Position/Title:	Phone Number
Reviewed By Please include the reviewers employer and email if not employed by ARCADIS:	Position/Title:	Review Date (MM/DD/YYYY)
Jav White	H&S Administrator	01/06/2014
Permits Required (general, hi-risk, etc.):	General PTW	
Specialized tools/equipment:	Interface probe (IP), Well Key,	
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT		
<input checked="" type="checkbox"/> (Class II) High-visibility vest or appropriate high-visibility clothing. <input checked="" type="checkbox"/> Long pants/Long shirt <input checked="" type="checkbox"/> Safety glasses, wraparound or with side shields labeled with ANSI Z87.1 rating, or a certification card for lenses and frames <input checked="" type="checkbox"/> Safety footwear meeting ASTM F2413-05 standard with chemical or oil resistant soles <input checked="" type="checkbox"/> Long-sleeved shirts <input checked="" type="checkbox"/> High visibility work gloves (when high visibility glove options exist for a particular glove type) <input checked="" type="checkbox"/> Hard hat that complies with ANSI Z89.1		
Personal Protective Equipment (PPE) Determination		
Check all that apply <input checked="" type="checkbox"/> and follow requirements associated with selection in PPE Hazard Assessment (App. H in HASP)		

Eye Protection

- Chemical protective goggles that comply with ANSI Z87.1
- Impact goggles that comply with ANSI Z87.1
- Flexible goggles that comply with ANSI Z87.1
- Welding goggles /helmet or face shield. Tinted lenses required. PPE must comply with Z87.1
- Laser safety glasses that comply with ANSI

Hazardous Atmosphere

- Photoionization detector (PID)
- Flame Ionization Detector (FID)
- Dust monitor
- LEL / O₂ meter
- H₂S meter

Head Protection

- Type E Hardhat (Electrical)
- Hard hat with chin strap, miner's helmet with chin strap or mountaineering helmet with chin strap

Body Protection

- Chemical resistant clothing recommended on SDS
- Chain saw chaps
- Snake chaps OR boots marketed as "snake proof"³
- DOT Class III vest (low light conditions or traffic flow at 50 mph or more)
- DOT Class II or III tear away vest when working around rotating or moving parts
- Sunscreen lotion >= SPF 30
- Insect repellent
- US Coast Guard approved personal flotation device (PFD) – Type I, II or III

Foot Protection

- Safety shoes or boots with metatarsal guards
- Safety boots with puncture-resistant midsoles or that have built-in puncture resistance (PR rated)
- Safety boots with electric hazard (EH) protection (standard in most footwear)
- Rubber-sole boots or grips
- Chemical resistant boot covers
- Lace-up safety boots conforming to ASTM F2413-05 or equivalent in non-US jurisdictions

Face Protection

- chemical protective goggles that comply with ANSI Z87.1
- Face Shield

Hearing Protection

- Ear Plugs (noise 80 db)
- Ear Muffs with Ear Plugs (noise 105 db)

Respiratory Protection

- Half-face respirator
- Full-face respirator
- SCBA

Fall Protection

- Personal fall arrest system designed or approved by a qualified person OR other means of fall protection determined by qualified person

Heat, Flame, Flash Fire or Arc Hazard

- cooling vest
- Fire retardant clothing (FRC)

Hand Protection

- chemical resistant gloves per SDS
- cut-resistant gloves or liners
- Leather/work gloves
- welding gloves
- leather gloves, insulated
- nitrile gloves
- Impact Resistant Gloves



Job Safety Analysis



JSA Description: Groundwater Monitoring				Site ID:			Date: 1/6/2015		
Biological Chemical Electrical Gravity Mechanical Motion Pressure Radiation Sound Temperature									
Job Steps	Potential Hazard(s)	1. Critical Action(s)			Responsible Person(s) - Initials	Mitigation Steps Verified ¹			
1. Establish work zone cones and/or barricades at proposed well locations	MOTION - Broken bones, sprains, lacerations, or death from being struck by motor vehicle	1. Observe vehicle traffic and pedestrian traffic in or around potential work zones. When setting up cones and barricades scan work zone and surrounding area for traffic. Make eye contact with drivers and give right-of-way to all motor vehicles present. 2. Wear DOT Class II or higher hi-visibility traffic vests to make personnel more visible to on and off site traffic.							
	MECHANICAL - Lacerations, abrasions to hands when carrying A-frame barricades	1. Identify pinch points with tape or highly visible marking ink to increase awareness. 2. Wear Level 2 cut-resistant gloves prevent soft tissue injuries.							
	MOTION - Nails or other sharp objects piercing the bottoms of boot and feet	1. Perform a site walks to clear area of nails and other sharp objects on the ground using broom to push the objects out of the work area 2. Wearing puncture resistant boots or steel sole inserts to prevent sharp objects from piercing the bottom of boots.							
2. Open wells for monitoring	GRAVITY - Slip/Trips/Falls over sampling equipment resulting in broken bones, sprains, or lacerations	1. Visually check and remove trip hazards in the work area prior to starting work at each well. Mark all identified fix hazards with cones or high-visibility tape. 2. Stage equipment in one central location to minimize trip hazards.							
	MOTION - Pinch points from leading edge of well housing and well cap resulting in lacerations, abrasions to hands	1. Do not grab well cap around edge to prevent entering line of fire of well cap and well housing and contact with sharp edges. 2. Use well/vault key to open wells to keep hands out of line of fire of well cap and well housing. 3. Use socket wrench to remove bolts and pry bar to remove lid to prevent having to touch sharp edges.							

		<ol style="list-style-type: none"> Keep hands free of lid when removing well cap to keep hands out of line of fire of well lid and well housing. Wear Level 2 resistant gloves to prevent lacerations to hands from sharp well caps or pinched hands. 		
	BIOLOGICAL - Bites/stings from insects or snakes inside or near well housing resulting in allergic reactions or skin irritation	<ol style="list-style-type: none"> Visually check for insects and snakes prior to opening the well. Do not open well if evidence of insects. Wear gloves, long sleeves and full-length pants to prevent insect bites to skin. 		
	PRESSURE - Lacerations or abrasions by flying well cap due to pressurized well	<ol style="list-style-type: none"> Open well cap slowly to depressurize well. Stay out of the line of fire above well cap. Keep face clear of well head while opening. Keep face away from well head, never place face over well opening. Wear hard hat to prevent head injury from a well cap that becomes airborne. Wear safety glasses to prevent debris from inside well contacting eyes. 		
	CHEMICAL - Chemical exposure from vapor/gas inhalation resulting in irritation or asphyxiation	<ol style="list-style-type: none"> Work upwind of well head. STOP WORK and report any noticeable vapors to supervisor. Air monitoring with a calibrated photo-ionization (PID) detector (fitted with a 10.6 eV bulb) must be utilized to determine concentrations of petroleum vapors in breathing zone. If PID reading exceeds 0.5 ppm, benzene-specific monitoring must take place with a colorimetric tube or real-time monitoring device. 		
	MOTION - Being struck by motor vehicle resulting in broken bones, lacerations, abrasions, sprains, or death	<ol style="list-style-type: none"> Scan work zone and surrounding area for vehicle and pedestrian traffic. If vehicle parks directly beside work zone STOP WORK and observe vehicle and driver for movement, make eye contact with driver. Wear DOT Class II or higher hi-visibility traffic vest to increase visibility to on and off site traffic. 		
3. Monitor groundwater level with probe	GRAVITY - Slip/Trip/Falls on measuring tape resulting in broken bones, sprains, or lacerations	<ol style="list-style-type: none"> Always deploy and retrieve measuring tape with a spool. Do not allow tape to drag the ground when walking between well locations to minimize trip hazard. 		
	MOTION - Back strain from bending over while dropping probe into well casing	<ol style="list-style-type: none"> Kneel instead of bending over at the waist or squatting. Use knee pads to prevent lacerations and bruising from kneeling on ground. 		
	CHEMICAL - Chemical exposure from skin contact with groundwater	<ol style="list-style-type: none"> Lower and retract tape slowly to reduce the potential for splashing. Wear nitrile gloves while using measuring tape over Level 2 cut resistant gloves to prevent chemical exposure to skin. 		
	MOTION - Lacerations or bruises to knees while gauging well volume	<ol style="list-style-type: none"> Inspect ground surface for sharp objects or stones which may cause lacerations or bruising. Removed objects from around well head. Kneel on soft surfaces or pads to prevent knee injuries. 		

Notes:

1 – Verifier may be any ARCADIS employee or Subcontractor under direct contract by ARCADIS. The Verifier may be the Responsible Person, Site H&S Officer, Construction Manager, Project Manager, Subcontractor, etc.



TEAM Chevron

Job Safety Analysis

JSA Description: Hand Augering		
Project Name:	Site Address:	Field Leader:
Date of JSA Development: 1/6/2015	Project No:	
Development Team <small>Please include the team members employer and email if not employed by ARCADIS:</small>	Position/Title:	Phone Number
Reviewed By <small>Please include the reviewers employer and email if not employed by ARCADIS:</small>	Position/Title:	Review Date (MM/DD/YYYY)
Jav White	H&S Administrator	01/06/2014
Permits Required (general, hi-risk, etc.):	General PTW, Excavation/Trenching/Overhead Clearance/Drilling HRPTW	
Specialized tools/equipment:	Hand Auger	
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT		
<small>✓ (Class II) High-visibility vest or appropriate high-visibility clothing. ✓ Long pants/Long shirt ✓ Safety glasses, wraparound or with side shields labeled with ANSI Z87.1 rating, or a certification card for lenses and frames ✓ Safety footwear meeting ASTM F2413-05 standard with chemical or oil resistant soles ✓ Long-sleeved shirts ✓ High visibility work gloves (when high visibility glove options exist for a particular glove type) ✓ Hard hat that complies with ANSI Z89.1</small>		
Personal Protective Equipment (PPE) Determination		
Check all that apply <input checked="" type="checkbox"/> and follow requirements associated with selection in PPE Hazard Assessment (App. H in HASP)		

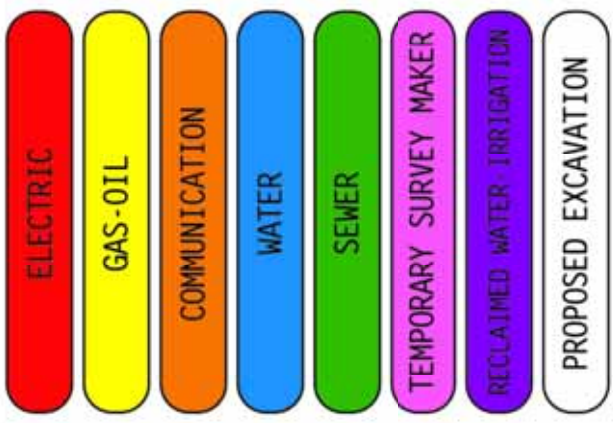
<p>Eye Protection</p> <ul style="list-style-type: none"> <input type="checkbox"/> Chemical protective goggles that comply with ANSI Z87.1 <input type="checkbox"/> Impact goggles that comply with ANSI Z87.1 <input type="checkbox"/> Flexible goggles that comply with ANSI Z87.1 <input type="checkbox"/> Welding goggles /helmet or face shield. Tinted lenses required. PPE must comply with Z87.1 <input type="checkbox"/> Laser safety glasses that comply with ANSI 	<p>Body Protection</p> <ul style="list-style-type: none"> <input type="checkbox"/> Chemical resistant clothing recommended on SDS <input type="checkbox"/> Chain saw chaps <input type="checkbox"/> Snake chaps OR boots marketed as "snake proof"³ <input type="checkbox"/> DOT Class III vest (low light conditions or traffic flow at 50 mph or more) <input checked="" type="checkbox"/> DOT Class II or III tear away vest when working around rotating or moving parts <input checked="" type="checkbox"/> Sunscreen lotion \geq SPF 30 <input checked="" type="checkbox"/> Insect repellent <input type="checkbox"/> US Coast Guard approved personal flotation device (PFD) – Type I, II or III 	<p>Face Protection</p> <ul style="list-style-type: none"> <input type="checkbox"/> chemical protective goggles that comply with ANSI Z87.1 <input type="checkbox"/> Face Shield
<p>Hazardous Atmosphere</p> <ul style="list-style-type: none"> <input checked="" type="checkbox"/> Photoionization detector (PID) <input type="checkbox"/> Flame Ionization Detector (FID) <input type="checkbox"/> Dust monitor <input type="checkbox"/> LEL / O₂ meter <input type="checkbox"/> H₂S meter 	<p>Foot Protection</p> <ul style="list-style-type: none"> <input type="checkbox"/> Safety shoes or boots with metatarsal guards <input checked="" type="checkbox"/> Safety boots with puncture-resistant midsoles or that have built-in puncture resistance (PR rated) <input type="checkbox"/> Safety boots with electric hazard (EH) protection (standard in most footwear) <input type="checkbox"/> Rubber-sole boots or grips <input type="checkbox"/> Chemical resistant boot covers <input type="checkbox"/> Lace-up safety boots conforming to ASTM F2413-05 or equivalent in non-US jurisdictions 	<p>Hearing Protection</p> <ul style="list-style-type: none"> <input type="checkbox"/> Ear Plugs (noise 80 db) <input type="checkbox"/> Ear Muffs with Ear Plugs (noise 105 db)
<p>Head Protection</p> <ul style="list-style-type: none"> <input type="checkbox"/> Type E Hardhat (Electrical) <input type="checkbox"/> Hard hat with chin strap, miner's helmet with chin strap or mountaineering helmet with chin strap 		<p>Respiratory Protection</p> <ul style="list-style-type: none"> <input type="checkbox"/> Half-face respirator <input type="checkbox"/> Full-face respirator <input type="checkbox"/> SCBA
		<p>Fall Protection</p> <ul style="list-style-type: none"> <input type="checkbox"/> Personal fall arrest system designed or approved by a qualified person OR other means of fall protection determined by qualified person
		<p>Heat, Flame, Flash Fire or Arc Hazard</p> <ul style="list-style-type: none"> <input type="checkbox"/> cooling vest <input type="checkbox"/> Fire retardant clothing (FRC)
		<p>Hand Protection</p> <ul style="list-style-type: none"> <input type="checkbox"/> chemical resistant gloves per SDS <input checked="" type="checkbox"/> cut-resistant gloves or liners <input checked="" type="checkbox"/> Leather/work gloves <input type="checkbox"/> welding gloves <input type="checkbox"/> leather gloves, insulated <input checked="" type="checkbox"/> nitrile gloves <input type="checkbox"/> Impact Resistant Gloves



Job Safety Analysis



JSA Description: Hand Augering		Site ID:							Date: 1/6/2015	
Job Steps	Potential Hazard(s)	Gravity	Mechanical	Motion	Pressure	Radiation	Sound	Temperature		
		1. Critical Action(s)							Responsible Person(s) - Initials	Mitigation Steps Verified ¹
1. Stage at pre-determined sampling location and set up work zone and sampling equipment	MOTION - Struck by vehicular traffic resulting in serious injury or death									
	MOTION - Back and muscle strains from carrying equipment									
	GRAVITY - Slips trips or falls on equipment or soil sampling materials resulting in broken bones, lacerations or sprains									
	MOTION - Personnel could be approached by trespassers or other community members									
	ELECTRICAL - Shock or injury from subsurface utilities									

<p>2. Hand Auger Advancement Activities</p>			
	<p>MOTION - Hitting a coworker or bystander with the hand auger</p>	<p>1. Do not lift hand auger above the shoulders. 2. Keep at least 10 feet between person augering and nearest other person.</p>	
	<p>MOTION - Back strain from hand augering and repetitive motions</p>	<p>1. Bend and squat at the knees and not at the waist when collecting samples. 2. Trade off with field co-worker every 15 minutes. 3. Add rod extensions as needed to keep auger handle between lower thighs and chest.</p>	
	<p>CHEMICAL - Skin irritation from contact with contaminated soil</p>	<p>1. Avoid handling contaminated soil with hands. 2. Wear nitrile gloves over Type II cut resistant gloves when handling soil.</p>	
	<p>MOTION - Blister or lacerations to hands and cuts from handle/bucket</p>	<p>1. Avoid placing hands on the sharp auger bucket. 2. Wear Type II cut resistant gloves when assembling and advancing the hand auger to prevent lacerations or blisters from forming on hands.</p>	
<p>3. Soil Sample Collection</p>	<p>TEMPERATURE - Heat Exhaustion</p>	<p>1. Take frequent breaks to hydrate. 2. Hand auger no more than 15 minutes continuous minutes per person before taking a break and switching with another co-worker. 3. Monitor co-workers for signs of heat stress/illness. 4. Purchase and use cooling products (neck coolers, bandanas, fans, etc.) if available.</p>	

		Temperature (°F)	Maximum Allowable		Minimum Mandatory Rest Time	
			Work Time	Rest Time		
		95+	8 minutes	15 minutes		
		85-95	13 minutes	10 minutes		
		75-85	20 minutes	10 minutes		
	MOTION - Back strain from bending over to collect samples	1. Bend and squat at knees and not at the waist when collecting samples.				
	CHEMICAL - Skin irritation from contact with contaminated soil	1. Avoid handling contaminated soil with hands. 2. Wear nitrile gloves over Type II cut-resistant gloves when handling contaminated soil.				
	MOTION - Cuts/lacerations from broken sample containers	1. Do not use broken glassware. Do not over tighten sample containers. 2. Wear nitrile gloves over Type II cut-resistant gloves when tightening jars.				

Notes:

1 – Site Checker may be any ARCADIS employee or Subcontractor under direct contract by ARCADIS. The Site Checker may be the Responsible Person, Site H&S Officer, Construction Manager, Project Manager, Subcontractor, etc.



TEAM Chevron

Job Safety Analysis

JSA Description: Monitoring Well Installation		
Project Name:	Site Address:	Field Leader:
Date of JSA Development: 1/7/2015	Project No:	
Development Team Please include the team members employer and email if not employed by ARCADIS:	Position/Title:	Phone Number
Reviewed By Please include the reviewers employer and email if not employed by ARCADIS:	Position/Title:	Review Date (MM/DD/YYYY)
Jav White	H&S Administrator	01/07/2014
Permits Required (general, hi-risk, etc.):	General PTW	
Specialized tools/equipment:	Geoprobe	
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT		
<input checked="" type="checkbox"/> (Class II) High-visibility vest or appropriate high-visibility clothing. <input checked="" type="checkbox"/> Long pants/Long shirt <input checked="" type="checkbox"/> Safety glasses, wraparound or with side shields labeled with ANSI Z87.1 rating, or a certification card for lenses and frames <input checked="" type="checkbox"/> Safety footwear meeting ASTM F2413-05 standard with chemical or oil resistant soles <input checked="" type="checkbox"/> Long-sleeved shirts <input checked="" type="checkbox"/> High visibility work gloves (when high visibility glove options exist for a particular glove type) <input checked="" type="checkbox"/> Hard hat that complies with ANSI Z89.1		
Personal Protective Equipment (PPE) Determination		
Check all that apply <input checked="" type="checkbox"/> and follow requirements associated with selection in PPE Hazard Assessment (App. H in HASP)		

Eye Protection

- Chemical protective goggles that comply with ANSI Z87.1
- Impact goggles that comply with ANSI Z87.1
- Flexible goggles that comply with ANSI Z87.1
- Welding goggles /helmet or face shield. Tinted lenses required. PPE must comply with Z87.1
- Laser safety glasses that comply with ANSI

Hazardous Atmosphere

- Photoionization detector (PID)
- Flame Ionization Detector (FID)
- Dust monitor
- LEL / O₂ meter
- H₂S meter

Head Protection

- Type E Hardhat (Electrical)
- Hard hat with chin strap, miner's helmet with chin strap or mountaineering helmet with chin strap

Body Protection

- Chemical resistant clothing recommended on SDS
- Chain saw chaps
- Snake chaps OR boots marketed as "snake proof"³
- DOT Class III vest (low light conditions or traffic flow at 50 mph or more)
- DOT Class II or III tear away vest when working around rotating or moving parts
- Sunscreen lotion >= SPF 30
- Insect repellent
- US Coast Guard approved personal flotation device (PFD) – Type I, II or III

Foot Protection

- Safety shoes or boots with metatarsal guards
- Safety boots with puncture-resistant midsoles or that have built-in puncture resistance (PR rated)
- Safety boots with electric hazard (EH) protection (standard in most footwear)
- Rubber-sole boots or grips
- Chemical resistant boot covers
- Lace-up safety boots conforming to ASTM F2413-05 or equivalent in non-US jurisdictions

Face Protection

- chemical protective goggles that comply with ANSI Z87.1
- Face Shield

Hearing Protection

- Ear Plugs (noise 80 db)
- Ear Muffs with Ear Plugs (noise 105 db)

Respiratory Protection

- Half-face respirator
- Full-face respirator
- SCBA

Fall Protection

- Personal fall arrest system designed or approved by a qualified person OR other means of fall protection determined by qualified person

Heat, Flame, Flash Fire or Arc Hazard

- cooling vest
- Fire retardant clothing (FRC)











Hand Protection

- chemical resistant gloves per SDS
- cut-resistant gloves or liners
- Leather/work gloves
- welding gloves
- leather gloves, insulated
- nitrile gloves
- Impact Resistant Gloves



Job Safety Analysis



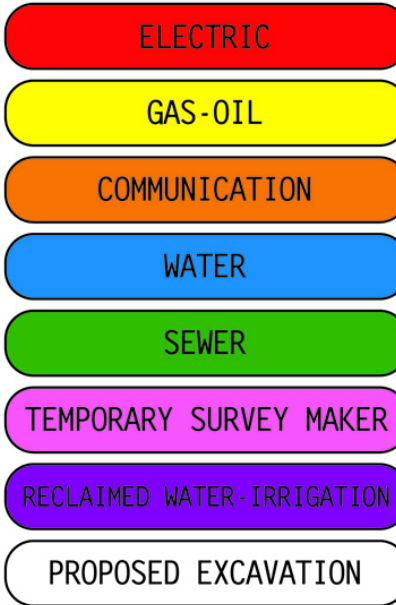
JSA Description: Monitoring Well Installation				Site ID:			Date: 1/7/2015		
 Biological  Chemical  Electrical  Gravity  Mechanical  Motion  Pressure  Radiation  Sound  Temperature									
Job Steps	Potential Hazard(s)	Critical Action(s)	Responsible Person(s) - Initials	Mitigation Steps Verified ¹					
1. Set up work zone	MOTION - Broken bones, sprains, lacerations, or death resulting by being struck by vehicle	1. Observe proposed area of work for potential hazards including moving vehicles and pedestrian traffic. 2. Use Traffic Control Plan to position work vehicle and cones or barricades.							
	MOTION - Nails or other sharp objects piercing the bottoms of boot and feet	1. Perform a site walk to visually confirm that area is clear of nails and other sharp objects on the ground. Use a broom to push any debris or sharp objects out of the work area. 2. Wearing puncture resistant boots or steel sole inserts to prevent sharp objects from piercing the bottom of boots.							
	GRAVITY - Slip, Trip and Fall hazard resulting in broken bones, sprains, abrasions or lacerations.	1. Observe work zone for potential slip, trip and fall hazards including uneven surfaces, pot holes, wet or slick surfaces. Move work zone if possible to avoid these hazards.							
	MECHANICAL - Lacerations or abrasions associated with handling A-Frame barricades	1. Inspect Cones with flag poles for potential pinch point when inserting pole. Do not place finger in line of fire. 2. Wear Level 2 cut resistant gloves to protect hands from lacerations or abrasions.							
2. Soft dig to clear utilities to a depth of 8 ft.	MOTION - Sprains or strains to hands and arms while hand auguring	1. Take breaks every 30 minutes and switch personnel at 2 foot intervals.							
	MOTION - Lacerations to hands while utilizing hand auger	1. Inspect hand auger handle, rods, and bucket for sharp edges or burs. Do not handle hand auger by sharp or leading edges. 2. Wear class II cut-resistant gloves to prevent lacerations, abrasions and blisters.							

	MOTION - Muscle strain due to twisting motion and pulling auger from borehole	<ol style="list-style-type: none"> 1. Take breaks every 30 minutes and switch personnel at 2 foot intervals. Do not twist hand auger above chest level or below waist level. Keep back straight while advancing hand auger. 2. Lift auger with the knees and arms and not the back. 		
	GRAVITY - Cuttings falling onto workers and resulting in chemical exposure and dermal irritations	<ol style="list-style-type: none"> 1. Remove cuttings at chest level by tapping with a rubber mallet. 2. When removing hand auger bucket keep bucket a minimum of 2 feet from face to reduce risk of dermal contact with soil. 3. Wear hard hat, nitrile gloves, long sleeves and safety glasses reduce risk of dermal contact. 		
3. Position drill rig at proposed well location	MOTION - Broken bones, lacerations, abrasions, sprains or death due to drill rig striking workers or pedestrians during vehicle travel to proposed boring location	<ol style="list-style-type: none"> 1. Establish a pedestrian-free zone between parked drill rig and proposed boring location. 2. Spotter must escort drill rig while maintaining a 45-degree position to movement of the drill rig. 3. Spotter must maintain a buffer of 10 feet from drill rig. Do not allow workers to walk within 20 feet of front of or 20 feet behind drill rig while it is moving. 4. Maintain contact with driver of drill rig. Drill rig driver must wait for spotter to confirm it is safe to back vehicle. 5. All personnel must remain at least 10 feet from drill rig while it is moving. Spotter must remain outside of the line of fire (direct path) of the drill rig. Any time the driver and spotter cannot see each other, the driver must stop the drill rig immediately. 6. Ground workers must wear DOT Class II or higher hi-visibility traffic vests to increase visibility of workers to operator. 		
	MECHANICAL - Broken bones, lacerations, abrasions, sprains or death due to drill rig striking workers or pedestrians by slipping out of gear	<ol style="list-style-type: none"> 1. When drill rig is in final position, place wheel chocks on both sides of rear tire. 		
	ELECTRICAL - Electrocution or explosion from contact with overhead and underground utilities by drill rig operator	<ol style="list-style-type: none"> 1. Confirm that utility location mark outs are current and visible. 2. Look up to see if there are any overhead power lines. 3. Do not operate excavator within 10 feet of overhead power line. 		


Power Line Voltage Phase to phase (kV)	Minimum Safe Clearance (feet)
50 or below	10
Above 50 to 200	15
Above 200 to 350	20
Above 350 to 500	25
Above 500 to 750	35
Above 750 to 1,000	45

ANSI standard B30.5-1994, 5-3.4.5

- Underground utilities must be physically identified and cleared prior to excavating.
- Do not begin excavation until the area has been cleared by the Site Supervisor.



<p>4. Commence advancement of hollow stem auger</p>	<p>MECHANICAL - Broken bones, lacerations, abrasions, sprains or death due worker being pulling in to spinning auger.</p>	<ol style="list-style-type: none"> All workers must remain outside of work zone during drilling activities. Loose clothing and jewelry must be removed prior to drilling. Long hair must be tied and tucked under clothing or hard hat Only one operator may stand at controls 		
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		<ol style="list-style-type: none"> Driller's helper must remain at least 5 feet from moving augers Initial placement of drill rig should be so that workers are upwind of boring. Drill cuttings should be placed in a drum at edge of exclusion zone during drilling activity to reduce potential for chemical exposure. Cutting removal should only take place when auger is not moving to prevent injury due to contact with moving augers. Workers must wear Class II cut-resistant gloves with nitrile glove liners to prevent abrasions/lacerations and dermal exposure to petroleum impacted soils 		
	CHEMICAL - Inhalation, eye and dermal exposure to petroleum impacted soil resulting in irritation	<ol style="list-style-type: none"> Air monitoring with a calibrated photo-ionization (PID) detector (fitted with a 10.6 eV bulb) must be utilized to determine concentrations of petroleum vapors in breathing zone. If PID reading exceeds 0.5 ppm, benzene-specific monitoring must take place with a colorimetric tube or real-time monitoring device. Workers must wear safety glasses to prevent soil to eye contact. 		
5. Cut section of PVC well casing	MOTION - Lacerations or abrasions to hand, arm or leg from reciprocating saw or hand saw.	<ol style="list-style-type: none"> Place PVC in a vice before cutting. Keep hands 1-foot away from cutting surface during activity. Wear Class II cut-resistant gloves to prevent soft tissue injury. 		
	MOTION - Lacerations or abrasions to hand from rough edge of PVC surface.	<ol style="list-style-type: none"> Utilize a file or sandpaper to remove sharp PVC cutting from pipe end. Wear Class II cut-resistant gloves to prevent soft tissue injury. 		
6. Install well casing	MOTION - Muscle strain due to lifting heavy PVC well casing	<ol style="list-style-type: none"> Utilize buddy system to place well casing in borehole to reduce muscle strain. Lift with the knees and not the legs. Assemble the well sections in phases to reduce weight and muscle strain 		
	MOTION - Striking other workers with PVC casing resulting in lacerations, abrasions or bruises	<ol style="list-style-type: none"> Utilize buddy system and maintain control of casing ends. Non-essential workers must remain out of exclusion zone during monitoring well casing. Assemble well sections in phases to reduce well casing length and control. 		
7. Placing sand and bentonite packs	MOTION - Muscle strain from lifting bags of sand and bentonite	<ol style="list-style-type: none"> Scoot bags to edge of trailer or truck bed before attempting lift to prevent worker from lifting in awkward position. Lift with arms and legs to prevent muscle strain. Carry bags close to body keeping back straight. 		

	GRAVITY - Tripping over bags of sand and bentonite (full and empty bags) resulting in broken bones, lacerations, abrasions, and sprains	1. Place bags in a designated and identified staging area that is outside of established walk paths. Place cones around staging area. After contents of bags are placed in well, place empty bag in trash receptacle at edge of exclusion zone.		
	MOTION - Lacerations to hand or other body part while opening bags of sand and/or bentonite	1. Utilize safety knife when opening bags to reduce change of laceration injury. 2. Wear Class II cut-resistant gloves to prevent soft tissue injury.		
8. Install man hole assembly and concrete pad	MOTION - Lacerations or abrasions from metal to skin contact.	1. Carry manhole assembly in box to the well location. Remove manhole assembly by contacting the lid and not the thin skirt to reduce change of laceration. 2. Wear Class II cut-resistant gloves to prevent soft tissue injury.		
	MOTION - Muscle strain due to lifting concrete bags and mixing concrete	1. Scoot bags to edge of trailer or truck bed before attempting lift to prevent worker from lifting in awkward position. Lift with arms and legs to prevent muscle strain. Carry bags close to body keeping back straight.		
	CHEMICAL - Inhalation of concrete dust during concrete mixing phase	1. Remain upwind of dry concrete when mixing to avoid inhalation of concrete dust. 2. Wear dust mask during mixing to prevent inhalation hazard.		
	MOTION - Cuts and abrasion to knees when finishing well pad	1. Inspect ground surface for puncture and abrasive material 2. Wear knee pads to prevent soft tissue abrasions and bruises.		

Notes:

1 – Verifier may be any ARCADIS employee or Subcontractor under direct contract by ARCADIS. The Verifier may be the Responsible Person, Site H&S Officer, Construction Manager, Project Manager, Subcontractor, etc.

JSA Acknowledgement

"I have read this JSA, and I understand the hazards and safe work practices associated with the task. If conditions change or an additional hazard is recognized, I will Stop Work and notify the Site H&S Officer immediately."

This JSA must be acknowledged by affected workers every time there is a modification to the form

Name	Signature	Initials Used on Form	Date	Name	Signature	Initials Used on Form	Date

End of Day Lookback – Utilize this section to log changes made to the JSA content throughout the day and note any recommendations for Task JSA.

Brief description Lookback	Name Lookback Leader	Date



TEAM Chevron

Job Safety Analysis

JSA Description: Sample Packing and Cooler Handling		
Project Name:	Site Address:	Field Leader:
Date of JSA Development: 1/7/2015	Project No:	
Development Team Please include the team members employer and email if not employed by ARCADIS:	Position/Title:	Phone Number
Reviewed By Please include the reviewers employer and email if not employed by ARCADIS:	Position/Title:	Review Date (MM/DD/YYYY)
Jay White	H&S Administrator	01/07/2014
Permits Required (general, hi-risk, etc.):	General PTW	
Specialized tools/equipment:	Coolers, Sample Bottles	
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT		
<input checked="" type="checkbox"/> (Class II) High-visibility vest or appropriate high-visibility clothing. <input checked="" type="checkbox"/> Long pants/Long shirt <input checked="" type="checkbox"/> Safety glasses, wraparound or with side shields labeled with ANSI Z87.1 rating, or a certification card for lenses and frames <input checked="" type="checkbox"/> Safety footwear meeting ASTM F2413-05 standard with chemical or oil resistant soles <input checked="" type="checkbox"/> Long-sleeved shirts <input checked="" type="checkbox"/> High visibility work gloves (when high visibility glove options exist for a particular glove type) <input checked="" type="checkbox"/> Hard hat that complies with ANSI Z89.1		
Personal Protective Equipment (PPE) Determination		
Check all that apply <input checked="" type="checkbox"/> and follow requirements associated with selection in PPE Hazard Assessment (App. H in HASP)		

Eye Protection

- Chemical protective goggles that comply with ANSI Z87.1
- Impact goggles that comply with ANSI Z87.1
- Flexible goggles that comply with ANSI Z87.1
- Welding goggles /helmet or face shield. Tinted lenses required. PPE must comply with Z87.1
- Laser safety glasses that comply with ANSI

Hazardous Atmosphere

- Photoionization detector (PID)
- Flame Ionization Detector (FID)
- Dust monitor
- LEL / O₂ meter
- H₂S meter

Head Protection

- Type E Hardhat (Electrical)
- Hard hat with chin strap, miner's helmet with chin strap or mountaineering helmet with chin strap

Body Protection

- Chemical resistant clothing recommended on SDS
- Chain saw chaps
- Snake chaps OR boots marketed as "snake proof"³
- DOT Class III vest (low light conditions or traffic flow at 50 mph or more)
- DOT Class II or III tear away vest when working around rotating or moving parts
- Sunscreen lotion >= SPF 30
- Insect repellent
- US Coast Guard approved personal flotation device (PFD) – Type I, II or III

Foot Protection

- Safety shoes or boots with metatarsal guards
- Safety boots with puncture-resistant midsoles or that have built-in puncture resistance (PR rated)
- Safety boots with electric hazard (EH) protection (standard in most footwear)
- Rubber-sole boots or grips
- Chemical resistant boot covers
- Lace-up safety boots conforming to ASTM F2413-05 or equivalent in non-US jurisdictions

Face Protection

- chemical protective goggles that comply with ANSI Z87.1
- Face Shield

Hearing Protection

- Ear Plugs (noise 80 db)
- Ear Muffs with Ear Plugs (noise 105 db)

Respiratory Protection

- Half-face respirator
- Full-face respirator
- SCBA

Fall Protection

- Personal fall arrest system designed or approved by a qualified person OR other means of fall protection determined by qualified person

Heat, Flame, Flash Fire or Arc Hazard

- cooling vest
- Fire retardant clothing (FRC)











Hand Protection

- chemical resistant gloves per SDS
- cut-resistant gloves or liners
- Leather/work gloves
- welding gloves
- leather gloves, insulated
- nitrile gloves
- Impact Resistant Gloves



Job Safety Analysis



JSA Description: Sample Packing and Cooler Handling				Site ID:		Date: 1/7/2015			
 Biological  Chemical  Electrical  Gravity  Mechanical  Motion  Pressure  Radiation  Sound  Temperature									
Job Steps	Potential Hazard(s)	Critical Action(s)	Responsible Person(s) - Initials	Mitigation Steps Verified ¹					
1. Setup processing area and unpack equipment	Motion - Struck by other vehicles due to lack of traffic controls or poor visibility	1. Locate non-traffic or low traffic areas to setup work station. 2. Park support vehicle away from active traffic or between work area and active traffic to protect workers from traffic. 3. Scan area for moving vehicles and hazards before opening door 4. Place cones around vehicle to alert drivers of upcoming work and to demarcate work area. 5. Wear reflective vest to increase visibility to drivers and reduce struck by hazard.							
	Motion/Gravity – Tripping over site debris/trip hazards or equipment on the ground	1. Visually check area to identify and remove trip hazards (equipment, debris). If hazards cannot be removed (uneven ground, roots, rocks) mark with cones, high visibility tape or flagging and notify others working in area. 2. Designate equipment storage area within work area to prevent clutter and reduce trip hazards. 3. Do not place any equipment in walking path.							
	Motion - Back strain from lifting coolers using improper lifting techniques	1. Do not lift loads heavier than 50 pounds without assistance from another person. 2. Get a firm grip, lift using legs and keep back straight, do not bend or twist at waist. 3. If possible, use portable field table, or secure work surface at table height to prepare packages.							

		4. Stage field vehicle as close as possible to cooler packing/staging area to minimize distance that coolers must be carried during loading.		
	Gravity - Dropping equipment on self or others causing injury	1. Lift coolers using designated handles and confirm they are securely attached prior to lifting. 2. Plan route and verify clear before starting lift.		
	Lacerations/pinch points on equipment when setting up work area	1. Identify pinch points on equipment and cases such as hinges, and keep hands 6 inches from identified pinch areas. 2. Use only closed-blade or self-retracting cutting tools to cut tape when opening taped coolers and wear cut resistant gloves. 3. Maintain a 4-foot radius from others when using cutting tools and always cut away from body.		
	Chemical - Chemical burns from broken/leaking sample bottles containing preservatives	1. Use wet paper towel to carefully remove leaking preservative from the outside of other sample containers and the cooler. 2. Do not touch broken sample bottles; discard bottles in accordance with Site waste disposal practices. 3. Do not touch glass or preservatives with bare hands. 4. If chemicals contact clothes, removed soiled clothing and wash contacted area on body. 5. Wear nitrile gloves over cut-resistant gloves to prevent dermal contact with leaking preservative when unpacking cooler from lab. 6. Wear safety glasses at all times to protect eyes from contact with chemicals.		
2. Packaging Samples	Chemical - Contact with contaminated soils on outside of sample bottles	1. Visually inspect bottles and wipe off any soil observed on outside of container before placing into bubble wrap and cooler. 2. Wear nitrile gloves when handling sample containers to avoid contact with soils.		
	Motion - Lacerations from broken sample containers or when taping coolers for shipment	1. Place glass containers in bubble wrap before placing in cooler. 2. Handle full bottles (liter) with 2 hands and dry outside with paper towels to avoid dropping. 3. Use minimal hand pressure necessary to remove or tighten bottle lids/caps. 4. Once lids/caps on VOA vials are placed on containers and tightened to where there is no leakage, do not over-tighten to prevent breakage of glass and potential lacerations to hands. 5. Pack sample bottles tightly in cooler and use bubble wrap to reduce excess space/potential for breakage. 6. Use only closed-blade cutting tools to cut tape when preparing coolers for shipment to prevent potential lacerations to hands.		
	Gravity/Motion -Exertion/muscle strain from lifting heavy coolers to place in vehicle	1. Bend at knees and keep back straight, do not twist or bend at waist.		

- | | | | | |
|--|--|---|--|--|
| | | <ol style="list-style-type: none">2. Limit weight of each cooler when packing and use two-man lift if carrying loads heavier than 50 pounds.3. Use countdown of 3 and keep continuous conversation if using 2 people to lift and carry coolers.4. Use cooler handles when lifting coolers, verify that handles are not broken prior to lifting.5. Plan route and have clear path of travel, secure equipment in vehicle once loaded. | | |
|--|--|---|--|--|



Notes:

1 – Verifier may be any ARCADIS employee or Subcontractor under direct contract by ARCADIS. The Verifier may be the Responsible Person, Site H&S Officer, Construction Manager, Project Manager, Subcontractor, etc.



TEAM Chevron

Job Safety Analysis

JSA Description: Soil Screening		
Project Name:	Site Address:	Field Leader:
Date of JSA Development: 1/7/2015	Project No:	
Development Team Please include the team members employer and email if not employed by ARCADIS:	Position/Title:	Phone Number
Reviewed By Please include the reviewers employer and email if not employed by ARCADIS:	Position/Title:	Review Date (MM/DD/YYYY)
Jav White	H&S Administrator	01/07/2014
Permits Required (general, hi-risk, etc.):	General PTW	
Specialized tools/equipment:		
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT		
<input checked="" type="checkbox"/> (Class II) High-visibility vest or appropriate high-visibility clothing. <input checked="" type="checkbox"/> Long pants/Long shirt <input checked="" type="checkbox"/> Safety glasses, wraparound or with side shields labeled with ANSI Z87.1 rating, or a certification card for lenses and frames <input checked="" type="checkbox"/> Safety footwear meeting ASTM F2413-05 standard with chemical or oil resistant soles <input checked="" type="checkbox"/> Long-sleeved shirts <input checked="" type="checkbox"/> High visibility work gloves (when high visibility glove options exist for a particular glove type) <input checked="" type="checkbox"/> Hard hat that complies with ANSI Z89.1		
Personal Protective Equipment (PPE) Determination		
Check all that apply <input checked="" type="checkbox"/> and follow requirements associated with selection in PPE Hazard Assessment (App. H in HASP)		

Eye Protection

- Chemical protective goggles that comply with ANSI Z87.1
- Impact goggles that comply with ANSI Z87.1
- Flexible goggles that comply with ANSI Z87.1
- Welding goggles /helmet or face shield. Tinted lenses required. PPE must comply with Z87.1
- Laser safety glasses that comply with ANSI

Hazardous Atmosphere

- Photoionization detector (PID)
- Flame Ionization Detector (FID)
- Dust monitor
- LEL / O₂ meter
- H₂S meter

Head Protection

- Type E Hardhat (Electrical)
- Hard hat with chin strap, miner's helmet with chin strap or mountaineering helmet with chin strap

Body Protection

- Chemical resistant clothing recommended on SDS
- Chain saw chaps
- Snake chaps OR boots marketed as "snake proof"³
- DOT Class III vest (low light conditions or traffic flow at 50 mph or more)
- DOT Class II or III tear away vest when working around rotating or moving parts
- Sunscreen lotion >= SPF 30
- Insect repellent
- US Coast Guard approved personal flotation device (PFD) – Type I, II or III

Foot Protection

- Safety shoes or boots with metatarsal guards
- Safety boots with puncture-resistant midsoles or that have built-in puncture resistance (PR rated)
- Safety boots with electric hazard (EH) protection (standard in most footwear)
- Rubber-sole boots or grips
- Chemical resistant boot covers
- Lace-up safety boots conforming to ASTM F2413-05 or equivalent in non-US jurisdictions

Face Protection

- chemical protective goggles that comply with ANSI Z87.1
- Face Shield

Hearing Protection

- Ear Plugs (noise 80 db)
- Ear Muffs with Ear Plugs (noise 105 db)

Respiratory Protection

- Half-face respirator
- Full-face respirator
- SCBA

Fall Protection

- Personal fall arrest system designed or approved by a qualified person OR other means of fall protection determined by qualified person

Heat, Flame, Flash Fire or Arc Hazard

- cooling vest
- Fire retardant clothing (FRC)

Hand Protection

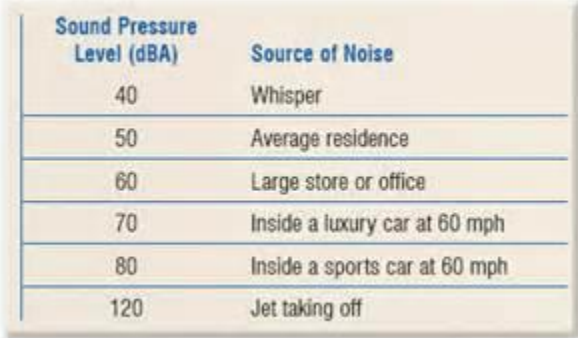
- chemical resistant gloves per SDS
- cut-resistant gloves or liners
- Leather/work gloves
- welding gloves
- leather gloves, insulated
- nitrile gloves
- Impact Resistant Gloves



Job Safety Analysis



JSA Description: Soil Screening		Site ID:		Date: 1/7/2015	
Job Steps		Potential Hazard(s)	Critical Action(s)	Responsible Person(s) - Initials	Mitigation Steps Verified ¹
<div style="display: flex; justify-content: space-around; text-align: center;"> <div> Biological</div> <div> Chemical</div> <div> Electrical</div> <div> Gravity</div> <div> Mechanical</div> <div> Motion</div> <div> Pressure</div> <div> Radiation</div> <div> Sound</div> <div> Temperature</div> </div>					
1. Set up of sampling equipment	MOTION - Lacerations from sharp edges of well head resulting in hand lacerations or abrasions	<ol style="list-style-type: none"> Do not grab edge of well head. Visually identify and verbalize sharp edges and pinch points with site workers. Wear Level 2 cut resistant gloves while handling equipment/debris to prevent hand lacerations. 			
	GRAVITY - Slip/Trips/Falls over sampling equipment resulting in broken bones, sprains, or lacerations	<ol style="list-style-type: none"> Visually check for and remove trip hazards prior to setup of sampling equipment. Stage equipment in one central location to minimize trip hazards. 			
	MOTION - Struck by vehicle resulting in broken bones, lacerations, abrasions, sprains or death	<ol style="list-style-type: none"> Scan work zone and surrounding area for vehicle traffic. If vehicle approaches work zone or parks beside work zone STOP WORK, make eye contact with driver and wait for vehicle to stop and driver to exit vehicle leaving work zone prior to resuming activities. Wear DOT Class II or higher hi-visibility traffic vests to make personnel more visible to on and off site traffic. 			
	MOTION - Nails or other sharp objects piercing the bottoms of boot and feet	<ol style="list-style-type: none"> Perform a site walks to clear area of nails and other sharp objects on the ground using broom to push the objects out of the work area. Wearing puncture resistant boots or steel sole inserts to prevent sharp objects from piercing the bottom of boots. 			
2. Collect soil sample for screening	GRAVITY - Slip, trip and fall hazard over sample equipment or debris in walking path resulting in broken bones, sprains, or lacerations	<ol style="list-style-type: none"> Keep sample equipment off ground and out of walking path. Designate a clear walking path from sample collection site to staging area where samples will be screened. Remove all debris from walking path. Mark fixed debris with high visibility marking paint or cones and verbalize hazard with other site workers. 			

	CHEMICAL - Removal of soil from hand auger bucket resulting in dermal exposure to potentially contaminated soils resulting in dermal irritation	<ol style="list-style-type: none"> 1. Keep hand auger bucket away from face while removing soils from hand auger bucket. 2. Wear nitrile gloves, long sleeves, and safety glasses with side shields to reduce exposure to potentially contaminated soils. 																
	MOTION - Removal of soils from hand auger bucket with mallet resulting lacerations, abrasions, or bruises to hands and fingers	<ol style="list-style-type: none"> 1. Do not hold hand auger bucket directly with hand while tapping loose soils from bucket. 2. Hold hand auger set by the lowest extension, above the top of the bucket, and tap lightly until soil becomes loose. 3. Wear leather gloves under nitriles to reduce impact hazard to hands and fingers. 																
	SOUND - Removal of soils from hand auger bucket with mallet resulting in hearing damage	<ol style="list-style-type: none"> 1. Tap hand auger bucket lightly until soils become loose. Use a rubber mallet to reduce high frequency pings while tapping bucket. 2. Wear ear plugs while tapping bucket to prevent overexposure to high noises.  <table border="1"> <thead> <tr> <th>Sound Pressure Level (dBA)</th> <th>Source of Noise</th> </tr> </thead> <tbody> <tr> <td>40</td> <td>Whisper</td> </tr> <tr> <td>50</td> <td>Average residence</td> </tr> <tr> <td>60</td> <td>Large store or office</td> </tr> <tr> <td>70</td> <td>Inside a luxury car at 60 mph</td> </tr> <tr> <td>80</td> <td>Inside a sports car at 60 mph</td> </tr> <tr> <td>120</td> <td>Jet taking off</td> </tr> </tbody> </table>	Sound Pressure Level (dBA)	Source of Noise	40	Whisper	50	Average residence	60	Large store or office	70	Inside a luxury car at 60 mph	80	Inside a sports car at 60 mph	120	Jet taking off		
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3. Screen soil sample	CHEMICAL - Dermal exposure to potentially impacted soils resulting in dermal irritation	<ol style="list-style-type: none"> 1. Keep face away from opening of sample bag while conducting soil screening. Open zip lock of bag enough to insert only the tip of screening probe into the bag. 2. Wear nitrile gloves, long sleeves, and safety glasses with side shields during screening to minimize dermal exposure. 																
	CHEMICAL - Chemical exposure from vapor/gas inhalation resulting in personal injury or asphyxiation	<ol style="list-style-type: none"> 1. Keep face away from sample bag opening. 2. Work upwind of while screening soils. 3. STOP WORK and report any noticeable vapors to supervisor. 																
4. Disposal of soil samples	GRAVITY - Slip, trip, or falls over refuse bucket or soil piles resulting in lacerations, abrasions, sprains, or broken bones	<ol style="list-style-type: none"> 1. Stage spent soil bucket and soil piles out of walking path. 2. Delineate spent soil bucket or soil piles with cones and high visibility tape. 3. Spread spent soils on ground outside of work zone in predetermined location away from walking paths and communicate location with other site workers. 																
	MOTION - Lacerations or abrasions to fingers or hands when handling and placing drum lid	<ol style="list-style-type: none"> 1. Keep hands away from leading edges on drum lids. Do not place fingers between rim of well and edge of drum lid. 																

		2. Use Level 2 cut-resistant gloves when handling well lids to prevent lacerations or abrasions to hands and fingers.		
5. Take down sampling equipment	MOTION - Back/muscle strain from loading equipment	1. Do not lift weight >50 lbs, lift with legs and not the back and keep all loads close to your body. Reposition body using feet, do not twist at waist.		
	MOTION - Lacerations to hands from sharp edges of equipment	1. Use handles on equipment to avoid grabbing sharp edges. 2. Avoid grabbing/holding sharp edges/points and wear Level 2 cut-resistant gloves while handling equipment.		
6. Set up of sampling equipment	GRAVITY - Slip/Trips/Falls on equipment resulting in broken bones, sprains, or lacerations	1. Visually check for and remove trip hazards in work area 2. Stage equipment in one central location to minimize trip hazards.		
	MOTION - Lacerations from sharp edges of well head resulting in hand lacerations or abrasions	1. Do not grab edge of well head. Visually identify and verbalize sharp edges and pinch points with site workers. 2. Wear Level 2 cut resistant gloves while handling equipment/debris to prevent hand lacerations.		
	GRAVITY - Slip/Trips/Falls over sampling equipment resulting in broken bones, sprains, or lacerations	1. Visually check for and remove trip hazards prior to setup of sampling equipment. 2. Stage equipment in one central location to minimize trip hazards.		

Notes:

1 – Verifier may be any ARCADIS employee or Subcontractor under direct contract by ARCADIS. The Verifier may be the Responsible Person, Site H&S Officer, Construction Manager, Project Manager, Subcontractor, etc.



TEAM Chevron

Job Safety Analysis

JSA Description: Air Knife Hand Clearing		
Project Name:	Site Address:	Field Leader:
Date of JSA Development: 1/5/2015	Project No:	
Development Team Please include the team members employer and email if not employed by ARCADIS:	Position/Title:	Phone Number
Reviewed By Please include the reviewers employer and email if not employed by ARCADIS:	Position/Title:	Review Date (MM/DD/YYYY)
Jay White	H&S Administrator	01/05/2014
Permits Required (general, hi-risk, etc.):	General PTW, Excavation/Trenching/Overhead Clearance/Drilling HRPTW	
Specialized tools/equipment:	Air Knife, Vac Truck	
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT		
<input checked="" type="checkbox"/> (Class II) High-visibility vest or appropriate high-visibility clothing. <input checked="" type="checkbox"/> Long pants/Long shirt <input checked="" type="checkbox"/> Safety glasses, wraparound or with side shields labeled with ANSI Z87.1 rating, or a certification card for lenses and frames <input checked="" type="checkbox"/> Safety footwear meeting ASTM F2413-05 standard with chemical or oil resistant soles <input checked="" type="checkbox"/> Long-sleeved shirts <input checked="" type="checkbox"/> High visibility work gloves (when high visibility glove options exist for a particular glove type) <input checked="" type="checkbox"/> Hard hat that complies with ANSI Z89.1		
Personal Protective Equipment (PPE) Determination		
Check all that apply <input checked="" type="checkbox"/> and follow requirements associated with selection in PPE Hazard Assessment (App. H in HASP)		

Eye Protection

- Chemical protective goggles that comply with ANSI Z87.1
- Impact goggles that comply with ANSI Z87.1
- Flexible goggles that comply with ANSI Z87.1
- Welding goggles /helmet or face shield. Tinted lenses required. PPE must comply with Z87.1
- Laser safety glasses that comply with ANSI

Hazardous Atmosphere

- Photoionization detector (PID)
- Flame Ionization Detector (FID)
- Dust monitor
- LEL / O₂ meter
- H₂S meter

Head Protection

- Type E Hardhat (Electrical)
- Hard hat with chin strap, miner's helmet with chin strap or mountaineering helmet with chin strap

Body Protection

- Chemical resistant clothing recommended on SDS
- Chain saw chaps
- Snake chaps OR boots marketed as "snake proof"³
- DOT Class III vest (low light conditions or traffic flow at 50 mph or more)
- DOT Class II or III tear away vest when working around rotating or moving parts
- Sunscreen lotion >= SPF 30
- Insect repellent
- US Coast Guard approved personal flotation device (PFD) – Type I, II or III

Foot Protection

- Safety shoes or boots with metatarsal guards
- Safety boots with puncture-resistant midsoles or that have built-in puncture resistance (PR rated)
- Safety boots with electric hazard (EH) protection (standard in most footwear)
- Rubber-sole boots or grips
- Chemical resistant boot covers
- Lace-up safety boots conforming to ASTM F2413-05 or equivalent in non-US jurisdictions

Face Protection

- chemical protective goggles that comply with ANSI Z87.1
- Face Shield

Hearing Protection

- Ear Plugs (noise 80 db)
- Ear Muffs with Ear Plugs (noise 105 db)

Respiratory Protection

- Half-face respirator
- Full-face respirator
- SCBA

Fall Protection

- Personal fall arrest system designed or approved by a qualified person OR other means of fall protection determined by qualified person

Heat, Flame, Flash Fire or Arc Hazard

- cooling vest
- Fire retardant clothing (FRC)

Hand Protection

- chemical resistant gloves per SDS
- cut-resistant gloves or liners
- Leather/work gloves
- welding gloves
- leather gloves, insulated
- nitrile gloves
- Impact Resistant Gloves

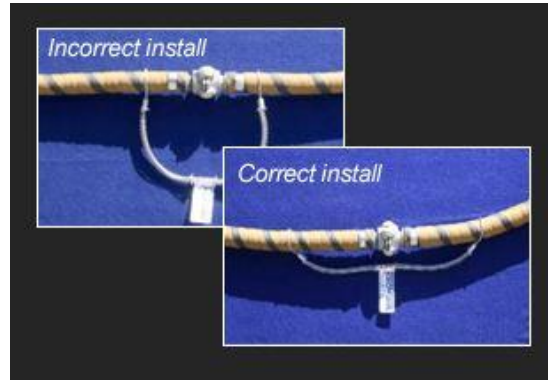


Job Safety Analysis



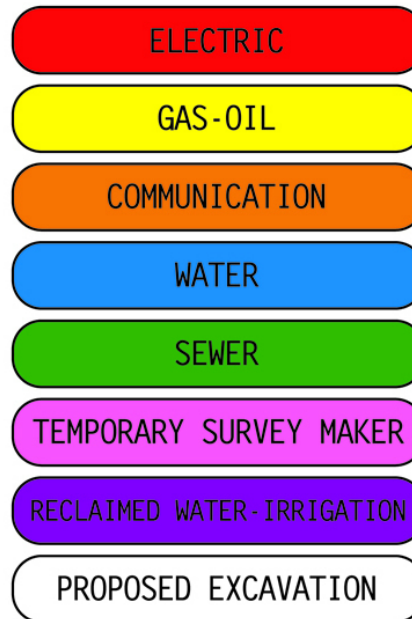
JSA Description: Air Knife Hand Clearing				Site ID:		Date: 1/5/2015				
Biological Chemical Electrical Gravity Mechanical Motion Pressure Radiation Sound Temperature										
Job Steps	Potential Hazard(s)	Critical Action(s)				Responsible Person(s) - Initials	Mitigation Steps Verified ¹			
1. Establish exclusion zone with cones, flags, caution tape, and/or barriers at the proposed air knife location.	MOTION - Injury or death from being struck by motor vehicle	1. Utilize buddy system. One person must focus on establishing work zone while the second person must focus on establishing eye contact with approaching motor vehicle drivers and alerting other workers to potential imminent hazards. 2. Wear DOT Class II or higher hi-visibility traffic vests to make personnel more visible to on and off site traffic.								
	MECHANICAL - Pinch and cuts to hands when carrying A-frame barricades	1. Identify pinch points with tape or high visibility marking ink to increase awareness. 2. Wear minimum Level 2 cut-resistant gloves to reduce potential for soft tissue injuries								
	GRAVITY - Slip, trip and fall hazards associated with debris, fixed obstacles, uneven or slippery surfaces resulting in personal bodily injury	1. Scan proposed work zone for debris, fix obstacles, uneven and slippery surfaces. 2. Remove all debris from work zone and mark fixed obstacles with cones or high visibility marking ink								
2. Air knife location and recover loosened soil using vacuum extraction equipment	PRESSURE - Personal bodily injury resulting from the separation of the pressured air line connection.	1. Prior to start of air knife operation ensure that all air line hoses are in working condition and have whip checks in place. Inspect and document condition of immediately prior to beginning work using heavy equipment checklist 2. Establish eye contact with the air knife operator before entering the exclusion zone. 3. Always point the air knife lance away from your body and other people even if the air knife is not operating.								


- All workers within the exclusion zone must wear a face shield in addition to safety glasses & hearing protection when the air knife is operating.



ELECTRICAL - Physical injury or property damage from encountering an underground utility.

- Prior to start of air knife operation confirm that a public and private utility markout has been conducted. Follow ARCADIS Utility Clearance guidance and verify ARCADIS utility clearance procedures. Follow the Subsurface Clearance Procedure Checklist to minimize encountering an underground utility. If a utility is encountered, immediately **STOP WORK** and call the Project Manager to inform immediately.



	<p>SOUND - Hearing loss due to excessive noise from air knife and vacuum extraction operation.</p>	<ol style="list-style-type: none"> 1. Keep nonessential workers safe working distance of 10 feet from established work zone to distance themselves from high noise levels and disturbed soil blown into the air. 2. Hearing protection is required if workers standing within 3 feet of each other must raise voices to have a conversation (over 85 dB) during air knifing  <table border="1"> <thead> <tr> <th>Sound Pressure Level (dBA)</th> <th>Source of Noise</th> </tr> </thead> <tbody> <tr> <td>40</td> <td>Whisper</td> </tr> <tr> <td>50</td> <td>Average residence</td> </tr> <tr> <td>60</td> <td>Large store or office</td> </tr> <tr> <td>70</td> <td>Inside a luxury car at 60 mph</td> </tr> <tr> <td>80</td> <td>Inside a sports car at 60 mph</td> </tr> <tr> <td>120</td> <td>Jet taking off</td> </tr> </tbody> </table>	Sound Pressure Level (dBA)	Source of Noise	40	Whisper	50	Average residence	60	Large store or office	70	Inside a luxury car at 60 mph	80	Inside a sports car at 60 mph	120	Jet taking off		
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	<p>PRESSURE - Injury to the eyes from soils disturbed during air knife activities.</p>	<ol style="list-style-type: none"> 1. Work upwind of air knife activities 2. Wear safety glasses to prevent soils or dust getting into eyes. Upgrade to spoggles if winds are above 20 mph. 																
	<p>PRESSURE - Physical injury resulting due to the air stream from the air lance.</p>	<ol style="list-style-type: none"> 1. Place air knife lance on the ground after prolonged use to cool. 2. Wear minimum Level 2 cut-resistant gloves to reduce potential for soft tissue injuries 																
	<p>CHEMICAL - Inhalation of chemical fumes from disturbed soil.</p>	<ol style="list-style-type: none"> 1. Continuously monitor proposed trenching area with a calibrated LEL meter. If at any point LEL meter reads 1%, STOP WORK and contact H&S Manager. 2. Wear dust mask if dust is generated during soil disturbance or if vapors/fumes are identified over the PEL. 																

Notes:

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TEAM Chevron

Job Safety Analysis

JSA Description: Air Monitoring		
Project Name:	Site Address:	Field Leader:
Date of JSA Development: 1/5/2015	Project No:	
Development Team Please include the team members employer and email if not employed by ARCADIS:	Position/Title:	Phone Number
Reviewed By Please include the reviewers employer and email if not employed by ARCADIS:	Position/Title:	Review Date (MM/DD/YYYY)
Jav White	H&S Administrator	01/05/2015
Permits Required (general, hi-risk, etc.):	General PTW	
Specialized tools/equipment:		
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT		
<input checked="" type="checkbox"/> (Class II) High-visibility vest or appropriate high-visibility clothing. <input checked="" type="checkbox"/> Long pants/Long shirt <input checked="" type="checkbox"/> Safety glasses, wraparound or with side shields labeled with ANSI Z87.1 rating, or a certification card for lenses and frames <input checked="" type="checkbox"/> Safety footwear meeting ASTM F2413-05 standard with chemical or oil resistant soles <input checked="" type="checkbox"/> Long-sleeved shirts <input checked="" type="checkbox"/> High visibility work gloves (when high visibility glove options exist for a particular glove type) <input checked="" type="checkbox"/> Hard hat that complies with ANSI Z89.1		
Personal Protective Equipment (PPE) Determination		
Check all that apply <input checked="" type="checkbox"/> and follow requirements associated with selection in PPE Hazard Assessment (App. H in HASP)		

Eye Protection

- Chemical protective goggles that comply with ANSI Z87.1
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- Flexible goggles that comply with ANSI Z87.1
- Welding goggles /helmet or face shield. Tinted lenses required. PPE must comply with Z87.1
- Laser safety glasses that comply with ANSI

Hazardous Atmosphere

- Photoionization detector (PID)
- Flame Ionization Detector (FID)
- Dust monitor
- LEL / O₂ meter
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Head Protection

- Type E Hardhat (Electrical)
- Hard hat with chin strap, miner's helmet with chin strap or mountaineering helmet with chin strap

Body Protection

- Chemical resistant clothing recommended on SDS
- Chain saw chaps
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- Sunscreen lotion >= SPF 30
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- US Coast Guard approved personal flotation device (PFD) – Type I, II or III

Foot Protection

- Safety shoes or boots with metatarsal guards
- Safety boots with puncture-resistant midsoles or that have built-in puncture resistance (PR rated)
- Safety boots with electric hazard (EH) protection (standard in most footwear)
- Rubber-sole boots or grips
- Chemical resistant boot covers
- Lace-up safety boots conforming to ASTM F2413-05 or equivalent in non-US jurisdictions

Face Protection

- chemical protective goggles that comply with ANSI Z87.1
- Face Shield

Hearing Protection

- Ear Plugs (noise 80 db)
- Ear Muffs with Ear Plugs (noise 105 db)

Respiratory Protection

- Half-face respirator
- Full-face respirator
- SCBA

Fall Protection

- Personal fall arrest system designed or approved by a qualified person OR other means of fall protection determined by qualified person

Heat, Flame, Flash Fire or Arc Hazard

- cooling vest
- Fire retardant clothing (FRC)

Hand Protection











- chemical resistant gloves per SDS
- cut-resistant gloves or liners
- Leather/work gloves
- welding gloves
- leather gloves, insulated
- nitrile gloves
- Impact Resistant Gloves



Job Safety Analysis



JSA Description: Air Monitoring	Site ID:	Date: 1/5/2015
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 Biological	 Chemical	 Electrical	 Gravity	 Mechanical	 Motion	 Pressure	 Radiation	 Sound	 Temperature
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Job Steps	Potential Hazard(s)	Critical Action(s)	Responsible Person(s) - Initials	Mitigation Steps Verified ¹
1. Calibration of air monitoring equipment	MECHANICAL - Pinch Points to hand and fingers from equipment cases	1. Keep fingers 6 inches from opening and closing edges on equipment cases.		
	GRAVITY - Broken bones, lacerations or sprains from slip, trip, and falls due to site hazards or equipment on the ground	1. Maintain good housekeeping practices in instrument room. 2. Visually check for hazards on ground. Identify and remove trip hazards if possible. If hazard cannot be removed, mark with high-visibility paint or flagging, and notify others. 3. Designate equipment storage area within work area to prevent clutter and reduce trip hazards. 4. Wear steel toe boots with puncture resistant soles to mitigate any debris puncturing the foot and to prevent from any tools being dropped		
	CHEMICAL - Hazardous atmosphere and respiratory irritation from calibration gas	1. Remove nozzle from calibration gas after done calibration to prevent accidental release 2. Keep MSDS onsite for calibration gases		
	MOTION - Laceration to hands from equipment lamps	1. Do not remove PID lamps that are stuck in the lamp housing. Reference equipment manuals for PID maintenance. 2. Wear type II cut resistant gloves to protect hands from lacerations		
	CHEMICAL - Chemical skin irritation from equipment cleaning material	1. Slowly pour cleaning chemicals on areas of the equipment that require regular cleaning. 2. Pour the cleaning materials over a containment pan or bucket to prevent spreading the chemicals over a large area. 3. Wear nitrile gloves and safety glasses to prevent exposure to cleaning chemicals, review and understand MSDS.		

2. Cleaning sensors	CHEMICAL – Skin irritation from splash hazard from cleaners	<ol style="list-style-type: none"> 1. If pouring cleaners, pour slow so no splash occurs 2. Wear safety glasses to protect eyes from splashes and use prongs when placing and removing sensors from cleaning solution. 3. Wear long sleeve shirts to protect against any splashes that may occur 													
	MOTION - Lacerations from equipment sensors	<ol style="list-style-type: none"> 1. Do not grasp sensor tightly to prevent breaking glass when removing sensors from cleaning solution. 													
	MOTION - Struck by or Against vehicles resulting in serious injury or death	<ol style="list-style-type: none"> 1. Look both ways for truck exiting and entering the jobsite. Yield to all truck traffic. 2. Don a high visibility reflective vest to be more visible to other traffic in the area and to mitigate any struck by hazards 3. Don a hard hat to prevent against any overhead hazards and any struck by hazards 													
3. Transport instrument to vehicle	GRAVITY - Broken bones, lacerations or sprains from slips, trips and falls from uneven terrain	<ol style="list-style-type: none"> 1. Maintain three points of contact up and down steps. 2. Maintain solid footing when walking the site. 3. Place ice melt on steps during winter conditions. 													
	MOTION - Personal injury or death from being struck by or against vehicles or equipment	<ol style="list-style-type: none"> 1. Plan work to stay out of active traffic areas and complete during low-traffic times, if possible. 2. Park support vehicle between active traffic and workers to protect workers from traffic. 3. Use traffic control measures (barricades and/or cones) to direct traffic around a designated work area. 4. Wear reflective vest/shirt to increase visibility to drivers. 													
4. Mobilizing and demobilizing instruments at field sampling locations	GRAVITY - Broken bones, lacerations, or sprains from slips, trips and falls from uneven terrain	<ol style="list-style-type: none"> 1. Select even and stable travel routes when walking to the instrument locations. Avoid iced over areas. 													
	BIOLOGICAL - Biological hazards (flying insects, ticks, poisonous snakes)	<ol style="list-style-type: none"> 1. Observe for wasps and bees nest in the instrument stands before placing instruments on the stand. 2. Survey the vegetation and identify poison ivy, oak or sumac and avoid these areas. Survey walking areas for snakes or varmints. 3. Avoid wild animal encounter by staying out of wooded or hidden areas. 													
	BIOLOGICAL - Heat and Cold Stress	<ol style="list-style-type: none"> 1. Cover exposed skin during cold weather conditions to prevent frost bite. 2. Drink fluids to hydrate body during hot weather. 3. Use of sunscreen is recommended to prevent sunburn. <table border="1"> <thead> <tr> <th>Temperature (°F)</th> <th>Maximum Allowable Work Time</th> <th>Minimum Mandatory Rest Time</th> </tr> </thead> <tbody> <tr> <td>95+</td> <td>8 minutes</td> <td>15 minutes</td> </tr> <tr> <td>85-95</td> <td>13 minutes</td> <td>10 minutes</td> </tr> <tr> <td>75-85</td> <td>20 minutes</td> <td>10 minutes</td> </tr> </tbody> </table>	Temperature (°F)	Maximum Allowable Work Time	Minimum Mandatory Rest Time	95+	8 minutes	15 minutes	85-95	13 minutes	10 minutes	75-85	20 minutes	10 minutes	
Temperature (°F)	Maximum Allowable Work Time	Minimum Mandatory Rest Time													
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	ELECTRICAL - Serious injury or death from electrical shock from lightning	<ol style="list-style-type: none"> 1. If lightening is observed, stop work immediately and discontinue work for 30 minutes after the last lightning strike. 2. Do not pick up instruments during lightning storms. 3. Pick up instruments 30 minutes after last lightning strike is observed. 		
	CHEMICAL - Skin and respiratory exposure and irritation to contaminants	<ol style="list-style-type: none"> 1. Use open air environments to allow exposure levels to dissipate prior to sampling. 2. Communicate overexposures in a timely manner to site Health and Safety Manager. 3. Follow proper employee decon JSA when donning/doffing PPE. 4. Don air purifying respirator if exposure level merits Level C protection. 5. Don Tyvek and nitrile gloves in addition to the PPE listed above when entering the exclusion zone to complete air monitoring. Inspect that the coveralls are taped at the cuffs and legs with tape if required. 		
	MOTION - Laceration from tools used to retrieve sample media	<ol style="list-style-type: none"> 1. Inspect hand tools prior to grabbing them. 2. Only place hand in designed location on tools 3. Wear cut resistant gloves underneath nitrile to prevent injury from tools. 		
5. Post Calibration	CHEMICAL - Chemical exposure to skin and respiratory system	<ol style="list-style-type: none"> 1. Work upwind of vapors. 2. See MSDS. 3. Don Nitrile Gloves Required when handling chemicals to prevent skin irritation. 		

Notes:

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JSA Description: Drilling Direct Push - Geoprobe/Hydropunch

Project Name:	Site Address:	Field Leader:
Date of JSA Development: 1/29/2015	Project No:	
Development Team Include the employer and email if not employed by ARCADIS:		Position/Title:
		Phone Number
Reviewed By Include the reviewer's employer and email if not employed by ARCADIS:		Position/Title:
		Review Date (MM/DD/YYYY)
Jay White		Health and Safety Administrator
		1/29/2015

Permits Required (general, hi-risk, etc.):	General PTW, EXCAVATION / TRENCHING / OVERHEAD CLEARANCE / DRILLING
Specialized tools/equipment:	Geoprobe, Hydropunch

MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT

(Class II) High-visibility vest or appropriate high-visibility clothing.
 Long pants
 Long-sleeved shirts
 Safety glasses, wraparound or with side shields labeled with ANSI Z87.1 rating, or a certification card for lenses and frames
 Safety footwear meeting ASTM F2413-05 standard with chemical or oil resistant soles
 High visibility work gloves (when high visibility glove options exist for a particular glove type)
 Hard hat that complies with ANSI Z89.1

Personal Protective Equipment (PPE) Determination

Check all that apply and follow requirements associated with selection in PPE Hazard Assessment (App. H in HASP)

Eye Protection Must comply w/ ANSI Z87.1 <input type="checkbox"/> Chemical protective goggles <input type="checkbox"/> Impact goggles <input type="checkbox"/> Flexible goggles <input type="checkbox"/> Welding goggles /helmet or face shield. Tinted lenses required. <input type="checkbox"/> Laser safety glasses <div style="background-color: red; color: white; padding: 2px;">Hazardous Atmosphere</div> <input checked="" type="checkbox"/> Photoionization detector (PID) <input type="checkbox"/> Flame Ionization Detector (FID) <input type="checkbox"/> Dust monitor <input type="checkbox"/> LEL / O ₂ meter <input type="checkbox"/> H ₂ S meter <div style="background-color: #00a0e3; color: white; padding: 2px;">Head Protection</div> <input type="checkbox"/> Type E Hardhat (Electrical) <input type="checkbox"/> Hard hat with chin strap, miner's helmet with chin strap or mountaineering helmet with chin strap <div style="background-color: #f4a460; padding: 2px;">Hearing Protection</div>	Body Protection <input type="checkbox"/> Chemical resistant clothing recommended on SDS <input type="checkbox"/> Chain saw chaps <input type="checkbox"/> Snake chaps OR boots marketed as "snake proof" <input type="checkbox"/> DOT Class III vest (low-light conditions or traffic flow at 50 mph or more) <input checked="" type="checkbox"/> DOT Class II or III tear away vest (working around rotating or moving parts) <input type="checkbox"/> Sunscreen lotion >= SPF 30 <input type="checkbox"/> Insect repellent <input type="checkbox"/> US Coast Guard approved personal flotation device (PFD) – Type I, II or III <div style="background-color: #28a745; color: white; padding: 2px;">Foot Protection</div> <input type="checkbox"/> Safety shoes or boots with metatarsal guards <input type="checkbox"/> Safety boots with puncture-resistant midsoles or built-in puncture resistance (PR rated) <input type="checkbox"/> Safety boots with electric hazard (EH) protection (standard in most footwear) <input type="checkbox"/> Rubber-sole boots or grips <input type="checkbox"/> Chemical resistant boot covers <input type="checkbox"/> Lace-up safety boots conforming to ASTM F2413-05 or equivalent in non-US jurisdictions	Face Protection <input type="checkbox"/> Chemical protective goggles (ANSI Z87.1) <input type="checkbox"/> Face Shield <div style="background-color: #e91e63; color: white; padding: 2px;">Respiratory Protection</div> <input type="checkbox"/> Half-face respirator <input type="checkbox"/> Full-face respirator <input type="checkbox"/> SCBA <div style="background-color: #8d6e63; padding: 2px;">Fall Protection</div> <input type="checkbox"/> Personal fall arrest system designed or approved by a qualified person OR other means of fall protection determined by qualified person <div style="background-color: red; color: white; padding: 2px;">Heat, Flame, Flash Fire or Arc Hazard</div> <input type="checkbox"/> Cooling vest <input type="checkbox"/> Fire retardant clothing (FRC) <div style="background-color: #6b8e23; padding: 2px;">Hand Protection</div> <input type="checkbox"/> Chemical resistant gloves per SDS <input checked="" type="checkbox"/> Cut-resistant gloves or liners <input type="checkbox"/> Leather/work gloves <input type="checkbox"/> Welding gloves
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<ul style="list-style-type: none"><input checked="" type="checkbox"/> Ear Plugs (noise >80 db)<input type="checkbox"/> Ear Muffs with Ear Plugs (noise >105 db)		<ul style="list-style-type: none"><input type="checkbox"/> Leather gloves, insulated<input type="checkbox"/> Nitrile gloves<input type="checkbox"/> Impact Resistant Gloves
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Job Safety Analysis

JSA Description: Drilling Direct Push - Geoprobe/Hydropunch				Site ID:			Date: 1/29/2015		
<div style="display: flex; justify-content: space-around; align-items: center;"> <div style="text-align: center;"> Biological</div> <div style="text-align: center;"> Chemical</div> <div style="text-align: center;"> Electrical</div> <div style="text-align: center;"> Gravity</div> <div style="text-align: center;"> Mechanical</div> <div style="text-align: center;"> Motion</div> <div style="text-align: center;"> Pressure</div> <div style="text-align: center;"> Radiation</div> <div style="text-align: center;"> Sound</div> <div style="text-align: center;"> Temperature</div> </div>									
Job Steps	Potential Hazard(s)	Critical Action(s)	Responsible Person(s) - Initials	Mitigation Steps Verified ¹					
1. Stage at pre-determined sampling location and set up work zone and sampling equipment.	Motion - Broken bones/ death from being hit by vehicular traffic.	1. Establish traffic control for exclusion zone per requirements; use high-visibility cones; and park vehicle as barrier, if feasible.							
	Gravity - Broken bones/lacerations from tripping over sampling equipment and tools.	1. Keep sampling equipment organized and staged in one central location to prevent tripping hazards. 2. Store equipment with sharp edges protected. 3. Wear Type II cut-resistant gloves to protect hands from lacerations from potential fall.							
	Biological - Biological hazards (flying insects, ticks, poisonous snakes).	1. Look for wasp and bee nests in work areas. If observed, Stop Work immediately until the issue is addressed. 2. Survey the vegetation and identify poison ivy, oak or sumac and avoid these areas. Survey walking areas for snakes or varmints. 3. Keep insect repellent available for use in the field. 4. Check thoroughly for ticks at the end of shift/day.							
	Motion - Muscle strain from lifting sampling equipment.	1. Unload as close to work area as safely possible. Use a buddy to lift loads greater than 50 pounds. Lift using legs and straight back. Limit twisting motions during lifting procedures. 2. Do not carry more weight than you can handle. 3. Plan route before lift, keep route clear.							
	Chemical – Potential release of fluids to the ground surface (i.e. hydraulic, fuel, etc.).	1. Place visqueen or other impermeable/ fluid absorbing sheeting underneath the rig location prior to rig positioning to prevent potential fluid contact with the ground surface.							
2. Hand clear boring locations	Electrical/Pressure – Electrocutation from contact with electrical utility/Bodily harm from rupture of water, product or gas line.	1. Review and verify that the ARCADIS Utility Clearance Checklist and CEMC Ground Disturbance Review Checklist have been completed. 2. Confirm that Borehole Clearance Memo has been submitted, as applicable.							

		<ol style="list-style-type: none"> Review proposed locations against available site map, One Call markings and private locate markings. DO NOT rely on GPS to locate previously cleared locations. All boring locations will be cleared to a depth of 8 ft 1 in. Inspect that rig and rig pathways are clear of overhead hazards (e.g. utilities, canopy). Stop Work immediately and contact PM/TM before proceeding if utility clearance procedures cannot be verified or if previously cleared locations are not adequately marked. 		
	Motion – Back strain from repetitive motion of hand clearing and lifting cuttings.	<ol style="list-style-type: none"> Use job rotation every 3 feet to prevent fatigue. Change out extension rods to prevent bending over to twist hand auger. Use team lifts to remove hand auger from boring deeper than 5 ft. 		
	Motion – Death, serious injury or damage caused by direct-push rig while accessing set-up location.	<ol style="list-style-type: none"> Verify clear pathway to boring/sampling location and clearance for raising mast/securing equipment. Provide as-needed hand signals and guidance to driver to place direct-push rig. Stay at least 3' feet from fixed objects during mobilization to boring location. 		
3. Backfill soil boring with cuttings	Gravity – Slips trips and falls on open soil boring.	<ol style="list-style-type: none"> Place a safety cone over the soil boring until the boring can be backfilled. 		
	Motion – Shearing/bending of drill rods due to lack of support in tow 8 ft.	<ol style="list-style-type: none"> Backfill soil boring with soil cuttings from the same hole to provide lateral and vertical support 		
4. Commence direct-push borehole.	Chemical - Dermal irritation or inhalation hazard from contact with potentially contaminated soil, groundwater or vapors.	<ol style="list-style-type: none"> Air monitoring with a calibrated photo-ionization (PID) detector (fitted with a 10.6 eV bulb) must be utilized to determine concentrations of petroleum vapors in breathing zone. If PID reading exceeds 0.5 ppm, benzene-specific monitoring must take place with a colorimetric tube or real-time monitoring device. Do not touch contaminated water/sludge/soil with ungloved hands. Wear Nitrile gloves over Type II cut-resistant gloves to prevent soils/liquids from contacting hands and causing irritation. 		
	Mechanical – Caught or pinched by parts of rig.	<ol style="list-style-type: none"> Discuss the location of the emergency shut off switches with the entire field crew. Emergency stops should be tested daily. Call out and mark locations of pinch point. Discuss how to avoid pinch points and mitigate that hazard. Refrain from wearing hoods, loose clothing and jewelry while in the exclusion zone. 		

		4. Keep non-essential personnel outside of the exclusion zone to eliminate risk.		
	Chemical – Cross contamination on DPT rods or hydro-punch sampler from previous borehole.	1. Decontaminate sampling equipment after collecting a sample and decontaminate hydro-punch accessories after sample collection at each boring location.		
	Temperature - Heat exhaustion or heat stress from weather conditions and dehydration.	1. Hydrate prior to working and take frequent breaks as needed. Mix water and sports drinks to hydrate and avoid caffeinated beverages. 2. If conditions are very hot and humid, forced breaks may be necessary. Anyone on the crew can recommend a forced break requirement.		
	Sound - Hearing damage or loss due from exposure to DPT noise.	1. Maintain 25 ft exclusion zone to prevent non-essential personnel away from high noise exposure. 2. Wear hearing protection during DPT macro-core/hydro-punch sampler advancement and rig operation per the PPE Determination section of this JSA and OSHA regulations. 3. When using ear plugs, reach around the back of the head, pulling outward and upward on the ear while inserting the ear plug until it seals. Note that most ear plugs are disposable and should not be used repeatedly.		
				
5. Clean site; Remove traffic control.	Motion - Death or serious injury resulting from being struck traffic and other vehicles entering and exiting the site.	1. Always use spotter and buddy system while cleaning up site. 2. Seek to make eye contact with vehicle drivers on site.		
	Gravity - Broken bones, lacerations and bruises from slipping and falling over drilling equipment or hand tools.	1. Visually inspect the work area or exclusion zone and check and remove trip hazards in the work area prior to breaking down the exclusion zone. 2. Organize tools and supplies in one central location and keep these items out of travel paths. 3. Use correct travel paths and 3-points of contact for loading equipment and supplies.		



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TEAM Chevron

Job Safety Analysis

JSA Description: Driving –		
Project Name:	Site Address:	Field Leader:
Date of JSA Development:	Project No:	
Development Team Please include the team members employer and email if not employed by ARCADIS:	Position/Title:	Phone Number
Reviewed By Please include the reviewers employer and email if not employed by ARCADIS:	Position/Title:	Review Date (MM/DD/YYYY)
Jay White	H&S Administrator	01/06/2014
Permits Required (general, hi-risk, etc.):	General PTW	
Specialized tools/equipment:		
MINIMUM REQUIRED PERSONAL PROTECTIVE EQUIPMENT		
<input checked="" type="checkbox"/> (Class II) High-visibility vest or appropriate high-visibility clothing. <input checked="" type="checkbox"/> Long pants/Long shirt <input checked="" type="checkbox"/> Safety glasses, wraparound or with side shields labeled with ANSI Z87.1 rating, or a certification card for lenses and frames <input checked="" type="checkbox"/> Safety footwear meeting ASTM F2413-05 standard with chemical or oil resistant soles <input checked="" type="checkbox"/> Long-sleeved shirts <input checked="" type="checkbox"/> High visibility work gloves (when high visibility glove options exist for a particular glove type) <input checked="" type="checkbox"/> Hard hat that complies with ANSI Z89.1		
Personal Protective Equipment (PPE) Determination		
Check all that apply <input checked="" type="checkbox"/> and follow requirements associated with selection in PPE Hazard Assessment (App. H in HASP)		

Eye Protection

- Chemical protective goggles that comply with ANSI Z87.1
- Impact goggles that comply with ANSI Z87.1
- Flexible goggles that comply with ANSI Z87.1
- Welding goggles /helmet or face shield. Tinted lenses required. PPE must comply with Z87.1
- Laser safety glasses that comply with ANSI

Hazardous Atmosphere

- Photoionization detector (PID)
- Flame Ionization Detector (FID)
- Dust monitor
- LEL / O₂ meter
- H₂S meter

Head Protection

- Type E Hardhat (Electrical)
- Hard hat with chin strap, miner's helmet with chin strap or mountaineering helmet with chin strap

Body Protection

- Chemical resistant clothing recommended on SDS
- Chain saw chaps
- Snake chaps OR boots marketed as "snake proof"³
- DOT Class III vest (low light conditions or traffic flow at 50 mph or more)
- DOT Class II or III tear away vest when working around rotating or moving parts
- Sunscreen lotion >= SPF 30
- Insect repellent
- US Coast Guard approved personal flotation device (PFD) – Type I, II or III

Foot Protection

- Safety shoes or boots with metatarsal guards
- Safety boots with puncture-resistant midsoles or that have built-in puncture resistance (PR rated)
- Safety boots with electric hazard (EH) protection (standard in most footwear)
- Rubber-sole boots or grips
- Chemical resistant boot covers
- Lace-up safety boots conforming to ASTM F2413-05 or equivalent in non-US jurisdictions

Face Protection

- chemical protective goggles that comply with ANSI Z87.1
- Face Shield

Hearing Protection

- Ear Plugs (noise 80 db)
- Ear Muffs with Ear Plugs (noise 105 db)

Respiratory Protection

- Half-face respirator
- Full-face respirator
- SCBA

Fall Protection

- Personal fall arrest system designed or approved by a qualified person OR other means of fall protection determined by qualified person

Heat, Flame, Flash Fire or Arc Hazard

- cooling vest
- Fire retardant clothing (FRC)

Hand Protection

- chemical resistant gloves per SDS
- cut-resistant gloves or liners
- Leather/work gloves
- welding gloves
- leather gloves, insulated
- nitrile gloves
- Impact Resistant Gloves



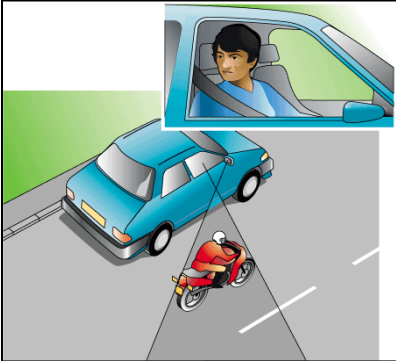
Job Safety Analysis




ISA Description: Driving – Passenger Vehicle	Site ID:	Date: 1/6/2015
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Biological	Chemical	Electrical	Gravity	Mechanical	Motion	Pressure	Radiation	Sound	Temperature

Job Steps	Potential Hazard(s)	Critical Action(s)	Responsible Person(s) - Initials	Mitigation Steps Verified ¹
1. Inspect vehicle	MOTION - Being struck by primary or passing vehicle resulting in broken bones, lacerations, abrasions, sprains, or death	1. Set parking brake before inspecting vehicle 2. Watch for approaching vehicle traffic. If conditions are unsafe, move vehicle to safe location before proceeding with inspection. Use cones or barricades to communicate activity with pedestrians and drivers 3. Wear level II traffic vest to make personnel more visible to on and off site traffic		
	MECHANICAL - Lacerations or abrasions to hands and arms due to contact with moving engine parts	1. Do not reach in to engine compartment while engine is operating or key is in ignition 2. Wear leather/Kevlar level 2 cut resistant gloves with nitrile liners when inspecting hoses and fluid levels to prevent		
	CHEMICAL - Dermal exposure to residual oils/lubricants in engine compartment	1. Clean off any residual oils/lubricants in engine compartment		
	TEMPERATURE - Burns to hands from contact with hot engine parts	1. Allow engine to cool a minimum of 30 minutes prior to inspection		
	CHEMICAL - Dermal abrasions associated with dust, debris, engine fluids contact	1. Inspect the vehicle upwind or behind a wind barricade (ex. building, wall, etc.) 2. Wear safety glasses to protect eyes from dust, debris and pressurized fluid lines during inspection		
3. Drive to Destination	MECHANICAL - Mechanical failure of vehicle leading to collision resulting in broken bones, lacerations, abrasions, sprains, or death	1. Document vehicle inspection. When possible, check previous inspection records 2. Fasten seatbelt prior to ignition. ALWAYS wear seatbelt when operating vehicle		

		<ol style="list-style-type: none"> 3. Check up-to-the-minute road conditions and traffic alerts prior to departing at http://www.fhwa.dot.gov/Trafficinfo/ 4. Familiarize yourself with vehicle controls (windshield wiper, locks, horn, hazard lights, etc.) prior to departing 5. Remain at least 4 seconds behind lead vehicles 6. Allow vehicles a 2 second head start at traffic lights and stop signs 7. Stop before pedestrian walkways 		
	<p>MOTION - Distractions, blind spots, fatigue or falling asleep while driving associated with vehicle crash resulting in broken bones, lacerations, abrasions, sprains, or death</p>	<ol style="list-style-type: none"> 1. Obey all postings and traffic laws 2. DO NOT USE CELL PHONE WHILE DRIVING 3. Do not drive while tired or not alert 4. Do not drive while under the influence of alcohol or drugs that affects mental alertness. Do not allow illegal drugs or alcohol in company vehicle 5. Utilize TRACK before beginning the each task/maneuver. 6. Be aware of vehicle's blind spots. Turn head or use blind spot mirror to check before changing lanes, slowing, or turning. 		
	<p>MOTION - Slippery / wet / icy roads leading to vehicle collision resulting in broken bones, lacerations, abrasions, sprains, or death</p>	<ol style="list-style-type: none"> 1. Inspect current and forecasted weather and road conditions that will be encountered during driving. 2. Use STOP WORK if road or weather conditions become dangerous 		

				
4. Park vehicle at destination	MOTION - Vehicle collision with stationary object, pedestrian or other vehicle resulting in broken bones, lacerations, abrasions, sprains, or death	<ol style="list-style-type: none"> 1. Park away from other vehicles when possible. 2. Pulling forward to adjacent parking space is preferred to backing; however, this maneuver should be avoided when visibility is restricted by parking spaces next to vehicle being occupied. 3. Back in to parking space if adjacent spaces are unoccupied and it is safe to do so. 4. Maintain a cushion of 3-feet between vehicle and stationary objects. Be aware of vehicle's blind spots and use a spotter. 5. Drive at low speed (5 mph) to slowly observe surrounding site objects and pedestrians 6. Use headlights to increase visibility of truck in parking lots 		
	MECHANICAL - Vehicle coming out of gear and rolling hitting workers, pedestrians, or other vehicles resulting in broken bones, lacerations, abrasions, sprains, or death	<ol style="list-style-type: none"> 1. Set parking brake when parked 2. Avoid parking on hills/uneven area whenever possible 		

Notes:

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2 – Photo source: <http://steppingoutinredshoes.blogspot.com/2014/01/blind-spot.html>

