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COMPLIANCE MONITORING PLAN

8801 East Marginal Way S.

TUKWILA, WASHINGTON
AGREED ORDER 6069

SHANNON & WILSON

March 15, 2021

Shannon & Wilson No: 21-1-12567-031

Submitted To: PACCAR Inc

Subject: COMPLIANCE MONITORING PLAN, 8801 EAST MARGINAL WAY S., TUKWILA, WASHINGTON
AGREED ORDER 6069

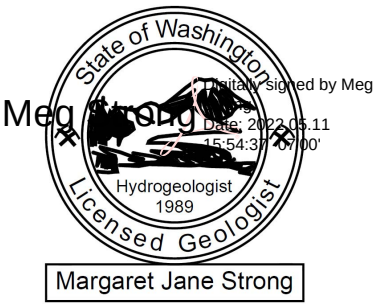
Shannon & Wilson prepared this report and participated in this project as a consultant to PACCAR Inc. This report presents the Compliance Monitoring Plan for the property at 8801 East Marginal Way S., Tukwila, Washington, and was prepared by the undersigned.

This compliance monitoring plan fulfills the requirements of Task 2C within the schedule given in Exhibit C of Agreed Order number 6069 dated September 2008. This report is also a companion document for the engineering design reports that fulfill the requirements of Task 2C of Agreed Order number 6069.

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

Sincerely,

SHANNON & WILSON



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Vice President

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EXECUTIVE SUMMARY

This report details the protection, performance, and confirmation monitoring to be conducted during remedial actions at the upland portion of the 8801 East Marginal Way South site in Tukwila, Washington (8801 site). The upland portion of the 8801 site is referred to as the 8801 property. Contaminated soil and groundwater are present on the 8801 property. Soil, groundwater, and air will be monitored during and following remedial action activities. The monitoring will be used to determine if remedial action objectives detailed in the Final Feasibility Study, Final Interim Action Work Plan, and Addendum to Feasibility Study and Interim Action Work Plan (Shannon & Wilson, 2020a, 2020b, and 2020c) have been achieved. The following compliance monitoring is planned:

Protection Monitoring

Protection monitoring includes:

- Personal and perimeter air monitoring during remedial excavations.
- Documentation of construction stormwater Best Management Practices (BMPs).

Performance Monitoring

Performance monitoring includes:

- Obtaining sidewall and base samples from remedial excavations.
- Sampling downgradient groundwater monitoring wells following remedial excavation and injection work.
- Sampling vapor from the sub-slab beneath the new warehouse proposed for construction on the 8801 property.

Confirmation Monitoring

Confirmation monitoring includes:

- Sampling of compliance groundwater monitoring wells.

An institutional control in the form of an environmental covenant will be established for the 8801 property to ensure that maintenance of the asphalt/concrete cover is undertaken to reduce stormwater infiltration and potential leaching of the soil chemicals of concern (COCs) into groundwater, to ensure that groundwater is not used as drinking water, to ensure that users of the 8801 property are protected from vapors and new buildings are

assessed for potential vapor mitigation requirements, and to ensure the clay cap and drainage layer installed along the shoreline are inspected and maintained, as necessary.

This plan is a companion document to engineering design reports (EDRs) that provide additional details and design of the remedial actions that will be undertaken. The companion EDR documents address eight hotspot excavations (two separate documents), groundwater injections, modifications to and extension of the air sparge and soil vapor extraction (AS/SVE) system, caulk removal, and a sub-slab depressurization system.

Attached to this plan are the sampling and analysis plan that provides sampling and quality control procedures, the health and safety plan for use during site activities, and the archaeological monitoring and inadvertent discovery plan.

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ACRONYMS

8801 property	upland portion of the 8801 site
8801 site	8801 East Marginal Way South site
Addendum	Addendum to the Feasibility Study and Interim Action Work Plan
AO	Agreed Order
AS/SVE	air sparge/soil vapor extraction
bgs	below ground surface
BMPs	Best Management Practices
CMP	Compliance Monitoring Plan
COCs	chemicals of concern
cPAHs	carcinogenic polycyclic aromatic hydrocarbons
CUL	cleanup level
DAHP	Department of Archaeology and Historic Preservation
Ecology	Washington State Department of Ecology
EDR	engineering design report
EPA	U.S. Environmental Protection Agency
ERD	enhanced reductive dechlorination
HASP	Health and Safety Plan
IAWP	Interim Action Work Plan
LDW	Lower Duwamish Waterway
MIDP	monitoring and inadvertent discovery plan
MSL	mean sea level
MTCA	Model Toxics Control Act
PCBs	polychlorinated biphenyls
PCE	tetrachloroethene
POCs	points of compliance
PQL	practical quantitation limit
RAOs	remedial action objectives
RL	remediation level
TCE	trichloroethene
TEQ	toxicity equivalent quotient
TESC	temporary erosion and sedimentation control
TPH	total petroleum hydrocarbons
VOCs	volatile organic compounds
WAC	Washington Administrative Code

1 INTRODUCTION

This Compliance Monitoring Plan (CMP) provides the information necessary to complete protection, performance, and compliance monitoring associated with the remedial actions described in the Final Feasibility Study (Shannon & Wilson, 2020a), Final Interim Action Work Plan (Shannon & Wilson, 2020b), and Addendum to the Feasibility Study and Interim Action Work Plan (Addendum) (Shannon & Wilson, 2020c). The Final Interim Action Work Plan and Addendum together constitute the Interim Action Work Plan (IAWP). In this CMP, a Sampling and Analysis Plan is provided in Appendix A, a Health and Safety Plan (HASP) is provided in Appendix B, and the archeological monitoring and inadvertent discovery plan (MIDP) is provided in Appendix C.

The 8801 site is located at 8801 East Marginal Way South in Tukwila, Washington (Figure 1). The 8801 site consists of an upland portion (the 8801 property) and the adjoining sediments in the Lower Duwamish Waterway (LDW). The 8801 site is subject to two separate Agreed Orders (AOs): AO No. 6069, which applies to the 8801 property, and AO No. 3599, which applies to the adjoining LDW sediments. This CMP fulfils the requirements of Task 2C of the schedule provided in Exhibit C of AO No. 6069 for the 8801 property, and is a companion report to the EDR documents. The EDRs address eight hotspot excavations (two separate documents), groundwater injections, modifications to and extension of the AS/SVE system, caulk removal, and a sub-slab depressurization system.

2 SITE DESCRIPTION

This section presents a brief overview of the 8801 property's location, history, geology, and hydrogeology. Additional information is provided in the IAWP.

2.1 Physical Description and Use

The 8801 property occupies 24.30 acres on the east bank of the LDW and is relatively flat, with a ground surface elevation of approximately 20 feet above mean sea level (MSL).

The property owner, CenterPoint 8801 Marginal LLC, plans to redevelop the 8801 property. The redevelopment is slated to commence in 2021. The redevelopment plans include demolition of the existing buildings, except part of the smaller warehouse on the west end of the 8801 property that houses the aboveground infrastructure for the existing AS/SVE remediation system. Redevelopment plans include construction of an approximately 414,400-square-foot warehouse for industrial use and trailer storage. The design of the

warehouse includes importing fill to raise the floor level approximately 4 feet above existing grade to allow direct truck loading. The footprint of the proposed warehouse relative to existing buildings and monitoring wells is shown in Figure 2.

2.2 Geology

The 8801 property is currently paved. Fill material underlies paved surfaces and is up to 10 feet thick in some locations. Fill material includes gravelly structural fill beneath buildings and paved areas, poorly graded sand to silty sand fill deposits, and gravelly backfill materials in excavations. Fill material at the 8801 property is underlain by a layer of fine-grained material, including silt, sandy silt, and silty sand that extends to a depth of 5 to 15 feet below ground surface (bgs). A poorly graded sand layer, which typically contains less than 10% silt, is generally present beneath the fine-grained layer beginning at 10 to 15 feet bgs, although at some locations it is present immediately beneath the pavement surface or the fill material. A layer of fine-grained materials, consisting mainly of silt and silty sand, is typically present beneath the poorly graded sandy layer at depths of approximately 30 to 50 feet bgs. This fine-grained silty material acts as a confining layer to groundwater flow on the western part of the 8801 property. The lower fine-grained layer is typically underlain by poorly graded sand to the maximum depth explored at the 8801 property (60 feet bgs).

2.3 Hydrogeology

Results of groundwater monitoring at the 8801 property indicate that the shallow aquifer is typically 8 to 10 feet bgs. Results of tidal influence analyses indicate that the maximum tidal fluctuation at the western boundary of the 8801 property ranges from -3.03 feet relative to MSL to +1.85 feet MSL in the southern portion of the 8801 property, where riprap demarcates the 8801 property boundary. Farther north, where the sheet piling bulkhead demarcates the 8801 property boundary, the maximum tidal fluctuation ranges between -1.80 feet MSL and +1.32 feet MSL.

The hydraulic gradient in the shallow aquifer is generally towards the west. Groundwater velocity is estimated to be 40 feet per year.

3 CLEANUP STANDARDS AND REMEDIATION LEVELS

This section discusses the cleanup levels (CULs) that are protective of human health and the environment, the remediation levels used for soil and halogenated volatile organic compounds (VOCs) in groundwater, and the points of compliance (POCs) where those

CULs apply. The CULs for soil, groundwater, and air at the 8801 property are based on unrestricted land use and are shown in Table 1.

3.1 Soil Cleanup Levels

For COCs in soil, the CULs are primarily the soil leaching CUL, background, practical quantitation limits (PQLs), or the Model Toxics Control Act (MTCA) Method B value for human health direct contact as discussed by chemical below. The more widespread soil COCs include trichloroethene (TCE), tetrachloroethene (PCE), vinyl chloride, bis(2-ethylhexyl)phthalate, total carcinogenic polyaromatic hydrocarbons (cPAHs) corrected for total equivalency quotient (TEQ), and total polychlorinated biphenyl (PCB) aroclors. More localized occurrences of soil COCs include arsenic, cadmium, chromium, copper, lead, gasoline-range hydrocarbons, oil-range hydrocarbons, and dioxin/furan TEQ.

TCE, PCE, and vinyl chloride are currently partitioning from soil into groundwater as concentrations in groundwater exceed the CUL. Therefore, the CULs selected for these three COCs are based on a value that is protective of transport to surface water via groundwater based on non-potable groundwater in either the saturated or unsaturated soil as appropriate. The CULs for TCE and vinyl chloride in soil are corrected to the PQLs achievable by analytical laboratories.

Soil CULs for bis(2-ethylhexyl)phthalate, cPAHs TEQ, and PCBs are also based on soil leaching CULs. The CULs for bis(2-ethylhexyl)phthalate, cPAHs, and PCBs in soil are corrected to the PQLs achievable by analytical laboratories.

The soil CULs for TCE, PCE, vinyl chloride, bis(2-ethylhexyl)phthalate, cPAHs, and PCBs are so low that compliance with soil CULs for these COCs will be based not on the concentration of these COCs in soil, but in groundwater, which is appropriate because the soil CULs are based on protection of groundwater. Attaining the groundwater CULs for these COCs will serve as proof that the soil is not or is no longer contributing COCs to the groundwater at a level that causes exceedance of the groundwater CUL.

Arsenic, copper, and dioxin/furan TEQ soil CULs are based on background concentrations. Cadmium and chromium soil CULs are based on protection of bank erosion and these criteria are only applicable for these chemicals in the southwest storage area as the concentrations of the two metals are below the more stringent CULs elsewhere on the 8801 property.

Lead is not present in groundwater above the CUL; therefore, the soil CUL is based on MTCA Method B for direct contact. Gasoline- and oil-range hydrocarbons are present in groundwater in only one location. Therefore, the gasoline-range hydrocarbons soil CUL is

based on protection for indoor air where the proposed warehouse overlies a sample with an exceedance. MTCA Method A residual concentration CUL is used for oil-range hydrocarbons.

3.2 Soil Remediation Levels

The soil remediation levels have been developed in accordance with Washington Administrative Code (WAC) 173-340-355 (Washington State Department of Ecology [Ecology], 2013), and take into consideration the expectations for cleanup alternatives in WAC 173-340-370. The soil remediation levels that have been selected will ensure that the areas that have significant mass of COCs will be removed. The concentrations of bis(2-ethylhexyl)phthalate in soil do not exceed the soil remediation level, therefore this chemical is not a COC for hotspot excavations.

Due to the stringent values required to ensure that soil is protective of the leaching pathway, soil remediation levels (RLs) are being used to delineate the limits of the remedial excavations except in Area 5 where cadmium and chromium CULs will be used and Areas 7 and 8 where the gasoline-range hydrocarbon CULs will be used. The soil RLs and COCs are shown in Table 2.

A disproportionate cost analysis and calculations performed as a part of the IAWP determined that using soil RLs to guide the remedial excavations would result in a 66% mass reduction of PCB aroclors, 63% mass reduction of cPAH TEQ, 65% mass reduction of arsenic, 91% mass reduction of copper, and 81% mass reduction of TCE.

The goal of the remedial excavations is to remove soil above the RLs in the selected excavation areas, and soil exceeding a COC-specific CUL may remain in place if appropriate soil RLs have been achieved at the extent of the excavations.

3.3 Groundwater Remediation Levels and Cleanup Levels

In groundwater, CULs for total cPAHs TEQ, total PCB aroclors, TCE, vinyl chloride, copper, and arsenic are discussed in detail below. This subset is discussed because those COCs are the primary drivers for remedial action in groundwater. The groundwater CULs for the COCs discussed below, as well as other site-specific CULs established in the IAWP, are provided in Table 1. The most stringent CULs for groundwater are based primarily on protection of surface water (consumption of organisms) and protection of sediments. Copper and arsenic are also discussed because they are being mobilized from the soil primarily due to the breakdown of TCE and vinyl chloride.

Total cPAHs TEQ and total PCB aroclors. The CULs for total cPAHs TEQ and total PCB aroclors in groundwater are extremely stringent (parts per trillion) and are not currently achievable by laboratories. For this reason, the CULs for both chemicals are based on the laboratory PQLs for PCB aroclors (by U.S. Environmental Protection Agency [EPA] Method 8082A) and cPAH TEQ (by EPA Method 8270 SIM). PCBs are only sometimes detected above the PQLs at one of the compliance wells, MW-30A, and cPAHs are only sometimes detected above the PQLs at two of the compliance wells, MW-30A and MW-37A. It is expected that after the remedial excavations, the groundwater concentration will drop below the CULs at all conditional point of compliance wells. Because the CULs for cPAHs and PCBs in groundwater are set at the PQL, which is the lowest concentration that can reliably be measured by the analysis, the timelines referenced are conservative to account for future improvements in laboratory technology, which may lower the PQL allowing for detections of these contaminates at lower concentrations.

TCE and Vinyl Chloride. Calculations undertaken using the BIOCHLOR model as discussed in the Final Feasibility Study (Shannon & Wilson, 2020a) demonstrate that halogenated VOCs are naturally degrading. TCE and vinyl chloride are targeted in the groundwater because lowering these values will lower other associated halogenated VOCs. RLs for TCE and vinyl chloride are being used to achieve groundwater targets that will achieve CULs within the 8801 property. Once RLs are achieved, the halogenated VOCs will naturally break down further and will be aided by the air sparge system such that they will be protective of surface water (e.g., less than or equal to groundwater CULs) by the time the groundwater reaches the compliance wells. Based on the BIOCLOR model various RLs are required in different parts of the groundwater plume (see Figure 4); more stringent RLs are required to be achieved to the west, whereas less stringent RLs are required to be achieved to the east. This is because in the east there is greater distance to travel before reaching the LDW and more time for concentrations to naturally decline than further west. Therefore, the RLs become more stringent the further west in the plume the performance well is located on the 8801 property. TCE and vinyl chloride RLs for the west and east locations are shown in Table 3.

Copper and Arsenic. Copper and arsenic present in soil is likely being mobilized by the anaerobic conditions generated by the dechlorination of the halogenated VOCs and hydrocarbon breakdown. As the dechlorination decreases, the groundwater condition will stabilize, and copper and arsenic will re-precipitate out of groundwater as demonstrated by the 2019 groundwater sampling event results (Shannon & Wilson, 2021). The cleanup values for copper and arsenic in groundwater are 8 micrograms per liter for both chemicals.

3.4 Indoor Air Cleanup Levels

Indoor air CULs are provided in Table 1. These values are based on unrestricted use.

3.5 Point of Compliance

MTCA defines the POC as the point or points at which CULs must be attained. The POC applies to all soil, groundwater, or air at or adjacent to any location where releases of hazardous substances have occurred or that has been impacted by releases from the location. The primary affected media at the 8801 property are soil and groundwater. The inhalation pathway is also significant for the 8801 property due to the presence of halogenated VOCs in soil and groundwater.

3.5.1 Soil

The POC demonstrating compliance for pathways protective of human health, namely potential direct contact, inhalation, or ingestion of impacted soil, shall be established in the soil throughout the 8801 property from the ground surface to 15 feet bgs (WAC 173-340-740(6)(d)).

The POC demonstrating protection of groundwater shall be established in soil throughout the 8801 property (WAC 173-340-740(6)(b)). The 8801 property will be covered by the new warehouse, paving, or a clay layer which will reduce infiltration of surface water into unsaturated soil. If soil leaching CULs are not met, empirical evaluations of contaminant concentration trends may be needed to demonstrate that soil concentrations are protective of groundwater.

The POC demonstrating compliance for pathways protective of human health and the environment by migration of chemicals from soil to air shall be established in the soil from the ground surface to the top of the uppermost saturated zone throughout the 8801 property (i.e., the Vadose zone) (WAC 173-340- 740(6)(c)).

3.5.2 Groundwater

Groundwater CULs are based on indoor air protection or protection of discharge to surface water of the LDW. MTCA regulations favor permanent cleanup of groundwater contamination at the standard POC (i.e., throughout the site). A standard POC for groundwater, as described in WAC 173-340-720(8)(b), would include all groundwater in the saturated zone beneath the 8801 property and in any area affected by contamination.

However, Ecology has approved the use of a conditional POC under WAC 173-340-720(8)(c) because it is not practicable to attain the standard POC throughout the full extent of the 8801

property due to the stringency of the CULs for total cPAH TEQ and total PCB aroclors. Although the cPAH and PCB groundwater CUL in this CMP are based on the laboratory PQLs, the current PQLs are orders of magnitude higher than the CUL calculated to be protective of surface water. As analytical methods improve, the PQL will move lower (closer to the value protective of surface water) and detectable cPAHs and PCBs may be encountered. These detections will result in additional groundwater sampling and increase the timeline before compliance is achieved. It is not possible with certainty to state the amount of time before the CULs are achieved at the 8801 property because the presence of these chemicals is not yet able to be measured. For this reason, it will likely be multiple decades before the 8801 property will be in compliance and, as such, the standard POC (i.e., throughout the site) cannot be achieved in a reasonable restoration timeline.

The conditional POC will be located on the western boundary of the 8801 property. In the south of the 8801 property, this point is immediately west of the area where cPAHs and PCB-containing soil will be excavated and removed and therefore is as close as practicable to the source of the release. Concentrations of total cPAHs TEQ have declined as soil hydrocarbon contamination has naturally degraded. However, total cPAHs TEQ across the 8801 property have been identified in groundwater at concentrations that are below laboratory reporting limits and yet may be above the CUL (set as PQL). Therefore, the western boundary of the 8801 property is as close as practicable to the source of the release since it is not possible to identify which wells exceed the CUL.

Groundwater CULs will apply at the conditional POC and downgradient of that location. Groundwater upgradient of the conditional POC, but within the 8801 site, will not be required to meet CULs within a reasonable time frame as long as conditions in WAC 173-340-720(8)(c) are met.

3.5.3 Air

The POC demonstrating compliance for pathways protective of air will be air throughout the 8801 property (WAC 173-340-750(6)). Per WAC 173-340-750(1)(a), the cleanup standard applies to ambient outdoor air and air within a building, manhole, utility vault, or any structure large enough for a person to fit into.

4 DESCRIPTION OF REMEDIAL ACTIONS

The IAWP (Shannon & Wilson, 2020b and 2020c) presents detailed descriptions of the remedial action objectives (RAOs) and remedial actions selected for the 8801 property. This section summarizes the RAOs and remedial actions.

4.1 Remedial Action Objectives

The RAOs are medium-specific goals for the protection of human health and the environment. RAOs form the basis for developing and evaluating remedial actions. The RAOs are:

- Protect current and future worker exposure to soil contaminants.
- Protect workers occupying future buildings.
- Allow for landscaping to be established within the 100-foot river buffer located along the western edge of the 8801 property.
- Protect current and future beneficial use of surface water and sediments in the LDW by attaining groundwater CULs before groundwater migrates to the LDW.
- Achieve the groundwater CULs for the halogenated VOC plume within a reasonable time frame.

4.2 Summary of Remedial Action

The remedial actions selected in the IAWP meet the MTCA threshold requirements (WAC 173-340-360(2)(a)) and other MTCA requirements (WAC 173-340-360(2)(b)). Selected remedial actions are shown in Figure 4 and presented below.

4.2.1 Soil Remedial Actions

The remedial actions selected for soil address saturated and unsaturated soil at the 8801 property that contain COCs at concentrations above the CULs. Primary COCs for soil are PCBs, cPAHs, and copper.

The remedial actions include:

- Excavate and remove soil containing COCs at concentrations exceeding their RLs,
- Within the 100-foot river buffer place a clay cap and overlying drainage layer, and
- Implement institutional controls to prevent leaching or exposure to COCs in subsurface soil and ensure clay cap and drainage layer inspection and maintenance.

4.2.2 Groundwater Remedial Actions

The remedial actions selected for groundwater address groundwater at the 8801 property that contains COCs at concentrations above the CULs and potential source material, including TCE-impacted soil, gasoline-impacted soil, and PCB-containing caulk and associated concrete. These remedial actions also include controls for potential effects to indoor air from the TCE groundwater plume. Primary COCs for groundwater are TCE, vinyl chloride, and PCBs.

The remedial actions include:

- Excavate and remove soil containing TCE and gasoline at concentrations exceeding their RLs,
- Apply enhanced reductive dechlorination (ERD) across the TCE/vinyl chloride plume and in the northwest area,
- Expand the AS/SVE system,
- Relocate monitoring wells,
- Remove PCB-containing caulk and associated concrete, and
- Implement institutional controls to restrict extraction of groundwater and protect indoor air from vapor.

The institutional controls will comply with the Uniform Environmental Covenants Act, Chapter 64.70 of the Revised Code of Washington.

5 COMPLIANCE MONITORING

This section discusses the compliance monitoring that will be undertaken to demonstrate compliance with the requirements detailed in this CMP and MTCA.

Three types of compliance monitoring are identified for remedial actions performed under MTCA (WAC 173-340-410): Protection, Performance, and Confirmation Monitoring. The definition of each is presented below (WAC 173-340-410(1)):

- Protection Monitoring – To confirm that human health and the environment are adequately protected during construction and the operation and maintenance period of the remedial action as described in the safety and health plan.
- Performance Monitoring – To confirm that the remedial action has attained cleanup standards and other performance standards, such as construction quality control measurements or monitoring necessary to demonstrate compliance with a permit or, where a permit exemption applies, the substantive requirements of other laws.
- Confirmation Monitoring – To confirm the long-term effectiveness of the remedial action once cleanup standards and other performance standards have been attained.

The remedial actions performed at the 8801 property will involve all three types of monitoring. Each type of monitoring is discussed below.

5.1 Protection Monitoring

A HASP for the remedial action that meets the minimum requirements for such a plan identified in federal (29 Code of Federal Regulations 1910.120 and 1926) and state (WAC 296) regulations is included as Appendix B. The protection monitoring will include personal and perimeter air sampling for lead, PCE, TCE, and vinyl chloride during earthworks. The frequency of sampling and period for personal monitoring is established in the HASP.

While conducting fieldwork, field personnel will identify an immediate work zone around their work area. This zone will be demarcated with tape or cones to ensure nobody accidently enters the work zone.

The remedial excavations may be undertaken concurrent with redevelopment of the 8801 property. CenterPoint has already prepared a temporary erosion and sedimentation control (TESC) plan, including BMPs, for the development project, and will obtain a construction stormwater permit. The TESC and construction stormwater permit can cover the remedial excavations too.

If the remedial excavations are not implemented concurrent with the redevelopment activities, then a TESC and construction stormwater permit specific to the remedial excavations will be necessary. A TESC specific to the remedial excavations would require silt fences around excavation areas, diversion of stormwater sheet flow away from the excavations, and may require inlet protection, covering of stockpiles, straw wattles to retain stockpile coverage in place, and other appropriate BMPs. Selected BMPs would be inspected daily before remedial work commences to ensure proper condition and installation. If any deficiency in the TESC requirements is observed, a repair or replacement would be made immediately.

5.2 Performance Monitoring

The objectives for performance monitoring are to demonstrate compliance with MTCA and to document the property conditions upon completion of the remedial action. To demonstrate compliance, the following separate performance monitoring activities are planned during implementation of the IAWP:

- Create a waste profile for off-site treatment or disposal,
- Confirm that RLs have been achieved within the sidewalls and bottom of hotspot excavations,
- Determine the suitability of imported fill material and compaction,
- Prepare for encountering archaeological artifacts,

- Monitor sub-slab vapor in the proposed new warehouse,
- Monitor the performance of the AS/SVE system, and ERD injections, and
- Monitor groundwater to determine if completed groundwater and soil remedial actions have attained groundwater CULs at the conditional POC.

5.2.1 Waste Profile for Off-Site Treatment or Disposal

Wastes generated during the implementation of the remedial actions will require characterization and profiling before shipment off site. Usually, the receiving facility specifies the minimum number of samples and analytical tests. Excavation, transport, dewatering, and other technical details of excavation are provided in EDRs. Waste that will be generated during the remedial actions will include:

- Excavated soil. Past characterization has identified that much of the soil and groundwater is non-hazardous. Stockpile sampling may be undertaken in advance of off-site disposal. If necessary, a leaching test will be performed to ensure that the correct disposal facility is identified.
- Soil cuttings generated during drilling, purge water from sampling, and by-products from injections. Samples will be collected from drums for waste characterization.
- Emissions generated during operation of the AS/SVE system. After the system has been extended and is operating, sampling of the concentration and measurement of the volume of air being discharged from the system will be undertaken to determine if a permit for discharge is required.

Each waste stream will be profiled in accordance with the minimum waste analysis requirements of the respective receiving facility.

5.2.2 Archaeological Artifacts

A licensed archaeologist will be present on the 8801 property anytime soil is excavated or removed from the subsurface of the 8801 property as part of the remedial action. This includes but is not limited to excavations and well installations. The archaeologist has prepared an MIDP detailing the required actions. The Department of Archaeology and Historic Preservation (DAHP) approved the MIDP in an email dated January 4, 2021. The MIDP and approval email from DAHP are presented in Appendix C.

5.2.3 Excavation Performance Monitoring

Confirmation soil samples will be collected from the sidewalls and bottom of each remedial excavation. In addition, sidewall and base samples will be collected from soil where signs of potential contamination are noted, if any. In shallow remedial excavations above the groundwater table, the four sidewalls and the bottom will be sampled. Generally, samples

will be collected on 20-foot centers from the sidewalls and bottom of each remedial excavation with a minimum of one sample collected from each sidewall and base as outlined below:

- If the final excavation depth is 4 feet or less, a minimum of one sample from each sidewall will be collected within the contaminant horizon identified during previous investigations or as noted during field observation.
- If the final excavation depth exceeds 4 feet, a minimum of one sample from each sidewall will be collected from the center (or within the contaminant horizon) of each 3-foot-thick (or portion of each) vertical layer. The thickness of the individual sample layers may be reduced to allow for more even sample distribution or accommodate field observations. For example, two samples from each sidewall when the excavation depth is 8 feet.
- Regardless of the total depth of the excavation, one sample from each fill layer observed in the excavation will be collected. This may require collection of additional sidewall samples.
- Bottom samples will be collected on a 20-foot grid in excavations where groundwater is not encountered.
- When groundwater is encountered during the excavation, the lowermost sidewall sample will be assumed to represent conditions at the water table.

In excavations where the base is likely to be below groundwater, borings will be used to collect base confirmation samples in advance of the excavation work. Borings are being used to collect base samples because most of the excavations that extend below the water table are within the tidal zone and will not be completely dewatered due to the constant tidal influx. Samples from borings can be used to target the proposed excavation depth more accurately than samples collected from an open excavation. Where borings are used to collect pre-excavation base confirmation samples, borings will be placed in locations where the maximum excavation depth is expected to be achieved. Soil samples will be collected from the borings at the targeted excavation depth and 1 foot above and 1 foot below the targeted depth. The sample collected from the targeted depth will be analyzed first for the COCs applicable to the excavation area. If the COCs in the sample are below the applicable CUL or RL, then the shallower sample will be analyzed, and if any of the COCs in the sample are above the applicable CUL or RL, then the deeper sample will be analyzed. The shallowest sample in which relevant COCs are below the applicable CUL or RL will constitute the confirmation base sample for the excavation. The pre-excavation base sampling was conducted in February 2021. The results of the sampling are described in the EDRs for the remedial excavations.

Each remedial excavation will have a unique sampling suite dependent upon the COCs present in the excavation. Figure 4 shows the location of the remedial excavations. Table 7 details soil sampling by each remedial excavation.

The goal of the remedial excavations is to remove soil containing excavation-specific COCs at concentrations above RLs, except in the shallow/near-surface portion of Area 5 where the CULs for cadmium and chromium will be used to determine the excavation limits, and in Areas 7 and 8 where the CUL for gasoline-range hydrocarbons will be used to determine excavation limits. Sample results will be used to extend the excavation if one or more excavation-specific COCs that exceed the RL/CUL as relevant are identified. The list below details the excavation-specific COCs for each remedial excavation.

Below are summaries of the planned remedial excavations, identifying the sampling that will be conducted in each area to confirm the lateral and vertical limits of each remedial excavation. The summaries call forward the results of the pre-excavation sampling conducted in February 2021 where they influence the sampling that will be performed in the field at the time of the remedial excavations.

Area 1 - Northern Property Boundary: This remedial excavation is designed to address TCE in shallow soil in the unsaturated zone. The excavation will be protective of groundwater by removing soil that has the potential to leach TCE into the groundwater table. Soil is proposed to be excavated to a depth of approximately 4 feet bgs, but the excavation may be extended to groundwater to allow for additional removal of TCE-impacted soil from the unsaturated zone if the base contains obvious visual or olfactory indications of elevated concentrations of TCE. Once the excavation extents have been achieved, samples will be collected from the sidewalls and the base of the excavation unless the base of the excavation is in contact with groundwater (in which case no base sample will be collected). The samples will be analyzed for TCE, PCE, and vinyl chloride.

Area 2 - H4 Area and Vicinity: This remedial excavation is designed to address total cPAHs that exceed the TEQ in shallow soil (1.5 feet bgs) in the unsaturated zone. Soil will be excavated to a depth of approximately 2.5 feet bgs. Samples will be collected from the sidewalls and the base of the excavation, unless the base of the excavation is in contact with groundwater, in which case no base sample will be collected. The east sidewall may not be sampled unless signs of potential contamination are noted as that is backfill material from the previous H4 excavation. The samples will be analyzed for cPAHs.

Area 3 - E7 and Vicinity: This remedial excavation is designed to address PCBs, copper, and gasoline-range hydrocarbons in shallow soil (2 to 3 feet bgs) in the unsaturated zone. The initially targeted depth of the excavation is approximately 6 feet bgs. The area surrounding

DG11-11 and DG11-12 will first be excavated to 6 feet bgs. The excavation will be stepped out based on visually obvious indications of contamination, such as beige and green putty-like material that was encountered in a remedial excavation of similar COCs on the south adjacent property. Samples will be collected from the sidewalls and base of the excavation and analyzed for PCBs, copper, and gasoline-range hydrocarbons.

Area 4 - DG11-1 and Vicinity: This remedial excavation is designed to address PCBs and dioxins/furans in shallow soil (3 to 4 feet bgs) in the unsaturated zone and copper in deeper soil (up to 8 feet bgs) in the unsaturated zone and potentially saturated zone. Based on the pre-excavation base sampling conducted in February 2021, the excavation will extend to a maximum depth of 8 feet bgs. Two dioxin/furan samples were collected at the proposed excavation depth. The two samples were collected approximately in the locations where exceedances had been previously detected, and the results are provided in the Western Area EDR. Samples will be collected from the east, north, and south sidewalls of the excavation and analyzed for PCBs and copper. The west sidewall of the excavation will not be sampled unless signs of potential contamination are noted because the soil in this location consists of clean material imported to backfill a former stormwater vault excavation, and the base of the excavation will not be sampled because confirmation base samples were collected in February 2021.

Area 5 - Southwest Storage Area: This remedial excavation is designed to address lead, arsenic, cadmium, and chromium in shallow soil (1 to 5 feet bgs) in the unsaturated zone and PCBs and lead in deeper soil (6 to 11 feet bgs) in the unsaturated and saturated zone. Based on the pre-excavation base sampling conducted in February 2021, the excavation base will be 11 feet bgs except at the location of MW-43A where the excavation will extend to 12 feet bgs. Samples will be collected from the north, east, and west sidewalls of the excavation in shallow soil (1 to 5 feet bgs) and analyzed for lead, arsenic, cadmium, and chromium. Samples will be collected from the north, east, and west sidewalls of the excavation in deeper soil (5 feet to 11 ft bgs), and analyzed for PCBs, lead, and arsenic; except no sidewall samples will be collected at depths that are in below the groundwater table. The south sidewall of the excavation will not be sampled unless signs of potential contamination are noted because the soil in this location consists of clean material imported to backfill a former stormwater vault excavation. The base of the excavation will not be sampled because confirmation base samples were collected in February 2021.

Area 6 - SFA-S15-3: This remedial excavation is designed to address arsenic in unsaturated soil at one sample location. The excavation is expected to extend to a depth of approximately 6 feet bgs. Samples will be collected from the sidewalls and base of the excavation. The samples will be analyzed for arsenic.

Area 7 - FWW-1: This remedial excavation is designed to address gasoline-range hydrocarbons in shallow soil at one sample location. This excavation is expected to extend to a depth of 9 feet bgs and into the groundwater. Samples will be collected from the sidewalls of the excavation and analyzed for gasoline-range hydrocarbons. The base of the excavation will not be sampled because a confirmation base sample was collected in February 2021.

Area 8 - A1: This remedial excavation is designed to address gasoline-range hydrocarbons in saturated soil (7 to 12 feet bgs). Based on the pre- excavation base sampling conducted in February 2021, the excavation will extend to a maximum depth of 10 feet bgs. Samples will be collected from the sidewalls of the excavation and analyzed for gasoline-range hydrocarbons. The base of the excavation will not be sampled because a sample was collected from this depth in February 2021. Vertical expansion of the Area 8 excavation is not possible due to existing infrastructure, and lateral expansion also is constrained by existing infrastructure. For this reason, this excavation is likely not to be expanded as discussed in the relevant EDR.

Except in Area 8, if a sample exceeds the RL as discussed above, then the area represented by the sample will be overexcavated a minimum of 1 additional foot, and subsequently resampled and tested for the COC with the RL exceedance. This procedure will be followed until the RL for that COCs has been attained or logistical or practical constraints (e.g., underground infrastructure) limit the excavation. If confirmation samples collected at or near the water table exceed RLs, nonaqueous-phase liquids are encountered, or field observations or previous sample results suggest that impacts extend beyond the water table, the vertical limits of the excavation may be extended below the water table to remove contamination above RLs; however, pre-base sampling and vertical delineation indicates that the RLs are not exceeded below the water table at most locations.

For CULs, but not for RLs, samples will also be evaluated to determine if the statistical test is met per WAC 173-340-740(7).

Except as otherwise indicated in Section 5.2.3, soil with concentrations exceeding one or more RLs will be removed unless such removal endangers the structural integrity of infrastructure, shoreline protection, or a building, in which case an engineering analysis will be provided to demonstrate the hazard.

Other excavation details such as dewatering and shoring are provided in EDRs.

5.2.4 Groundwater Performance Monitoring

Groundwater performance monitoring samples will be collected after remedial activities have been performed to verify that the concentrations of COCs are declining and that remedial actions are effective. Groundwater performance monitoring flowcharts are presented in Figures 5 and 6.

Groundwater samples will be collected from groundwater monitoring wells located downgradient of the remediated areas following completion of the remedial excavations and groundwater treatment. The locations of the proposed compliance and performance wells are shown in Figure 3. The proposed wells to be sampled for performance monitoring and the selected analyses are provided in Table 4. The performance wells were selected to be close to each remedial area, ensuring that performance monitoring will be effective within the sampling timeline.

Groundwater samples will be collected four months after completion of the Area 1 remedial excavation and ERD injections to assess halogenated VOCs in groundwater. The performance monitoring well locations are within and downgradient of the proposed injection area. Samples will be analyzed for halogenated VOCs to determine if the RLs for TCE and vinyl chloride have been achieved. Natural attenuation parameters will be analyzed at the same frequency as halogenated VOCs in three monitoring wells: one near the east of the plume, and two mid-plume near the border of the ERD injection area to help determine if subsurface conditions are remaining favorable for the degradation of halogenated VOCs as discussed in Section 3.3. Natural attenuation parameters include methane, ethane, ethene, manganese, nitrate, nitrite, chloride, sulfate, sulfide, and ferrous iron. A VOC performance monitoring flowchart is provided in Figure 5. The groundwater data collected from the performance wells will be assessed for the risk of vapor intrusion.

Four months after completion of the ERD remedial injection for groundwater in the northwest area, samples will be collected from performance monitoring wells MW-44A and IT-MW-7. Samples will be analyzed for total petroleum hydrocarbons (TPH) and VOCs to determine if CULs have been achieved. Performance monitoring for the northwest area is also shown in Figure 5.

Verifying remedial activities for the area where PCB containing caulk will be removed will consist of sampling performance monitoring wells MW-16A and MW-34A for PCBs. A PCB performance monitoring flowchart is provided in Figure 6.

5.2.5 Performance Monitoring of Sub-Slab Vapor in Proposed Warehouse

Following construction of the proposed new warehouse, air samples will be collected to measure whether the sub-slab depressurization system is effective. The warehouse will have a sub-slab vapor depressurization system, which is detailed in an EDR. As a part of the design, sub-slab vapor will be routed through vent pipes to the roof of the warehouse. The vent pipes will contain sampling ports which will be utilized to collect samples. Baseline sub-slab vapor samples will be collected from five of the available sampling ports. The baseline samples will be analyzed for halogenated VOCs.

Quarterly monitoring will be undertaken from five sampling ports and analyzed for halogenated VOCs. After one year, if there is a significant decline (greater than 10%) in concentrations, monitoring will reduce in frequency to semi-annual.

Sub-slab vapor monitoring will cease when four consecutive events indicate TCE and vinyl chloride concentrations in both (a) groundwater immediately adjacent to the warehouse building and (b) sub-slab vapor samples, are below the upper value protective of indoor air for that media.

5.2.6 Performance Monitoring of the Suitability of Imported Fill Material and Compaction

Imported fill will be tested for geotechnical properties to confirm its structural integrity for future development and analyzed for select COCs. Fill will be tested to ensure that no PCBs or TPH are present at detectable levels and that cPAHs, lead, arsenic, and copper do not exceed the CUL. A minimum of one sample from every type of material or every 5,000 tons will be tested. Samples failing geotechnical performance criteria or showing exceedance of any analyte will be rejected. Soil performance monitoring is detailed in Table 7.

Compaction testing of the fill will also be performed. The compacted fill will be tested so that a minimum of 95% of the maximum dry density, as determined by ASTM D1557, is achieved. The moisture content will be monitored during placement and compaction of the fill.

5.2.7 Performance Monitoring of Air Sparge/Soil Vapor Extraction Groundwater Treatment Systems

Performance monitoring of the AS/SVE groundwater treatment systems will involve monitoring of the AS/SVE systems' input and output parameters to ensure the systems are functioning as designed and to allow modifications to increase the systems' effectiveness. Some of the monitoring parameters include measuring flow rates and relevant VOC

concentrations and will be fully documented in a subsequent Operation and Maintenance Manual for the system.

5.2.8 Performance Monitoring of Enhanced Reductive Dechlorination Groundwater Treatment Systems

Performance monitoring of the groundwater injection treatment systems will involve monitoring of the injection systems' input and output parameters to ensure the systems are functioning as designed and to allow modifications to increase the systems' effectiveness. The monitoring parameters are identified in an EDR.

5.3 Groundwater Confirmation Monitoring

Groundwater samples will be collected from the compliance wells along the western boundary of the 8801 property to determine if CULs have been achieved. The proposed wells to be sampled and the analyses are provided in Table 5. The selected wells include MW-50A, a new well that will be installed in the southwest corner of the 8801 property, and the well on the property adjacent to the north, IT-MW-7. These wells are located adjacent to the POC for groundwater and will be sampled on a quarterly basis for the two years after active remediation has been completed (refer to Table 5 for the complete list of compliance monitoring wells). The frequency of monitoring will then be assessed in coordination with Ecology. The quantity and range of analysis will be reduced as the analytical results meets the criteria laid out in Figure 7 and defined below.

Sampling will be reduced as follows:

- If a COC concentration is below the CUL for the final four consecutive quarters of the eight-quarter events, it will be removed from that monitoring well or the program, as relevant. A COC may also be removed if statistical cleanup requirements are met per WAC 173-340-720(9)(e) and (f).
- If total PCBs concentrations are non-detect at a PQL that is practical (meaning a low-level method of analysis is used but not a congener analysis) for six consecutive quarters of PCB aroclors sampling, followed by two quarters of PCB congener homolog sampling, then the analysis will be removed from that monitoring well or the program, as relevant. Because detections will be identified with the PCB congener homolog analytical method and those concentrations are likely to be above the CUL, the results will be compared to the PCB aroclor PQL being used at that time. Total PCBs analysis may also be removed from a monitoring well or the program, as relevant, if statistical cleanup requirements are satisfied after a minimum of eight quarters of monitoring per WAC 173-340-720(9)(e) and (f).

In advance of the five-year review by Ecology, sampling from the set of compliance monitoring wells will be undertaken and groundwater analyzed for the relevant site COCs. The sampling schedule for the five-year review may be reduced based on discussions with Ecology.

5.4 Groundwater Monitoring Well Network Modifications

The existing groundwater monitoring well network is proposed to be heavily modified due to redevelopment of the 8801 property. The modifications are shown in Figure 2 and are detailed in Table 6. The modifications are as follows:

- In advance of construction for the proposed new warehouse, 39 monitoring wells will be decommissioned. Three recovery well have also been used historically on the 8801 property, one of these has been located and will be decommissioned. The remaining two recovery wells may have been previously decommissioned, if not, they will be decommissioned if construction activities expose the well locations. Compliance monitoring wells along the western boundary of the 8801 property, adjacent to the LDW will not be decommissioned. Wells will be decommissioned in accordance with all applicable requirements and WAC 173-160-381.
- After approximately eight months of construction, 14 new monitoring wells will be installed. The installation schedule will be coordinated with the construction activities to avoid newly installed monitoring wells potentially being damaged by ongoing construction work. Eleven of the new wells will replace decommissioned wells and will be used for performance monitoring, and one new well will be installed and used for compliance monitoring (MW-50A), as shown in Figure 3. Two replacement monitoring wells (MW-18A(R) and MW-1A(R)) will not be utilized for performance or compliance monitoring but are being installed to replace existing wells that have been utilized during previous investigations and may be used in the future.

Replacement monitoring wells will be constructed to the same depth and screened in the same portion of the aquifer as the well which is being removed. Replacement wells that will be utilized for performance or compliance monitoring are shown in Figures 2 and 3.

5.5 Schedule for Implementation

It is anticipated the remedial excavations and the first injection event would occur within one year after Ecology approves the EDRs for the remedial actions at the 8801 property. Performance monitoring will then be used to determine whether additional injections are required. At least one ERD injection is required for the main part of the plume, and up to two ERD injections may be required in the northwest corner. Compliance monitoring will then commence. If required, additional injections will likely be undertaken within one to three years after the initial injections.

5.6 Contingencies

This section discusses the decision points to determine if additional soil and/or groundwater remedial actions are required after the proposed remedy has been implemented. As previously discussed, groundwater monitoring is being used to assess the performance of the remedial actions and to establish whether the RAOs and CULs are being met. The RAOs are to protect current and future worker exposure to soil contaminants, to protect occupants of future buildings, allow for landscaping to be established within the 100-foot river buffer; to protect the surface water and sediments of the LDW, and to achieve remediation of the halogenated VOC groundwater plume in a reasonable timeframe. The groundwater data will be used to establish whether additional remedial actions are required and to assess the restoration timeline.

As previously discussed, soil confirmation samples will be collected to evaluate the effectiveness of soil excavations to the RLs in removing most of the COC mass in soil. Four of the excavations (Excavations 3, 4, 5, and 8) are close to the western boundary of the 8801 property. Groundwater for some of the COC concentrations from monitoring wells adjacent to these locations have exceeded their respective CULs. Excavation work is expected to disturb the soil and groundwater equilibrium resulting in temporary impacts to groundwater. Contaminants adsorbed to the finer soil particles may temporarily increase contaminant concentrations in total groundwater samples immediately after the excavation activities. Because it may take up to a year before this disturbance effect diminishes and the soil/groundwater equilibrium is restored, contingency actions will not be evaluated until after a minimum of four groundwater monitoring events associated with the excavation activities. Therefore, the timeline for consideration of actions associated with the excavation areas will be over a greater time-period than for groundwater remedial actions. Detection of chemicals associated with the laboratory's ability to achieve lower detection limits and consequently result in a detection where previous samples were non-detect are not considered applicable to the triggers discussed below.

Triggers and potential remedial actions that will be considered for soil commencing one year after completion of the excavations are:

- If total PCB aroclors are detected in groundwater in the compliance monitoring wells for more than three consecutive sampling events at concentrations greater than CULs and do not show a declining trend in concentration, a discussion with Ecology regarding additional alternatives will be undertaken. PCB aroclors in groundwater tend to be near the laboratory detection limit when analyzed so concentration fluctuations may be difficult to distinguish. In addition, PCB aroclor concentrations may fluctuate with the seasons, which could complicate identifying whether trends are declining. Ecology will determine whether the trend is declining based on all available data. Ecology may

decide that additional data are required before the decision regarding trends can be made.

Within the halogenated VOC groundwater plume, the injected reagents have a designed lifespan of approximately two to four years and will impact groundwater both near and downgradient of the injection point. Triggers and potential actions that will be considered for the halogenated VOC groundwater plume after completion of the injections are:

- If the maximum concentration of TCE has not declined by 80% within three years and the geochemistry demonstrates that dechlorination is still occurring, re-injection of the ERD compounds or other stimulate compounds will be considered.
- If vinyl chloride increases are greater than those predicted from the mass conversion of the remaining TCE or the concentrations stall, alternative injection substrates may be considered. These could include, but are not limited to, permanganate, peroxide, or persulfate.
- Since a large warehouse is proposed to be constructed over much of the 8801 property, including part of the halogenated VOC groundwater plume, some alternative injection points may need to be established to address on-going remedial actions. Once the warehouse has been constructed, if remedial action is still necessary (as discussed above), injection points will be placed alongside the exterior of the warehouse and wells downgradient of the warehouse will be monitored.
- On the western edge of the halogenated VOC plume, vinyl chloride is being addressed with the existing AS/SVE system and the proposed extension of the AS/SVE system. The northern and southern AS/SVE system wellfield legs of the existing AS/SVE system can be independently shutdown if CULs are achieved upgradient of these legs.

Triggers and potential remedial actions that will be considered for vinyl chloride and hydrocarbons in groundwater in the northwest corner of the 8801 property after completion of the injections are:

- If vinyl chloride concentrations in groundwater exceed the CULs at MW-7A (upgradient) and MW-44A (within the injection area) after three injection periods (if three injections are undertaken as they may not all be required), consideration of other options, such as alternative injection compounds, will be discussed with Ecology.
- If hydrocarbon concentrations in groundwater exceed the CULs at MW-44A after three injection periods (if three injections are undertaken as they may not all be required), consideration of other options, such as alternative injection compounds, will be discussed with Ecology.

6 LIMITATIONS

This report was prepared exclusively for PACCAR by Shannon & Wilson. The quality of information, conclusions, and estimates contained herein are consistent with the level of effort involved in our services and based on (a) information available at the time of preparation; (b) data supplied by outside sources; and (c) the assumptions, conditions, and qualifications set forth in this report and our proposal. This report is intended to be used for the 8801 property only, subject to the terms and conditions of the contract. Any other use of, or reliance on, this report by any third party is at the sole risk of that party.

7 REFERENCES

Shannon & Wilson, 2020a, Final feasibility study for 8801 East Marginal Way S, Tukwila, Wash.: Report prepared by Shannon & Wilson, Inc., 21-1-12567-021, for PACCAR Inc, July 27.

Shannon & Wilson, 2020b, Final interim action work plan for 8801 East Marginal Way S, Tukwila, Wash.: Report prepared by Shannon & Wilson, Inc., 21-1-12567-021, for PACCAR Inc, July 27.

Shannon & Wilson, 2020c, Final addendum to feasibility study and interim action work plan for 8801 East Marginal Way S, Tukwila, Wash.: Report prepared by Shannon & Wilson, Inc., 21-1-12567-023, for PACCAR Inc, December 11.

Shannon & Wilson, 2021, Post-Pilot Injection Monitoring Results, 8801 East Marginal Way South, Tukwila, Wash: Report prepared by Shannon & Wilson, Inc., 103485-003, for PACCAR Inc, April 29.

Washington State Department of Ecology (Ecology), 2013, Model toxics control act regulation and statute: MTCA cleanup regulation, chapter 173-340 WAC; model toxics control act, chapter 70.105D RCW; uniform environmental covenants act, chapter 64.70 RCW (rev.): Olympia, Wash., Washington Dept. of Ecology, Publication no. 94.06, 324 p., available: https://fortress.wa.gov/ecy/publications/summarypages/9406.html.

Table 1: Cleanup Levels

Analyte	Soil					Groundwater			Indoor Air
	Soil – Protective of Sediment or Surface Water[a] (mg/kg)	**Soil –** Background (mg/kg)	**Human Health –** MTCA Method A or B[b] (mg/kg)	Practical Quantitation Limit (mg/kg)	**Soil –** Protective of Vapor[c] (mg/kg)	Groundwater[a] (µg/L)	**Groundwater –** Protective of Indoor Air[b] (µg/L)	Practical Quantitation Limit (µg/L)	MTCA Method B Indoor Air[b] (µg/m^3)
Arsenic	—	7.3	—	—	—	8	—	—	—
Bis(2-ethylhexyl)phthalate	0.005/0.1	—	—	0.12	—	0.046	—	0.2	—
Cadmium	5.1	—	—	—	—	—	—	—	—
Total Chromium	2,600	—	—	—	—	—	—	—	—
Copper	—	36	—	—	—	8	—	—	—
Dichloroethane, 1,1-	—	—	—	—	—	—	11	—	1.56
Diesel-range hydrocarbons	—	—	—	—	—	500[d]	—	—	—
Dioxin/furan TEQ	—	0.0000052	—	—	—	—	—	—	—
Gasoline-range hydrocarbons	—	—	100	—	250	1,000[d]	—	—	1,400
Lead	—	—	250	—	—	—	—	—	—
Oil-range hydrocarbons	—	—	2,000	—	—	500[d]	—	—	—
Tetrachloroethene	0.0016	—	—	—	—	2.9	—	—	9.62
Total cPAHs TEQ	0.000016	—	—	0.005	—	0.000016	—	0.01	—
Total PCB aroclors	0.0000022	—	—	0.002	—	0.000007	—	0.01	—
Trichloroethene	0.00027/0.0044	—	—	0.001	—	0.7	—	—	0.37
Vinyl chloride (chloroethylene)	0.000055 /0.001	—	—	0.001	—	0.18	—	—	0.28

NOTES:
a Washington State Department of Ecology's (Ecology's) Lower Duwamish Waterway (LDW) Preliminary Cleanup Levels (PCUL) Work Book (Ecology, 2018). Soil values are based on protection of sediment or surface water via leaching from saturated/unsaturated soil into non-potable groundwater or from bank spall at locations close to water (cadmium and chromium). The first value is saturated soil and the second value is unsaturated soil.
b Model Toxics Control Act (MTCA) Method A or B levels from the Cleanup Levels and Risk Calculation (CLARC) database (March 2019).
c Ecology Implementation Memo 14: Updated process for initially assessing the potential for petroleum vapor instrusion (March 2016).
d A1 boring area is the one area with gasoline is impacted groundwater and the adjacent well MW-44A is the only location with diesel and oil impacted groundwater in 2019.
Bold = Selected proposed cleanup level for chemical in the media.
— = Not a selected cleanup level and/or chemical of concern for this media; µg/L = micrograms per liter; µg/m3 = micrograms per meter cubed; cPAHs = carcinogenic polycyclic aromatic hydrocarbons; mg/kg = milligrams per kilogram; PCB = polychlorinated biphenyl; TEQ = toxicity equivalency quotient

Table 2: Soil Remediation Levels

Analyte	Human Health Method B Carcinogen[a] (mg/kg)	Human Health Method B Non-Carcinogen[a] (mg/kg)	Remediation Level (mg/kg)
Arsenic	—	—	14.6
Bis(2-ethylhexyl)phthalate	71.4	1,600	71.4
Copper	—	3,200	250
Oil-range hydrocarbons	—	—	4,000
Tetrachloroethene	476	480	5
Total cPAHs TEQ	—	—	0.6
Total PCB aroclors	—	—	0.5
Trichloroethene	12	40	5
Vinyl chloride	0.67	—	5

NOTES:
a Model Toxics Control Act (MTCA) Method B direct contact levels from the Cleanup Levels and Risk Calculation (CLARC) database (March 2019).
— = Not a criterion selected for this media; cPAHs = carcinogenic polycyclic aromatic hydrocarbons; mg/kg = milligrams per kilogram; PCB = polychlorinated biphenyl; TEQ = toxicity equivalency quotient

Table 3: Halogenated Volatile Organic Compounds Groundwater Remediation Levels

Area	Trichloroethene (µg/l)	Vinyl Chloride (µg/l)
Plume at MW-14A/G0	5	1
Plume east of existing AS/SVE	1	0.5

AS/SVE = air sparing/soil vapor extraction; µg/l = micrograms per liter

Table 4: Groundwater Performance Monitoring

Location Name	Location Description	Rationale	Sampling Timeframe	Groundwater Analyses							
				TPH-G	TPH-Dx	BTEX	HVOCs[1]	PCB Aroclors	PCB Congener[2]	Copper	Natural Attenuation[3]
IT-MW-6	Boeing property north of MW-46A	Monitor performance of excavation Area 1 and ERD injections	4 months after ERD Injection Event				x				
MW-48A(R)	West side of proposed new building	Monitor performance of excavation Area 1 and ERD injections	4 months after ERD Injection Event				x				
MW-28A(R)	Northwest side of proposed new building	Monitor performance of excavation Area 1 and ERD injections	4 months after ERD Injection Event				x				x
MW-12A(R)	South limit of western edge of HVOC plume	Monitor performance of excavation Area 1 and ERD injections	4 months after ERD Injection Event				x				
MW-14A(R)	North of proposed new building	Monitor performance of excavation Area 1 and ERD injections	4 months after ERD Injection Event				x				x
MW-25A(R)	Northern property near northwest corner	Monitor performance of excavation Area 1 and ERD injections	4 months after ERD Injection Event				x				
MW-47A(R)	Center of site and center of plume	Monitor performance of excavation Area 1 and ERD injections	4 months after ERD Injection Event				x				x
MW-7A(R)	East of small warehouse near northwest corner	Monitor performance of excavation Area 1 and ERD injections	4 months after ERD Injection Event	x	x	x	x				
MW-41A(R)	Southwest north of property boundary	Monitor performance of ERD injections and copper	4 months after ERD Injection Event				x			x	
MW-16A(R)	North of main warehouse	Monitor performance of PCB caulk removal	4 months after PCB Caulk Removal					x	x*		
MW-34A(R)	North of main warehouse	Monitor performance of PCB caulk removal	4 months after PCB Caulk Removal					x	x*		
IT-MW-7	Boeing property western side	Monitor performance of EDR Injections in northwest area	4 months after EDR Injection Event				x				
MW-32A(R)	North property boundary to at the west extent	Monitor performance of EDR Injections in northwest area	4 months after EDR Injection Event				X				
MW-44A	Northwest corner	Monitor performance of EDR Injections in northwest area	4 months after EDR Injection Event	x	x	x	x				

NOTES:
1 Analysis includes tetrachloroethene, trichloroethene, 1,1-dichloroethene, 1,1-dichloroethane, cis-1,2-dichloroethene, and vinyl chloride.
2 PCB Congeners homolog analysis
3 Natural attenuation parameters include methane, manganese, nitrate, nitrite, sulfate, sulfide, and ferrous iron.
MW-1A(R) and MW-18A(R) are contingency wells and not included in the groundwater monitoring regieme.
* See PCB Performance Monitoring Flowchart (Figure 6) for details on PCB monitoring
BTEX = benzene, toluene, ethylbenzene, and xylenes; ERD = enhanced reductive dechlorination; HVOCs = halogenated volatile organic compounds; PCBs = polychlorinated biphenyls; TPH-Dx = total petroleum hydrocarbons-diesel extended; TPH-G = total petroleum hydrocarbons-gasoline-range

Table 5: Groundwater Compliance Monitoring

Type	Location Name	Location Description	Rationale	Groundwater Analyses						
				TPH-G	TPH-Dx	PCB Aroclors*	HVOCs[1]	BEHP	cPAHs	Copper
Groundwater Monitoring Well	IT-MW-7	Boeing property western side	HVOC evaluation				x	x		
	MW-44A	Northwest corner	HVOC and TPH evaluation	x	x	x	x	x		
	MW-35A	Small warehouse	HVOC evaluation				x	x		
	MW-26A	Small warehouse	HVOC evaluation				x	x		
	MW-36A	South of small warehouse	HVOC evaluation				x	x		
	MW-36B	South of small warehouse	HVOC evaluation				x	x		
	MW-29A	South of small warehouse	HVOC evaluation				x	x		
	MW-29B	South of small warehouse	HVOC evaluation				x	x		
	MW-37A	End of sheet pile wall	HVOC evaluation				x	x		
	MW-37B	End of sheet pile wall	HVOC evaluation				x	x		
	MW-43AR	South west storage area	HVOC, TPH, PCB, cPAH, and copper evaluation	x	x	x	x	x	x	x
	MW-30A	South of south west storage area	HVOC, TPH, PCB, cPAH, and copper evaluation	x	x	x	x	x	x	x
	MW-50A	Southwest corner	HVOC, TPH, PCB, and copper evaluation	x	x	x	x	x		x

NOTES:
1 Analysis includes tetrachloroethene, trichloroethene, 1,1-dichloroethene, cis-1,2-dichloroethene, and vinyl chloride.
* Congener homolog analysis may be undertaken on some samples prior to completion of the quarterly monitoring.
cPAHs = carcinogenic polycyclic aromatic hydrocarbons; BEHP = bis(2-ethylhexyl)phthalate; HVOCs = halogenated volatile organic compounds; PCBs = polychlorinated biphenyls; TPH = total petroleum hydrocarbons; TPH-Dx = total petroleum hydrocarbons-diesel extended; TPH-G = total petroleum hydrocarbons-gasoline-range

Table 6: Groundwater Monitoring Well Network Modifications

Well Name	Location	Base of Screened Interval (ft bgs)	Screened Interval (ft bgs)	Diameter (in.)	Material	Proposed Modification	Rationale/Comment
MW-1A	E of Warehouse	9.8	4.75-9.8	4	PVC	Decommission	Inside of new proposed warehouse footprint
MW-1A(R)	200 Feet E of Existing MW-1A	9.8	5-10	2	PVC	Install	Replace MW-1A - upgradient well for use, if necessary
MW-6A(R)	S of Warehouse	20	5-20	2	PVC	Decommission	Inside of new proposed warehouse footprint; no longer needed to monitor south fire aisle groundwater
MW-7A	NE of Fiberglass Shop	19.2	5.5-19.2	2	PVC	Decommission	Allow for site redevelopment
MW-7A(R)	Near existing MW-7A	19	5-20	2	PVC	Install	Replace MW-7 - use for performance monitoring
MW-8A	N of Water tower	18	3-18	2	PVC	Decommission	Monument has been paved over and well is no longer used
MW-8B	N of Water tower	28.5	23.5-28.5	2	PVC	Decommission	Well not useable and no longer needed
MW-9A	SW of Warehouse	20	5-20	2	PVC	Decommission	Inside of new proposed warehouse footprint; no longer needed to monitor south fire aisle groundwater
MW-10	SW of Warehouse	20.3	5-20.3	2	PVC	Decommission	Inside of new proposed warehouse footprint and out of service for multiple years
MW-11A	S Boundary - Center	20.8	5-20.8	2	PVC	Decommission	Allow for site redevelopment and not needed
MW-12A	S Center SW Quadrant	20.5	5-20.5	2	PVC	Decommission	Allow for site redevelopment
MW-12A(R)	Near MW-12A	20	5-20	2	PVC	Install	Replace MW-12A - use for southern plume delineation and performance monitoring
MW-14A	NW of Water tower	15.4	1.4-15.4	2	PVC	Decommission	Allow for site redevelopment
MW-14A(R)	Near MW-14A	15.5	1.5-15.5	2	PVC	Install	Replace MW-14A - use for monitoring upgradient portion of plume and performance monitoring
MW-15A	W of Water tower	15.9	1.9-15.9	2	PVC	Decommission	Allow for site redevelopment and not needed
MW-16A	N of Warehouse	16.9	1.9-16.9	2	PVC	Decommission	Allow for site redevelopment
MW-16A(R)	Near MW-16A	17	2-17	2	PVC	Install	Replace MW-16 - use to monitor for PCBs and performance monitoring
MW-18A	SW of Water tower	18.6	8.6-18.6	2	PVC	Decommission	Inside of new proposed warehouse footprint
MW-18A(R)	100 Feet NW of Existing MW-18A	19	9-19	2	PVC	Install	Replace MW-18A - for possible use to evaluate upgradient portion of plume
MW-22A	N of Warehouse	20.3	5-20.3	2	PVC	Decommission	Allow for site redevelopment and no longer needed
MW-23A	N of Water tower	20.3	5-20.3	2	PVC	Decommission	Allow for site redevelopment and no longer needed

Table 6: Groundwater Monitoring Well Network Modifications

Well Name	Location	Base of Screened Interval (ft bgs)	Screened Interval (ft bgs)	Diameter (in.)	Material	Proposed Modification	Rationale/Comment
MW-24A	N Boundary - Center	25.5	20.5-25.5	2	SS	Decommission	Allow for site redevelopment and no longer needed
MW-25A	N Boundary - West	23	13-23	2	PVC	Decommission	Allow for site access
MW-25A(R)	Near MW-25A	23	13-23	2	PVC	Install	Replace MW-25A - use to monitor NW corner and performance monitoring
MW-27A	N of Fiberglass Shop	25.5	20.5-25.5	2	SS	Decommission	Allow for site redevelopment and no longer needed
MW-28A	Center NW Quadrant	20.5	15.3-20.5	2	SS	Decommission	Inside of new proposed warehouse footprint
MW-28A(R)	30 Feet W of Existing MW-28A(R)	20.5	15.5-20.5	2	SS	Install	Replace MW-28A - use for mid plume monitoring and performance monitoring
MW-28B	Center NW Quadrant	40.3	35.3-40.3	2	SS	Decommission	Inside of new proposed warehouse footprint and no longer needed
MW-31A	S Center NW Quadrant	23	13-23	2	PVC	Decommission	Allow for site redevelopment and no longer needed
MW-32A	N Boundary - West	23	13-23	2	PVC	Decommission	Allow for site redevelopment and no longer needed
MW-32A(R)	Near MW-32A	23	13-23	2	PVC	Decommission	Replace MW-32A - use to monitor for HVOCs and performance monitoring
MW-33A	NW of Water tower	20	10-20	2	PVC	Decommission	Allow for site redevelopment and no longer needed
MW-34A	NE of Water tower	20	10-20	2	PVC	Decommission	Allow for site redevlopment
MW-34A(R)	Near MW-34A	20	10-20	2	PVC	Install	Replace MW-34A - use to monitor for PCBs and performance monitoring
MW-38A	S Center NW Quadrant	23	13-23	2	PVC	Decommission	Allow for site redevelopment and no longer needed
MW-39A	Location on Property	23	13-23	2	PVC	Decommission	Allow for site redevelopment and no longer needed
MW-40A	Location on Property	20	10-20	2	PVC	Decommission	Allow for site redevelopment and no longer needed
MW-40B	N of Fiberglass Shop	39	29-39	2	PVC	Decommission	Allow for site redevelopment and no longer needed
MW-41A	S Center SW Quadrant	20	10-20	2	PVC	Decommission	Allow for site redevelopment
MW-41A(R)	Near MW-41A	20	10-20	2	PVC	Install	Replace MW-41A - use to monitor southern plume boundary and performance monitoring
MW-42A	S of Warehouse	20	5-20	2	PVC	Decommission	Inside of new proposed warehouse footprint and no longer needed
MW-43A	W Boundary - South	20	5-20	2	PVC	Decommission	In remedial excavation footprint
MW-43A(R)	75 Feet W of Existing MW-43A	20	5-20	2	PVC	Install	Replace MW-43A - use as compliance well

Table 6: Groundwater Monitoring Well Network Modifications

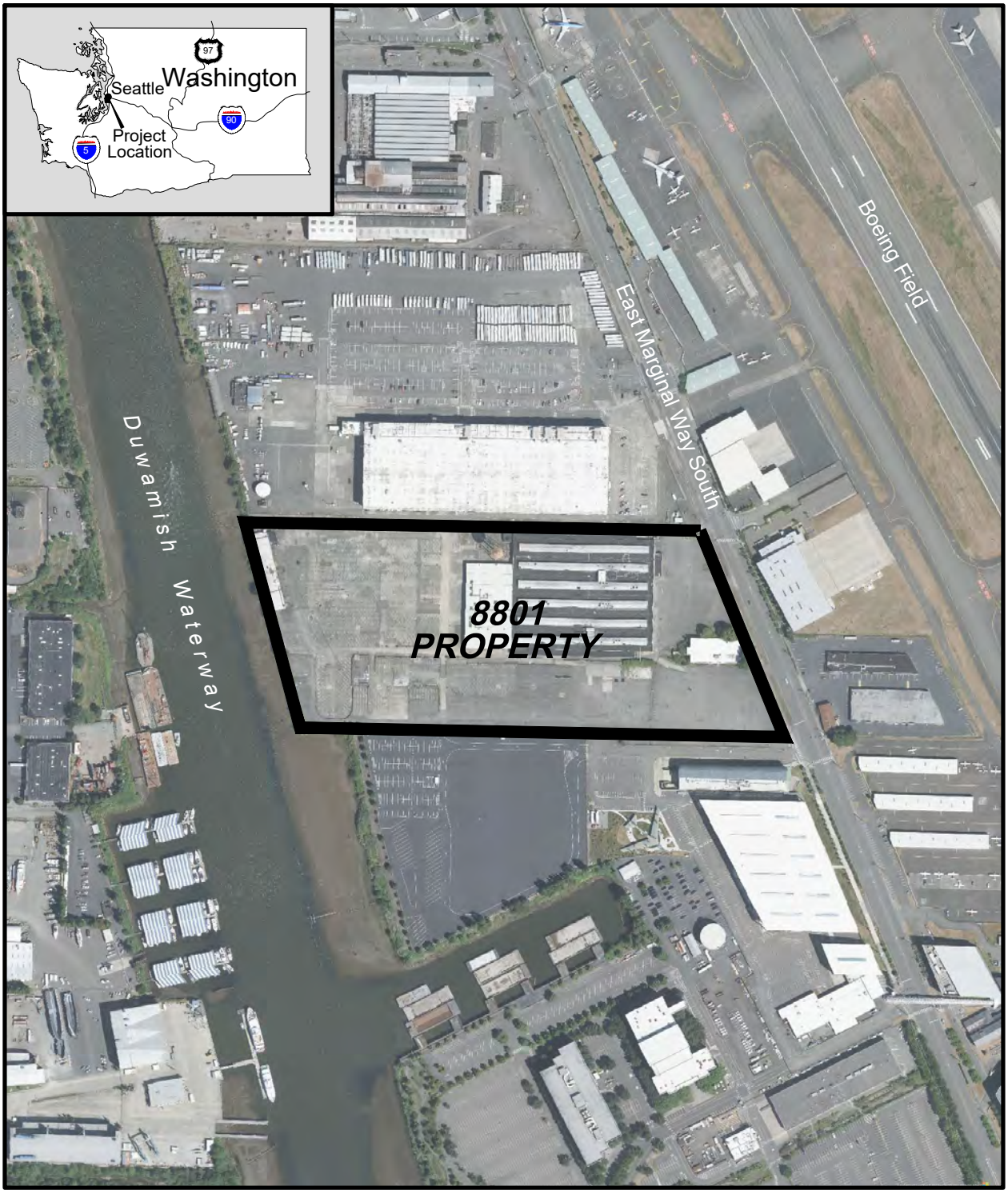
Well Name	Location	Base of Screened Interval (ft bgs)	Screened Interval (ft bgs)	Diameter (in.)	Material	Proposed Modification	Rationale/Comment
MW-45A	N Boundary - West	15	5-15	2	PVC	Decommission	Allow for site redevelopment and no longer needed
MW-46A	N Boundary W of Water tower	16	6-16	2	PVC	Decommission	In remedial excavation footprint and no longer needed
MW-47A	SW of Center NW Quadrant	15	5-15	2	PVC	Decommission	Allow for site access
MW-47A(R)	**Near MW-47A**	**15**	**5-15**	**2**	**PVC**	**Install**	**Replace MW-47A - use to monitor mid plume and performance monitoring**
MW-47B	SW of Center NW Quadrant	40	30-40	2	PVC	Decommission	Allow for site redevelopment and no longer needed
MW-48A	N of Center SW Quadrant	15	5-15	2	PVC	Decommission	Inside of new proposed warehouse footprint
MW-48A(R)	**80 Feet W of existing MW-48A**	**15**	**5-15**	**2**	**PVC**	**Install**	**Replace MW-48A - use to monitor mid plume and performance monitoring**
MW-48B	N of Center SW Quadrant	10	30-10	2	PVC	Decommission	Inside of new proposed warehouse footprint and no longer needed
MW-49A	S of Center SW Quadrant	15	5-15	2	PVC	Decommission	Allow for site redevelopment and no longer needed
MW-49B	S of Center SW Quadrant	45	35-45	2	PVC	Decommission	Allow for site redevelopment and no longer needed
MW-50A	**SW Corner of Property**	**20**	**5-20**	**2**	**PVC**	**Install**	**Use to monitor southwest corner and as a compliance well**
RW1	N of Water tower	--	--	6	SS	Decommission	No longer in use
RW2	W of Warehouse	--	--	6	SS	Decommission	No longer in use
RW3	N of Warehouse	--	--	6	SS	Decommission	No longer in use

NOTES:
Shaded rows refers to wells to be decommissioned and replaced with a similar monitoring well.
Bold rows refer to wells to be installed.
ft bgs = feet below ground surface; GW = groundwater; in. = inch or inches; PVC = polyvinyl chloride; SS = stainless steel

Table 7: Soil Sampling Performance Monitoring

				Soil Analyses												
Type	Location Name	Excavation Area	Location Description	TPH-G	TPH-Dx	cPAHs	PCB Aroclors	Dioxin/ Furan	TCE*	RCRA 8 metals and Cu+Ni+Zn	Arsenic	Copper	Lead	Cadmium	Chromium
Remedial Excavation	G0	Area 1	Northern Property Boundary						X						
	H4	Area 2	West of Existing Building			X									
	E7	Area 3	Southern Property Boundary	X			X					X			
	DG11-1	Area 4	Near South Stormwater Vault				X	X[#]				X			
	SWS	Area 5	North of South Stormwater Vault				X				X		X	X	X
	SFA-S15-3	Area 6	East of Existing Warehouse								X				
	FWW-1	Area 7	Inside of Existing Warehouse	X											
	A1	Area 8	Northwest corner	X											
	Drill Cuttings	NA	Monitoring Well Installations	X	X		X			X	X				
	Fill	All	Imported Fill	X	X	X	X				X	X	X		

NOTES:
[#] Dioxin/furan analysis in two base samples in the proximity of the location of C6 and DG-11-1 only
* Includes tetrachloroethylene and vinyl chloride
cPAHs = carcinogenic polycyclic aromatic hydrocarbons; Cu = copper; Ni = nickel; PCB = polychlorinated biphenyl; RCRA = Resource Conservation and Recovery Act; TCE = trichloroethylene; TPH-Dx = total petroleum hydrocarbons-diesel extended; TPH-G = total petroleum hydrocarbons-gasoline-range; Zn = zinc



0 500 1,000

Approximate Scale in Feet

8801 East Marginal Way South
Tukwila, Washington

VICINITY MAP

March 2021 21-1-12567-031

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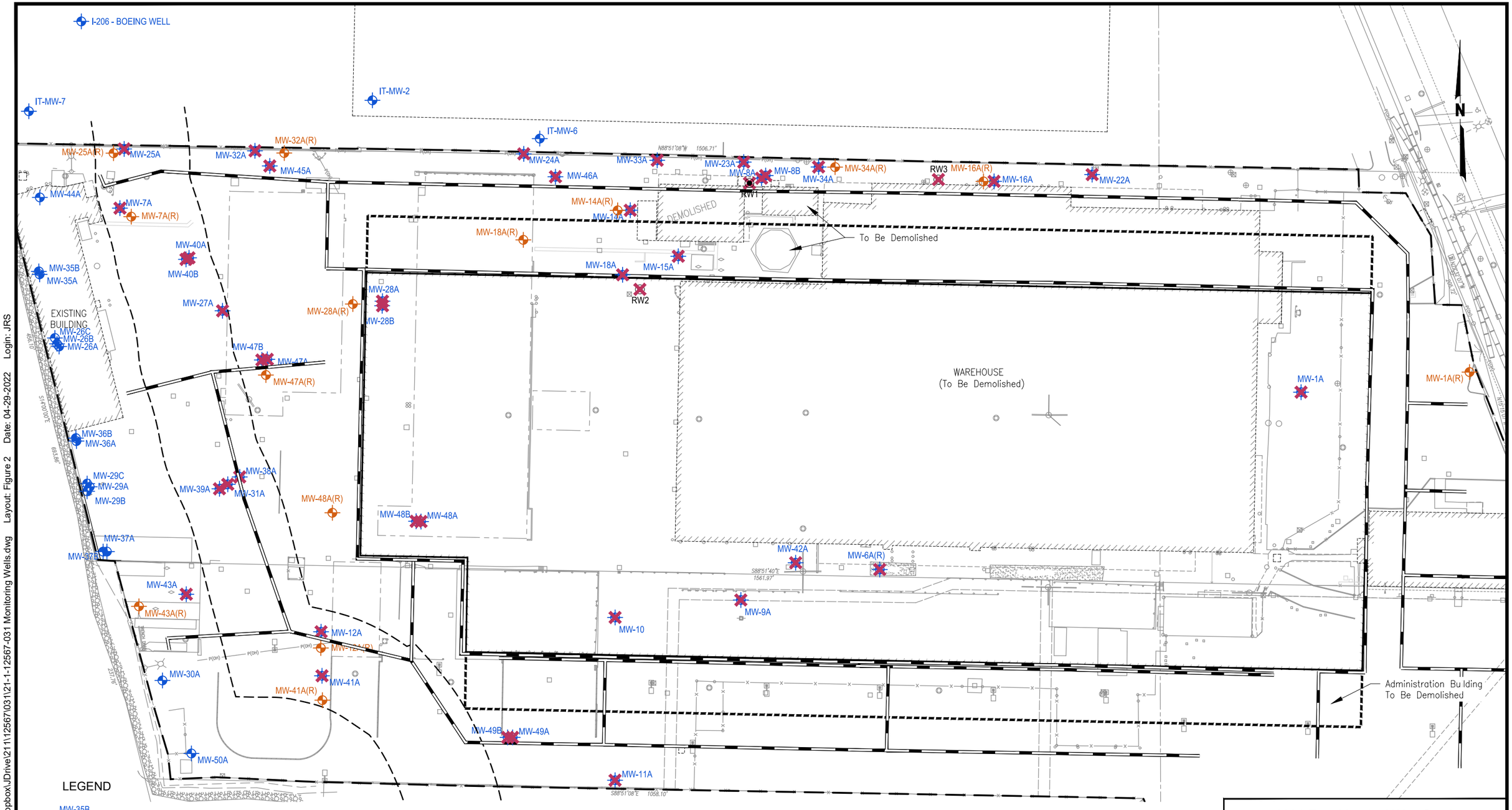
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 1

Filename: C:\Users\jrs\CAD Group Dropbox\JDrive\211\12567\031\21-1-12567-031 Vicinity Map.dwg Date: 04-29-2022 Login: JRS



8801 East Marginal Way South
Tukwila, Washington

MONITORING WELL NETWORK MODIFICATION

March 2021 21-1-12567-031

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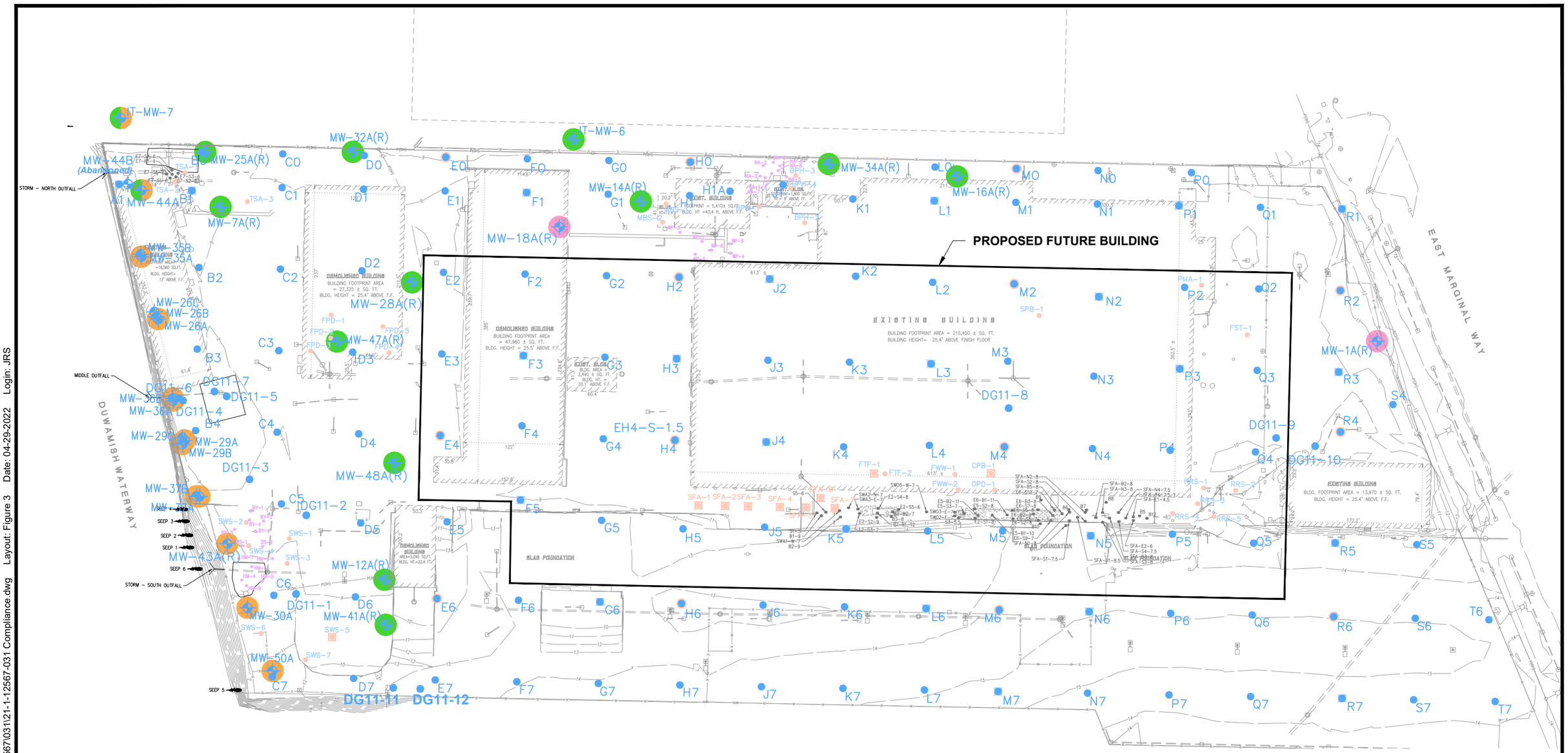
FIG. 2

Filename: C:\Users\jrs\CAD Group Dropbox\JDrive\21\11\12567\03\121-1-12567-031 Monitoring Wells.dwg Layout: Figure 2 Date: 04-29-2022 Login: JRS



NOTES

1. Exploration locations are approximate.
2. Base map and historic exploration points are from Kennedy-Jenks Figures 2 and 3, 046001.00/Report/Po4SK003.

SAMPLING LOCATIONS

- Soil Sample Location
- MW-34A(R) Shallow Zone Groundwater Monitoring Well
- Previous Soil Boring Location
- Fenceline

SAMPLING CONFIRMATION

- Performance Wells
- Compliance Wells
- Re-Installed Wells

8801 East Marginal Way South
Tukwila, Washington

PERFORMANCE AND COMPLIANCE MONITORING WELLS

March 2021 21-1-12567-031

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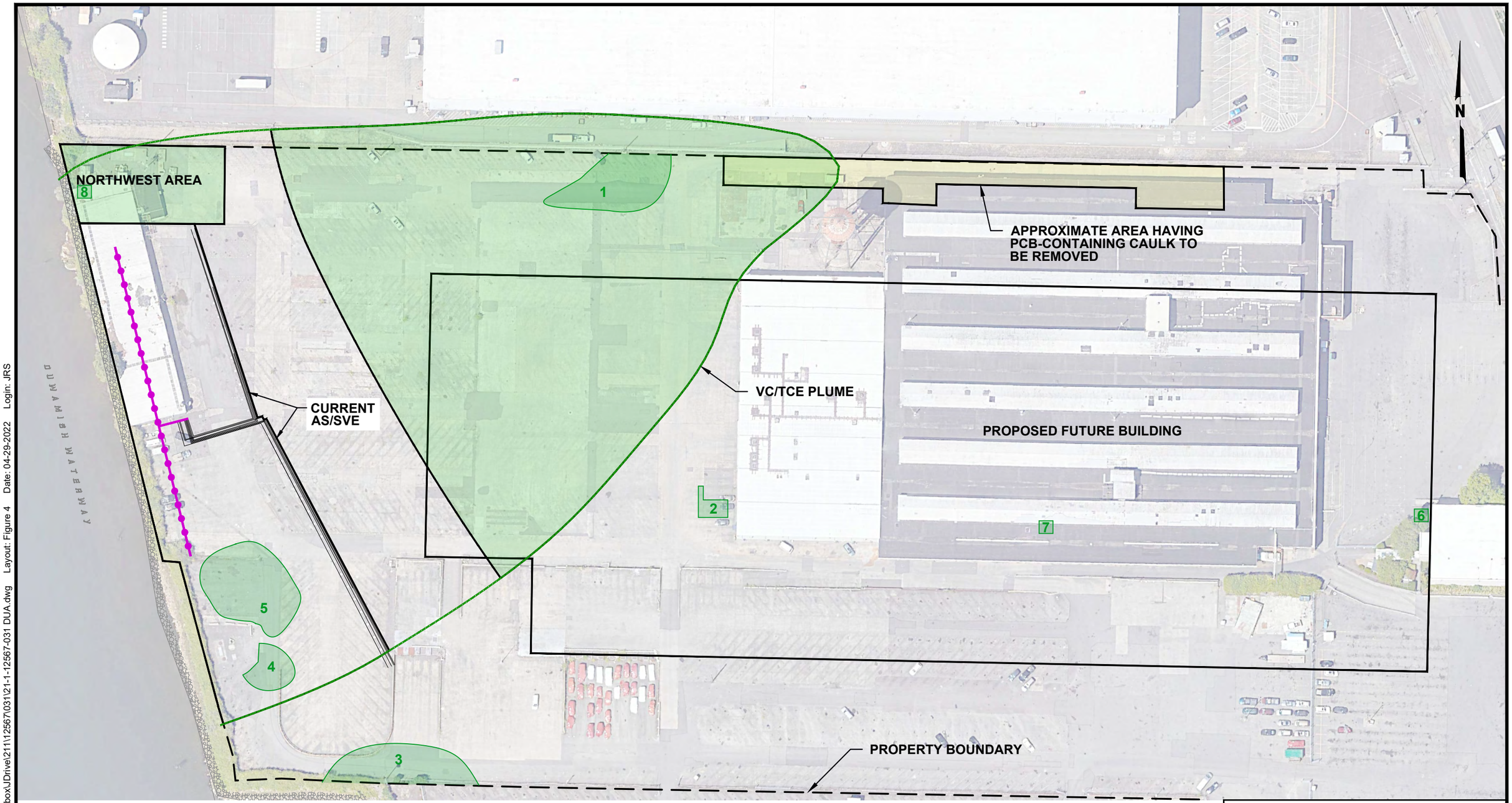
FIG. 3

Filename: C:\Users\jrs\CAD Group Dropbox\JDrive\21\112567\031\21-1-12567-031 Compliance.dwg Layout: Figure 3 Date: 04-29-2022 Login: JRS



LEGEND

- 3 — Soil Excavation Area
- Proposed Enhanced Reductive Dechlorination Groundwater Remediation Area
- Proposed Extension of Air Sparge/Soil Vapor Extraction Groundwater Remedy

0 100 200

Scale in Feet

8801 East Marginal Way South
Tukwila, Washington

PROPOSED REMEDIATION

March 2021 21-1-12567-031

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FIG. 4

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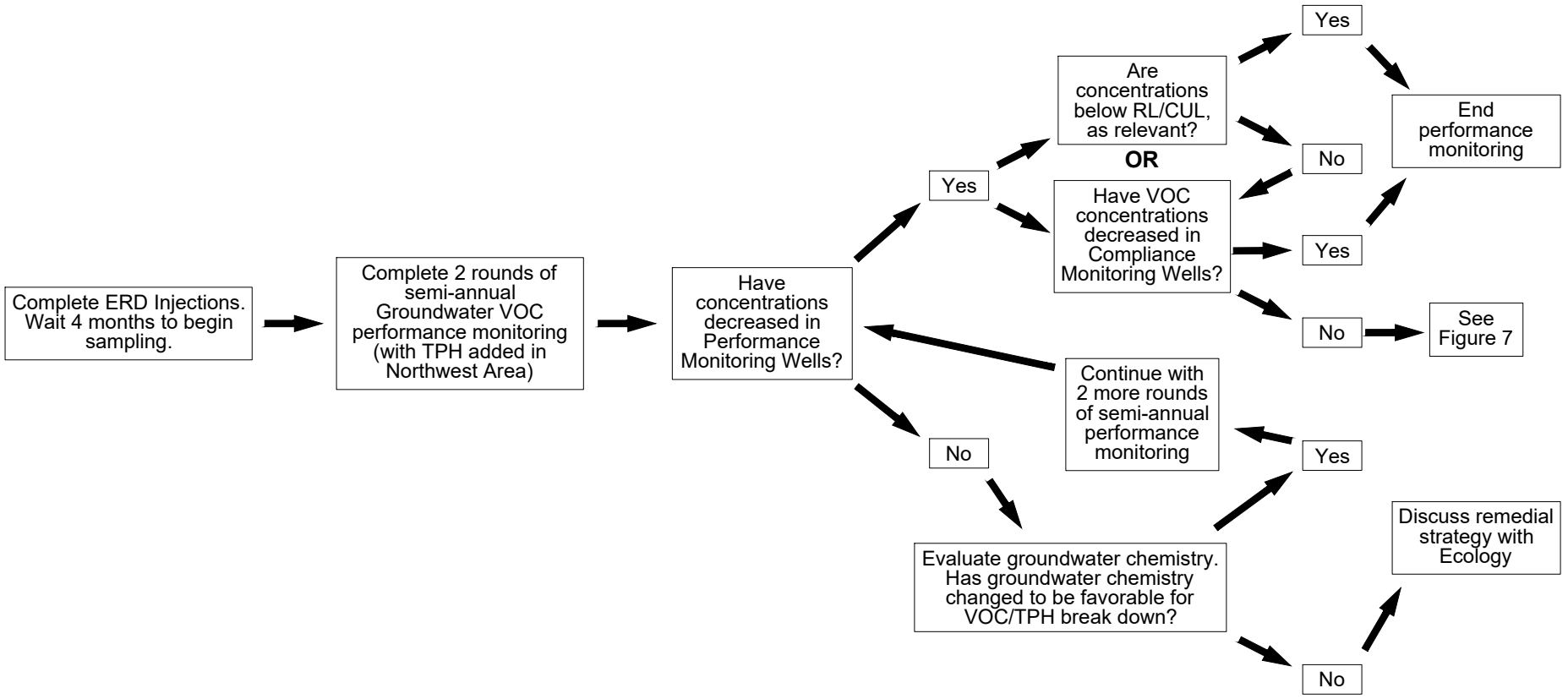

Abbreviations

CUL = Cleanup Level

ERD = Enhanced Reduction Dechlorination

RL = Remediation Level

TPH = Total Petroleum Hydrocarbon

VOC = Volatile Organic Compounds

NOTE

If no noticeable reduction has occured within two years of groundwater sampling, the monitoring/remedial strategy will be discussed with Ecology.

8801 East Marginal Way South
Tukwila, Washington

ENHANCED REDUCTIVE DECLORINATION PERFORMANCE MONITORING FLOWCHART

March 2021 21-1-12567-031

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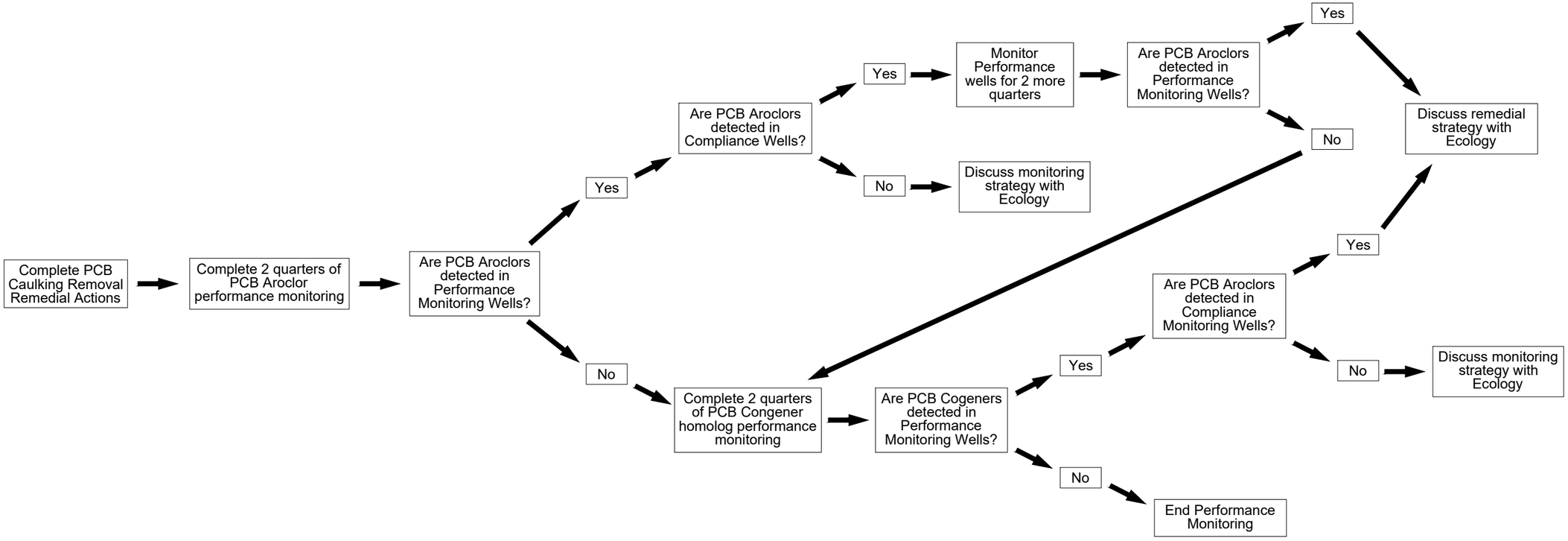
FIG. 5

FIG. 5



Abbreviation

PCB = Polychlorinated Biphenyl

NOTE

If no noticeable reduction has occured within two years of groundwater sampling, the monitoring/remedial strategy will be discussed with Ecology.

8801 East Marginal Way South
Tukwila, Washington

PCBs PERFORMANCE MONITORING FLOWCHART

March 2021 21-1-12567-031

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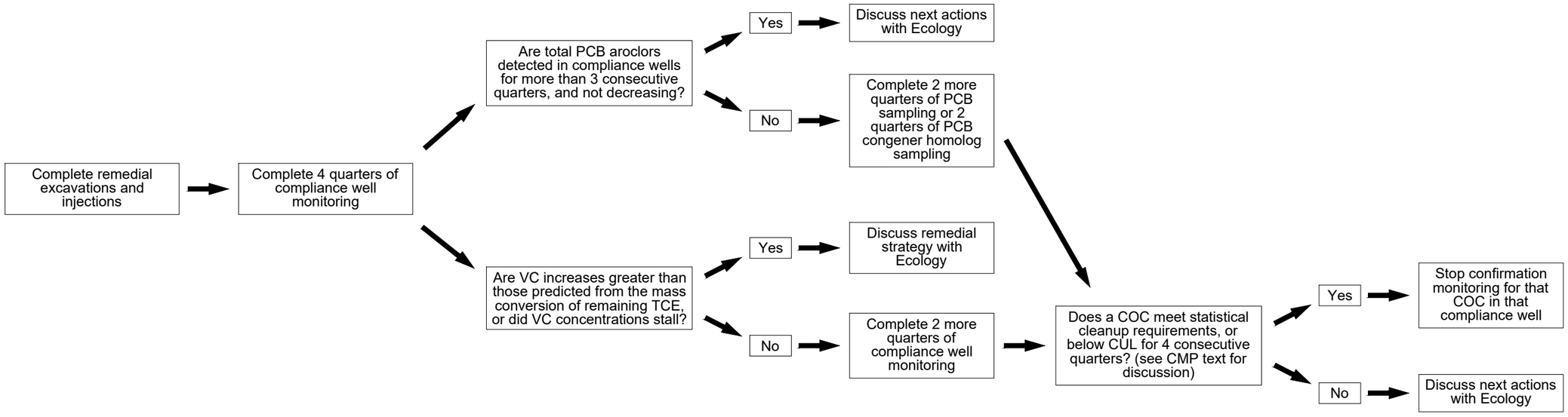
FIG. 6



Abbreviations

CMP = Compliance Monitoring Plan

cPAHs = Carcinogenic Polycyclic Aromatic Hydrocarbon

COC = Chemical of Concern

CUL = Cleanup Level

PCBs = Ploychlorinated Biphenyls

TCE = Trichloroethylene

VC = Vinyl Chloride

NOTE

If no noticeable reduction has occured within two years of initial groundwater sampling, the monitoring/remedial strategy will be discussed with Ecology.

8801 East Marginal Way South
Tukwila, Washington

CONFIRMATION MONITORING FLOWCHART

March 2021 21-1-12567-031

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FIG. 7

PREPARED FOR:
PACCAR Inc

BY:
Shannon & Wilson
400 N. 34th Street, Suite 100
Seattle, WA 98103

(206) 632-8020
www.shannonwilson.com

SAMPLING, ANALYSIS, AND QUALITY CONTROL PLAN

Compliance Monitoring Plan

8801 East Marginal Way S., Tukwila, Washington
Agreed Order No. 6069

SHANNON & WILSON

March 15, 2021

Shannon & Wilson No: 21-1-12567-031

CONTENTS

CONTENTS

Attachments

ACRONYMS

°C	degrees Celsius
8801 property	upland portion of the 8801 site
8801 site	8801 East Marginal Way South site
ARI	Analytical Resources, Inc.
bgs	below ground surface
BTEX	benzene, toluene, ethylbenzene, and xylenes
CMP	Compliance Monitoring Plan
COC	chemicals of concern
cPAHs	carcinogenic polycyclic aromatic hydrocarbons
CUL	cleanup level
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
F&B	Friedman & Bruya, Inc.
HASP	Health and Safety Plan
HVOC	halogenated volatile organic compound
IDW	investigation-derived waste
mg/L	milligrams per liter
MS/MSD	matrix spike/matrix spike duplicate
NTUs	nephelometric turbidity units
NWTPH-Dx	Northwest Total Petroleum Hydrocarbons-Diesel Extended
NWTPH-Gx	Northwest Total Petroleum Hydrocarbons-Gasoline Extended
PCBs	polychlorinated biphenyls
PCE	tetrachloroethene
PPE	personal protective equipment
RL	remediation level
QA/QC	quality assurance and quality control
SAQP	Sampling, Analysis, and Quality Control Plan
SSD	sub-slab depressurization
TCE	trichloroethene
TPH	total petroleum hydrocarbons
TPH-D	total petroleum hydrocarbons as diesel
TPH-G	total petroleum hydrocarbons as gasoline-range organics
TPH-O	total petroleum hydrocarbons as oil
VOA	volatile organic analyte
WAC	Washington Administrative Code

1 INTRODUCTION

This Sampling, Analysis, and Quality Control Plan (SAQP) has been prepared to detail field and laboratory procedures for the proposed activities outlined within the Compliance Monitoring Plan (CMP).

The proposed activities are to be conducted at the upland portion of the 8801 East Marginal Way South site in Tukwila, Washington (8801 site). The upland portion of the 8801 site is referred to as the 8801 property. A location map of the 8801 property is provided in the CMP Figure 1.

1.1 Scope of Work

The scope of work, as outlined in the CMP, consists of the following tasks and objectives:

- Remedial Excavations
  - Excavate soil in known hotspots to remove mass of chemicals of concern (COCs).
- Remedial Injections
  - Inject chemicals to stimulate enhanced reductive dechlorination in the volatile organic compound plume to remediate trichloroethene (TCE), vinyl chloride and total petroleum hydrocarbons (TPH) contamination, and
- Groundwater Investigation
  - Decommission 17 groundwater monitoring wells that are being impacted by construction or are no longer useable,
  - Install 14 new or replacement groundwater monitoring wells to allow performance and compliance monitoring, and
  - Conduct groundwater monitoring and sampling to show performance and compliance monitoring.
- Sub-Slab Vapor Investigation
  - Sample sub-slab vapor inside of the new warehouse building.

1.2 Project Contact Information

Key contact information for the proposed scope of work includes:

- Project Manager: Meg Strong, (206) 695-6787
- Project Coordinator: Ryan Peterson, (206) 695-6673
- Quality Assurance Manager: David Randall, (206)-695-6918

- Facility Representative: Bridget Fisher, (213) 330-6287
- Health and Safety Coordinator: Mindy Buxton (206) 695-6813
- Site Safety Officer: Christian Canfield, (206) 695-6716

Fremont Analytical Incorporated (Fremont) of Seattle, Washington, Friedman & Bruya, Inc. (F&B) of Seattle, Washington, NVL Laboratories, Inc. of Seattle, Washington, and ARI Laboratory of Tukwila, Washington (all Washington State Department of Ecology [Ecology]- and National Environmental Laboratories Accreditation Program-certified laboratories) will provide analytical testing services for the project. F&B will provide analytical testing for vapor samples. Fremont will provide analytical testing for soil samples. ARI will provide analytical testing for groundwater samples. NVL will provide analytical testing of lead air monitoring samples.

Mike Ridgeway - Fremont
3600 Fremont Avenue North
Seattle, WA 98103
Telephone: (206) 352-3790

Mr. Eric Young – F&B
3012 16th Avenue West
Seattle, WA 98119-2029
Telephone: (206) 285-8282

Mrs. Shaista Khan – NVL
4708 Aurora Ave N.
Seattle, WA 98103
Telephone: (888) 685-5227

Ms. Shelly Fishel - ARI
4611 S. 134th Place, Suite 100
Tukwila, WA 98168-3240
Telephone: (206) 695-6210

Select soil samples will also be submitted to the Shannon & Wilson Seattle Soils Laboratory, an American Association of State Highway and Transportation Officials Accreditation Program-accredited laboratory, for grain-size analysis.

Mr. Kerem Kalkay – Shannon & Wilson Seattle Soils Laboratory
400 N. 34th Street, Suite 100
Seattle, WA 98103
Telephone: (206) 695-6695

1.3 Organization

The remainder of this SAQP is broken into eight sections. Section 2 outlines preparation activities to be completed prior to field sampling events. Section 3 outlines soil investigation and sampling. Groundwater investigation activities are outlined within Section 4. Section 5 describes the field quality assurance and quality control (QA/QC) procedures, including sample handling, QA/QC samples, and equipment decontamination. Investigation-derived waste (IDW) management is discussed within Section 6, and health and safety

considerations are provided in Section 7. Relevant field forms are provided in Attachment 1.

2 PREPARATION

2.1 Site Access Requirements and Notifications

The Shannon & Wilson team staff will coordinate with a representative from CenterPoint's (the property owner) or tenant's representative, as relevant at the time of site work, in advance of mobilizing to the 8801 property. We will also notify Ecology either in advance of the work or by providing a schedule detailing the timeline of the work.

2.2 Utility Clearance

Utilities will be cleared prior to starting excavations or drilling. The locations will be marked in advance of the drilling activities, and the public One-Call utility check system will be notified. Applied Professional Services, Inc., a private utility clearance contractor, will clear each location. Drilling locations may be moved slightly due to discovered utilities.

2.3 Equipment Preparation

Necessary field equipment and documentation materials will be prepared prior to undertaking work. A checklist of equipment required during sampling activities will be prepared and checked each morning. Laboratory-supplied sample containers will be inspected for the proper preservative and inventoried to ensure adequate containers are available.

Meters will be calibrated at the start of each work period or prior to arrival on the 8801 property. Calibration will be valid for field conditions and will be completed in accordance with manufacturer recommendations. Calibration measurements will be documented in the field activity log for the project. Calibrations will be checked approximately every four hours thereafter and will be recalibrated, as necessary, during the work period. At the end of each day, all meters will be checked against their last calibration to document any drift that may have occurred.

A field sampling tablet, in conjunction with a field label printer, will be used during groundwater sampling activities. The tablet will be charged and setup prior to the start of each work period. Tablet setup will include pre-loading the tablet with the wells to be sampled, the analyses to be performed, and the bottles (quantity, type, size, and preservation information) needed for each sample.

3 SOIL-RELATED WORK

A Shannon & Wilson representative will be on site to locate excavations, observe utility locating activities, observe excavation activities, and prepare descriptive logs of the materials encountered. Agreed Order No. 6069 requires that any geologic work be completed under the supervision of a geologist or engineer licensed in the State of Washington. Direct-push work and remedial excavations will be overseen by a licensed engineer or geologist.

3.1 Pre-Excavation Base Sampling

In excavations where the base is likely to be below groundwater, push-probe borings will be used to collect base confirmation samples in advance of the excavation work. Borings are being used to collect base samples because most of the excavations that extend below the water table are within the tidal zone and will not be completely dewatered due to the constant tidal influx. Samples from borings can be used to target the proposed excavation depth more accurately than samples collected from an open excavation. Where borings are used to collect pre-excavation base confirmation samples, borings will be placed in locations where the maximum excavation depth is expected to be achieved. Soil samples will be collected from the borings at the targeted excavation depth, and one-foot above and one-foot below the targeted depth. The sample collected from the targeted depth will be analyzed first for the COCs applicable to the excavation area. If the COCs in the sample are below the applicable CUL or RL, then the shallower sample will be analyzed, and if any of the COCs in the sample are above the applicable CUL or RL then the deeper sample will be analyzed. The shallowest sample in which all relevant COCs are below the applicable CUL or RL will constitute the confirmation base sample for the excavation.

3.2 Remedial Excavations Sampling

Remedial excavation performance sampling is described in the CMP. Soil samples will be taken directly from the bucket of the excavator. Excavation locations can be seen in Figure 4 of the CMP.

Confirmation soil samples will be collected from the sidewalls and bottoms of each excavation area. In shallow excavations above the groundwater table, the four sidewalls and the bottom will be sampled. Generally, samples will be collected on 20-foot centers from the sidewalls and bottom of each excavation area with a minimum of one sample collected from each sidewall and base as outlined below:

- If the final excavation depth is 4 feet or less, a minimum of one sample from each sidewall will be collected within the contaminant horizon identified during previous investigation or as noted during field observation.
- If the final excavation depth exceeds 4 feet, a minimum of one sample from each sidewall will be collected from the center (or within the contaminant horizon) of each 3-foot-thick (or portion of each) vertical layer. The thickness of the individual sample layers may be reduced to allow for more even sample distribution or accommodate field observations. For example, two samples from each sidewall when the excavation depth is 8 feet.
- Regardless of the total depth of the excavation, one sample from each fill layer observed in the excavation will be collected. This may require collection of additional sidewall samples.
- Bottom samples will be collected on a 20-foot grid in excavations where groundwater is not encountered.
- When groundwater is encountered during the excavation, the lowermost sidewall sample will be assumed to represent conditions at the water table, except where pre-excavation base samples have been previously collected.
- In excavations where the base is likely to be below groundwater, borings will be used to collect base confirmation samples in advance of the excavation work. Borings are being used to collect base samples because most of the excavations that extend below the water table are within the tidal zone and will not be completely dewatered due to the constant tidal influx and borings can be used to target the proposed excavation depth more accurately than can be collected when the base is water saturated. The borings will be completed within months of the excavations being completed.

Each excavation area will have a unique sampling suite dependent upon the COC present in the area. CMP Figure 4 shows excavation locations. CMP Table 7 details soil sample analysis by each excavation area. The goal of the excavations is to remove soil containing excavation-specific COCs at concentrations above remediation levels (RLs) (except in Area 5 for cadmium and chromium and Areas 7 and 8 for gasoline-range hydrocarbons), and sample results will be used to extend the excavation if one or more excavation-specific COCs that exceed the RL are identified. The list below details the excavation-specific COCs for each area. Samples collected will be analyzed for the COCs previously documented in that location as follows:

Area 1 - Northern Property Boundary: This remedial excavation is designed to address TCE in shallow soil in the unsaturated zone. The excavation will be protective of groundwater by removing soil that has the potential to leach TCE into the groundwater table. Soil is proposed to be excavated to a depth of approximately 4 feet bgs, but the excavation may be extended to groundwater to allow for additional removal of TCE-

impacted soil if the base contains obvious visual or olfactory indications of elevated concentrations of TCE. Samples will be collected from the sidewalls and the base of the excavation, unless the base of the excavation is in contact with groundwater, in which case no base sample will be collected. The samples will be analyzed for TCE, PCE, and vinyl chloride.

Area 2 - H4 Area and Vicinity: This remedial excavation is designed to address total cPAHs that exceed the TEQ in shallow soil (1.5 feet bgs) in the unsaturated zone. Soil will be excavated to a depth of approximately 2.5 feet bgs. Samples will be collected from the sidewalls and the base of the excavation, unless the base of the excavation is in contact with groundwater, in which case no base sample will be collected. The east sidewall may not be sampled unless signs of potential contamination are noted as that is backfill material from the previous H4 excavation. The samples will be analyzed for cPAHs.

Area 3 - E7 and Vicinity: This remedial excavation is designed to address PCBs, copper, and gasoline-range hydrocarbons in shallow soil (2 to 3 feet bgs) in the unsaturated zone. The initially targeted depth of the excavation is approximately 6 feet bgs. The area surrounding DG11-11 and DG11-12 will first be excavated to 6 feet bgs. The excavation will be stepped out based on visually obvious indications of contamination, such as beige and green putty like material that was encountered in a remedial excavation of similar COCs on the south adjacent property. Samples will be collected from the sidewalls and base of the excavation and analyzed for PCBs, copper, and gasoline-range hydrocarbons.

Area 4 - DG11-1 and Vicinity: This remedial excavation is designed to address PCBs and dioxins/furans in shallow soil (3 to 4 feet bgs) in the unsaturated soil and copper in unsaturated and potentially saturated soil (up to 8 feet bgs). Based on the pre- excavation base sampling conducted in February 2021, the excavation will extend to a maximum depth of 8 feet bgs. Samples will be collected from the east, north, and south sidewalls of the excavation and analyzed for PCBs and copper. The west sidewall of the excavation will not be sampled unless signs of potential contamination are noted because the soil in this location consists of clean material imported to backfill a former stormwater vault excavation. And the base of the excavation will not be sampled because confirmation base samples were collected in February 2021.

Area 5 - Southwest Storage Area: This remedial excavation is designed to address lead, arsenic, cadmium, and chromium in shallow soil (1 to 5 feet bgs) in the unsaturated zone and PCBs and lead in deeper soil (6 to 11 feet bgs) in the unsaturated and saturated zone. Based on the pre- excavation base sampling conducted in February 2021, the excavation base will be 11 feet bgs except at the location of MW-43A where the excavation will extend to 12 feet bgs. Samples will be collected from the north, east, and west sidewalls of the

excavation in shallow soil (1 to 5 feet bgs) and analyzed for lead, arsenic, cadmium, and chromium. Samples will be collected from the north, east, and west sidewalls of the excavation in deeper soil (5 feet to 11 ft bgs) except where below the groundwater table, and analyzed for PCBs, lead, and arsenic. The south sidewall of the excavation will not be sampled unless signs of potential contamination are noted because the soil in this location consists of clean material imported to backfill a former stormwater vault excavation. The base of the excavation will not be sampled because confirmation base samples were collected in February 2021.

Area 6 - SFA-S15-3: This remedial excavation is designed to address arsenic in unsaturated soil at one sample location. The excavation is expected to extend to a depth of approximately 6 feet bgs. Samples will be collected from the sidewalls and base of the excavation. The samples will be analyzed for arsenic.

Area 7 - FWW-1: This remedial excavation is designed to address gasoline-range hydrocarbons in shallow soil at one sample location. This excavation is expected to extend to a depth of 9 feet bgs and into the groundwater. Samples will be collected from the sidewalls of the excavation and analyzed for gasoline-range hydrocarbons. The base of the excavation will not be sampled because a confirmation base sample was collected in February 2021.

Area 8 - A1: This remedial excavation is designed to address gasoline-range hydrocarbons in saturated soil (7 to 12 feet bgs). Based on the pre- excavation base sampling conducted in February 2021, the excavation will extend to a maximum depth of 10 feet bgs. Samples will be collected from the sidewalls of the excavation and analyzed for gasoline-range hydrocarbons. The base of the excavation will not be sampled because a sample was collected from this depth in February 2021. Vertical expansion of the Area 8 excavation is not possible due to existing infrastructure, and laterally expansion also is constrained by existing infrastructure. For this reason, this excavation is likely not to be expanded as discussed in the relevant EDR.

3.3 Imported Fill Sampling

Imported fill will be tested for geotechnical properties to confirm its structural integrity for future site development and analyzed for select COCs. Soil will be tested to ensure that no PCBs or TPH are present at detectable levels and that cPAHs, lead, arsenic, and copper do not exceed the RL. It is assumed that a minimum of one sample from every type of material or every 5,000 tons will be tested. Samples failing geotechnical performance criteria or showing exceedance of any analyte will be rejected. Soil performance monitoring is detailed in the CMP Table 7.

Compaction testing of the fill will also be performed. The compacted fill will be tested so that a minimum of 95% of the maximum dry density, as determined by ASTM D6938, is achieved. The moisture content will be monitored during site placement and compaction.

3.4 Soil Sample Collection

Field personnel will collect soil samples by first donning a new pair of disposable nitrile gloves. New disposable steel spoons will be used to transfer soil from the excavator bucket or sample sleeve to the appropriate laboratory-supplied sample containers. Samples for volatile analyses will be collected using disposable syringes into methanol-preserved vials or pre-tared vials in accordance with U.S. Environmental Protection Agency (EPA) Method 5035. Once filled, the sample containers will be placed in a cooler with blue ice to maintain the samples within the acceptable temperature range of between 0 degree Celsius (°C) and 6°C. The samples will be transported under standard chain-of-custody procedures to ARI. Sample handling and field QA sample collection procedures are outlined within Section 5. Analytical limits of detection are presented in Attachment 4.

The following analyses will be completed as relevant and in accordance with the sample schedule in Table 7 of the CMP:

- Total petroleum hydrocarbons as gasoline (TPH-G) by Method Northwest Total Petroleum Hydrocarbon-Gasoline Extended (NWTPH-Gx);
- TPH as diesel and oil (TPH-D and TPH-O) by Method Northwest Total Petroleum Hydrocarbons-Diesel Extended (NWTPH-Dx);
- Halogenated volatile organic compound (HVOCs), including PCE, TCE, and vinyl chloride by EPA Method 8260;
- cPAHs by EPA Method 8270 selected ion monitoring;
- PCBs as aroclors by EPA Method 8082;
- Resource Conservation and Recovery Act 8 Metals, including arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver by EPA Methods 6020 and 7471. Additional metals analysis may include copper, nickel, and zinc; and
- Dioxins/Furans by EPA Method 1613.

4 GROUNDWATER MONITORING WELLS

Many of the existing monitoring wells will be decommissioned and new monitoring wells installed after completion of CenterPoint's construction activities. New and existing monitoring wells will be sampled.

4.1 Monitoring Well Decommissioning

Each existing monitoring well, except for the compliance wells along the shoreline, are to be decommissioned. CMP Table 6 provides decommissioning rationale, and CMP Figure 2 shows the locations of wells to be decommissioned.

Wells will be decommissioned in accordance with Washington Administrative Code (WAC) 173-160-460. At each well to be decommissioned, the well screen, and casing will be sliced, pulled, or over-drilled (dependent on the condition of the well and availability of Ecology-held logs). The casing will be sealed with bentonite, bentonite slurry, neat cement grout, or neat cement. The surface monument will be removed, and the casing will be cut below the level of the former monument. Concrete may be used to fill the void created by removing the monument, and the ground surface will be patched to replicate nearby surface conditions (unless undertaken in conjunction with re-development activities). A notice of intent and decommissioning log will be provided to Ecology for each well decommissioned.

4.2 Monitoring Well Installation

A total of 15 monitoring wells will be installed using auger drilling methods. Soil samples will not be collected from the borings. Monitoring wells will be screened across the water table at depth intervals ranging from 5 to 25 feet bgs. Screened interval depths may be adjusted based on field conditions and are expected to be between 5 to 15 feet long. A Shannon & Wilson representative will be on site to observe drilling activities, log soil, and select screened intervals for the monitoring wells. Well construction logs will be completed for each well (Attachment 1). The wells will be completed to conform with the State of Washington standards.

4.3 Monitoring Well Development

New monitoring wells will be developed after completed installation. Development will be completed using a pump-and-surge method with a surge block and submersible pump. Groundwater quality parameters, including conductivity, pH, turbidity, and temperature, will be measured periodically during development. Development will be considered complete when the measured turbidity is below 5 nephelometric turbidity units (NTUs), and the water becomes clear, once six well volumes have been removed, or at a maximum of four hours. Water levels, amount of water removed, observations of the discharge water, and turbidity measurements will be recorded on a Well Development Log (Attachment 1).

4.4 Groundwater Monitoring and Sampling

Wells selected for performance and compliance monitoring are described in Sections 5.2 and 5.3 of the CMP. Tables 6 and 7 of the CMP details the analytical suite to be completed at each monitoring well.

4.4.1 Groundwater Sample Collection

Groundwater samples will be obtained from monitoring wells in accordance with the below procedure. Groundwater samples will be collected using low-flow methods and will utilize a peristaltic pump. If the well to be sampled is a newly installed well, at least 24 hours will pass between finishing development and beginning groundwater sampling. Wells impacted by the tide will be sampled during or near low tide. The following procedure outlines groundwater sample collection:

1. Remove well cap and allow the pressure in the well and atmospheric pressure to equilibrate for at least three minutes.
2. Measure depth to water to the closest 0.01 foot from a marked location on the well casing or the northern rim of the casing if no marking exists. Record the depth and measuring location on the field data sheet.
3. Insert tubing into the peristaltic pump system. If samples are to be analyzed for PCB congener homologs, use thin-walled 0.25-inch-outside-diameter copper tubing and platinum-cured silicone tubing. Otherwise, standard polyethylene tubing and size 15 silicone tubing will be used. Lower the end of the peristaltic tubing into the middle of the water column. Connect the Horiba U-52 (or similar) into the system to allow collection of water quality data.
4. Turn on the pump and adjust the flowrate to be between 145 and 300 milliliters per minute. Reduce flow to keep drawdown to less than 0.3 foot. Purge into a 5-gallon bucket or similar.
5. Record water quality measurements every 3 to 5 minutes. Parameters to be recorded include temperature, pH, specific conductance, salinity, dissolved oxygen, oxidation-reduction potential, and turbidity.
6. Water quality will be considered stable when three readings of parameters are sequentially within the following ranges:
   - ± 0.1 pH units
   - ± 5% electrical conductivity (milli-Siemens per centimeter)
   - ± 15 millivolts oxidation-reduction potential
   - ± 10% turbidity NTUs or < 5 NTUs, with a goal of <50 NTUs.
   - ± 10% dissolved oxygen (mg/L), or <0.5 mg/L

- ± 1 degrees Centigrade

7. If water quality parameters do not stabilize after three well volumes have been purged, the purged volume will be considered sufficient to begin sampling.
8. Sample directly from pump discharge tubing into laboratory-supplied glassware complete with identifying labels. Sample in order of the most to least volatile COC. Reduce the pump flowrate for collection of the volatile organic compound samples to avoid creating bubbles in the collected sample. Once collected, place the samples in a cooler with blue ice.

If the well is purged dry before the groundwater is considered stable, the well will be allowed to recharge to a point sufficient to allow sampling. Samples will be collected following the well recharging.

4.4.2 Selected Analytical Analysis

Upon completion of purging and parameter stabilization, samples will be collected from the discharge end of the pump tubing into the laboratory-supplied containers.

Sample containers will be filled in order from most to least volatile in accordance with the sample schedule presented in CMP Tables 4 and 5. Sample handling and field QA sample collection procedures are outlined within Section 5.

Volatile organic analyte (VOA) vials will be filled by allowing the sample water to pour down the inside wall of the vials without splashing onto the base. VOAs will be filled to eliminate headspace, and the seal/lid will be secured. Samples for dissolved metals analysis will not be field-filtered or preserved. Upon receipt, the laboratory will filter and when necessary preserve the samples with nitric acid. We will request laboratory filtering on the COC.

After sample collection is complete, the equipment will be removed, the well cap will be replaced, and the monument lid will be secured. Samples will be submitted to an analytical laboratory. Analytical limits of detection are presented in Attachment 3. The following analyses may be completed in accordance with the sample schedule:

- TPH-G by NWTPH-Gx and BTEX by EPA Method 8260;
- TPH-D and TPH-O by Method NWTPH-Dx;
- HVOCs, including 1,1-dichloroethene, cis-1,2-dichcloroethene, PCE, TCE, and vinyl chloride by EPA Method 8260;
- cPAHs by EPA Method 8270 SIM;
- PCBs as aroclors by EPA Method 8082;

- PCBs as congener homolog by EPA Method 1668 (2015); and
- Total and dissolved copper and arsenic by EPA Method 200.8.

The following natural attenuation parameters analysis will be completed:

- Ferrous iron by EPA Standard Method 3500,
- Nitrate and nitrite as nitrogen by EPA Method 300.0,
- Sulfate by EPA Method 300.0,
- Sulfite by EPA Standard Method 4500,
- Manganese ion by EPA Method 200.8, and
- Methane by RSK-175.

5 SUB-SLAB VAPOR SAMPLING

Sub-slab vapor sampling will be conducted to monitor sub-slab vapor beneath the new proposed building.

5.1 Sampling Port Installation

Sampling ports will be installed within the new proposed building as a part of the sub-slab depressurization (SSD) system. The SSD system is detailed in a separate Engineering Design Report.

5.2 Sub-Slab Vapor Sample Collection

Each quarter for two years following construction, five sub-slab vapor samples will be collected directly from the SSD system sampling ports. One duplicate sample will be obtained during each sampling event. The five sampling locations will be the same as those used for the baseline sample for the first two quarters. After the first two quarters, a randomly selected but spaced set of five points will be sampled until the CUL parameters are met.

Vapor samples will be collected using a SUMMA canister connected to the sampling port via a teflon tube. The negative pressure in the SUMMA canister will be recorded in advance of sampling commencing and sampling will cease when the vacuum gauge reads approximately 5 inches of mercury. The time the canister was opened and closed, and the final vacuum will be recorded on the monitoring log. It is anticipated that sampling will take approximately 10 to 15 minutes per location.

The barometric pressure and tide cycle will be recorded for the sampling date and time.

Upon completion of sample collection, the samples will be transported to an analytical laboratory for the following analysis:

- Halogenated VOCs by EPA Method TO-15.

6 FIELD QUALITY ASSURANCE/QUALITY CONTROL (QA/QC) REQUIREMENTS

Field QA/QC procedures, discussed below, have been established to ensure that samples can be tracked from collection through analysis, evaluate the efficiency and reproducibility of sampling procedures, and ensure that sampling activities do not result in cross-contamination.

6.1 Sample Handling, Chain-of-Custody, and Transportation Procedures

Environmental samples collected during the project will be labeled, stored, and transported using standard Shannon & Wilson protocols. Samples will be collected in clean, laboratory-supplied containers. Sample container, preservation, and holding times are presented in Attachment 5. These protocols are summarized below.

6.1.1 Sample Labeling

Sample container labels will be completed immediately before or immediately following sample collection. At a minimum, container labels will include the following information:

- Date and time of collection,
- Location of the sample,
- Name or initials of sample collector,
- Unique sample identification,
- Analysis requested, and
- Chemical preservative used.

The established nomenclature for soil samples will be:

Site: Boring/Excavation
Name: Sample Depth-Date

For example, a soil sample collected from 5.5 feet bgs from boring B-2020 on February 1, 2020, would be identified as:

8801:B-2020:5.5-02012020

The established nomenclature for groundwater samples will be:

Well Name-Date

For example, a groundwater sample from well MW-53 collected on February 1, 2020, would be identified as:

MW-53-02012020

Duplicate samples will be labeled with a discrete well/boring name commencing at numeral 100. For example:

MW-100-02012020 or B-100:5.5-02012020

Equipment blanks will have the initials EB, will be numbered sequentially, and dated:

EB-1-02012020

Trip blanks will have the initials TB, will be numbered sequentially, and dated:

TB-1-02012020

Matrix spike/matrix spike duplicate (MS/MSD) samples (water only) will be identified with the initials MS/MSD, with the identification of the well from which it was collected and dated. For example, an MS/MSD sample collected from MW-43 on February 1, 2020, would be labeled:

MS/MSD-MW-43-02012020

6.1.2 Chain of Custody

Once a sample is collected, it will be placed within a cooler with blue ice and will remain in the custody of the sampler until shipment, pick-up, or delivery to the laboratory, or until the sample possession is transferred to another party. Sample information will be entered onto a chain-of-custody form along with the requested analyses.

Upon transfer of sample possession to subsequent parties, the chain-of-custody form will be signed, and time stamped by the person(s) transferring and receiving custody of the sample container. Upon receipt of samples at the laboratory, the condition of the samples will be

recorded by the receiver. Chain-of-custody records will be included in the analytical report prepared by the laboratory.

Upon receipt of samples (which will be accompanied by a completed chain-of-custody record detailing requested analyses), the Laboratory Coordinator(s) or designee will:

- Verify all paperwork, chain-of-custody records, and similar documentation;
- Log in samples, assign unique laboratory sample numbers, and attach the numbers to the sample container(s);
- Perform any requested laboratory filtration and preservation;
- Open a project file and enter data into the file;
- Store samples in a refrigerated sample bank; and
- Email a record of the sample receipt and log-in form to the Shannon & Wilson Project Manager noting any problems with the samples.

6.1.3 Sample Transportation

Samples will be transported to the analytical laboratory within a cooler containing blue ice to ensure that samples are maintained within the appropriate temperature range (between 0°C and 6°C). Samples will be dropped at the laboratory by field personnel, picked up by the laboratory (or courier) at the Shannon & Wilson office, picked-up by the laboratory (or courier) at the 8801 property, or shipped directly to the laboratory from the Shannon & Wilson office. Carriers who are only involved in the transport of sealed coolers are not required to sign the chain of custody. However, shipping documents will be included in the project files if a carrier is used to transport the project samples.

6.2 Quality Assurance/Quality Control (QA/QC) Samples

QA/QC samples will be collected during the event to evaluate the reproducibility of the sampling technique and the subsequent laboratory analysis. These will include field duplicate samples, trip blank samples, equipment blank samples, MS/MSD samples, and temperature blank samples.

6.2.1 Field Duplicate Samples

Field duplicate samples are a second sample collected from a location. This sample is submitted to the laboratory with a "dummy" sample number and time as a regular sample. It is analyzed for the same suite as the original sample to allow for evaluation of the reproducibility of the sampling technique and the subsequent laboratory analysis. One field duplicate sample will be collected for every 20 groundwater and 20 soil samples. If fewer than 20 samples of soil or groundwater are collected, at least one field duplicate will be

sampled per sampling event for each media sampled. The field team will note in the field log where each duplicate sample was collected.

6.2.2 Trip Blank Samples

One trip blank will be submitted with each cooler containing soil or groundwater samples for volatile analytes (HVOCs or TPH-G/BTEX). Samples for volatile analyses will be grouped into as few coolers as possible to minimize trip blanks. The trip blank sample will be analyzed for the same set of volatile constituents that is contained within the cooler.

6.2.3 Equipment Blank Samples

Multiple equipment blank samples will be collected to evaluate potential contamination from the equipment used during sampling. This includes water used for decontamination, copper tubing, platinum-cured silicone tubing, polyethylene tubing, and standard silicone tubing.

Because some of the water screening levels for this project are significantly lower than drinking water standards, one equipment blank sample will be collected from the water source used to perform equipment decontamination. This sample will be collected in advance of the field activities to evaluate its adequacy for use. This sample will be collected by pouring the water used for the final rinse of decontamination directly into sampling containers, bypassing any tubing or sampling system.

During the field activities, equipment blank samples will be collected from the peristaltic pump sampling system and each tubing sampling system. Two equipment blank samples per sampling system will be taken to evaluate potential contributions from the tubing. The samples will be collected by running laboratory-distilled water through equipment tubing into laboratory-supplied containers. The laboratory-distilled water will also be analyzed separately by pouring laboratory-distilled water directly into sample containers. The equipment blanks will be analyzed for each contaminant that the system is used to sample for.

6.2.4 Matrix Spike/Matrix Spike Duplicate (MS/MSD) Samples

MS/MSD samples are used by the laboratory to evaluate potential matrix interferences and evaluate analytical accuracy. One field MS/MSD sample will be collected for every 20 groundwater samples. Due to the high level of variability within soil, MS/MSD soil samples will not be collected.

6.2.5 Temperature Blank Samples

Temperature blank samples are used to determine whether the samples have been maintained within the appropriate temperature range. The samples are provided by the laboratory and are not analyzed for chemical constituents.

6.3 Equipment Decontamination

All non-disposable and non-dedicated sampling and monitoring equipment will be decontaminated prior to initial use, between sampling locations, and at the completion of the 8801 property-specific sampling. The procedure will include:

- Tap water initial rinse (if needed),
- Tap water and non-phosphate detergent (Alconox™) mixture wash,
- Tap water rinse, and
- Distilled water final rinse.

Additional decontamination steps may be incorporated as needed. Decontamination of personnel involved in sampling activities will be accomplished as described in a site-specific Health and Safety Plan (HASP).

7 INVESTIGATION-DERIVED WASTE (IDW) MANAGEMENT

IDW generated during this effort will include soil cuttings and groundwater purged from wells during development and sampling and decontamination water generated during probing and drilling activities. Soil, and water will be placed into separate drums, sealed, labeled, and temporarily stored on site.

Drums will be stored in or close to the air sparge/soil vapor extraction system building. Following receipt of analytical results and disposal facility acceptance, the IDW will be picked up by an appropriately licensed waste transporter and disposed of offsite at the appropriate accepting disposal facility.

Miscellaneous IDW consists of used personal protective equipment (PPE), disposable sampling equipment (spoons, tubing, etc.), and other wastes that originated from site activities. This IDW will be placed in doubled, heavy-duty plastic bags. The waste PPE and disposable sampling equipment will be disposed of in a dumpster at the Shannon & Wilson office.

8 HEALTH AND SAFETY

A site-specific HASP is provided in Appendix B of the CMP. The HASP was prepared consistent with the requirements of the Washington State Division of Occupational Safety and Health Hazardous Waste Operations Regulation (WAC 296-843). The HASP includes a description of the project team, the scope of work, site control, site hazard information, site hazard control, air monitoring, and emergency response. Information about the nearest hospital, including a map, is also provided.

ATTACHMENT 1: FIELD FORMS

Attachment 1

Field Forms

CONTENTS

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIELD LOG OF GEOPROBE

PROBING COMPANY/DRILLER: _____ JOB NO: _____ PROBE NO: _____

PROBE RIG EQUIPMENT: _____ JOB NAME: _____

PROBING METHOD: _____ LOGGED BY: _____

PROBE DIAM.: _____ TYP. RUN LENGTH: _____ LOCATION: _____ ELEV.: _____

WEATHER DURING DRILLING: _____ START DATE: _____ END DATE: _____

PROBE RUN AND SAMPLE DATA

TIME / DATE	RUN NO.	RUN	FROM / TO	LENGTH RECOVERED	FIELD CLASSIFICATION [Density/consistency, color, slightly, minor, MAJOR, then trace constituents; moisture; structure; other; (Geology) USCS classification.]	PID READING	SAMPLE NO.	SAMPLE DEPTH FROM	SAMPLE DEPTH TO	SAMPLE PURPOSE OR COMMENT

SUMMARY FIELD LOG OF GEOPROBE

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

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

GROUNDWATER DATA

WATER DEPTH	TIME	DATE

SUMMARY OF TIME AND FOOTAGE

PROBE/SAMPLE _____ hrs. STANDBY: _____ hrs.

SETUP/CLEANUP: _____ hrs. DECON: _____ hrs.

OTHER: _____

BORING: _____ SHEET _____ OF _____

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

WELL / VWP CONSTRUCTION LOG

JOB NO. _____

BORING NO: _____ APPROX. GROUND ELEV: _____ ft.

INSPECTOR: _____ LOCATION: _____

INSTALL DATE: _____ (indicate if several installation dates)

ECOL. TAG NO: _____

TOTAL DRILLED DEPTH: _____ ft.

TOTAL SAMPL. DEPTH: _____ ft.

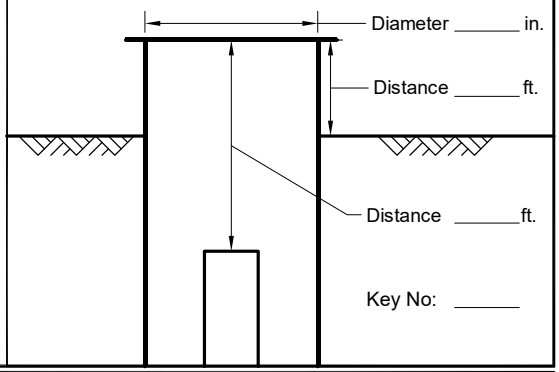
DRILLING METHOD: _____ (HSA, Mud Rotary, ect.)

DRILLING FLUID USED: _____ (Bentonite, Polymer, ect.)

BOREHOLE DIAMETER: _____ in.

DRILL MUD REMOVAL RMKS: _____

SURFACE MONUMENT DETAILS

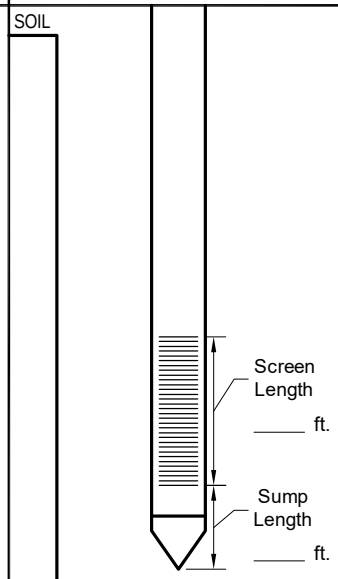


PIPE / INSTRUMENT DETAILS

DEPTH FROM	DEPTH TO	WELL / VWP NO.	SOLID	SLOTTED	DESCRIPTION (include OD/ID, slot width, pipe material, schedule, etc.)	VWP

SKETCH

SAND BENT. CHIPS BENT. GROUT BENT. CEMENT



NOT TO SCALE
Use Reverse Side if Desired

HOLE BACKFILL DETAILS

DEPTH FROM	DEPTH TO	FILTER	SEAL	DESCRIPTION (include seal or filter type, size, gINT code, etc.)	POUR	TREMIE

ADDITIONAL WELL DETAILS

CENTRALIZERS: ☐ Yes → Type: _____ ☐ No → Depths: _____

CASING JOINTS: ☐ Threaded ☐ Glued End Cap Type: _____ How Secured: _____

DEPTH TO WATER AFTER INSTALLATION: _____ ft.

INSTALLATION MATERIALS USED

SAND: _____ bags

CEMENT: _____ bags

BENTONITE POWDER: _____ bags

BENT. CHIPS/PELLETS: _____ bags

SLOTTED PVC: _____ ft.

BLANK PVC: _____ ft.

_____

VWP INITIALIZATION DETAILS

TRANSDUCER DEPTH: VWP #1 _____ ft.
VWP #2 _____ ft.

SER.# / PRESSURE RATING: VWP #1 _____ / _____ psi
VWP #2 _____ / _____ psi

VWP # and Reading Type	Zero Reading	Zero Temp	Date and Time of Reading	Readout Box S/N
#1 Unsaturated				
#1 Saturated				
#2 Unsaturated				
#2 Saturated				

ADDITIONAL COMMENTS: _____

_____

_____

SHANNON & WILSON, INC. GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

WELL DEVELOPMENT LOG

JOB NO. _____

PAGE _____ OF _____

OWNER / LOCATION: _____ DATE: _____

WELL NO: _____ WEATHER: _____ PERSONNEL: _____

ECOLOGY TAG NO: _____ MEASURING POINT (MP): _____

LOCK NO. OR COMBINATION: _____ CASING DIA: _____ in. CASING: _____ gal / ft. TIME / PID HEADSPACE: _____ ppm

CASING STICKDOWN < OPEN MON. RIM: _____ ft. MON. HEIGHT: _____ ft. MONUMENT TYPE & DIA: _____ in.

SURGE BLOCK TYPE: _____ PRODUCT THICKNESS: _____ ft. PRODUCT MEASUREMENT METHOD: _____

TIME / STATIC WL < MP: _____ ft. DEVELOPMENT METHOD: (Bailer-SS, Teflon, HDPE) (Hand Waterra) (Powered Waterra) (Other_____)

TIME / VWP READING: _____ (Digits, Temp.) VWP READOUT BOX ID: _____ DECON. METHOD: _____

WELL DEPTH < MP: _____ ft. (Hard or Soft?) WATER COLUMN HEIGHT: _____ ft. VOLUME IN WELL: _____ gal.

WATER VOLUME ADDED? _____ (Tap or Distilled?) VOLUME PURGED: _____ gal. REPAIRS NEEDED? _____

MEANS OF SEDIMENT MEASUREMENT IN PURGE WATER: _____ SCREEN LENGTH: _____ ft.

FIELD PARAMETERS

START TIME/ WATER VOLUME ADDED, if any (gal)	END TIME	INTERVAL SURGED/ PURGED (ft > TD*)	TOTAL VOLUME PURGED (gal)	SEDIMENT THICKNESS (in or ml)	COLOR/ ODOR/ SHEEN?	FIELD PARAMETERS, if any (including units)		

*TD = Total Depth of Well

PURGE WATER DISPOSITION: _____ DRUM NUMBERS / LOCATION: _____

RELATIVE RECOVERY RATE: _____ (Rapid - Moderate - Slow) FINAL WELL DEPTH < MP: _____ ft. SHEEN / ODOR? _____

COMMENTS: _____

CASING CAP LEFT LOOSE OR TIGHT ? _____ WAS ALL SEDIMENT REMOVED? _____

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

JOB NO.: _____

Project: _____ Conducted by: _____

Weather: _____

WATER LEVEL MEASUREMENTS

Location ID	Date	Time	Measuring Point (MP)	Depth to Water from MP (feet)	VWP Reading		Comments (i.e. pressure change when opend, inaccesibility, etc.)
					Digits	˚ C	

Comments: _____

Checked By: _____ Date: _____

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

WATER SAMPLING LOG

JOB NO. _____
PAGE _____ OF _____

OWNER / LOCATION: _____ DATE: _____

WELL NO: _____ SAMPLE NO: _____ ECOLOGY TAG NO: _____ DUPLICATE NO: _____

WEATHER: _____ MS / MSD? Yes ☐ No ☐

WELL SITE CONDITIONS / MP DEFINITION: _____
(MP is typically the north PVC rim)

SAMPLING DATA

TIME STARTED: _____

PID HEAD SPACE: _____ ppm

MP DISTANCE ABOVE / BELOW GROUND SURFACE: _____ ft.

TOTAL DEPTH OF WELL BELOW MP: _____ ft.

DTW BELOW MP: _____ ft.

WATER COLUMN IN WELL: _____ ft.

CASING DIAMETER: _____ in.

GALLONS PER FOOT: _____

GALLONS IN WELL: _____

TIME PURGING STARTED: _____

LNAPL THICKNESS: _____ ft. Sample ☐

DNAPL THICKNESS: _____ ft. Sample ☐

SAMPLE CONTAINERS

Number	Size	Type	Pres.

FIELD PARAMETERS

GALLONS REMOVED	TEMP. (C°)	Eh (mV)	pH	COND. (µmhos / cm)	D.O. (mg / L)	TURBIDITY (NTU)	SALINITY (%)	TDS (g / L)	COLOR	TIME
Initial										
After Sampling										

EVACUATION METHOD: _____

PUMP INTAKE DEPTH (if applicable): _____

PURGE WATER DISPOSITION (e.g., drum #): _____

WATER QUALITY (e.g., sheen, odor): _____

WATER QUALITY METER(S) USED; CALIBRATION DATE / TIME: _____

SAMPLING METHOD: _____ SAMPLE TIME: _____

SAMPLING PERSONNEL: _____ DUPLICATE "TIME": _____

REMARKS (e.g., recovery rate): _____

TIME COMPLETED: _____

WELL CASING VOLUMES

Gal / ft 1-1/4" = 0.077 2" = 0.16 3" = 0.37 4" = 0.65
1-1/2" = 0.10 2-1/2" = 0.24 3-1/2" = 0.50 6" = 1.46

VAPOR MONITORING LOG

SITE:		**INSTRUMENTS:**		**WEATHER CONDITIONS:**
SAMPLER:		**CALIBRATION DATE:**		COVER:
DATE:		**MAINTENANCE:**		TEMP:

LOCATION ID	Time	Depth to Water (Feet)	BAROMETRIC PRESSURE (in Hg)	PUMP RUN TIME (s)	CH_4 (% VOL)	CO_2 (% VOL)	O_2 (% VOL)	COMMENTS/ OBSERVATIONS

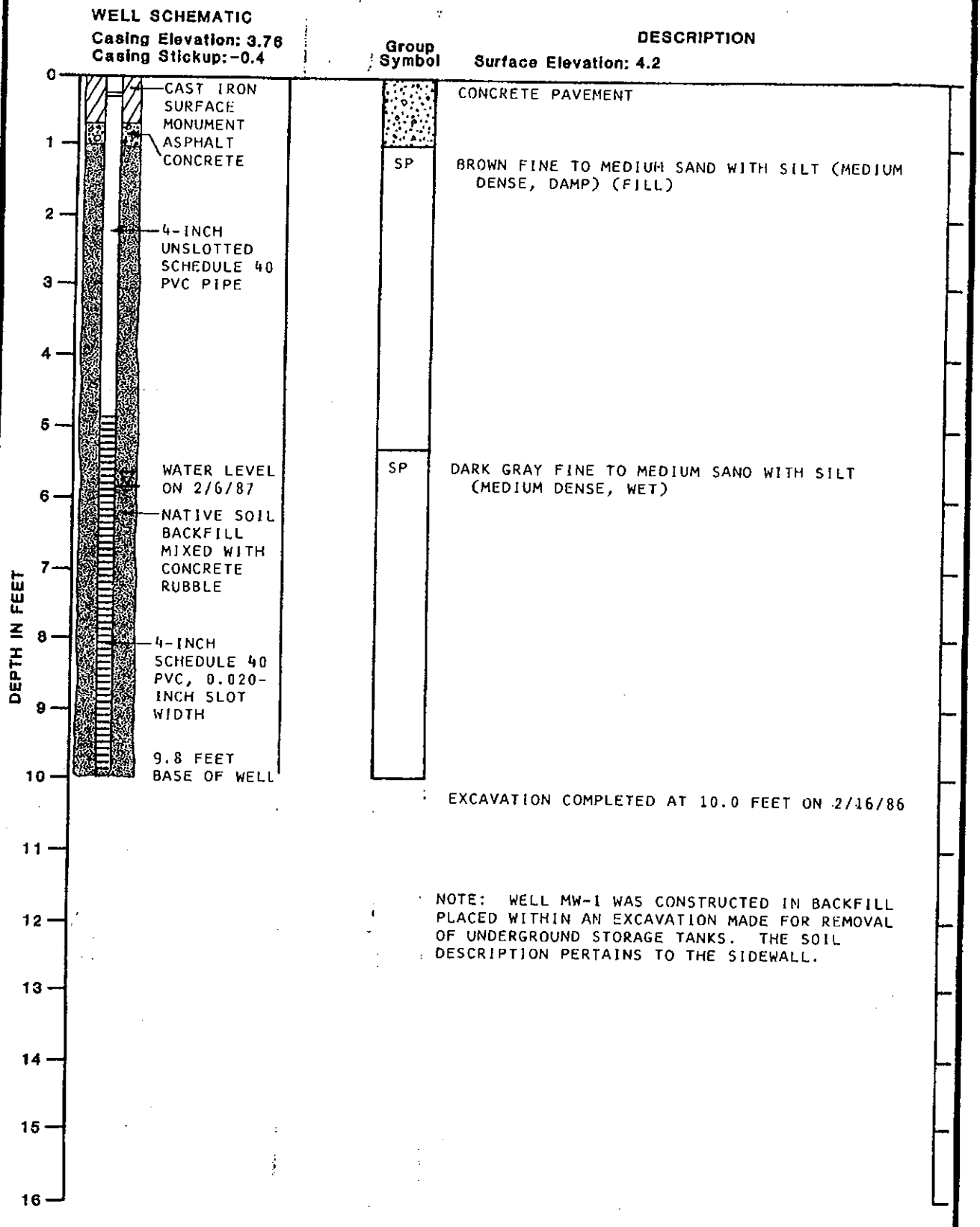
Notes:

ATTACHMENT 2: AVAILABLE BORING LOGS

Attachment 2

Available Boring Logs

MONITOR WELL NO. 1



Note: See Figure A-2 for Explanation of Symbols

929-04 SEW:JAM:a1 2/6/87

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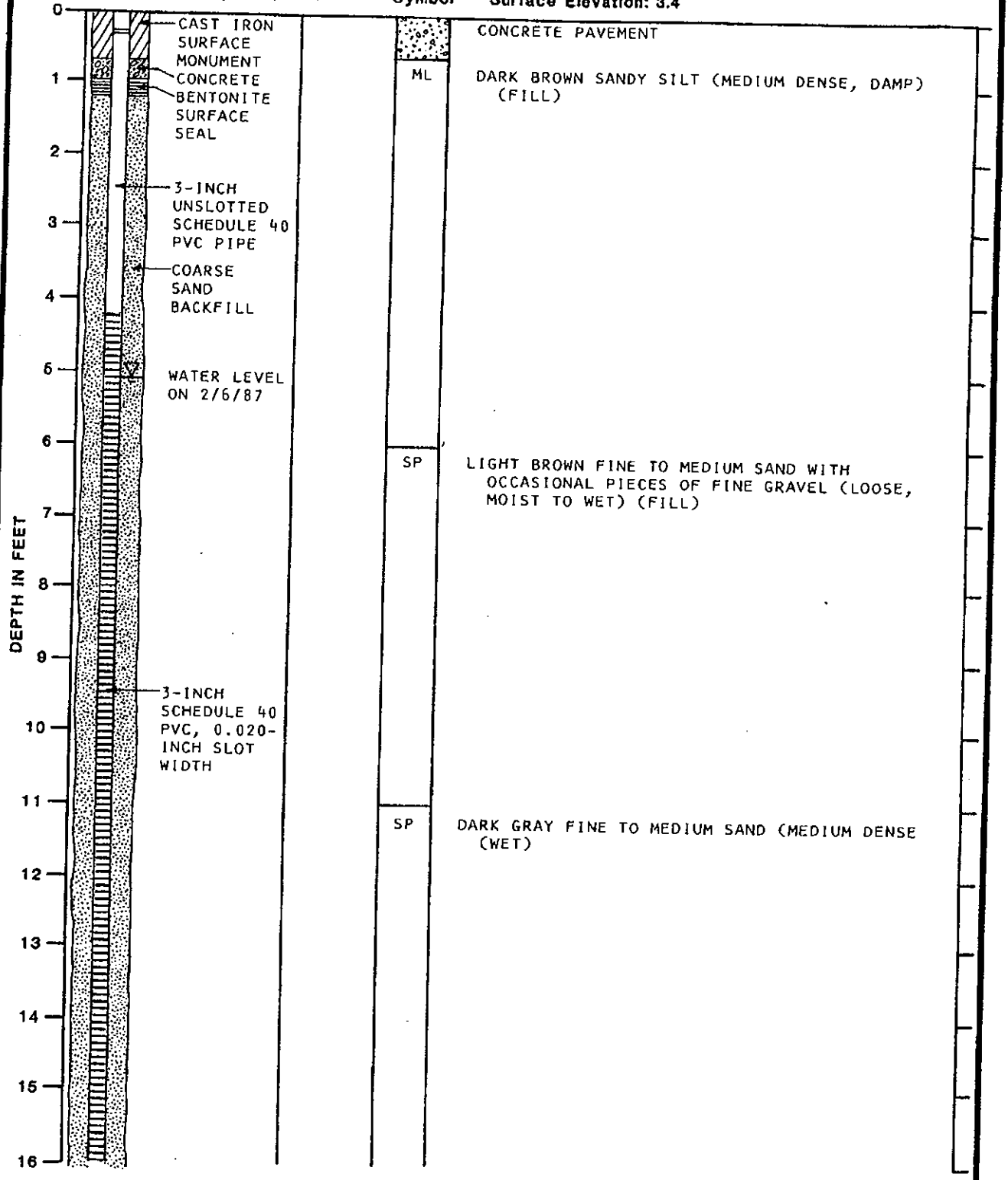
LOG OF MONITOR WELL

FIGURE A-3

MONITOR WELL NO. 2



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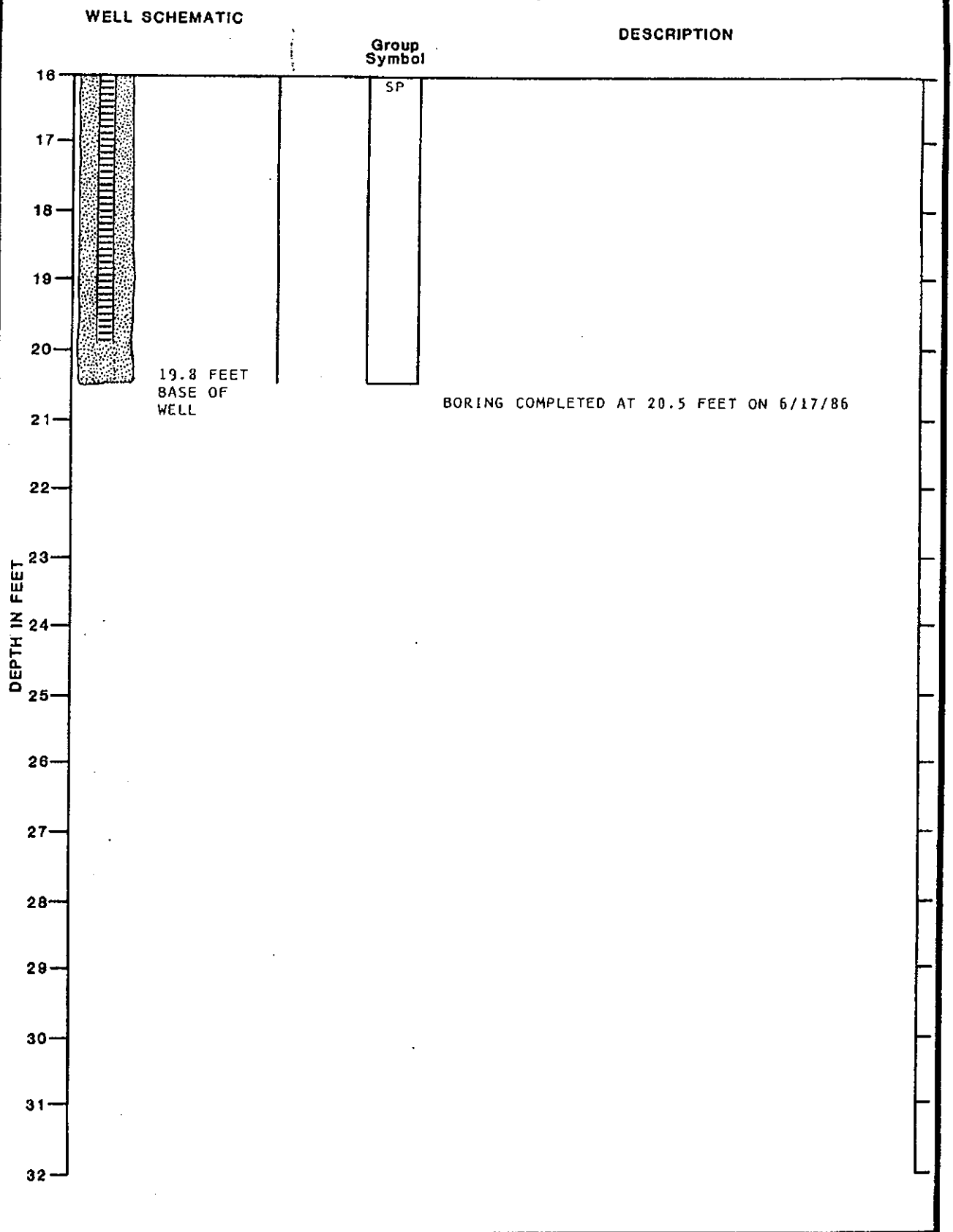
LOG OF MONITOR WELL

FIGURE A-4A

929-04 SEW:JAM:e1 2/6/87

MONITOR WELL NO. 2
(CONTINUED)



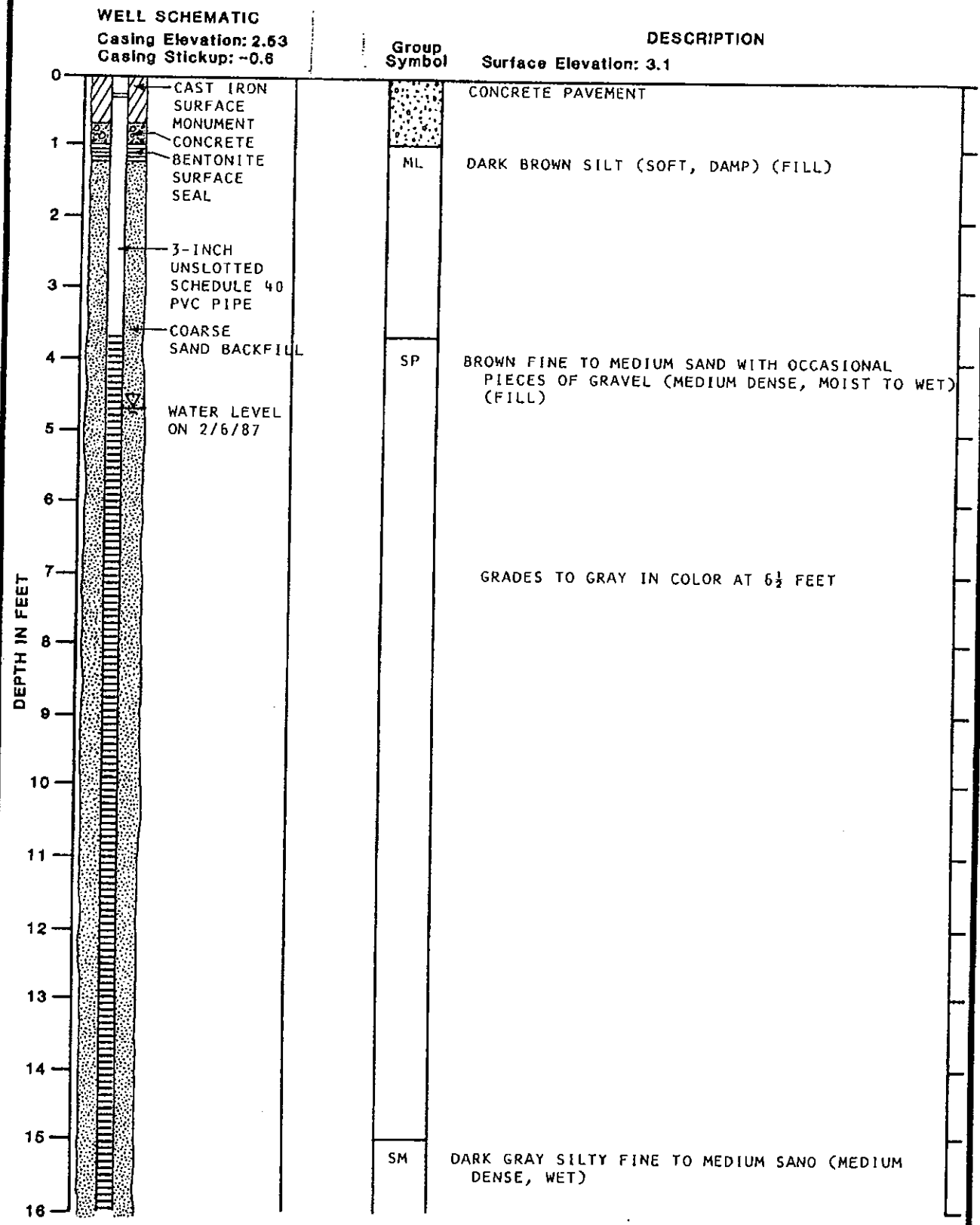
GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-4B

929-04 SEW:JAM:el 2/6/87

MONITOR WELL NO. 3



929-04 SEW:JAN:el 2/6/87

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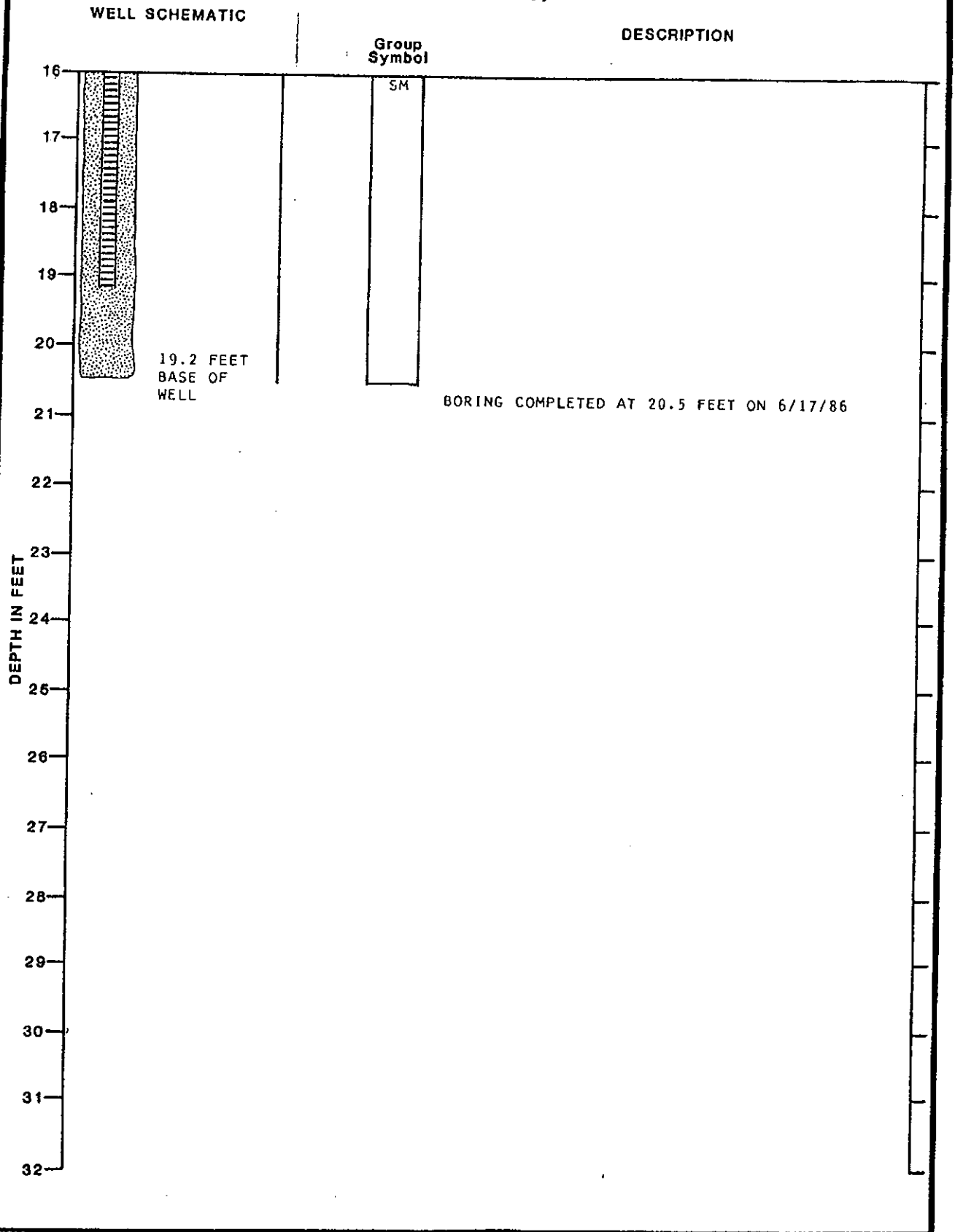
LOG OF MONITOR WELL

FIGURE A-5A

MONITOR WELL NO. 3
(CONTINUED)



929-04 SEW:JAM:el 2/6/87

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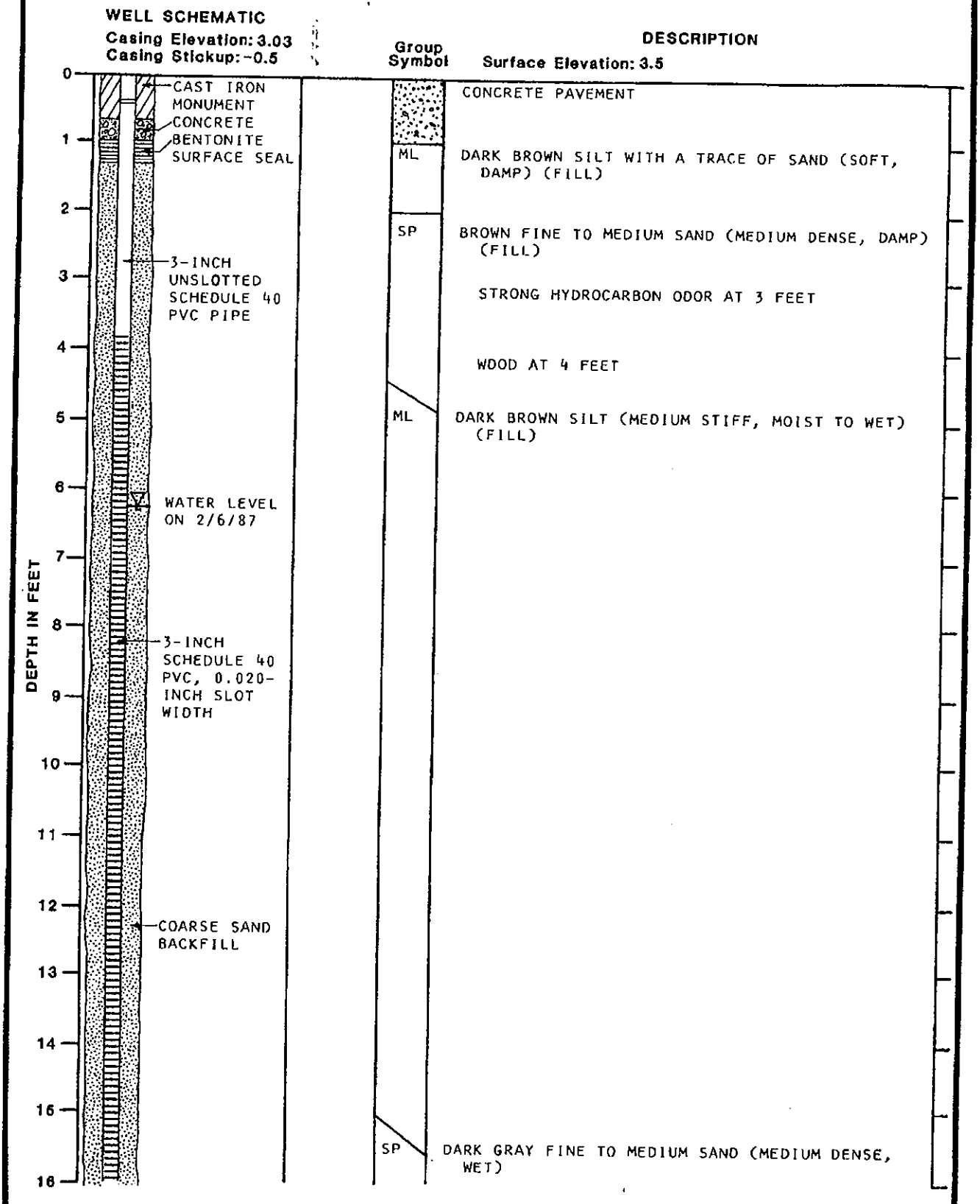
LOG OF MONITOR WELL

FIGURE A-5B

MONITOR WELL NO. 4



929-04 SEW:JAM:el 2/6/87

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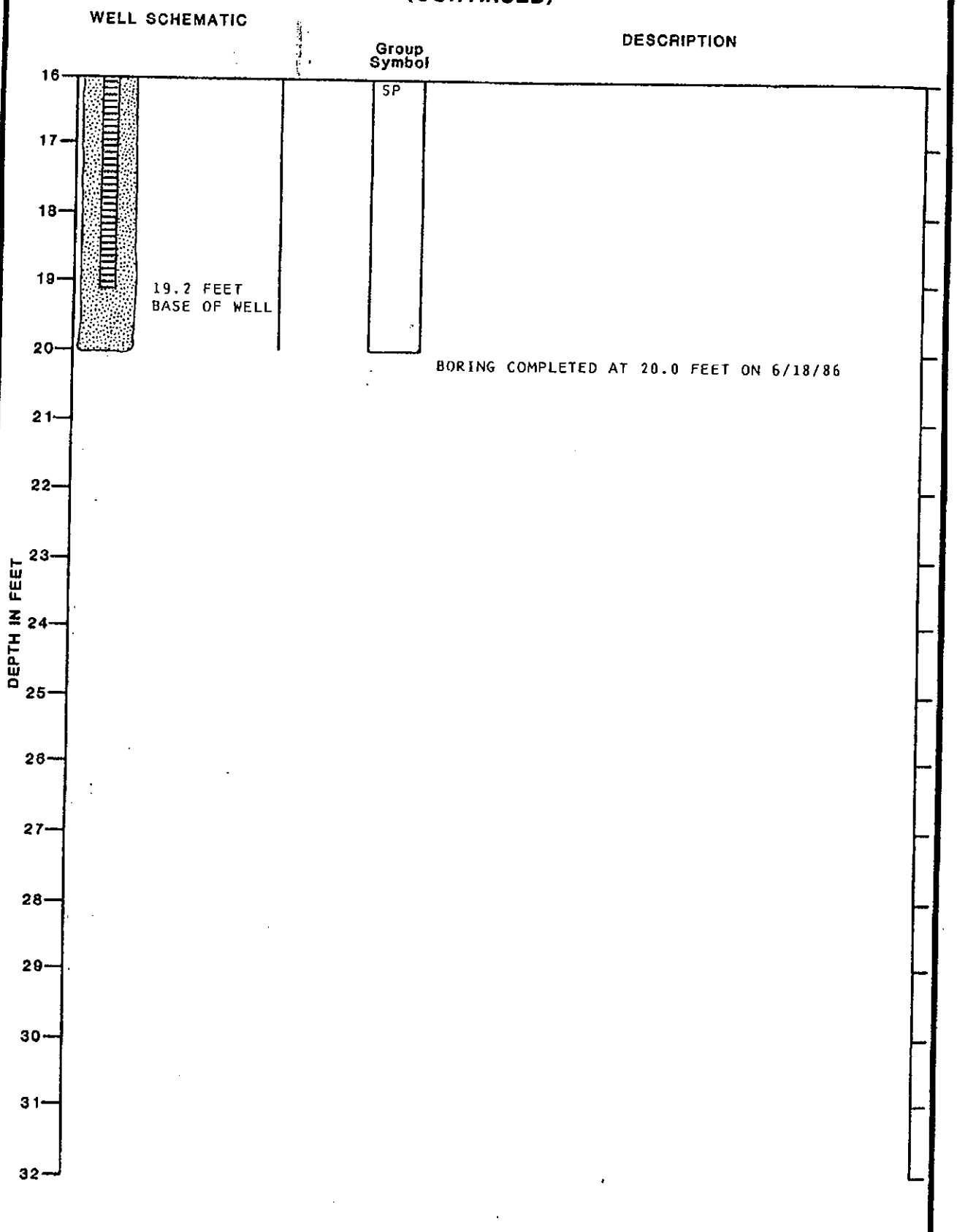
LOG OF MONITOR WELL

FIGURE A-6A

MONITOR WELL NO. 4
(CONTINUED)



929-04 SEW:JAN:dmp:el 2/6/87

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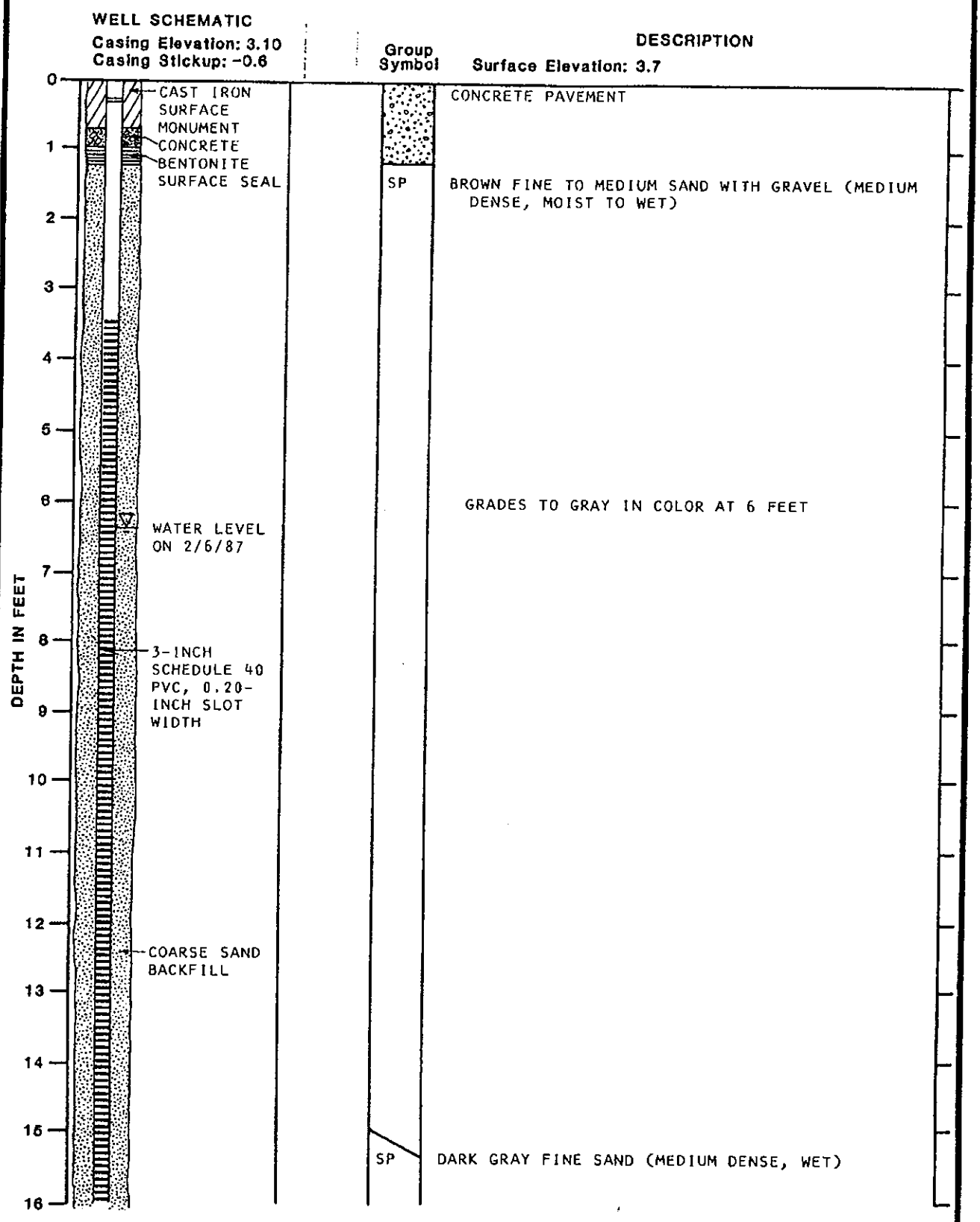
LOG OF MONITOR WELL

FIGURE A-6B

MONITOR WELL NO. 5



929-04 SEW:JAM:dmp:el 2/6/87

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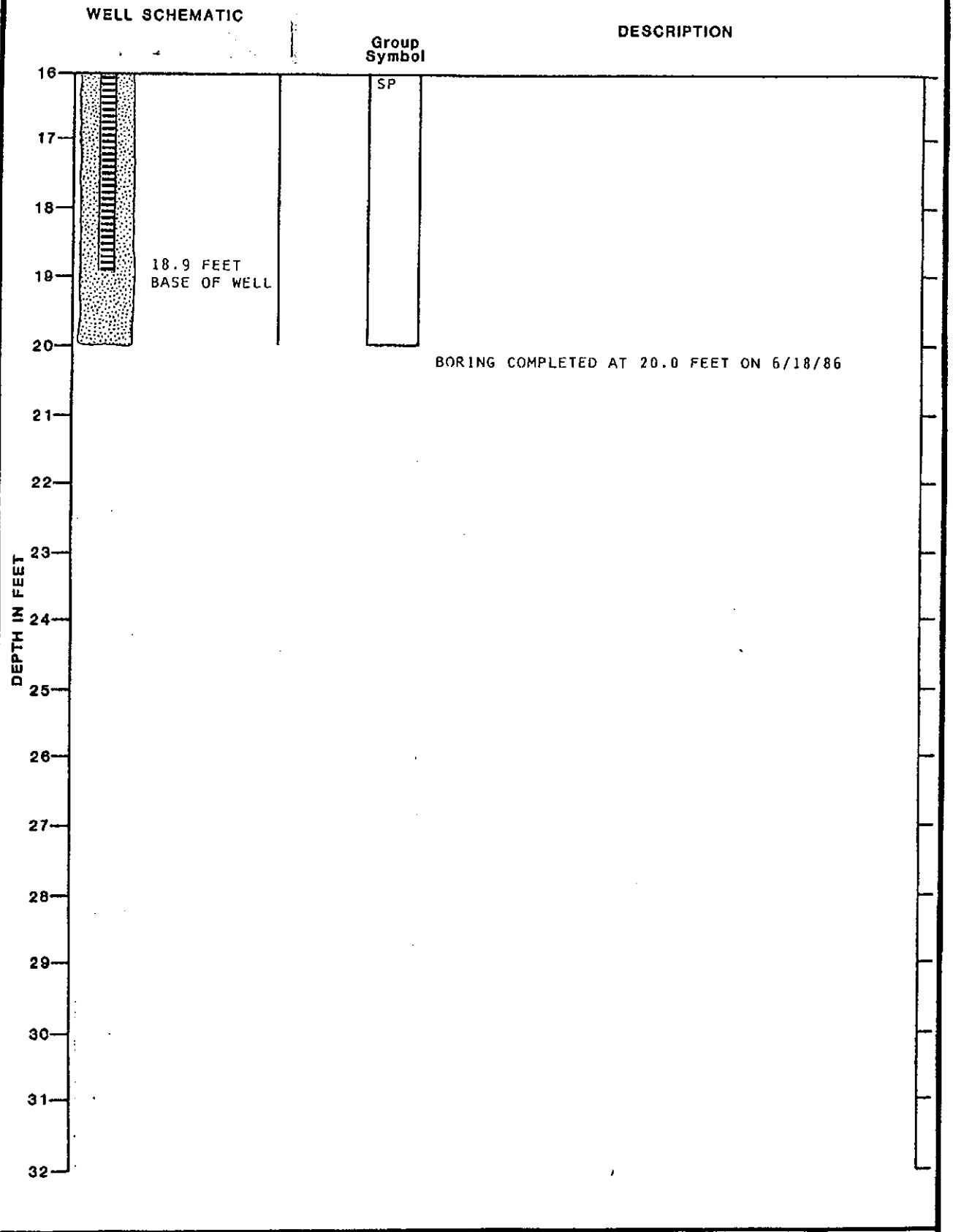
LOG OF MONITOR WELL

FIGURE A-7A

MONITOR WELL NO. 5
(CONTINUED)



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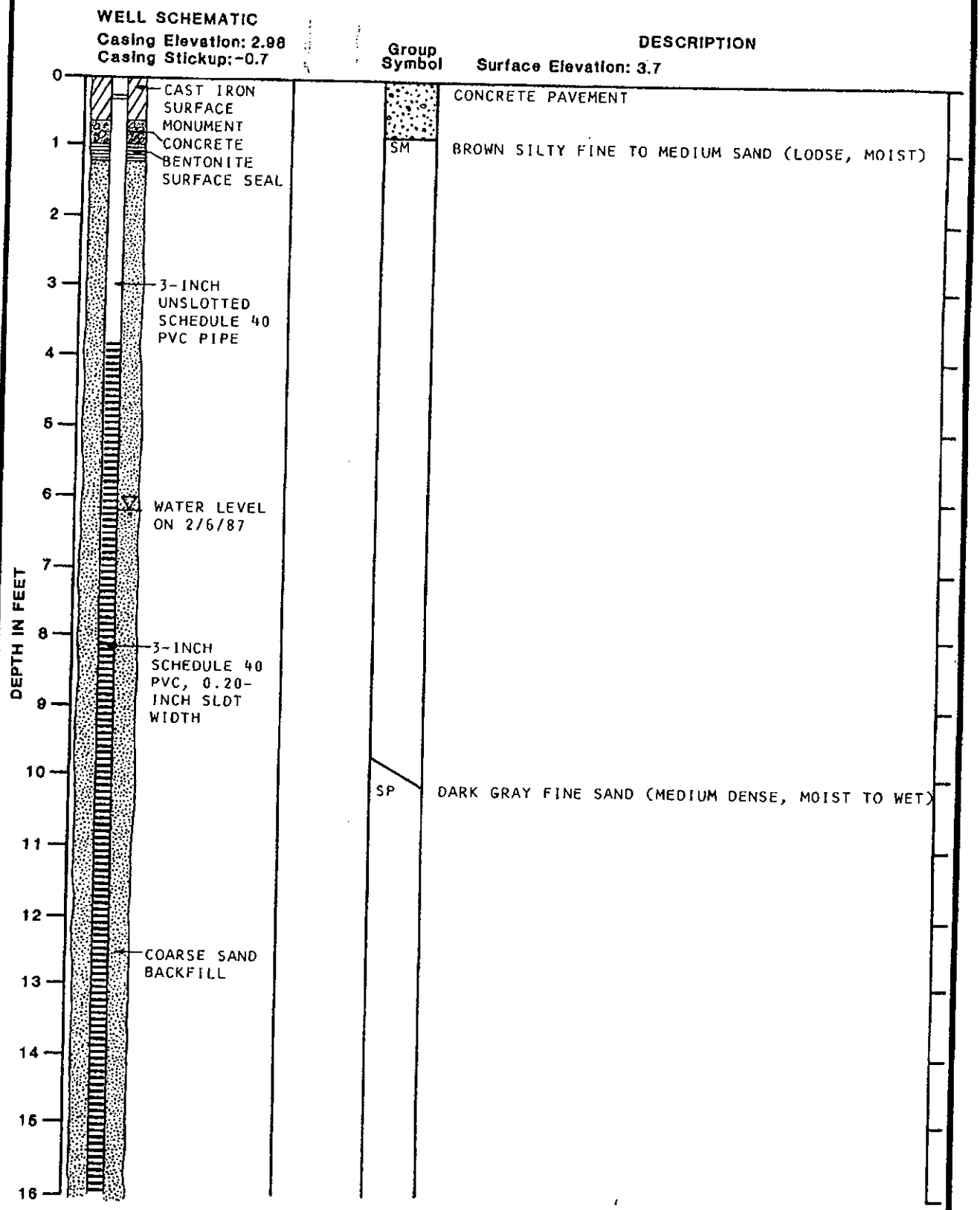
LOG OF MONITOR WELL

FIGURE A-7B

929-04 SEW:JAM:dmp:el 2/6/87

MONITOR WELL NO. 6



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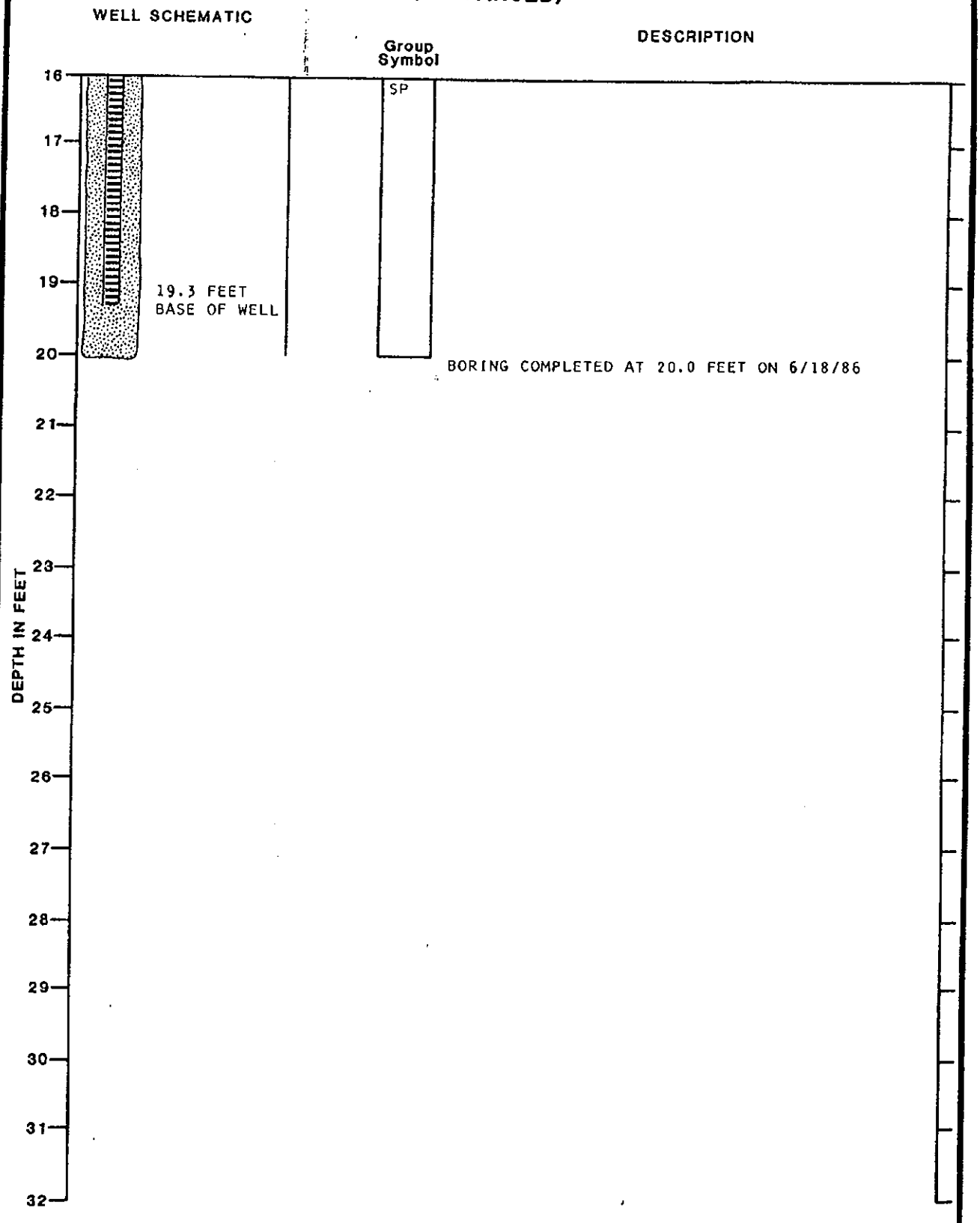
LOG OF MONITOR WELL

FIGURE A-8A

929-04 SEW:JAM:dmp:e1 2/6/87

MONITOR WELL NO. 6
(CONTINUED)



929-04 SEW:JAN:dmp:e1 2/6/87

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LOG OF MONITOR WELL

FIGURE A-8B

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION: MW-6A Replacement SFA		**Well Name**	MW-6A(R)
DRILLING COMPANY: Cascade Drilling, Inc.	DRILLER	**Project Name**	PACCAR
DRILLING METHOD(S): HSA	DRILL BIT(S) SIZE: 9 inches	**Project Number**	046001.00
ISOLATION CASING: N/A	FROM N/A TO N/A FT.	ELEVATION AND DATUM	TOTAL DEPTH: 20.0 ft. bgs
BLANK CASING: 2" Sched. 40 PVC Pipe	FROM 0 TO 5 FT.	DATE STARTED: 4/26/04	DATE COMPLETED: 4/26/04
SLOTTED CASING: 2" Sched. 40 PVC 0.010 Slot	FROM 5 TO 20 FT.	INITIAL WATER DEPTH (FT): N/A	
SIZE AND TYPE OF FILTER PACK: #2/12 Monterey Sand	FROM 3 TO 20 FT.	LOGGED BY: DKM	
SEAL: Bentonite Chips	FROM 1 TO 3 FT.	SAMPLING METHODS: NA	WELL COMPLETION: ☐ SURFACE HOUSING ■ STAND PIPE N/A FT.
GROUT: Concrete	FROM 0 TO 1 FT.		

SAMPLES TYPE	SAMPLES RECOV. (FEET)	SAMPLES PENETR. RESIST. BLOWS/6"	DEPTH (FEET)	SAMPLE NUMBER	WELL CONSTRUCTION	OVA/PID	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
									Approximately 4 inches from concrete.
								GP/ GC	**Poorly graded GRAVEL with clay and sand** CSBC gravel.
			5					GP	**Poorly graded GRAVEL** Pea gravel.
			10					SM	**Silty SAND** Silt/silty sand.
			15					SP	**Poorly graded SAND** Poorly graded sand.
			20						

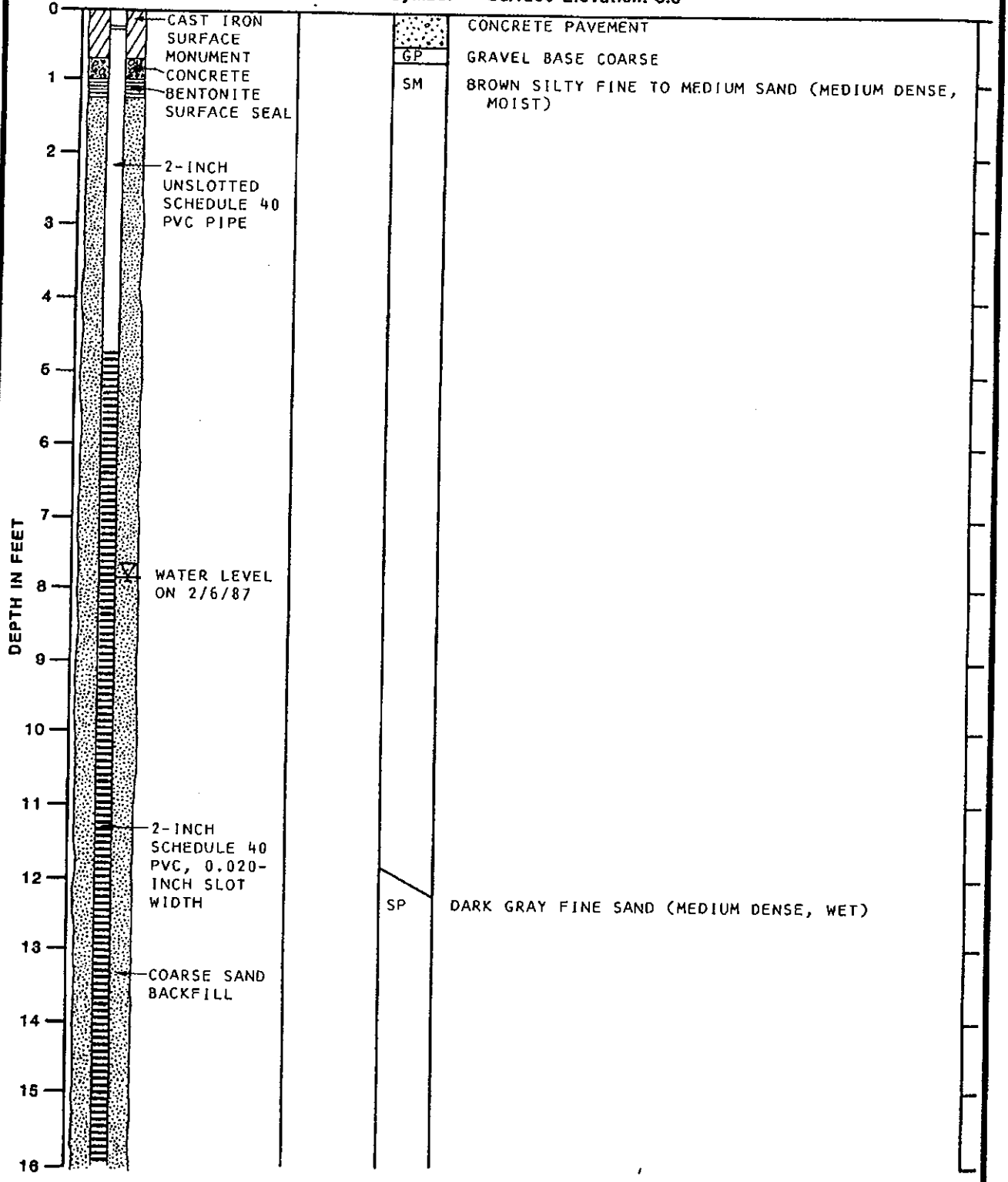
NOTES

1. No samples collected. Auger advanced with wood block at bottom to minimize disturbance to pea gravel.
2. Lithology based on previous data from soil boring and excavations.

KJ PNW PACCAR BORING LOGS SFA.GPJ KJ PNW.GDT 9/10/04

F-40.1
(6-87) (3-88) (8-90)

MONITOR WELL NO. 7



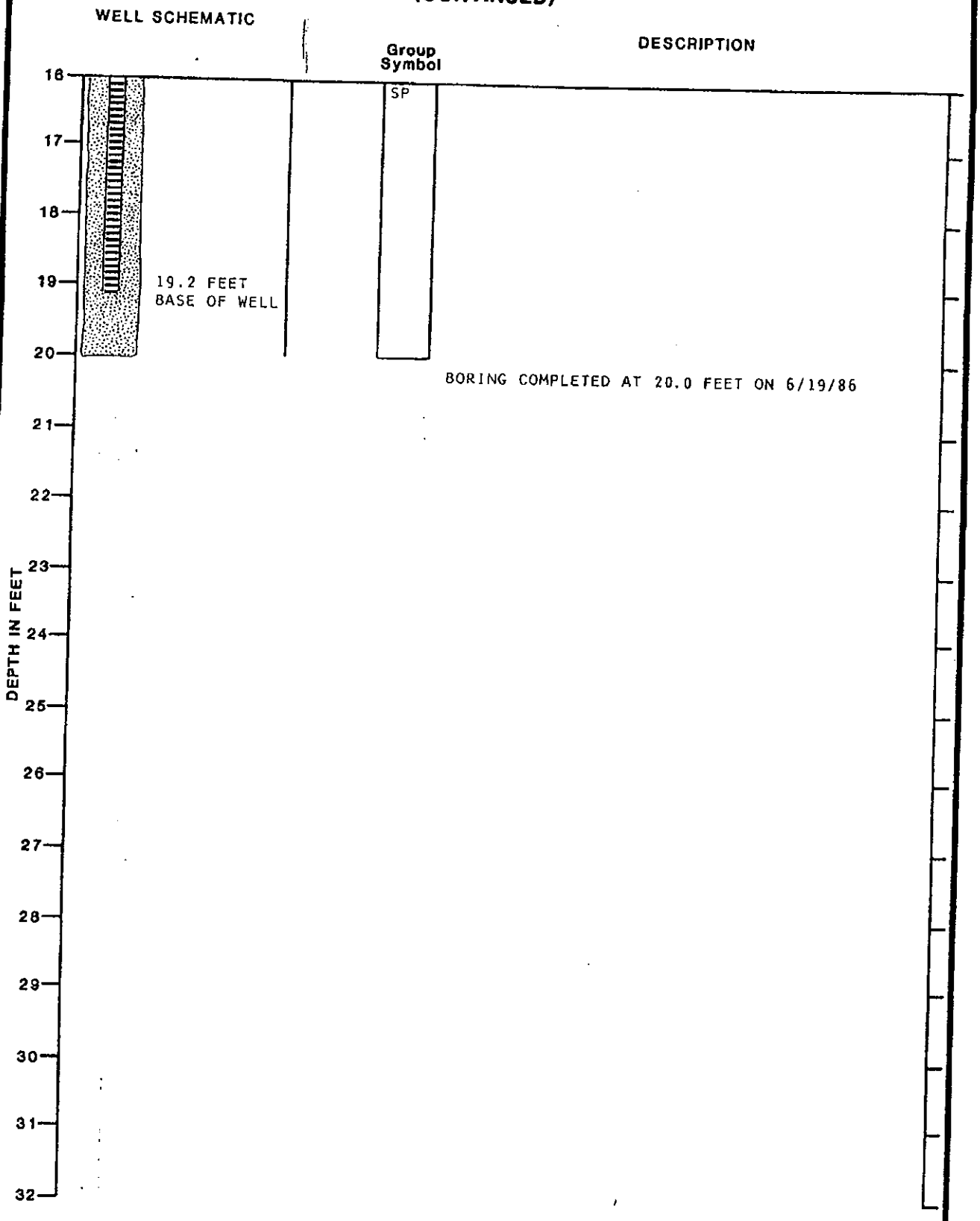
GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-9A

929-04 SEW:JAM:dmp:el 2/6/87

MONITOR WELL NO. 7
(CONTINUED)



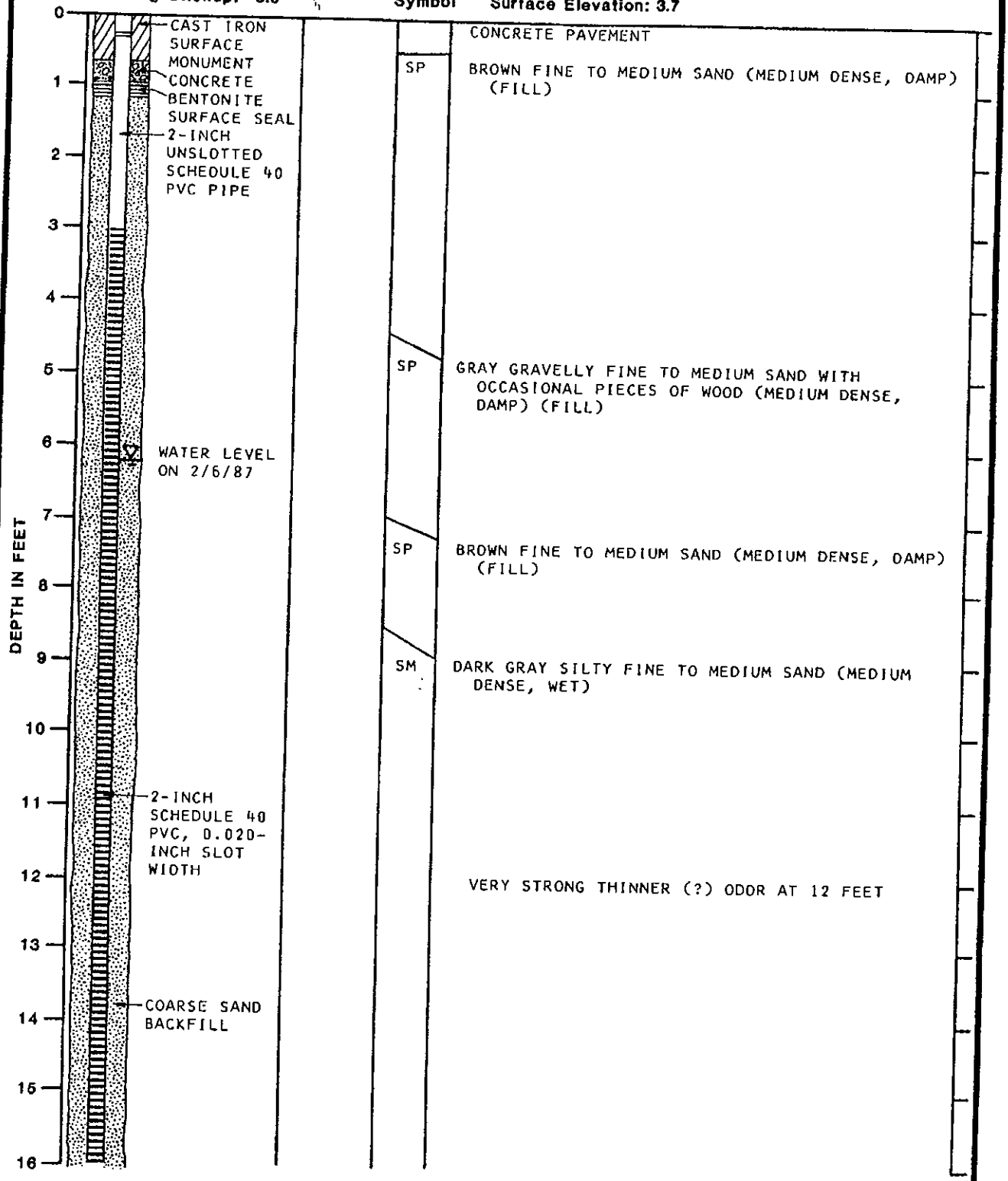
GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-9B

929-04 SEW:JAM:dmp:el 2/6/87

MONITOR WELL NO. 8



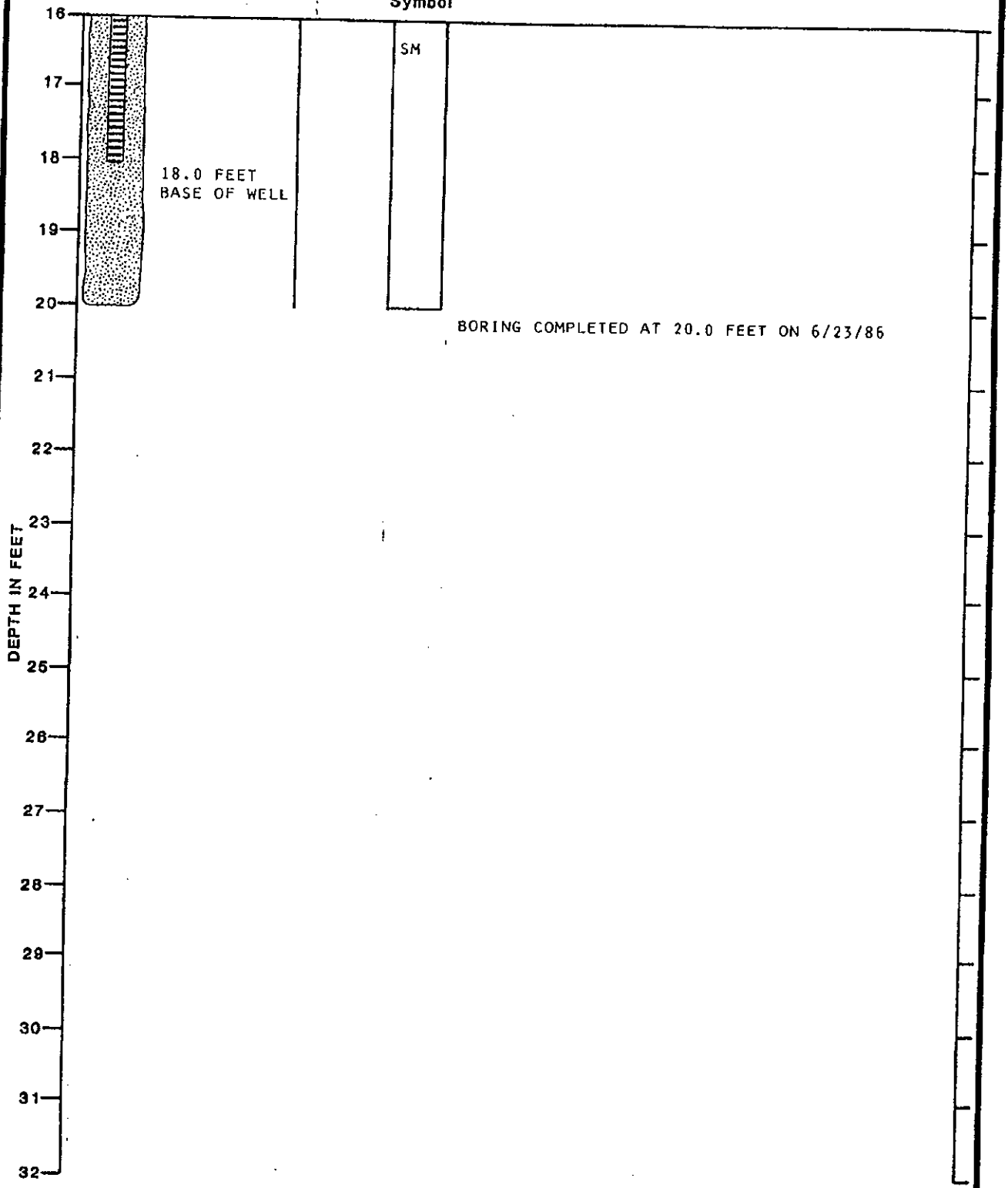
GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-10A

929-04 SEW:JAM:dmp:el 2/6/87

MONITOR WELL NO. 8
(CONTINUED)



GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-10B

929-04 SEW:JAM:dmp:el 2/6/87

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION	NORTH FIRE AISLE		
DRILLING COMPANY	CASCADE	DRILLER	JAMES
DRILLING METHOD	HSA	DRILL BIT(S) SIZE:	9-INCH OD

	FROM	TO	FT.
ISOLATION CASING			
BLANK CASING 2" SCHEDULE 40 PVC PIPE	0.0	23.5	FT.
PERFORATED CASING 2" SCHEDULE 40 PVC PIPE (0.010 SLOT)	23.5	28.5	FT.
SIZE AND TYPE OF FILTER PACK LAPIS LUSTRE #2/12 MONTEREY SAND	21.5	28.5	FT.
SEAL PURE GOLD BENTONITE CHIPS	1.0	21.5	FT.
GROUT CONCRETE (FOR SETTING MONUMENT)	0.0	1.0	FT.

Boring/Well Name MW-88

Project Name PACCAR DATA GAPS

Project Number 016110.00

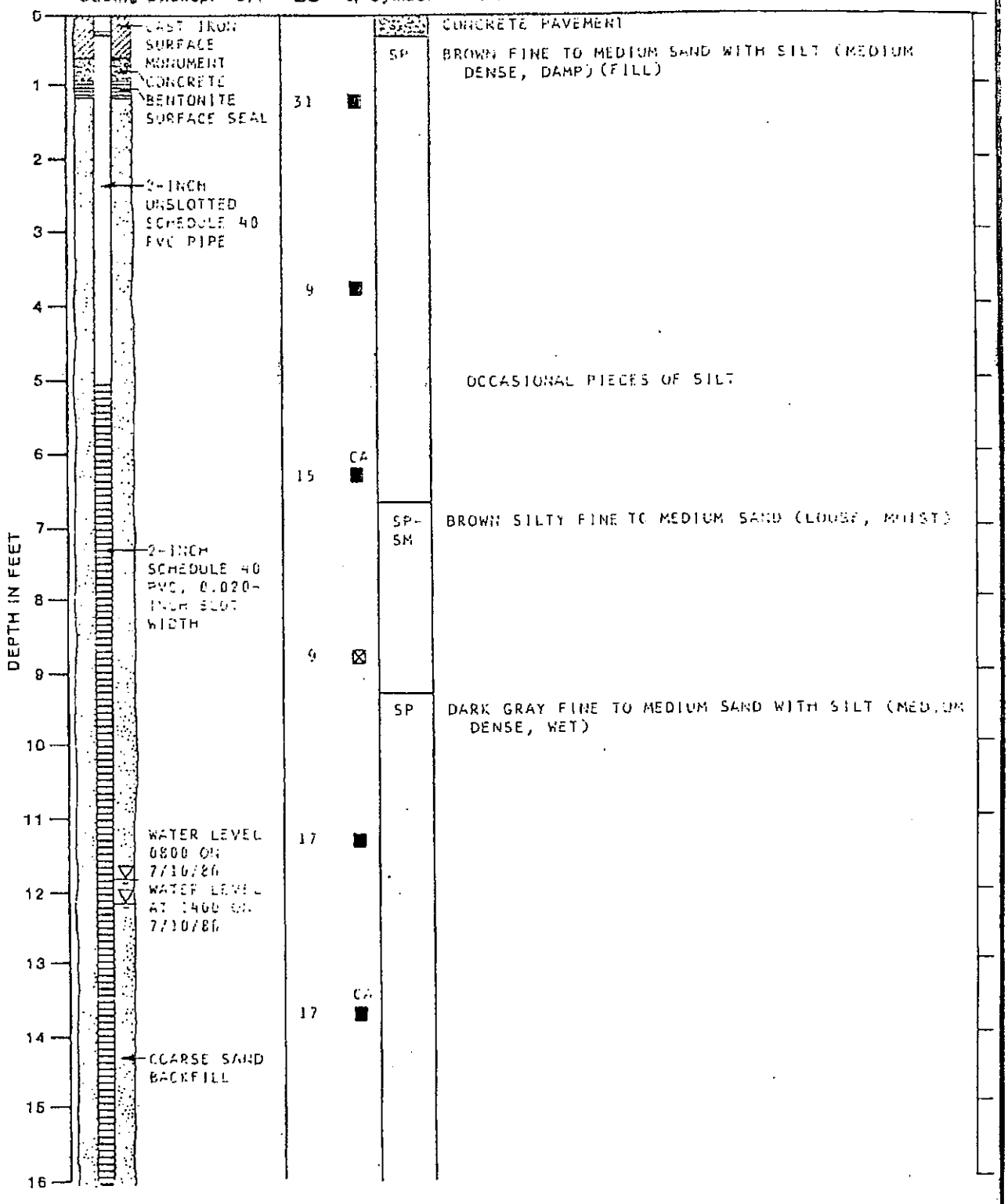
ELEVATION AND DATUM	TOTAL DEPTH 28.5
DATE STARTED 03/14/2002	DATE COMPLETED 03/14/2002
INITIAL WATER DEPTH (FT) 7.0	
LOGGED BY DKM	
SAMPLING METHODS	WELL COMPLETION ■ SURFACE HOUSING ☐ STAND PIPE ____ FT.

SAMPLES TYPE	SAMPLES RECOVERY (FEET)	SAMPLES PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
			0					**Concrete**
							SW	**Well-graded SAND with gravel** Gray sand with 25–35% gravel, appears to be fill material.
			5		▽		SW/SM	**Well-graded SAND with silt and gravel**
							ML	Dark gray sand with fine gravel (5–10%) and silt (5–10%), strong chemical odor.
			10					**SILT** Gray dense silt, no odor.
							ML	**Sandy SILT** Gray, wet, silt and fine sand mixture.
			15					**Poorly graded SAND** Gray poorly graded fine- to medium- sand, no odor.
			20				SP	
			25					
							ML	**SILT** Gray dense silt, no odor.
			30					

Notes:

1. Lithology is based on geoprobe boring NA-7.

MONITOR WELL NO. 9



Note: See Figure A-2 for Explanation of Symbols

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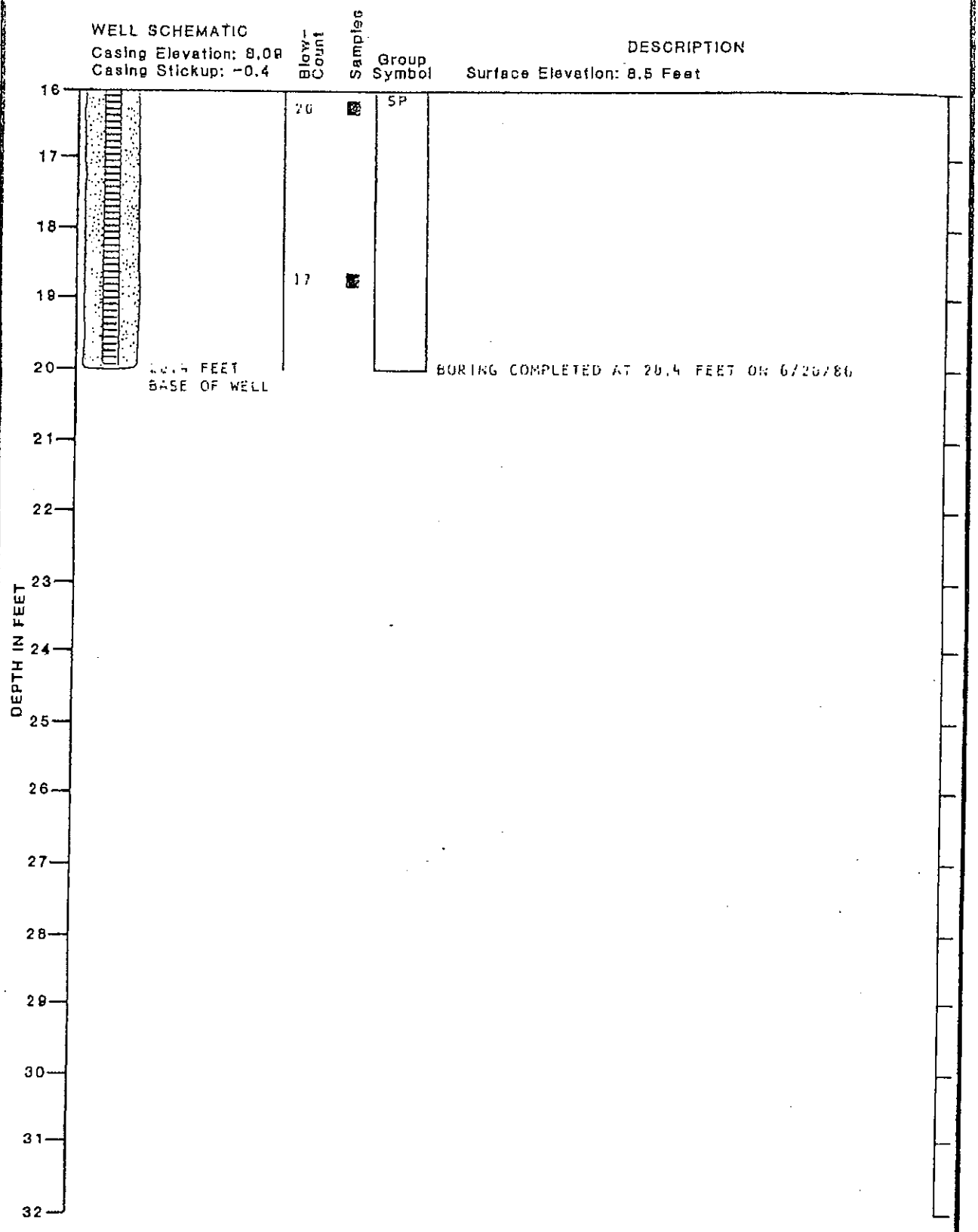
LOG OF MONITOR WELL

FIGURE A-3A

MONITOR WELL NO. 9 (CONTINUED)



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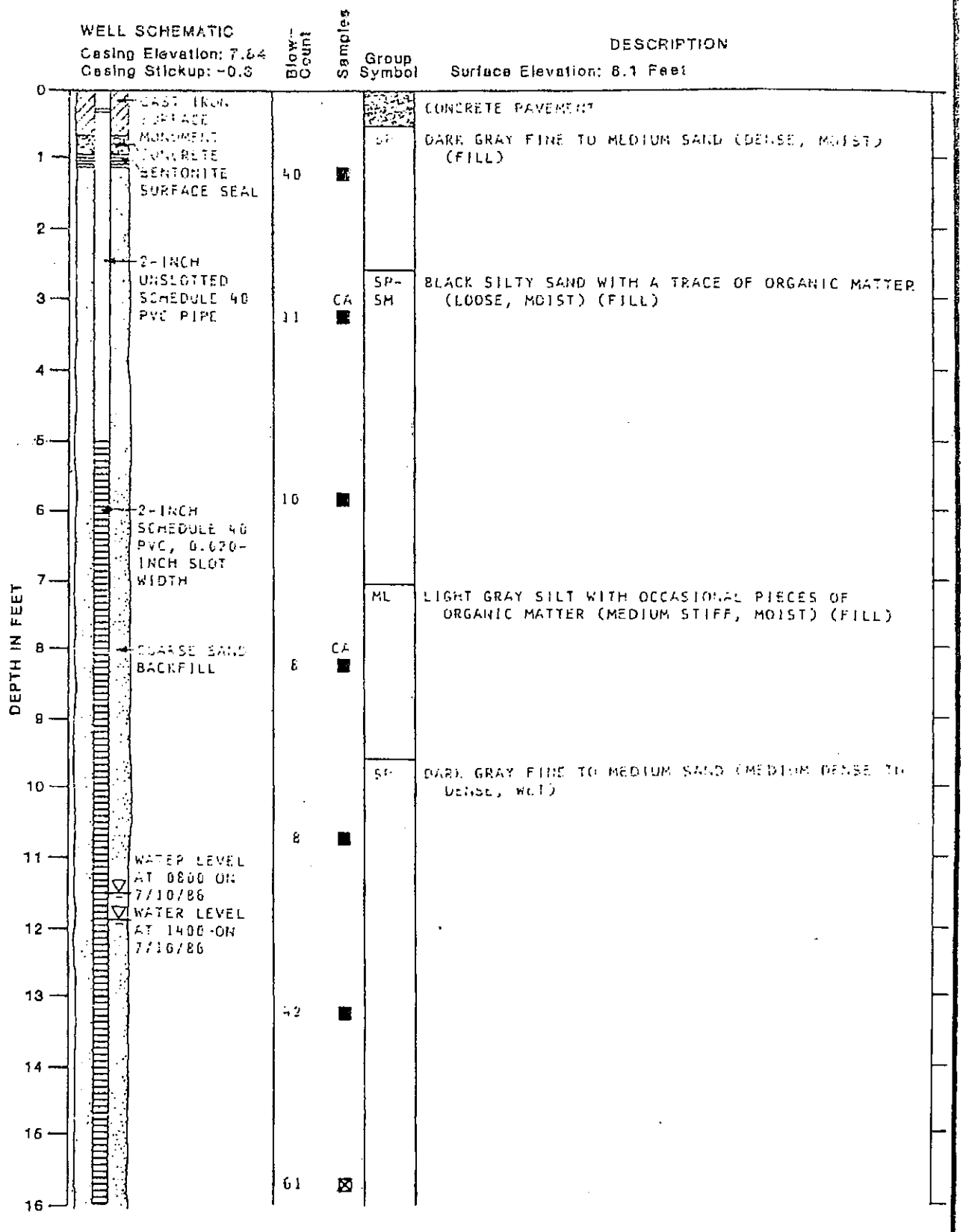
LOG OF MONITOR WELL

FIGURE A-3B

MONITOR WELL NO. 10

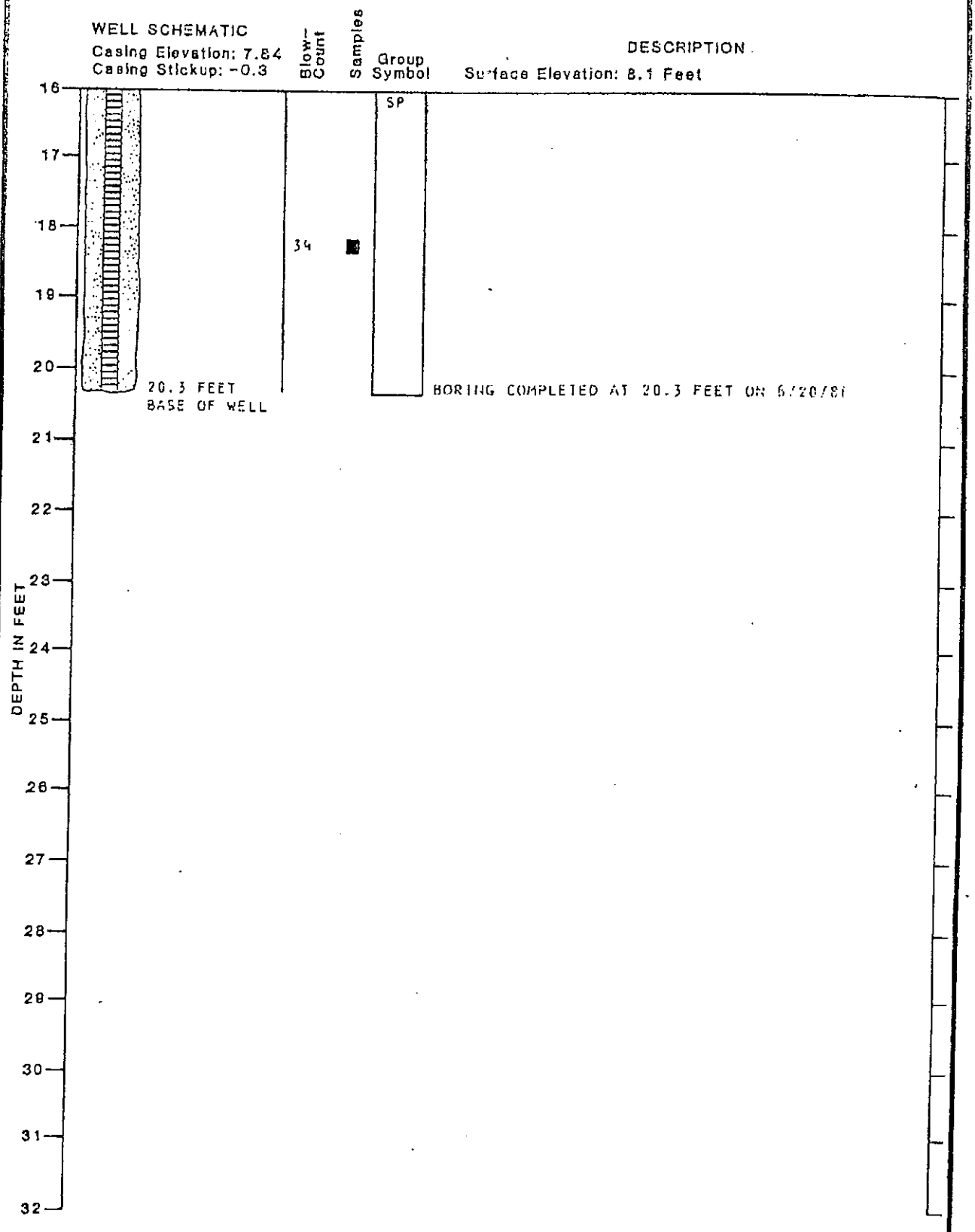


GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-4A

MONITOR WELL NO. 10 (CONTINUED)



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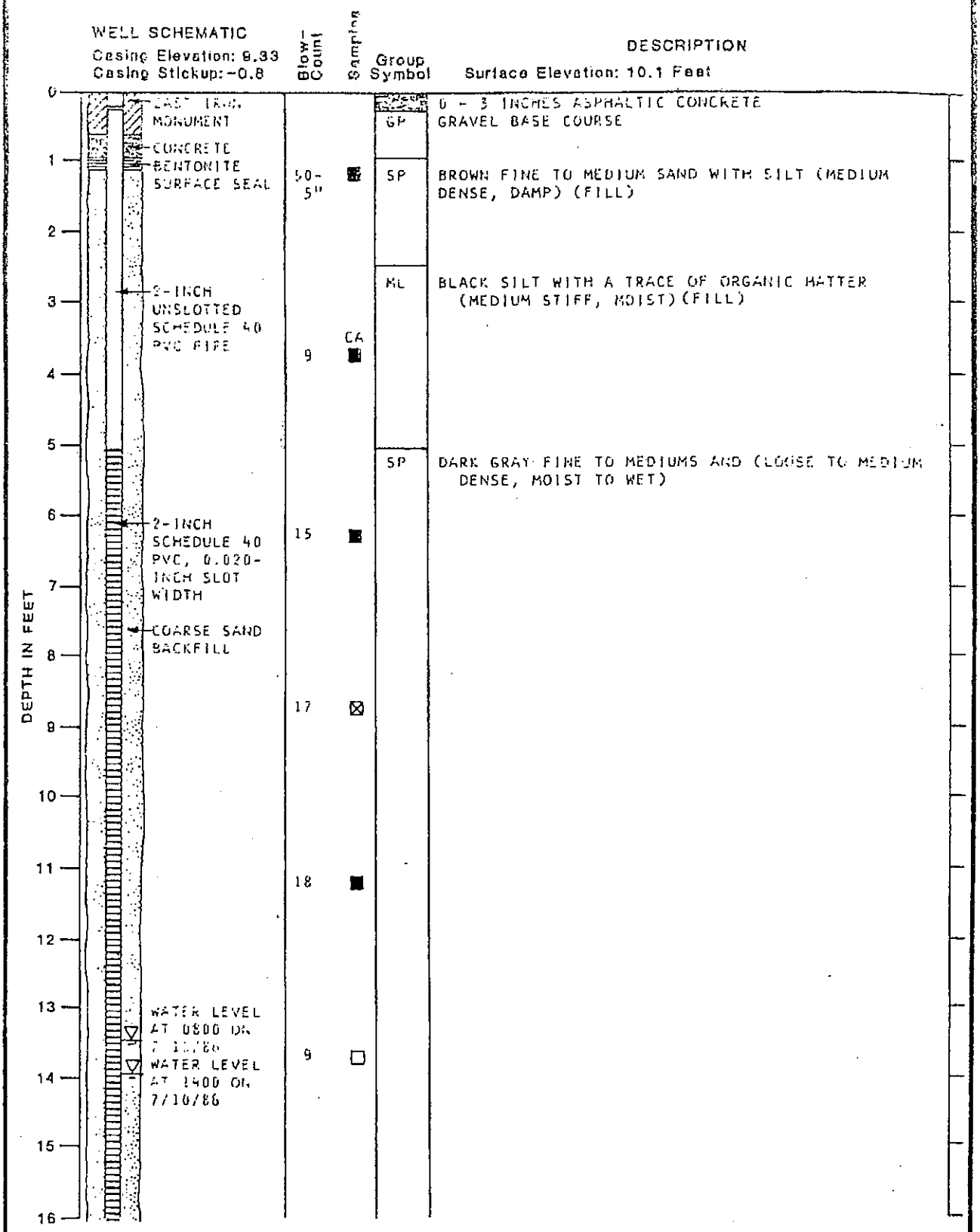
LOG OF MONITOR WELL

FIGURE A-4B

MONITOR WELL NO. 11

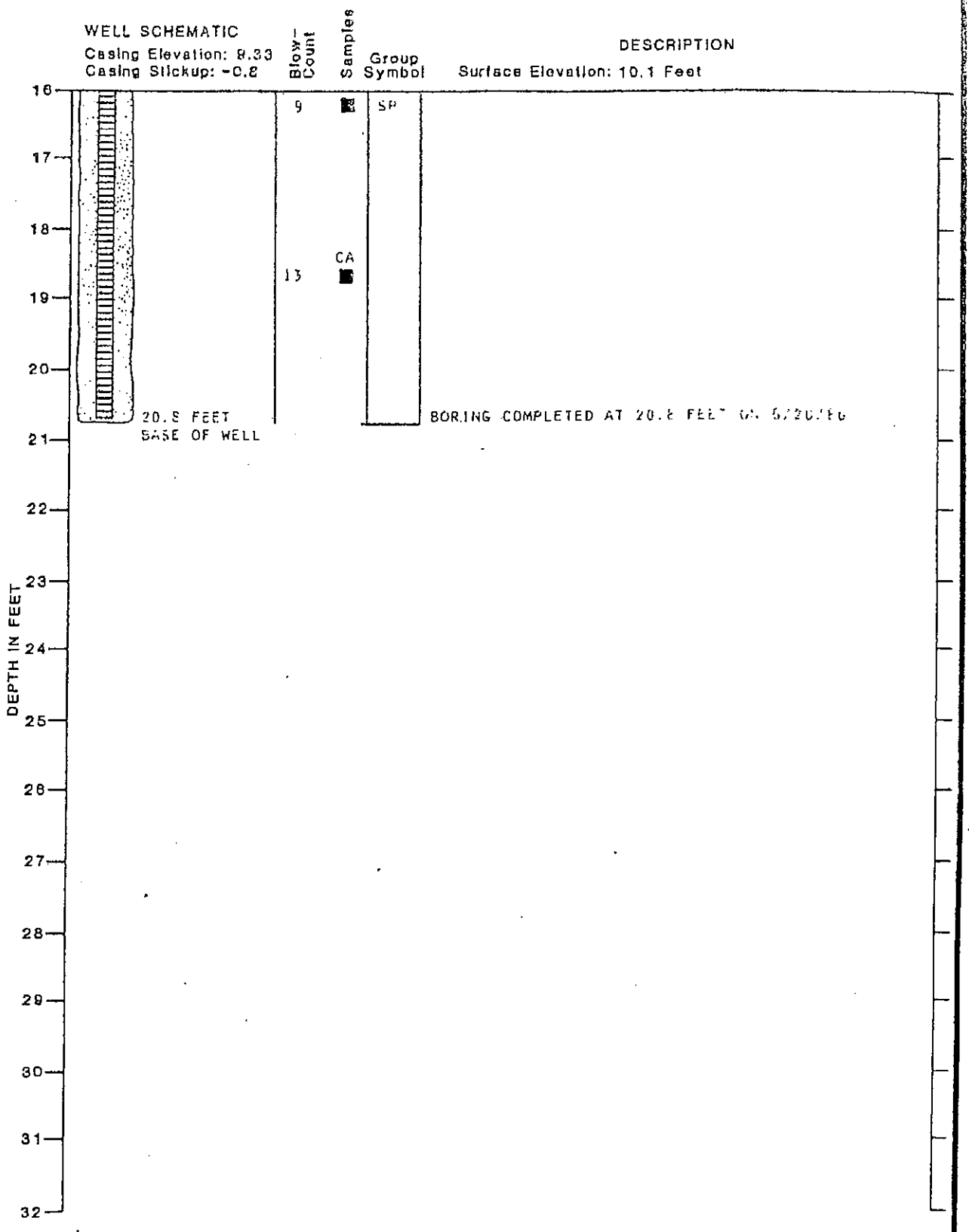


GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-5A

MONITOR WELL NO. 11 (CONTINUED)

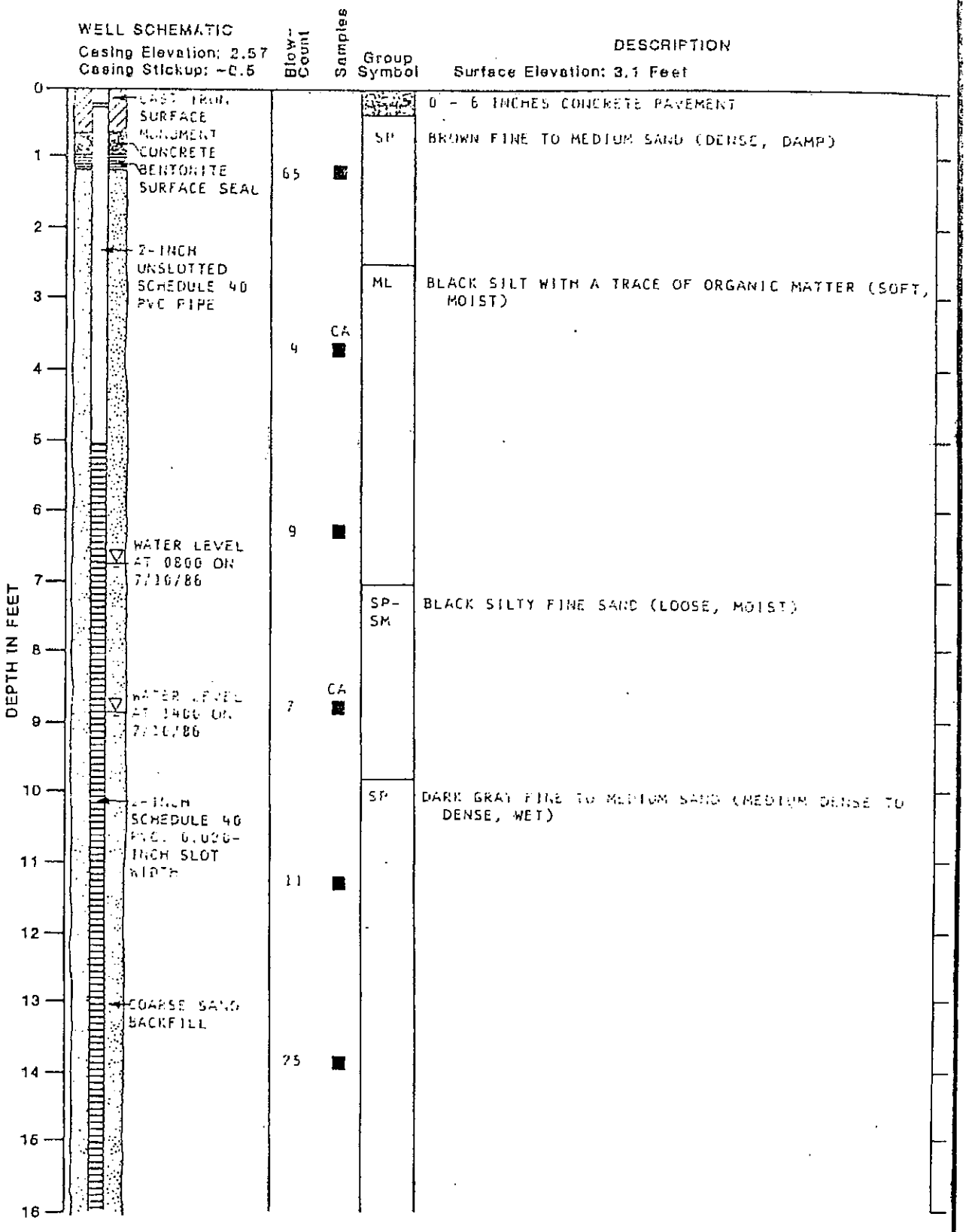


GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-5B

MONITOR WELL NO. 12



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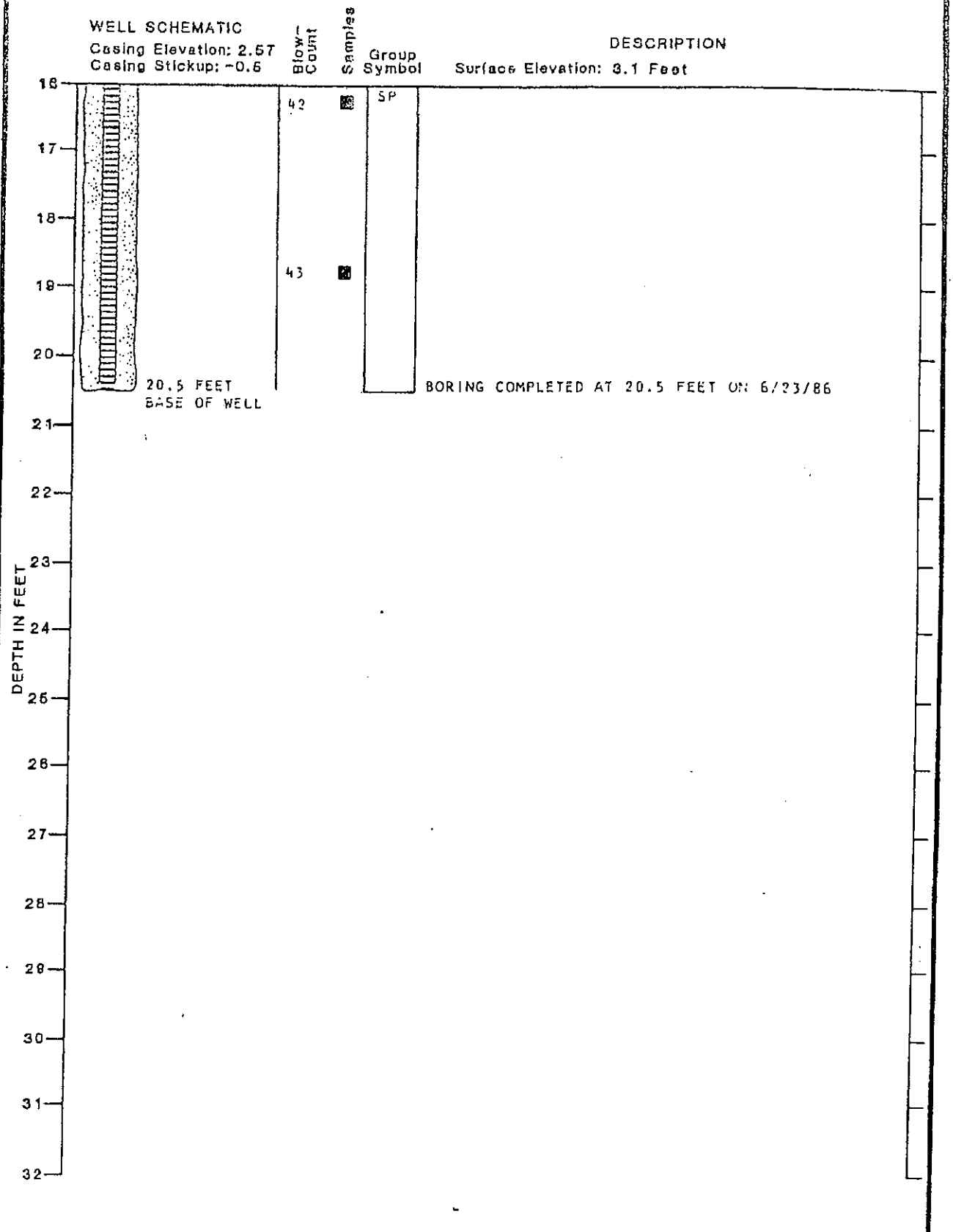
LOG OF MONITOR WELL

FIGURE A-6A

MONITOR WELL NO. 12 (CONTINUED)



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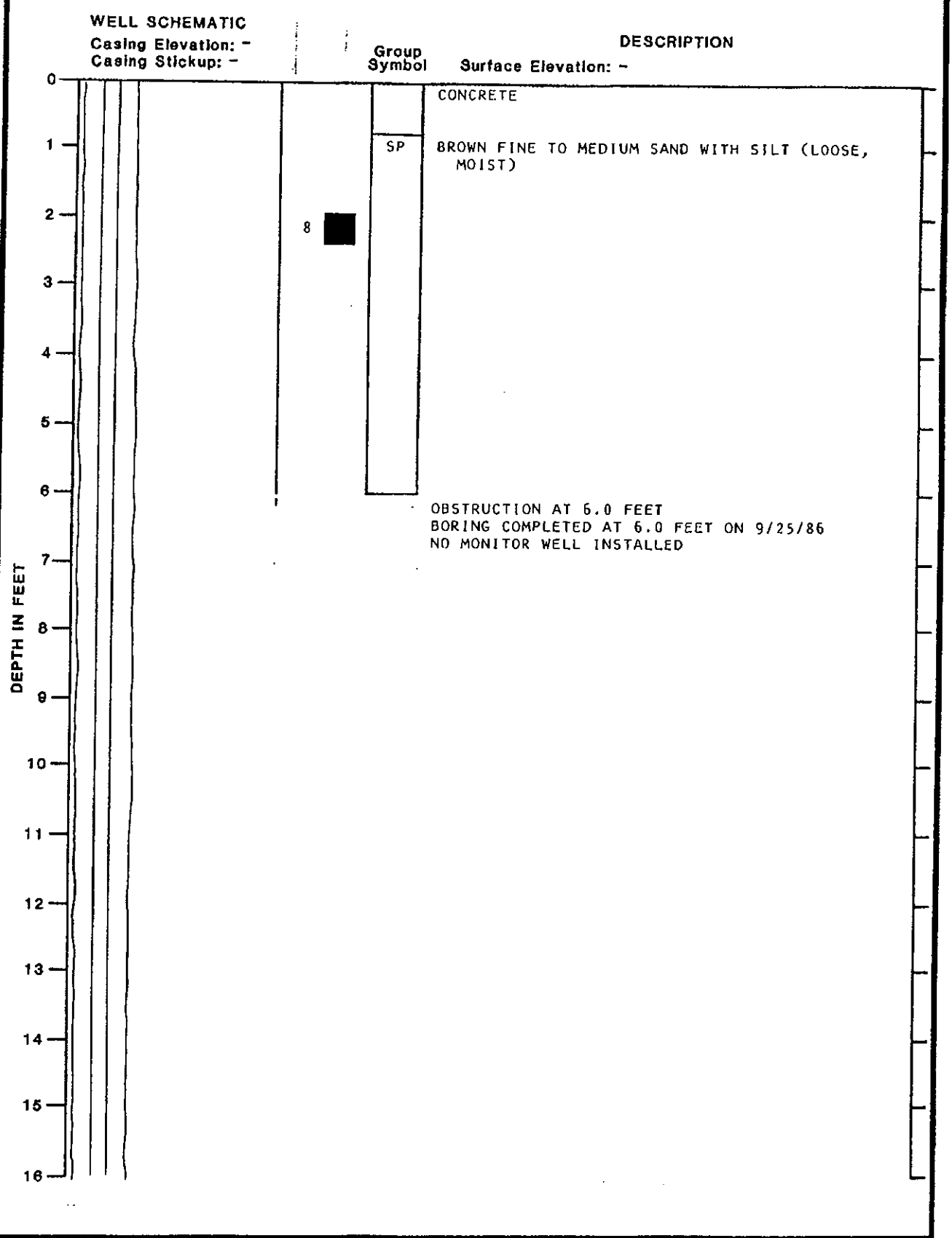
LOG OF MONITOR WELL

FIGURE A-6B

920-03 9/11/86

MONITOR WELL NO. 13



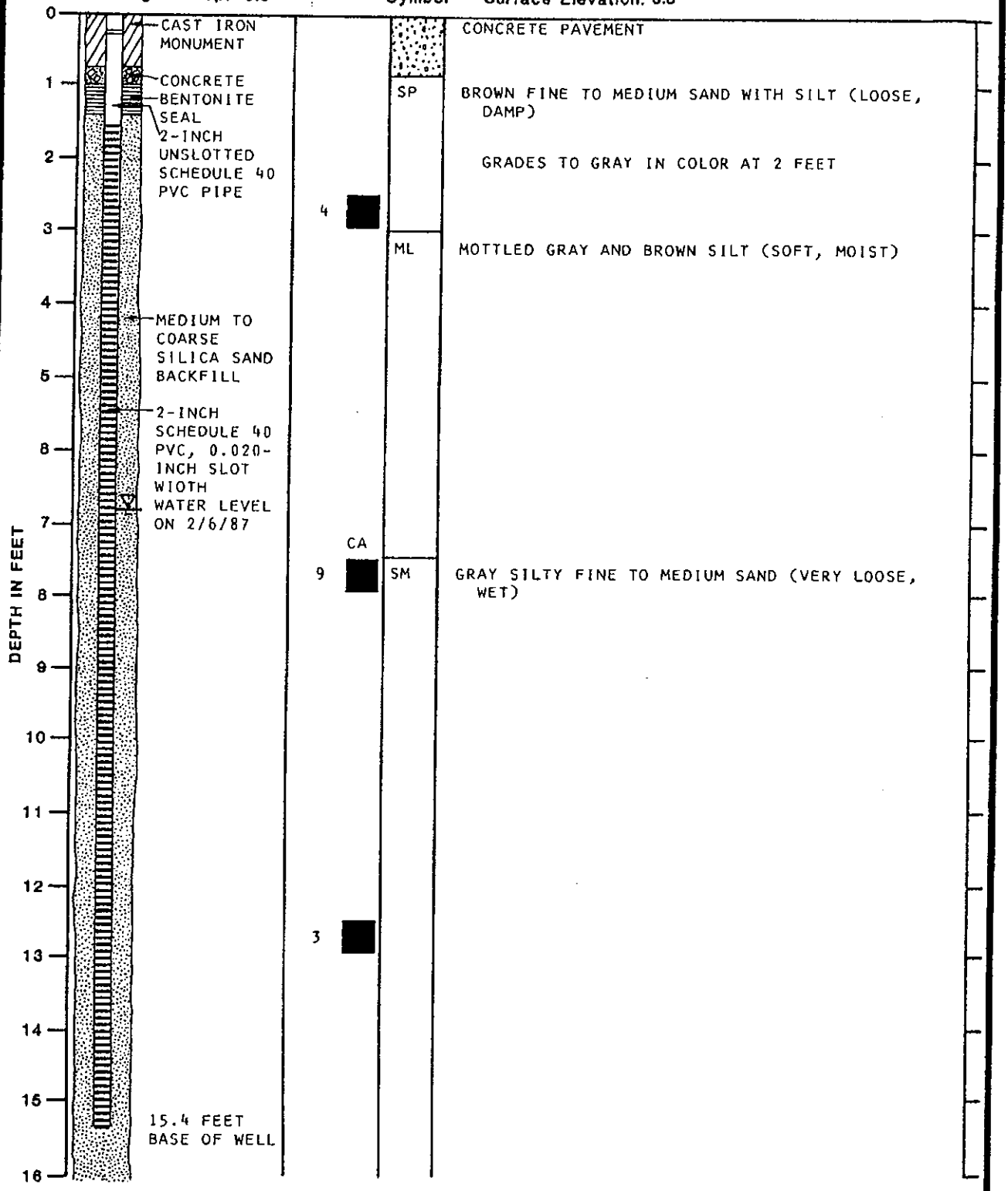
GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-11

929-04 SEW:JAM:DMP:EL 2/18/87

MONITOR WELL NO. 14



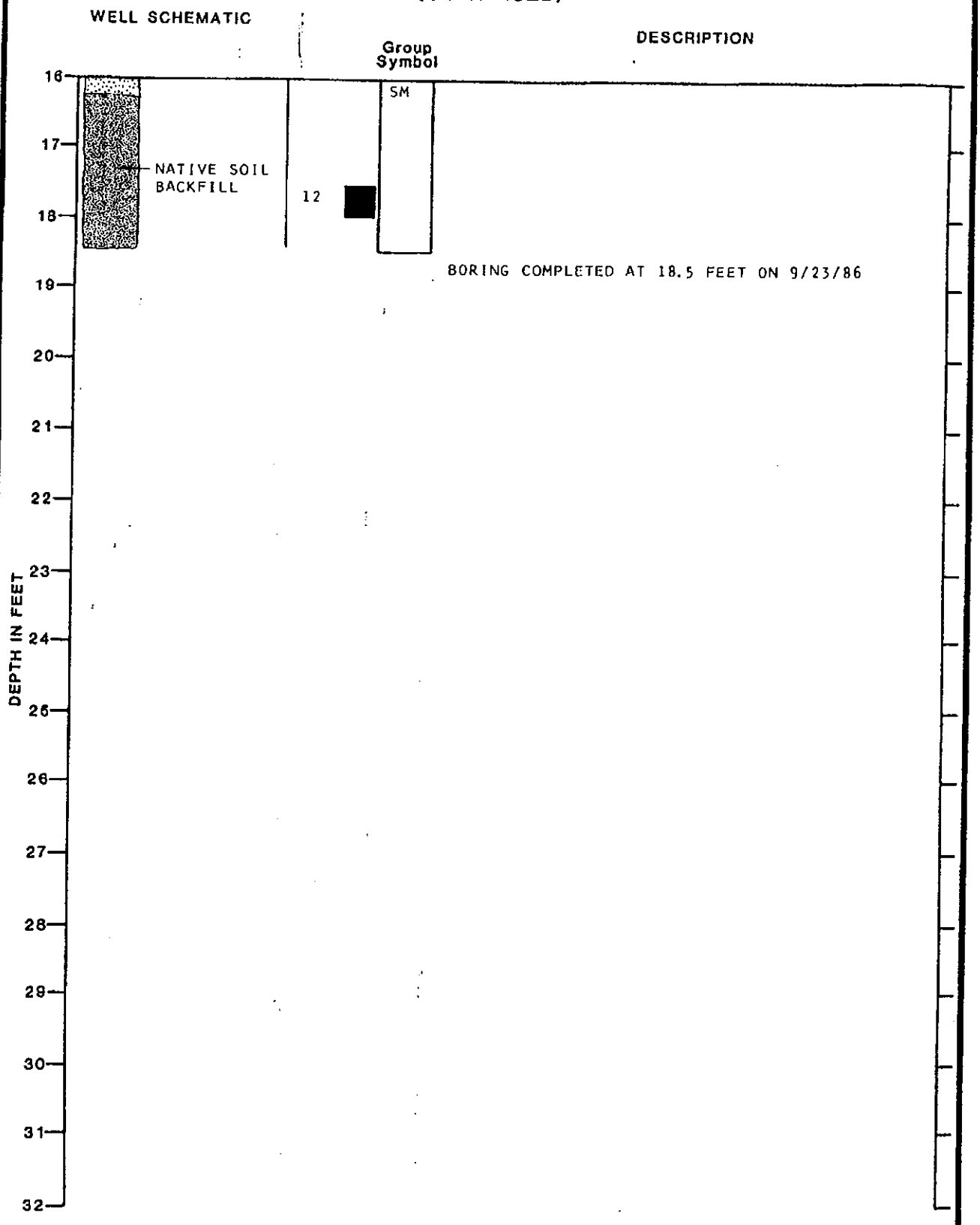
GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-12A

929-04 SEW:JAM:dmp:e1 2-6-87

MONITOR WELL NO. 14
(CONTINUED)



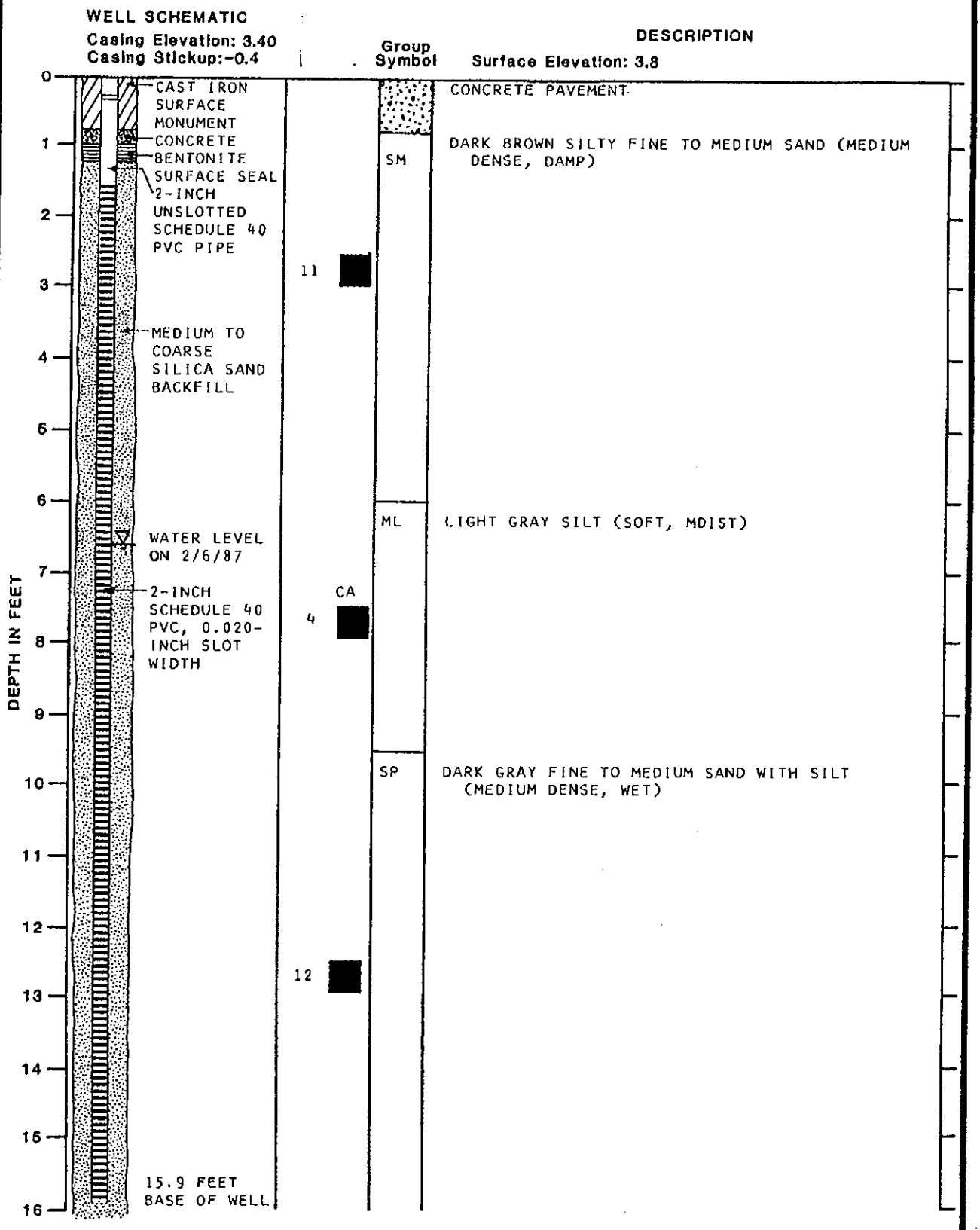
GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-12B

929-04 SEW:JAM:dmp:el 2/6/87

MONITOR WELL NO. 15



929-04 SEW:JAM:dmp:el 2/6/87

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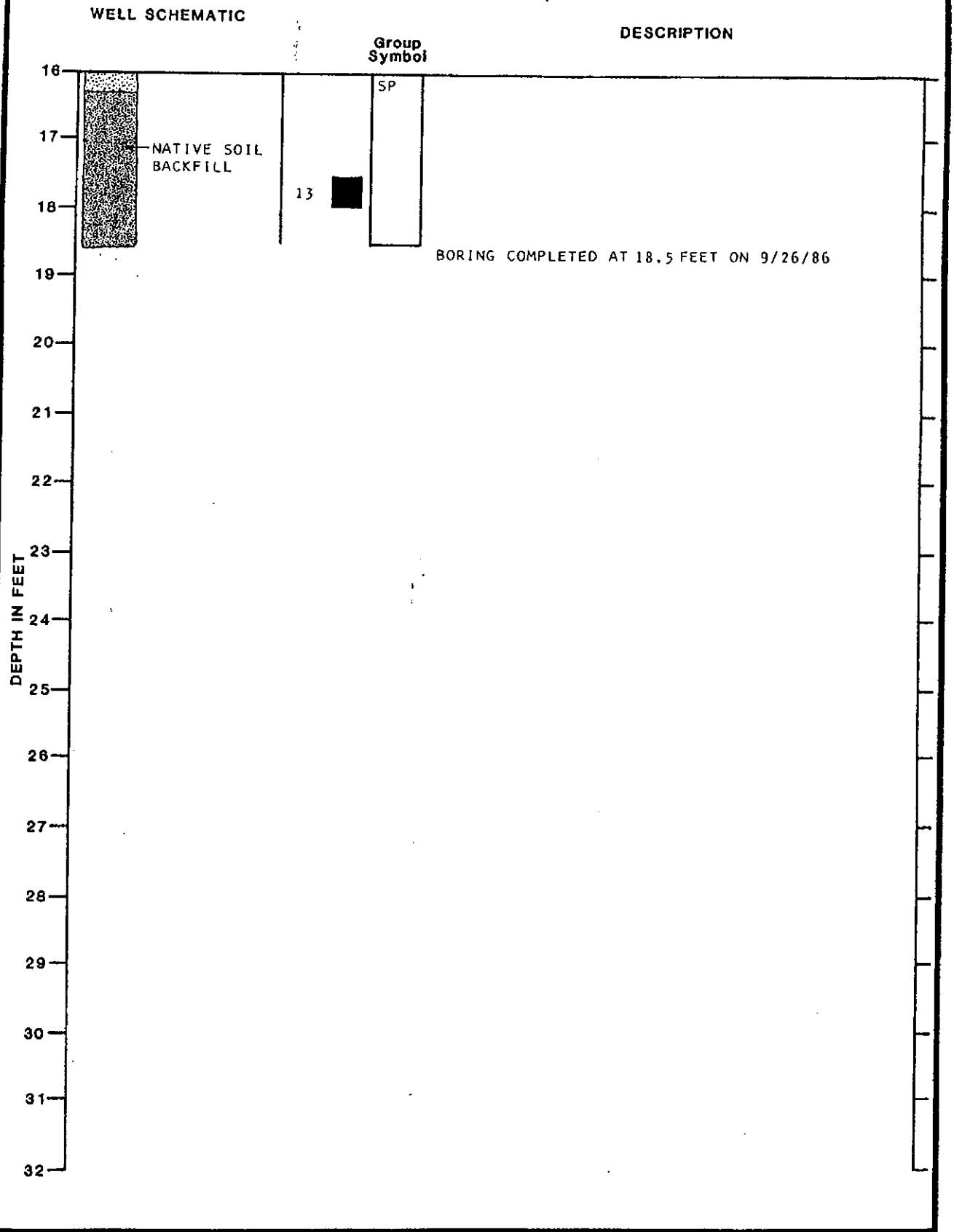
LOG OF MONITOR WELL

FIGURE A-13A

MONITOR WELL NO. 15
(CONTINUED)



929-04 SEW:JAM:dmp:e1 2/6/87

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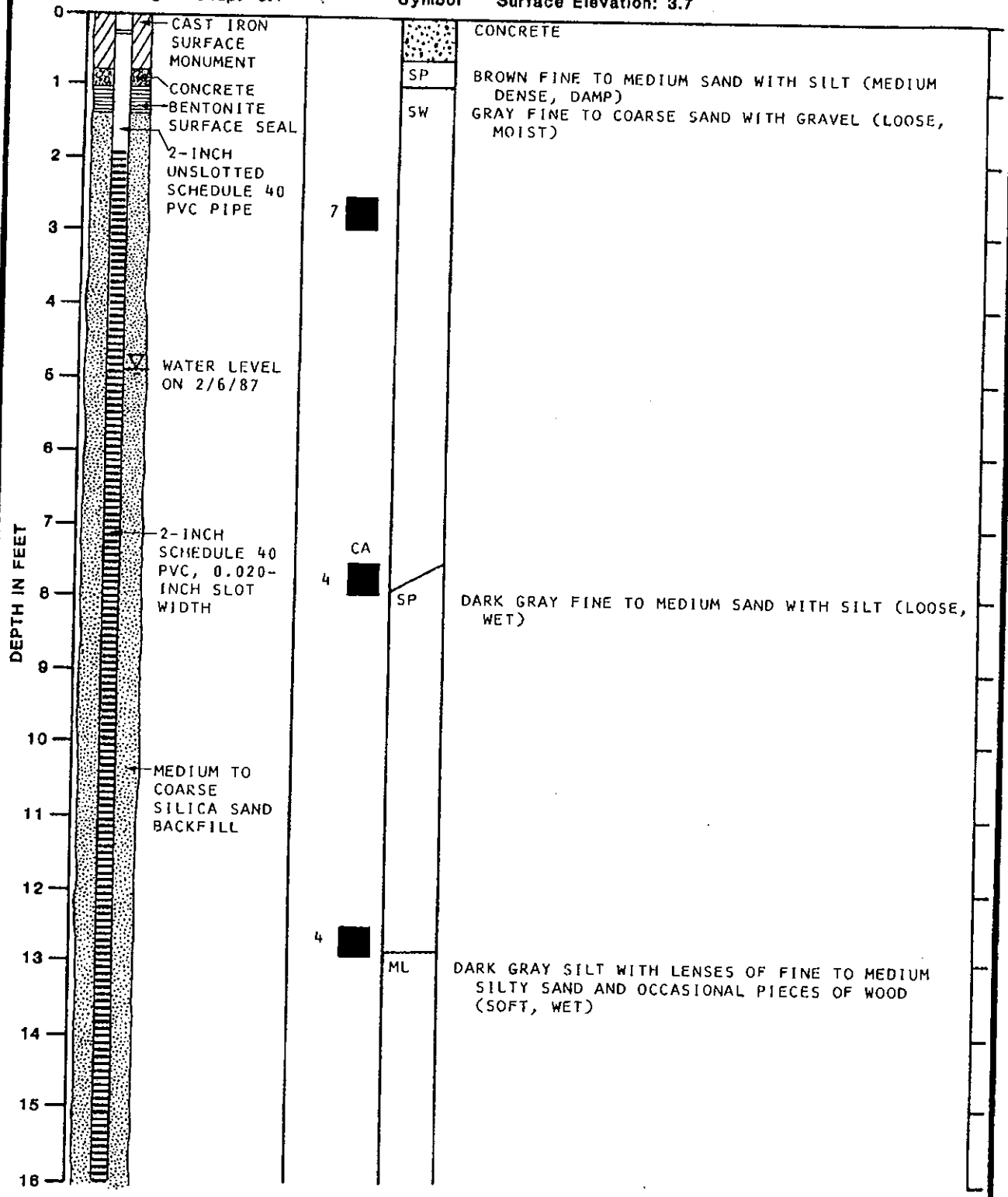
LOG OF MONITOR WELL

FIGURE A-13B

MONITOR WELL NO. 16



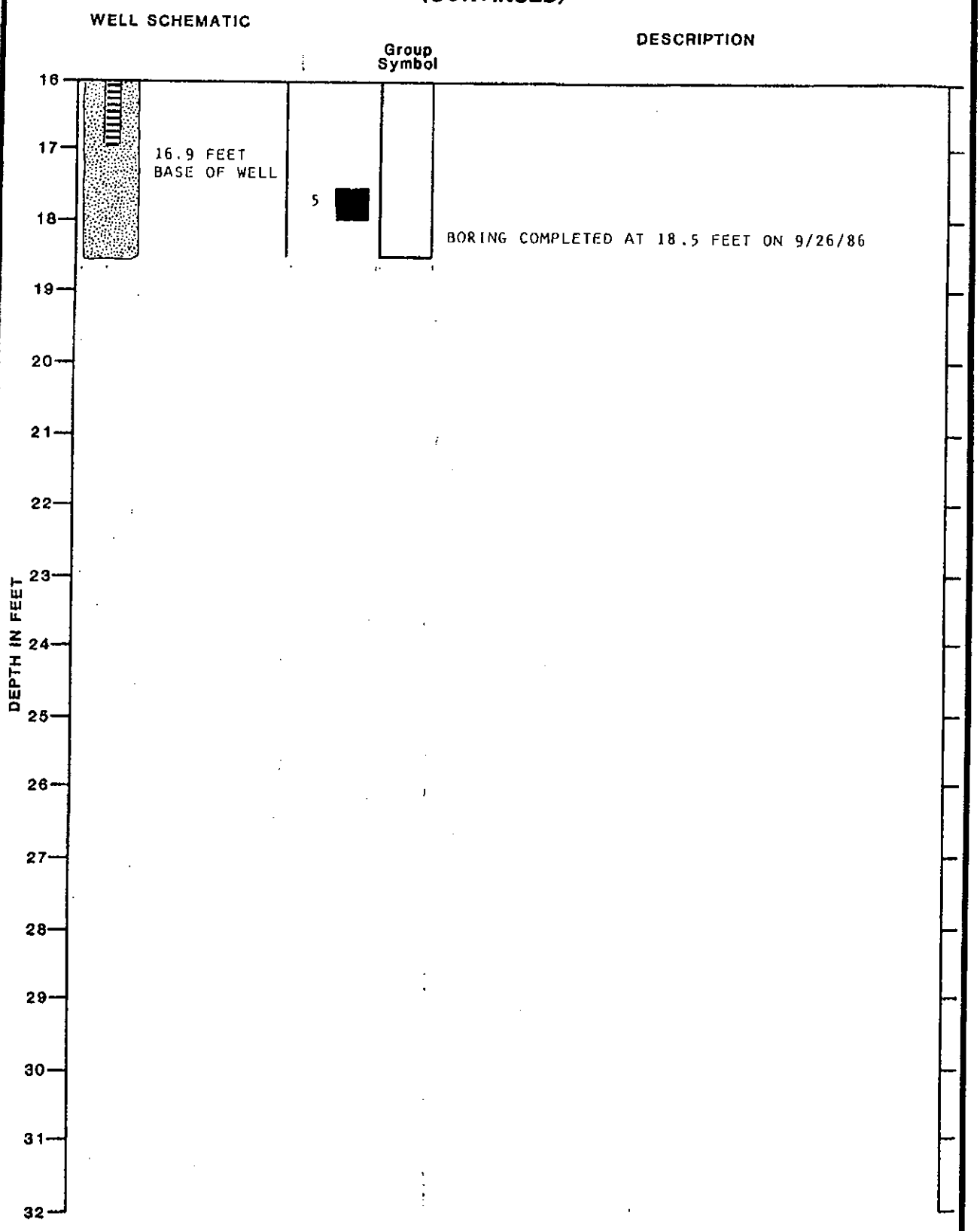
GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-14A

929-04 SEW:JAM:dmp:el 2/6/87

MONITOR WELL NO. 16
(CONTINUED)



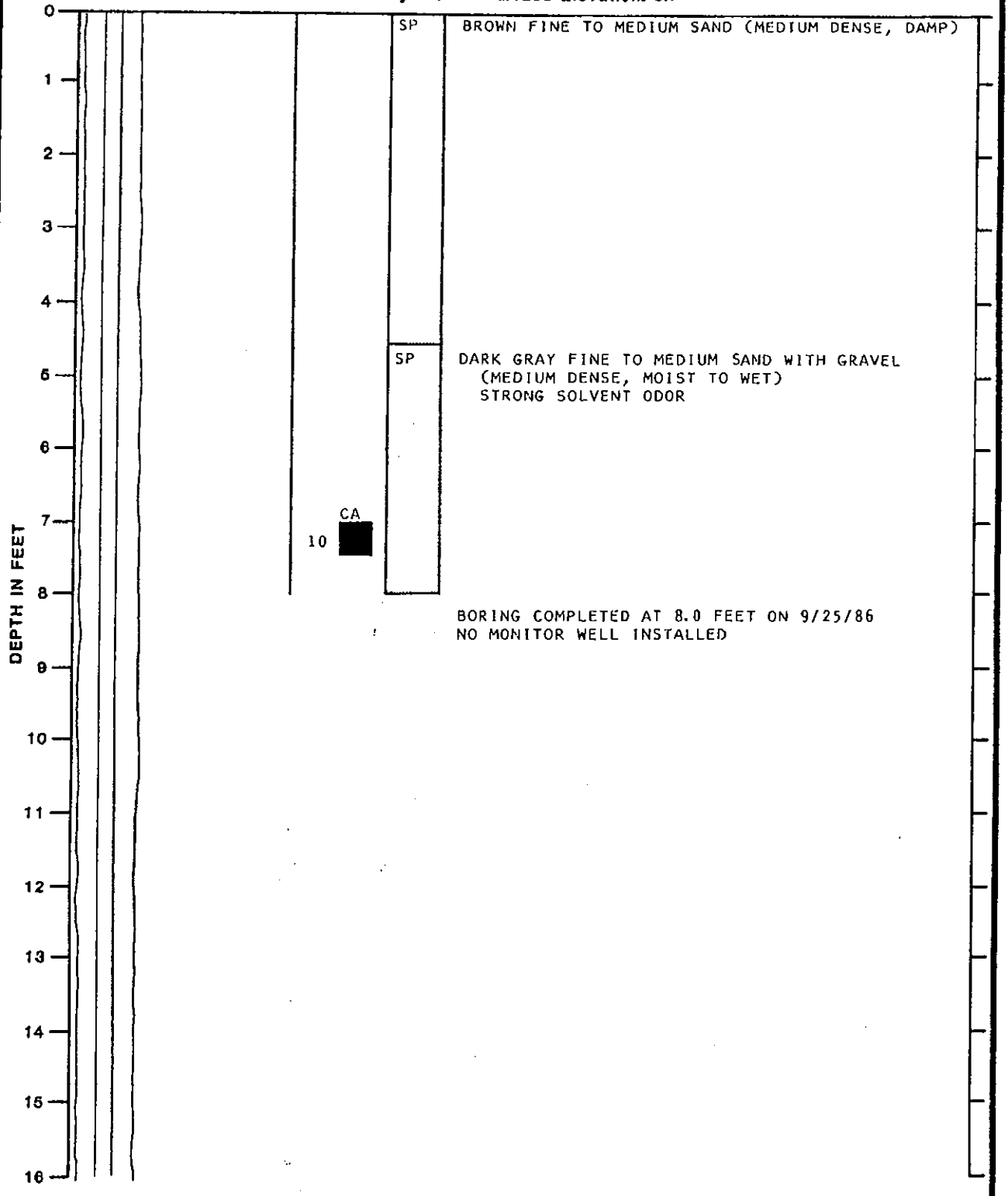
GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-14B

SEW:JAM:DMP:EL 929-04 2/9/87

MONITOR WELL NO. 17



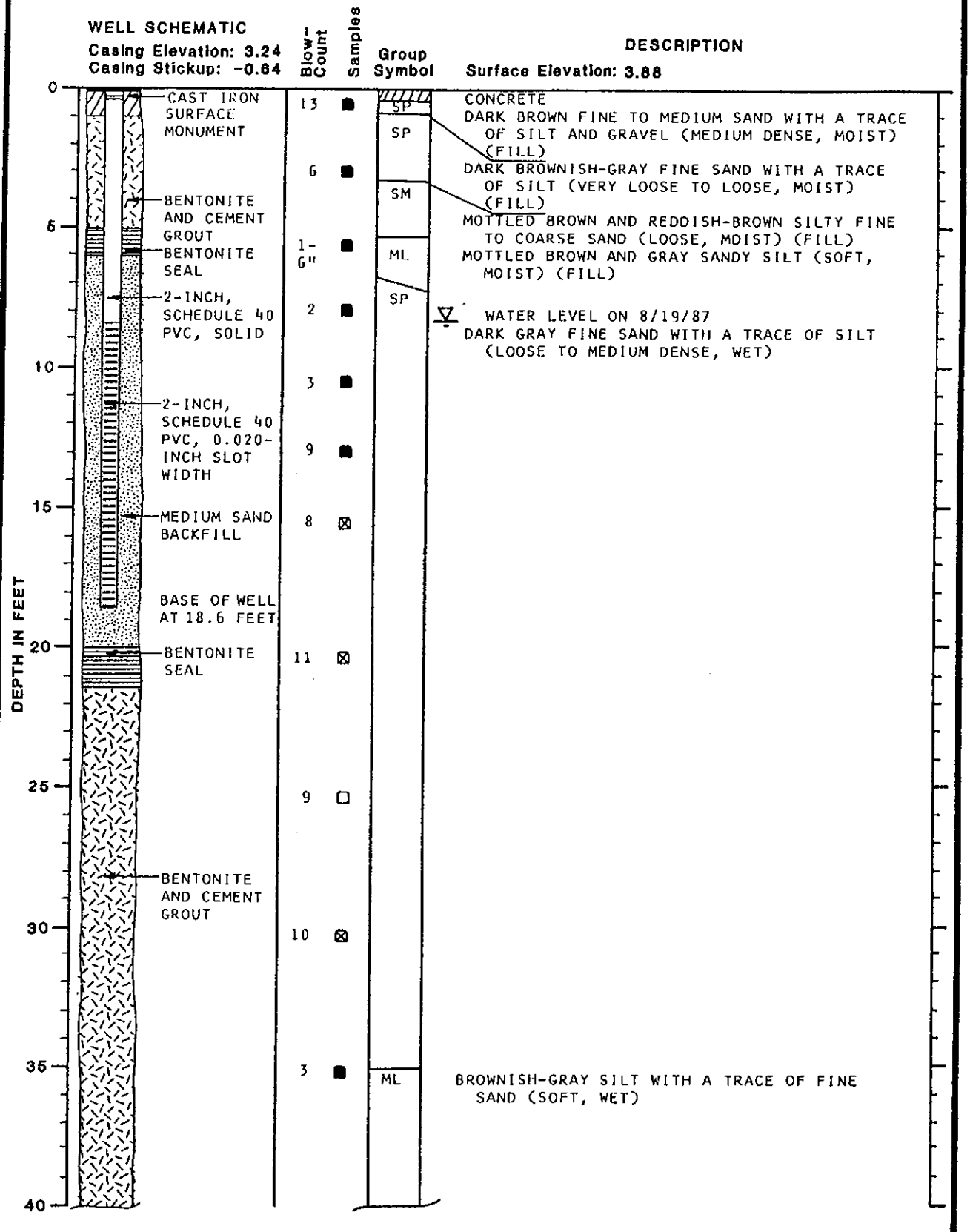
GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-15

929-04 SEW:JAM:DMP:EL 2/9/87

MONITOR WELL NO. MW-18



Note: See Figure A-2 for Explanation of Symbols

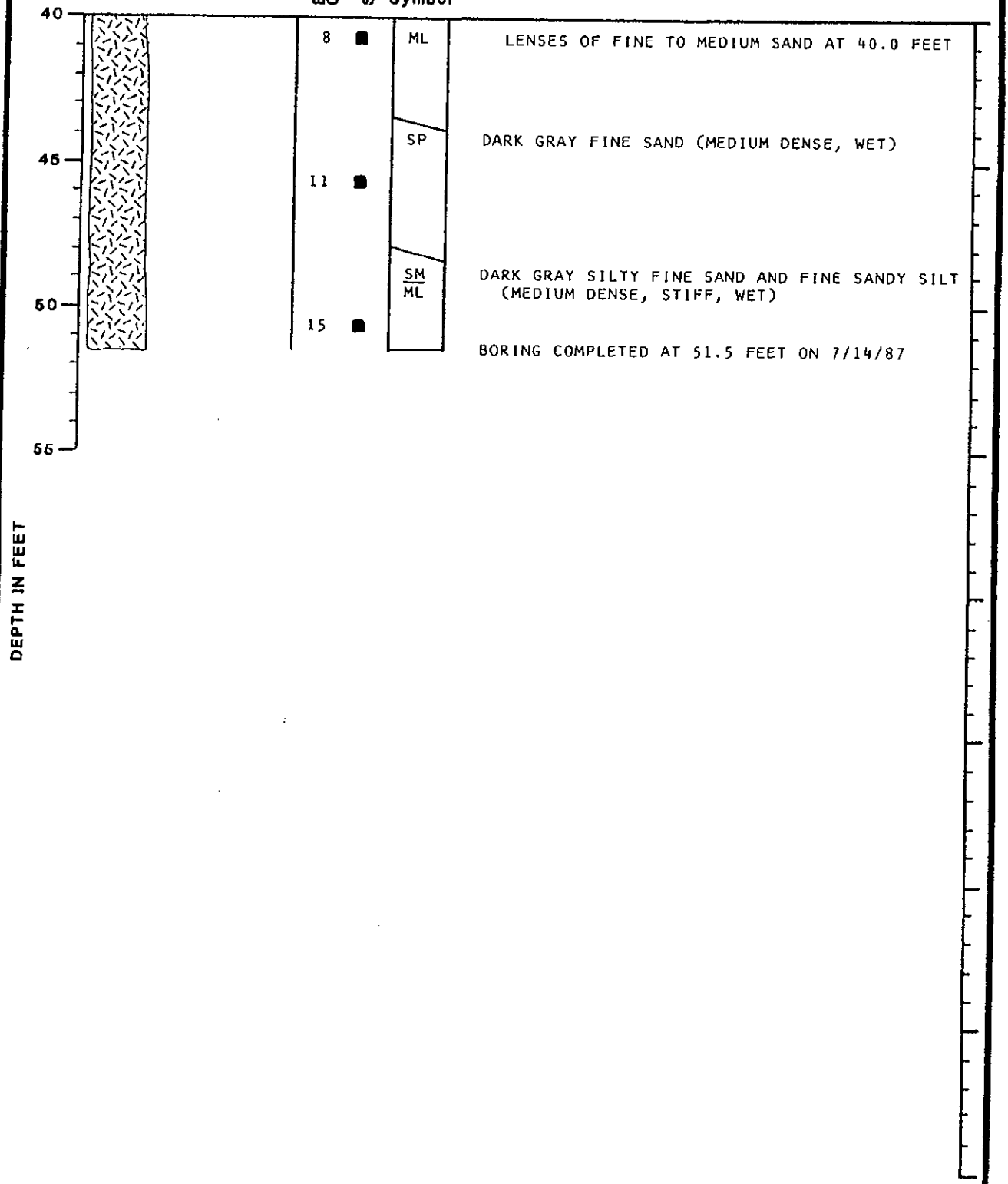
GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-16A

0929-06-4 SEW:EL:KKT 9-4-87

MONITOR WELL NO. MW-18
Continued



Note: See Figure A-2 for Explanation of Symbols

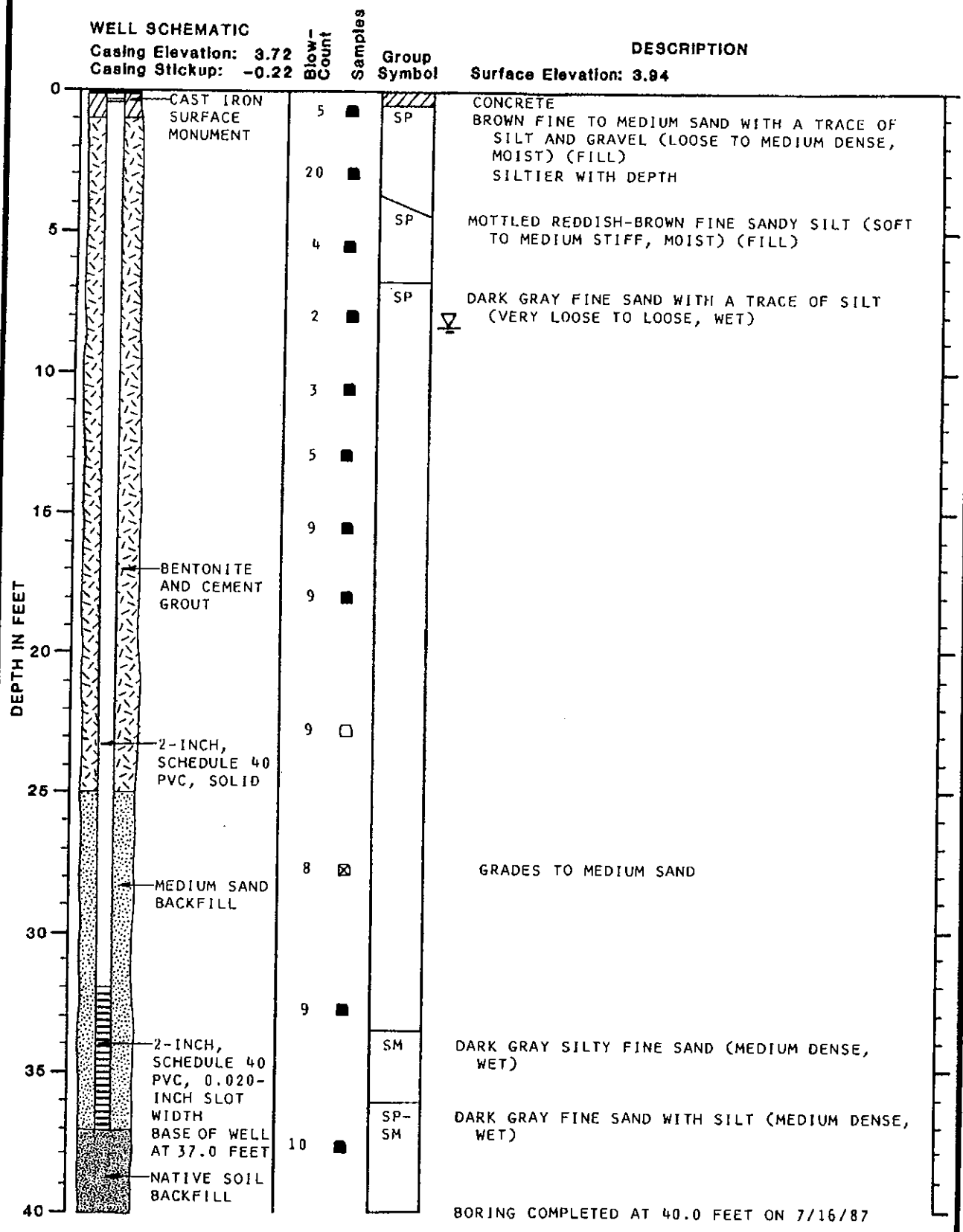
GeoEngineers incorporated

LOG OF MONITOR WELL

FIGURE A-16B

0929-06-4 SEW:EL:KKL 9-4-87

MONITOR WELL NO. MW-19



Note: See Figure A-2 for Explanation of Symbols

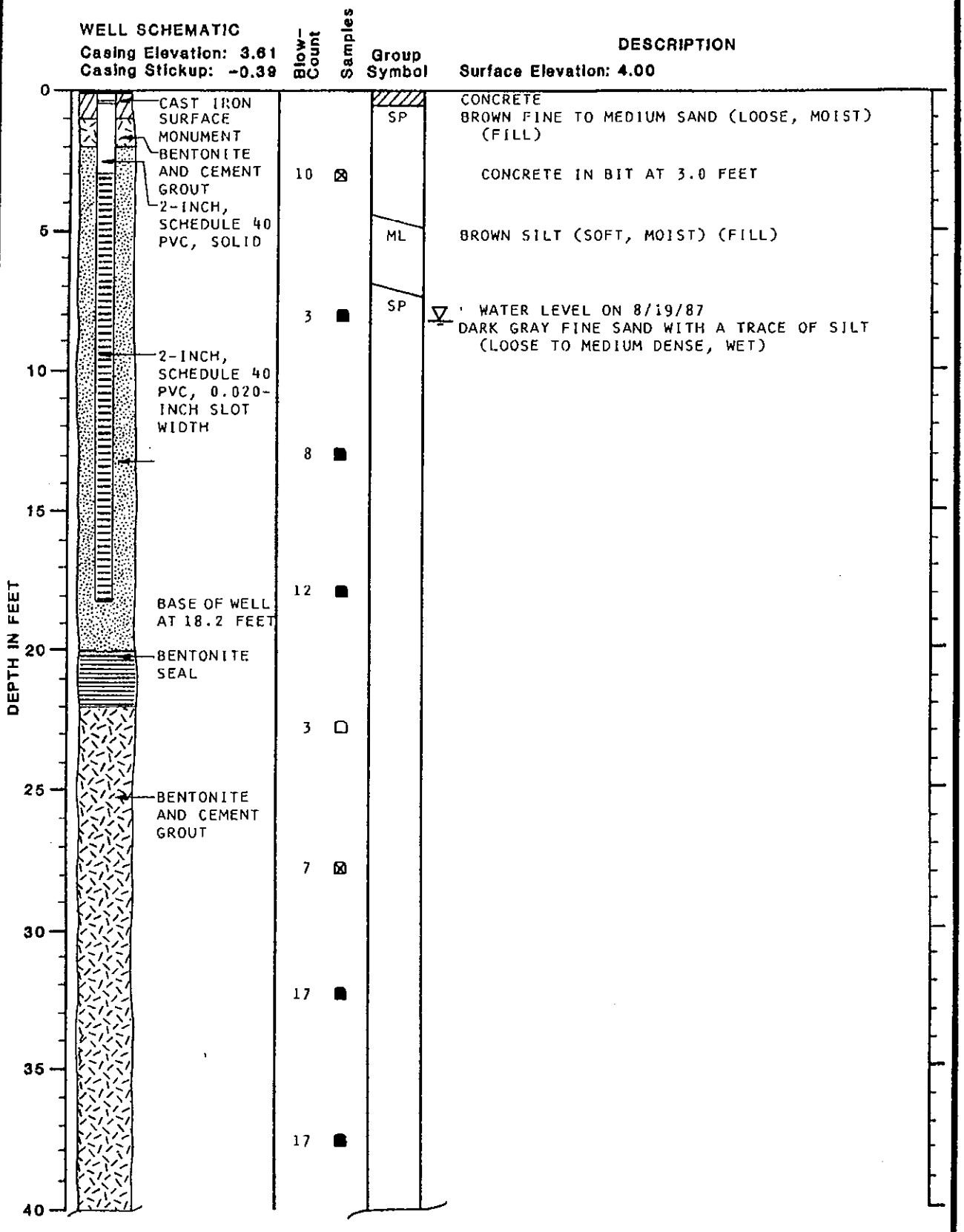
GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-17

0929-06-4 SEW:EL:KKT 9-4-87

MONITOR WELL NO. MW-20



Note: See Figure A-2 for Explanation of Symbols

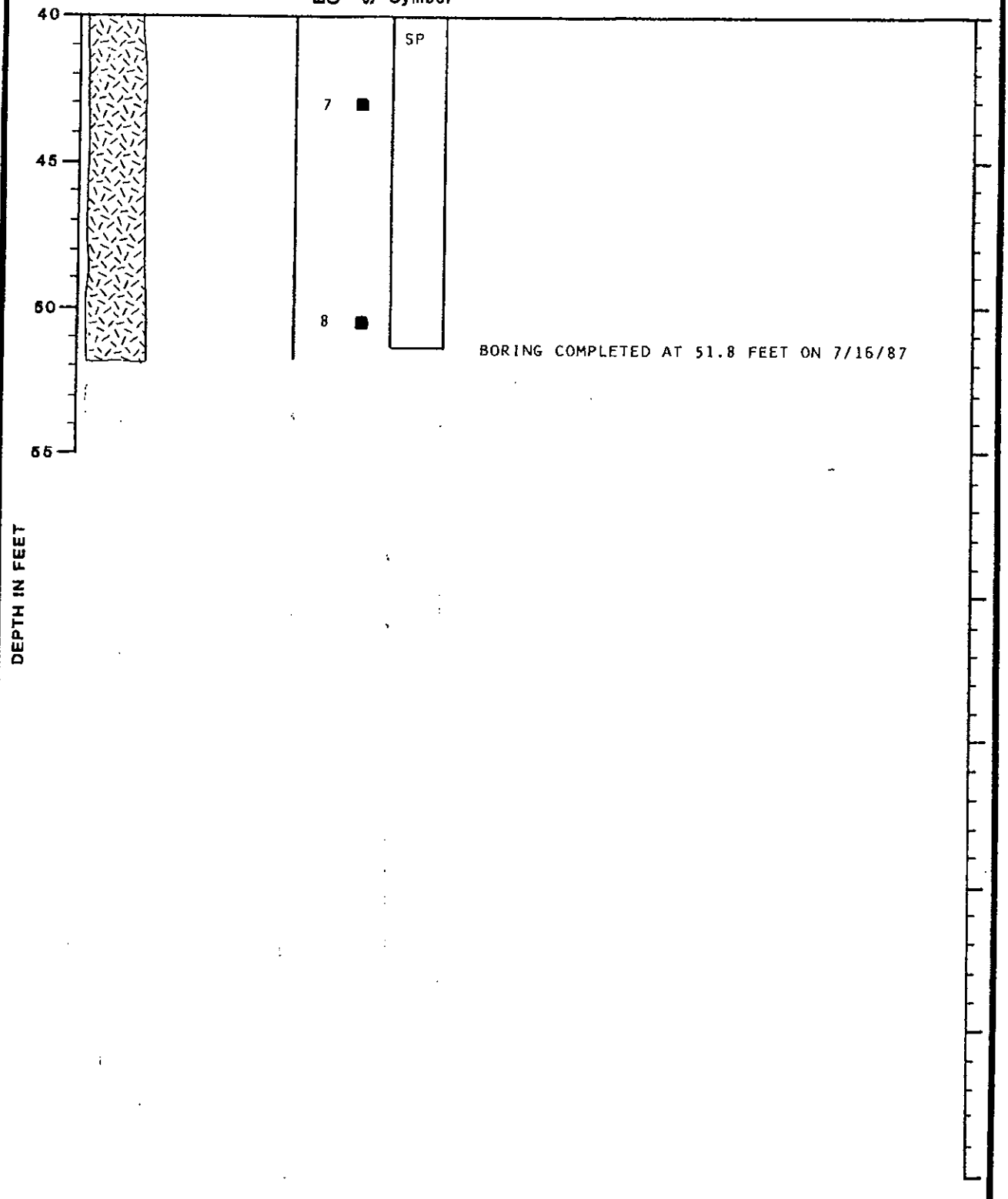
GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-18A

0929-06-4 SEW:EL:KKT 9-4-87

MONITOR WELL NO. MW-20
Continued



Note: See Figure A-2 for Explanation of Symbols

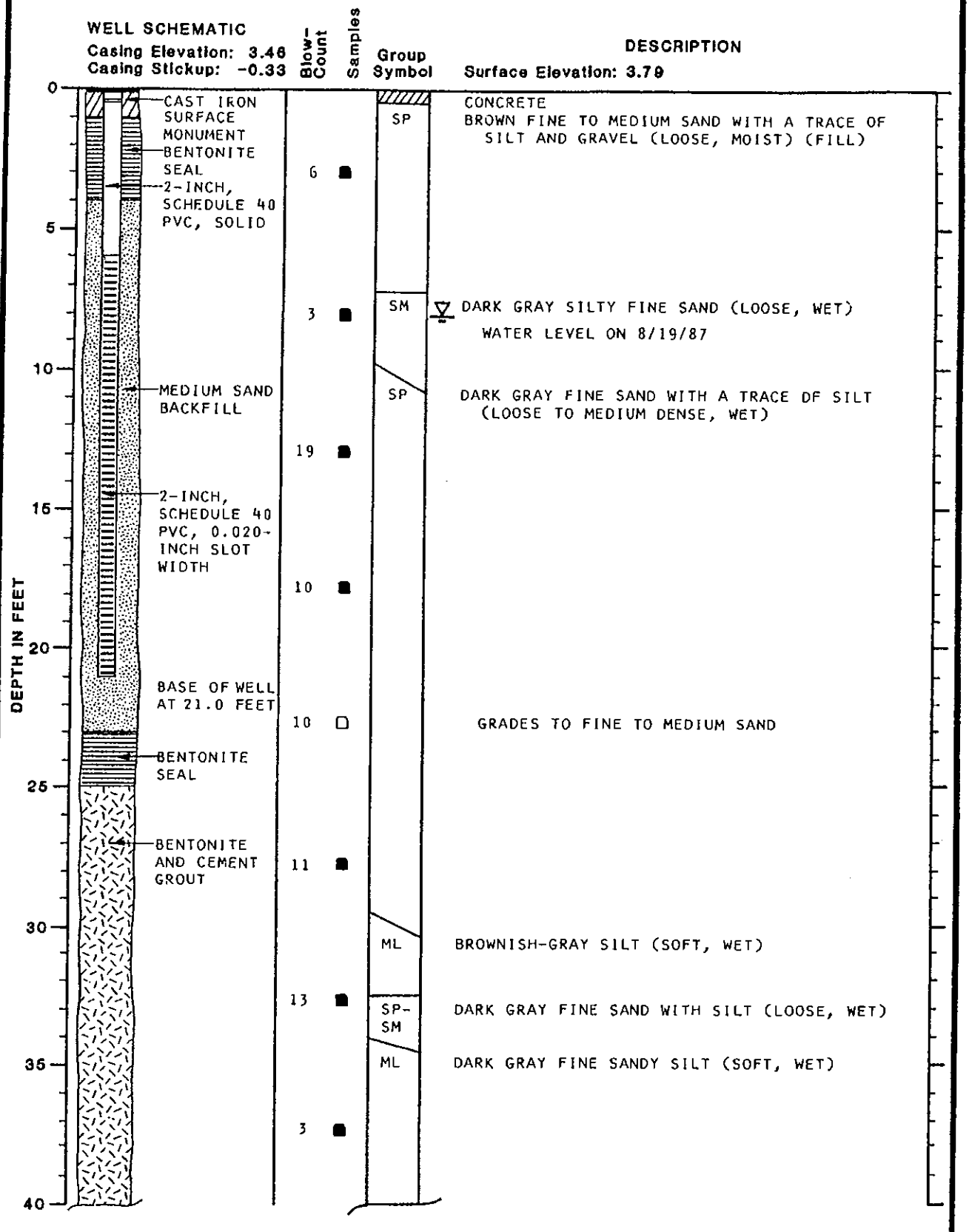
GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-18B

0929-06-4 SEW:EL:KJT 9-4-87

MONITOR WELL NO. MW-21



Note: See Figure A-2 for Explanation of Symbols

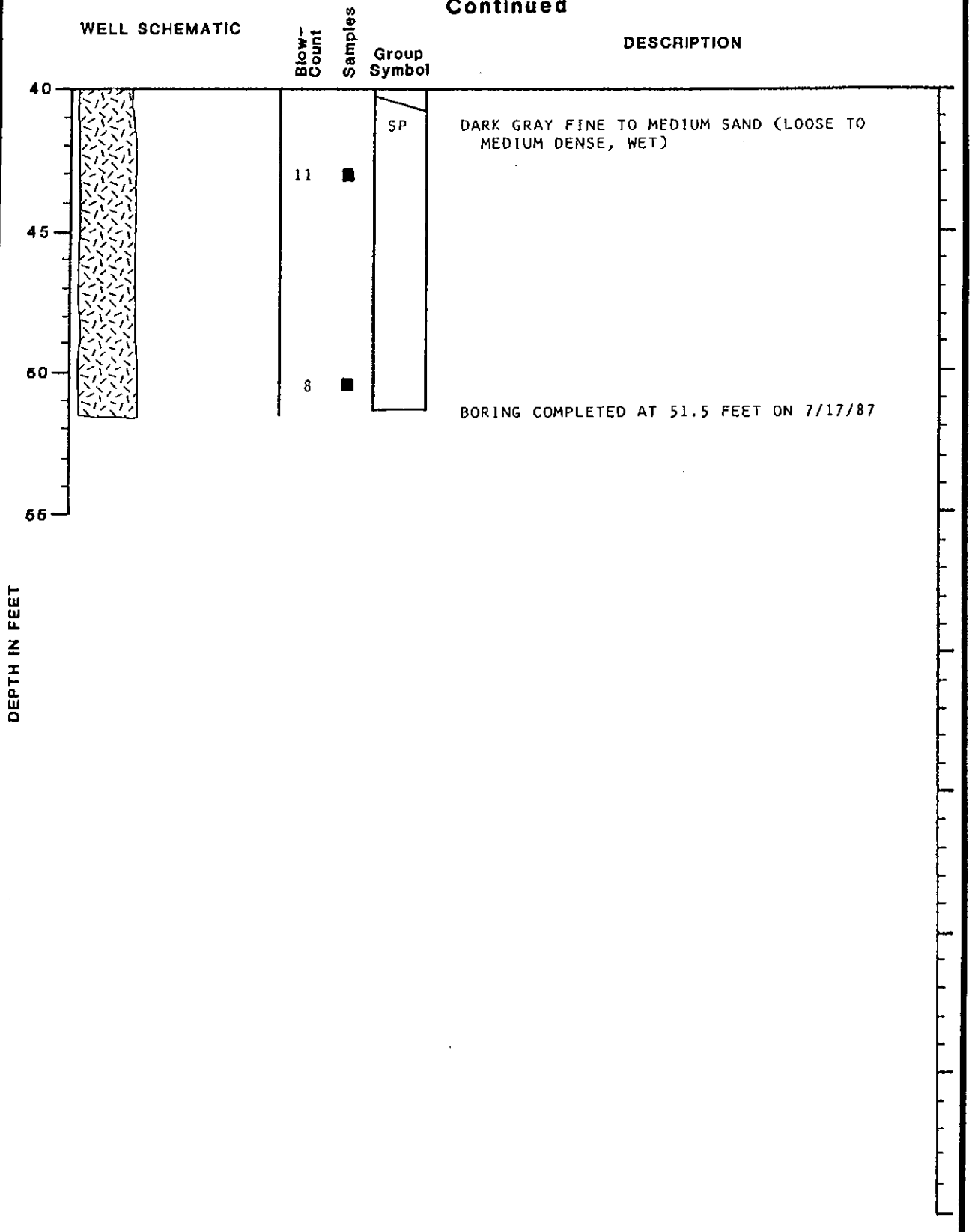
GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-19A

0929-06-4 SEW:EL:KKT 9-4-87

MONITOR WELL NO. MW-21
Continued



Note: See Figure A-2 for Explanation of Symbols

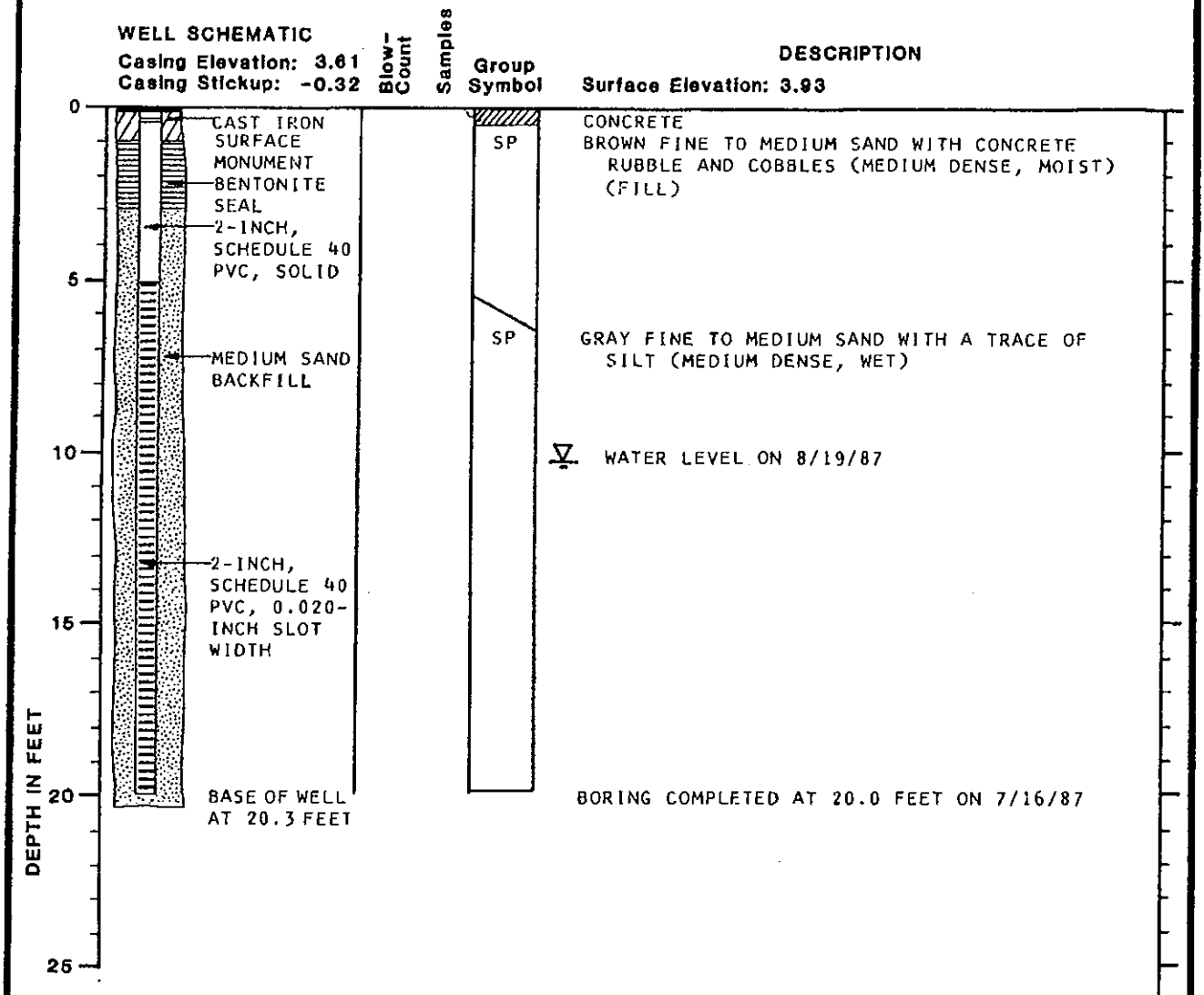
GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-19B

0929-06-4 SEW:EL:KKT 9-4-87

MONITOR WELL NO. MW-22



Note: See Figure A-2 for Explanation of Symbols

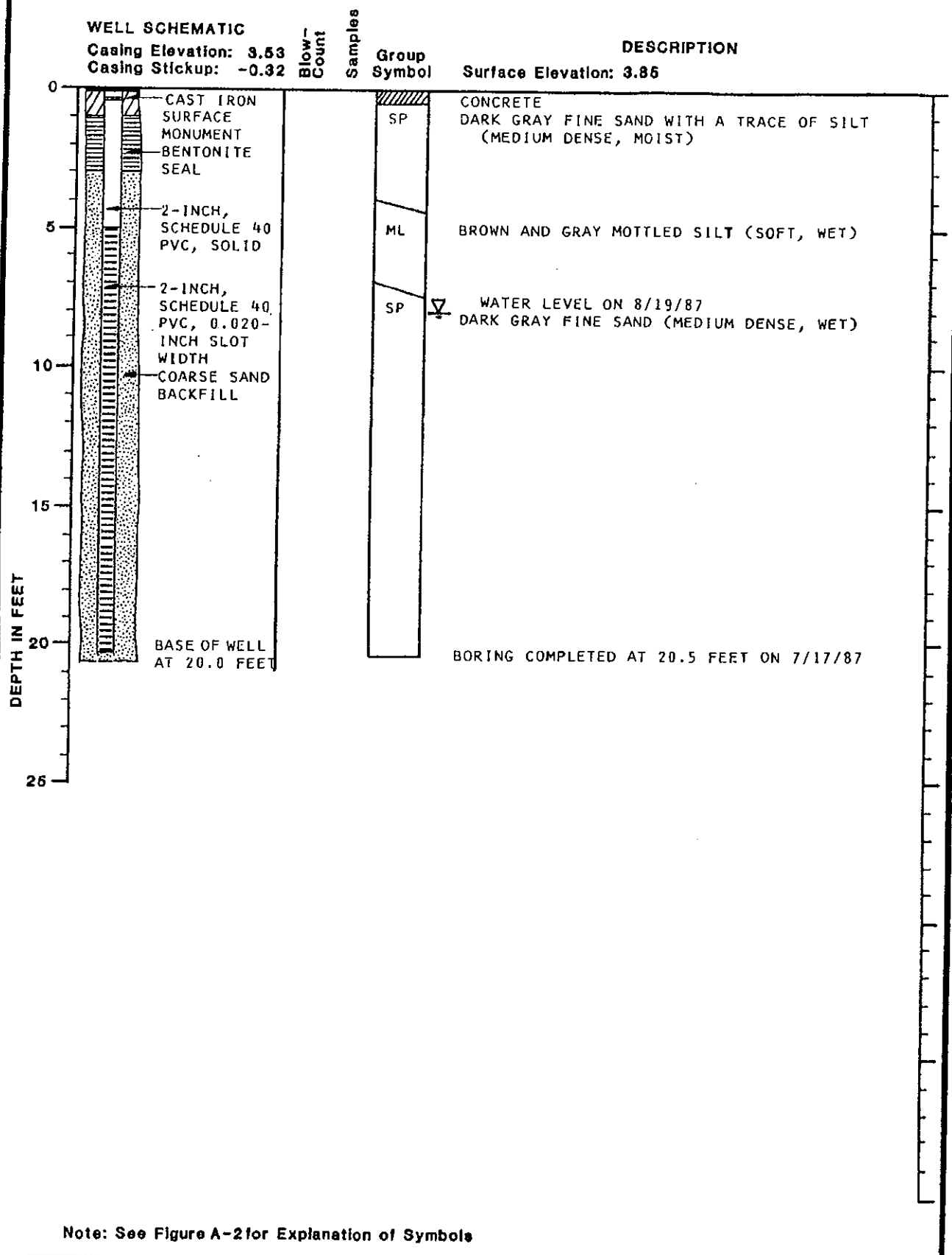
GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-20

0929-06-4 SEW:EL:KKT 9-4-87

MONITOR WELL NO. MW-23



Note: See Figure A-2 for Explanation of Symbols

GeoEngineers Incorporated

LOG OF MONITOR WELL

FIGURE A-21

0929-06-4 SEW:EL:KKT 9-4-87

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION	NORTH FIRE ISLE
DRILLING COMPANY	TACOMA PUMP AND DRILLING, INC.
DRILLER	MIKE BRANKLINE
DRILLING METHOD	HOLLOW STEM AUGER
DRILL BIT(S) SIZE:	9-INCH O.D.

		FROM	TO	FT.
ISOLATION CASING	NONE			
BLANK CASING	2-INCH 316 STAINLESS STEEL	0.3	20.3	
PERFORATED CASING	2-INCH 316 STAINLESS STEEL (0.010" SLOT)	20.3	25.3	
SIZE AND TYPE OF FILTER PACK	COLORADO SILICA (#10-20)	15.0	25.5	
SEAL	BENTONITE CHIPS (3/4-INCH)	1.0	15.0	
GROUT	NONE			

Boring/Well Name	MW-24A
Project Name	KENWORTH - SEATTLE
Project Number	956085.03
ELEVATION AND DATUM	9.09 (ALUM.)
TOTAL DEPTH	25.5
DATE STARTED	04/15/1997
DATE COMPLETED	04/15/1997
INITIAL WATER DEPTH (FT)	7.4
LOGGED BY	DON HANSON
SAMPLING METHODS	SPLIT SPOONS
WELL COMPLETION	■ SURFACE HOUSING ☐ STAND PIPE ____ FT.

SAMPLES TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	Hnu	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
									8-inches concrete
									Poorly graded SAND with silt Mottled yellowish brown and grayish brown fine sand. Some siltier (SM) and cleaner (SP) intervals, moist, medium dense, no odors
S	1.2	8 14 12	5	MW-24a-5.0		10		SP/ SM	
				Water Level 7.4 feet 4/15/97					
S	1.0	2 3 4	10			15			At 11 ft., grades to more uniform grayish brown, more uniform silt content, wet, slight chemical odor
S	0.8	16 12 18	15			3		SP	**Poorly graded SAND** Very dark gray fine to medium sand with a trace of silt interlayered with grayish brown fine sand with silt, wet, very loose, slight chemical odor
S	1.0	19 20 25	20			4			At 17 ft. driller begins adding water to casing to fight heaving sand
S	0.6	42 32 38				3		SP/ SM	At 21 ft. a slight chemical/sweet odor
			25						**Poorly graded SAND with silt** Interlayered very dark grayish brown medium sand and grayish brown fine sand with silt, wet, medium dense, no odors
			30						At 24.5 becomes cleaner, silt content decreases, wet, no odors.

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION	WEST END – NORTH FIRE ISLE
DRILLING COMPANY	CASCADE DRILLING, INC.
DRILLER	BRENT MALOW
DRILLING METHOD	HOLLOW STEM AUGER
DRILL BIT(S) SIZE	9-INCH O.D.

Boring/Well Name MW-25A
Project Name KENWORTH – SEATTLE
Project Number 956085.03

	FROM	TO	FT.
ISOLATION CASING: NONE			
BLANK CASING: 2-INCH SCHEDULE 40 PVC	0.5	13.0	FT.
PERFORATED CASING: 2-INCH SCHEDULE 40 PVC (0.010" SLOT)	13.0	23.0	FT.
SIZE AND TYPE OF FILTER PACK: LONESTAR LAPIS LUSTRE #2/12 SAND	10.0	29.0	FT.
SEAL: BENTONITE CHIPS	1.0	10.0	FT.
GROUT: NONE			FT.

ELEVATION AND DATUM: 8.75	TOTAL DEPTH: 29.0
DATE STARTED: 04/09/1997	DATE COMPLETED: 04/09/1997
INITIAL WATER DEPTH (FT): 9.3	
LOGGED BY: DON HANSON	
SAMPLING METHODS: 2.5" SPLIT SPOONS	WELL COMPLETION: ■ SURFACE HOUSING; ▭ STAND PIPE ____ FT.

SAMPLES TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	Hnu	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
									Concrete, 8 inches, pre-cored
								SM	**Silty SAND** Grayish brown, mostly fine sand, moist, no odors
			5					SM	
S	1.5	5 5 5				0		SP	**Silty SAND/sandy SILT** grayish brown, alternating layers of fine to med. sand (4–5" thick) and sandy silt (2–3" thick), moist, very loose, no odors
				Water Level 9.3 feet 4/10/97				SP	
S	1.5	6 5 6	10			0		SP	**Poorly graded SAND** Reddish brown, fine to medium sand, trace of silt, moist, very loose, no odors
								SP/ SM	**Poorly graded SAND** Reddish brown, fine to medium sand, trace of silt, moist, very loose, no odors
S	1.2	5 4 4	15			0			
S	1.0	7 8 7				0			
									Poorly graded SAND with silt Very dark gray fine sand interbeded with wood chips and sawdust layers (2–3" thick), wet, very loose, no odors
S		4 5 6	20			0		SP	
S									**Poorly graded SAND** Very dark gray, mostly fine to medium sand, interbeded with siltier sand layers and trace layers of wood debris, moist, very loose, no odors
			25						
S	1.2								At 17 ft. becomes wet, no odors
			30						From 26 ft. to 29 ft. wood frogments decreose, no odors

Note:

1) The augers were raised to 24 feet to install the monitoring well and the borehole caved in from 24 to 29 feet.

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION	INSIDE PLASTIC SHOP
DRILLING COMPANY	CASCADE DRILLING, INC.
DRILLER	BRENT MALOW
DRILLING METHOD	HOLLOW STEM AUGER
DRILL BIT(S) SIZE	9-INCH O.D.

		FROM	TO	FT.
ISOLATION CASING	NONE			
BLANK CASING	2-INCH SCHEDULE 40 PVC		0.5 TO 10.0	FT.
PERFORATED CASING	2-INCH SCHEDULE 40 PVC (0.010" SLOT)		10.0 TO 20.0	FT.
SIZE AND TYPE OF FILTER PACK	LONESTAR LAPIS LUSTRE #2/12 SAND		8.0 TO 22.5	FT.
SEAL	BENTONITE CHIPS		1.0 TO 8.0	FT.
GROUT	NONE			FT.

Boring/Well Name	MW-26A
Project Name	KENWORTH - SEATTLE
Project Number	956085.03
ELEVATION AND DATUM	8.85
TOTAL DEPTH	22.5
DATE STARTED	04/09/1997
DATE COMPLETED	04/09/1997
INITIAL WATER DEPTH (FT)	8.8
LOGGED BY	DON HANSON
SAMPLING METHODS	2.5" SPLIT SPOONS
WELL COMPLETION	■ SURFACE HOUSING; ▭ STAND PIPE ____ FT.

SAMPLES TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	Hnu	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
			0						**Concrete, 6-inches, pre-cored**
								ML	**Sandy SILT**
								SM	Yellowish brown with a trace of roots, moist, no odors
S	1.5	3 3 5	5			0			**Silty SAND**
								ML	Yellowish brown, mostly fine sand, moist, no odors
				Water Level 8.8 feet 4/9/97					**Sandy SILT/Silty SAND**
S	1.2	2 16 19	10			0			Mottled dark gray sandy silt interbeded with 4-6" thick layers of dark yellowish brown silty fine sand, moist, very loose, no odors
								SP	**Poorly graded SAND**
S	1.2	4 6 7	15			0			Dark grayish brown fi-med sand interbeded with 1" thick layers of grayish brown sandy silt approximately every 6", wet, medium dense, no odors
								SP	
			20						**Poorly graded SAND**
									Very dark grayish brown fine to medium sand, wet, loose, no odors
			25						

Boring & Well Construction Log — Kennedy/Jenks Consultants

BORING LOCATION	PLASTIC SHOP		
DRILLING COMPANY	TACOMA PUMP AND DRILLING, INC.	DRILLER	MIKE BRANKLINE
DRILLING METHOD	HOLLOW STEM AUGER	DRILL BIT(S) SIZE:	9-INCH O.D.

		FROM	TO	FT.
ISOLATION CASING	NONE			
BLANK CASING	2-INCH SCHEDULE 40 PVC	0.5	35.0	
PERFORATED CASING	2-INCH SCHEDULE 40 PVC (0.010" SLOT)	35.0	40.0	
SIZE AND TYPE OF FILTER PACK	COLORADO SILICA SAND (#10-20)	33.0	40.0	
SEAL	BENTONITE CHIPS (3/4-INCH)	1.5	33.0	
GROUT	NONE			

Boring/Well Name MW-26B

Project Name KENWORTH - SEATTLE

Project Number 956085.03

ELEVATION AND DATUM: 8.92	TOTAL DEPTH: 40.0
DATE STARTED: 04/15/1997	DATE COMPLETED: 04/16/1997
INITIAL WATER DEPTH (FT)	
LOGGED BY: DON HANSON	
SAMPLING METHODS: SPLIT SPOONS	WELL COMPLETION: ■ SURFACE HOUSING; ▭ STAND PIPE _____ FT.

SAMPLES TYPE	SAMPLES RECOVERY (FEET)	SAMPLES PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	Hnu	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
			0					ML	**Concrete, 6-inches, pre-cored**
								SM	**Sandy SILT** Yellowish brown with a trace of roots, moist, no odors
			5					ML	**Silty SAND** Yellowish brown, mostly fine sand, moist, no odors
			10					SP	**Sandy SILT/Silty SAND** Mottled dark gray sandy silt interbeded with 4-6" thick layers of dark yellowish brown silty fine sand, moist, very loose, no odors
			15					SP	**Poorly graded SAND** Oork grayish brown fi-med sand interbeded with 1" thick layers of grayish brown sandy silt approximotely every 6", wet, medium dense, no odors
			20						**Poorly graded SAND** Very dark grayish brown fine to medium sand, wet, loose, no odors
			25						
			30						From 30 to 40 feet lithology was inferred from cuttings and drilling conditions

Boring & Well Construction Log — Kennedy/Jenks Consultants

Project Name KENWORTH – SEATTLE **Project Number** 956085.03 **Boring/Well Name** MW-26B

SAMPLES TYPE	SAMPLES RECOVERY (FEET)	SAMPLES PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	Hnu	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
O	0.5	PUSH	35			0		SP	
			40					ML	**Sandy SILT** Very dark gray, approximately 60% silt, 40% fine sand, medium density, no odors

Notes:

1) Sampling was not conducted below 30 feet due to heaving sand in the augers.

Boring & Well Construction Log — Kennedy/Jenks Consultants

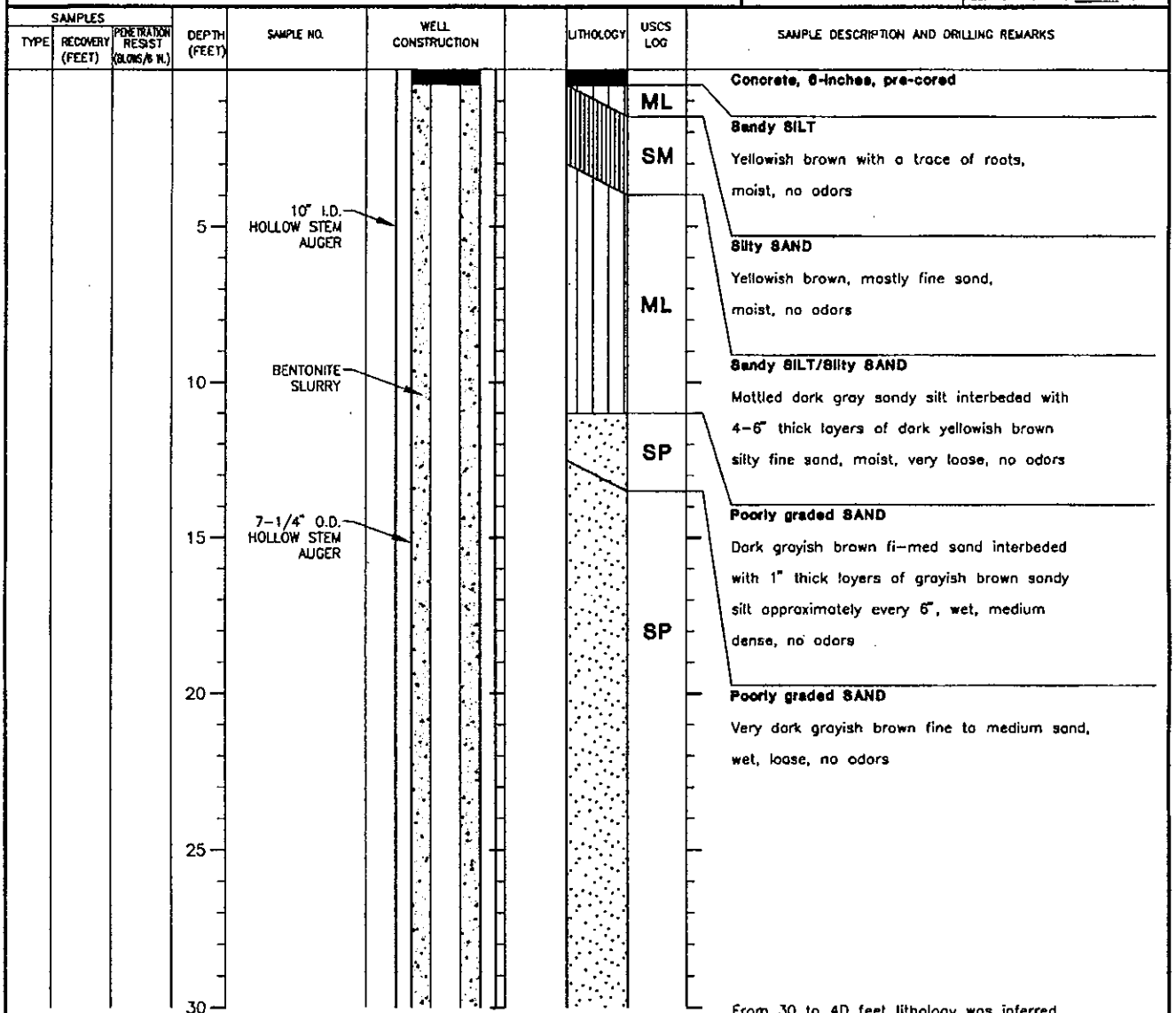
BORING LOCATION	PLASTIC SHOP		
DRILLING COMPANY	HOLT DRILLING, INC.	DRILLER	MIKE BRANKLINE
DRILLING METHOD	HOLLOW STEM AUGER	DRILL BIT(S) SIZE:	9-INCH O.D.
ISOLATION CASING	10-INCH I.D. HOLLOW STEM AUGER	FROM 0.0 TO 42.0 FT.	
BLANK CASING	2-INCH SCHEDULE 40 PVC	FROM 0.0 TO 49.0 FT.	
PERFORATED CASING	2-INCH SCH 40 PVC (0.010" SLOT)	FROM 49.0 TO 59.0 FT.	
SIZE AND TYPE OF FILTER PACK	COLORADO SILICA SAND (#10-20)	FROM 46.0 TO 60.0 FT.	
SEAL	BENTONITE CHIPS	FROM 43.0 TO 46.0 FT.	
GROUT	QUIK-GROUT BENTONITE SLURRY	FROM 0.0 TO 43.0 FT.	

Boring/Well Name MW-26C

Project Name KENWORTH - SEATTLE

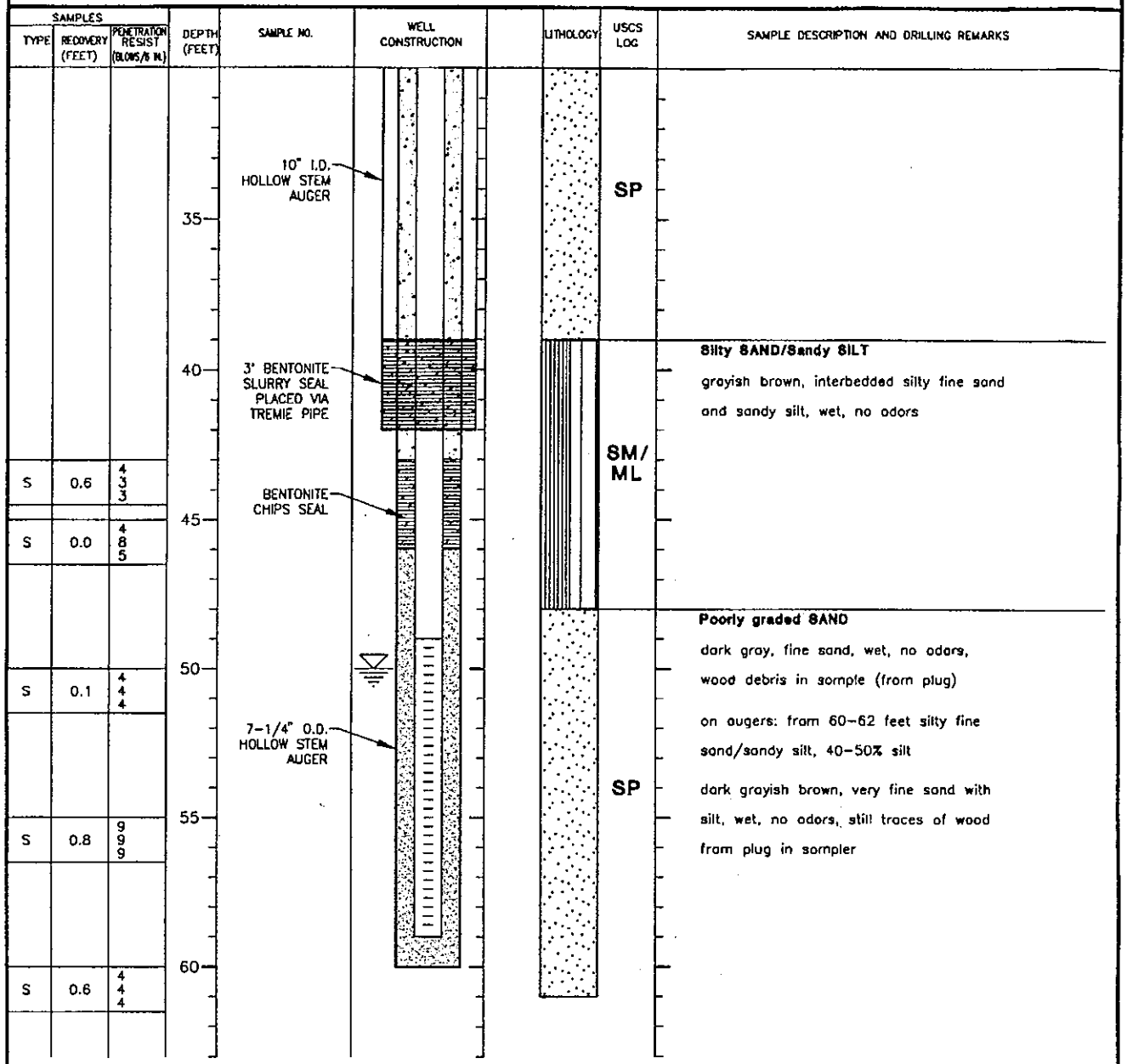
Project Number 956085.03

ELEVATION AND DATUM: 8.94 FEET MSL	TOTAL DEPTH: 60.0
DATE STARTED: 06/05/1997	DATE COMPLETED: 06/05/1997
INITIAL WATER DEPTH (FT): 50.0	
LOGGED BY: DON HANSON	
SAMPLING METHODS: 1.5" SPLIT SPOONS	WELL COMPLETION: ■ SURFACE HOUSING; ☐ STAND PIPE ____ FT.



Boring & Well Construction Log — Kennedy/Jenks Consultants

Project Name KENWORTH – SEATTLE **Project Number** 956085.03 **Boring/Well Name** MW-26C



Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION	WEST OF PARTS WAREHOUSE
DRILLING COMPANY	CASCADE DRILLING, INC.
DRILLER	RODNEY LA BROSSE
DRILLING METHOD	HOLLOW STEM AUGER
DRILL BIT(S) SIZE:	9-INCH O.D.

		FROM	TO	FT.
ISOLATION CASING	NONE			
BLANK CASING	2-INCH 316 STAINLESS STEEL	0.5	20.5	
PERFORATED CASING	2-INCH 316 STAINLESS STEEL (0.010" SLOT)	20.5	25.5	
SIZE AND TYPE OF FILTER PACK	LONESTAR LAPIS LUSTRE SAND #2/12	15.0	25.5	
SEAL	BENTONITE CHIPS	1.5	15.0	
GROUT	NONE			

Boring/Well Name MW-27A

Project Name KENWORTH - SEATTLE

Project Number 956085.03

ELEVATION AND DATUM: 8.56 (ALUM.)	TOTAL DEPTH: 25.5
DATE STARTED: 04/14/1997	DATE COMPLETED: 04/14/1997
INITIAL WATER DEPTH (FT): 7.8	
LOGGED BY: DON HANSON	
SAMPLING METHODS: SPLIT SPOONS	WELL COMPLETION: ■ SURFACE HOUSING; □ STAND PIPE ____ FT.

SAMPLES TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	Hnu	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
								GP/GM	**6 inches pre-cored concrete**
									Poorly graded GRAVEL with silt and sand
								SP/SM	Brown, coarse gravel fill, moist, no odors
S	1.5	5 7 8	5			2			**Poorly graded SAND with silt** Yellowish brown fine sand, moist, no odors
				Water Level 7.8 feet 4/14/97					**Poorly graded SAND** Mottled yellowish brown and gray fine sand, trace of med. sand and silt, moist, no odors
S	1.2	6 8 10	10			47			At 10.5: grayish brown, mostly fine to medium sand, wet, slight chemical odor
S	1.0	15 18 27				17		SP	At 13 Ft.: grades to dark grayish brown, traces of sandy silt nodules, sand stratified in horizontal layers, wet, chemical odor
S	1.2	6 15 26	15			6			17': driller begins to fight heaving sands
S	1.2	15 29 42				3			18': mostly med. sand, no silt nodules, less chemical odor
S	1.5	19 28 34	20			1		SP/SM	**Poorly graded SAND with silt** Very dark brown medium sand, silt is in thin lenses/inclusions, trace of coarse sand, wet, slight chemical odor
S	1.5	19 28 34				1		SW	**Well-graded SAND** Very dark brown fine to coarse sand, wet, slight chemical odor
			25						

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION	INSIDE HI-BAY
DRILLING COMPANY	CASCADE DRILLING, INC.
DRILLER	RODNEY LA BROSSE
DRILLING METHOD	HOLLOW STEM AUGER
DRILL BIT(S) SIZE	9-INCH O.D.

		FROM	TO	FT.
ISOLATION CASING	NONE			
BLANK CASING	2-INCH 316 STAINLESS STEEL	0.3	15.3	
PERFORATED CASING	2-INCH 316 STAINLESS STEEL (0.010" SLOT)	15.3	20.3	
SIZE AND TYPE OF FILTER PACK	LONESTAR LAPIS LUSTRE #2/12 SAND	13.0	20.5	
SEAL	BENTONITE CHIPS	1.5	13.0	
GROUT	NONE			

Boring/Well Name	MW-28A
Project Name	KENWORTH - SEATTLE
Project Number	956085.03
ELEVATION AND DATUM	8.68 (ALUM.)
TOTAL DEPTH	20.5
DATE STARTED	04/14/1997
DATE COMPLETED	04/14/1997
INITIAL WATER DEPTH (FT)	7.8
LOGGED BY	DON HANSON
SAMPLING METHODS	SPLIT SPOONS
WELL COMPLETION	■ SURFACE HOUSING; ☐ STAND PIPE ____ FT.

SAMPLES TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	Hnu	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
									9-inches pre-cored concrete
								SP	**Poorly graded SAND** Yellowish brown medium sand interstratified with lenses of sandy silt, moist, no odors
U			5					ML	**Sandy SILT** Mottled yellowish red and brown sandy silt, interstratified with .5" to 2" thick layers of clean medium sand from 6.5 ft to 7.5 ft., moist, medium stiff, no odors
S	1.0	5 6 8		Water Level 7.8 feet 4/14/97				SM	
U	1.0	6 8 9	10						**Silty SAND** Yellowish brown silty fine sand, interstratified with layers of clean fine sand wet, medium stiff, no odors
			15					SP	**Poorly graded SAND** Very dark gray fine sand with a trace of silt, wet, medium dense, slight chemical odor
			20						At 18 ft., grades to mostly fine-medium sand, wet, very slight chemical odor

Lithology based on boring for well MW-28b.

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION	INSIDE HI-BAY
DRILLING COMPANY	CASCADE DRILLING, INC.
DRILLER	RODNEY LA BROSSE
DRILLING METHOD	HOLLOW STEM AUGER
DRILL BIT(S) SIZE:	9-INCH O.D.

		FROM	TO	FT.
ISOLATION CASING	NONE			
BLANK CASING	2-INCH 316 STAINLESS STEEL	0.3	35.3	
PERFORATED CASING	2-INCH 316 STAINLESS STEEL (0.010" SLOT)	35.3	40.3	
SIZE AND TYPE OF FILTER PACK	LONESTAR LAPIS LUSTRE #2/12 SAND	33.0	40.5	
SEAL	BENTONITE CHIPS	1.5	33.0	
GROUT	NONE			

Boring/Well Name	MW-288
Project Name	KENWORTH - SEATTLE
Project Number	956085.03
ELEVATION AND DATUM	8.39 (ALUM.)
TOTAL DEPTH	40.5
DATE STARTED	04/14/1997
DATE COMPLETED	04/14/1997
INITIAL WATER DEPTH (FT)	7.8
LOGGED BY	DON HANSON
SAMPLING METHODS	SPLIT SPOONS
WELL COMPLETION	■ SURFACE HOUSING ▭ STAND PIPE ____ FT.

SAMPLES TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	Hnu	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
									9-inches pre-cored concrete
								SP	**Poorly graded SAND** Yellowish brown medium sand interstratified with lenses of sandy silt, moist, no odors
S	1.5	4 5 6	5			3		ML	**Sandy SILT** Mottled yellowish red and brown sandy silt, interstratified with .5" to 2" thick layers of clean medium sand from 6.5 ft to 7.5 ft., moist, medium stiff, no odors
S	1.5	5 5 6		Water Level 7.8 feet 4/14/97		8		SM	
S	1.2	6 8 11	10			35			**Silty SAND** Yellowish brown silty fine sand, interstratified with layers of clean fine sand wet, medium stiff, no odors
S	1.0	11 18 26				49			
S	1.2	10 14 19	15			56			**Poorly graded SAND** Very dark gray fine sand with a trace of silt, wet, medium dense, slight chemical odor
S	1.5	14 20 32				3		SP	At 18 ft., grades to mostly fine-medium sand, wet, very slight chemical odor
S	1.2	25 30 38	20			6			At 20 ft., trace of yellowish brown silt/clay nodules, slight organic odor
S	1.2	21 22 25				18			At 23 ft., grades to mostly medium sand, slight chemical odor
S	1.2	42 40 50/4	25			5			
S	1.2	22 52 41				0			
			30			2		SP/ SM	**Poorly graded SAND with silt** Very dark grayish brown sand interstratified with 1-4 inch layers of sandy silt, 60% sand, 40% silt, wet, no odors

Boring & Well Construction Log — Kennedy/Jenks Consultants

Project Name KENWORTH – SEATTLE **Project Number** 956085.03 **Boring/Well Name** MW-28B

SAMPLES TYPE	SAMPLES RECOVERY (FEET)	SAMPLES PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	Hnu	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
S	1.5	13 30 39				2			30–31 ft. clean sand layer, driller begins adding water to augers to prevent sand heave
S	1.2	11 36 39				2			Grades to mostly silt interstratified with sand from 34 to 39 feet
S	1.2	11 24 32				2		SP/ SM	
S	1.0	16 20 27	35			0			
S	1.5	18 24 38				2			
S	1.2	10 12 15				2			
S	1.2	15 18 29	40			2		SM	**Silty SAND/Sandy SILT** Very dark gray, approximately 50% silty fine sand and 50% sandy silt, wet, medium dense, no odors

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION	FORMER HOOD STORAGE AREA
DRILLING COMPANY	CASCADE DRILLING, INC.
DRILLER	BRIAN GOSE
DRILLING METHOD	HOLLOW STEM AUGER
DRILL BIT(S) SIZE:	9-INCH O.D.

Boring/Well Name MW-29A
Project Name KENWORTH - SEATTLE
Project Number 956085.03

	FROM	TO	FT.
ISOLATION CASING: NONE			
BLANK CASING: 2-INCH SCHEDULE 40 PVC	0.5	15.0	FT.
PERFORATED CASING: 2-INCH SCHEDULE 40 PVC (0.010" SLOT)	15.0	25.0	FT.
SIZE AND TYPE OF FILTER PACK: LONESTAR LAPIS LUSTRE #2/12 SAND	12.0	49.5	FT.
SEAL: BENTONITE CHIPS	1.0	12.0	FT.
GROUT			FT.

ELEVATION AND DATUM: 8.76	TOTAL DEPTH: 49.5
DATE STARTED: 04/08/1997	DATE COMPLETED: 04/08/1997
INITIAL WATER DEPTH (FT): 8.5	
LOGGED BY: DON HANSON	
SAMPLING METHODS: 2.5" SPLIT SPOONS	WELL COMPLETION: ■ SURFACE HOUSING; ☐ STAND PIPE ____ FT.

SAMPLES TYPE	SAMPLES RECOVERY (FEET)	SAMPLES PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	Hnu	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
								SP/SM	**6-inches pre-cored concrete** **Poorly graded SAND with silt** Brown, mostly fine sand, moist, no odors
								SP	
S	1.4	12 10 12	5					ML	**Poorly graded SAND** Brown, mostly fine sand, trace of silt, moist, no odors,
				Water Level 8.5 feet 4/8/97				SP/SM	**Sandy SILT** Yellowish brown, sand is mostly fine, moist, stiff, no odors
S	1.3	16 28 30	10			2			
S	1.0	12 20 25							**Poorly graded SAND with silt** Dark yellowish brown fine sand, moist, no odors
S	1.0	8 14 14	15			2			
S	1.5	14 17 20				2		SP	**Poorly graded SAND** Mottled dark yellowish brown and yellowish red, fine-med. sand interbedded about every 2.5 to 5 feet with .5 to 1.5' thick layers of black organic silt and wood debris, moist, medium dense, no odors
S	1.0	15 17 23	20	MW-29A-20.0		--			
S	1.0	15 17 19		MW-29A-22.5		0		OL	**21'-22': Wood/Bark layer** 24.5-25.5: Wood debris layer
S	1.0	23 25 25	25	MW-29A-25.0		2		SW	**Well-graded SAND with gravel** Dark grayish brown, wet, medium dense, no odors
S	1.2	12 21 27				0		SP	**Poorly graded SAND** Dark grayish brown, mostly fine to medium sand with traces of coarse sand and fine gravel, wet, no odors
			30						

Boring & Well Construction Log — Kennedy/Jenks Consultants

Project Name KENWORTH – SEATTLE **Project Number** 956085.03 **Boring/Well Name** MW-29A

SAMPLES TYPE	SAMPLES RECOVERY (FEET)	SAMPLES PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
S	1.0	10 15 15		MW-29a-30.0		0			Thin (<1 ft.) organic silt layer at 29.75 ft.
S	1.0	12 18 23				0			Thin (1/2 cm) silt layers interbeded in sand from 31 to 33 ft.
S	1.0	18 17 18	35			0		SP	
S	1.0					--			
S	1.0	18 17 18	40			0			**Silty SAND/SAND with Silt** Dark grayish brown silty fine sand interbeded with layers of sandy silt, ranging in thickness from 1-2 inches to 2 feet, saturated, loose to medium dense, no odors
S	1.2	14 10 10				0		SM	
S	1.2	14 18 25	45			0			
S	1.5	15 21 25				0		SP/SM	**Poorly graded SAND with silt** Dark grayish brown fine to medium sand, wet, medium dense, no odors

Notes:

1) The boring was backfilled with bentonite chips from 40 to 49.5 feet. Native soil caved in from 38 to 40 feet. Bentonite chips were used to backfill the boring from 30 to 38 feet.

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION: SOUTH OF PLASTICS SHOP NEAR BULKHEAD	**Boring/Well Name** MW-29B
DRILLING COMPANY: CASCADE	DRILLER: JAMES	**Project Name** PACCAR DATA GAPS
DRILLING METHOD: HSA	DRILL BIT(S) SIZE: 9-INCH OD	**Project Number** 016110.00
ISOLATION CASING	FROM TO FT.	ELEVATION AND DATUM	TOTAL DEPTH: 44.0
BLANK CASING: 2" SCHEDULE 40 PVC PIPE	FROM 0.0 TO 34.0 FT.	DATE STARTED: 03/12/2002	DATE COMPLETED: 03/12/2002
PERFORATED CASING: 2" SCHEDULE 40 PVC PIPE (0.010 SLOT)	FROM 34.0 TO 44.0 FT.	INITIAL WATER DEPTH (FT): 8.0	
SIZE AND TYPE OF FILTER PACK: LAPIS LUSTRE #2/12 MONTEREY SAND	FROM 32.0 TO 44.0 FT.	LOGGED BY: DKM	
SEAL: PURE GOLD BENTONITE CHIPS	FROM 1.0 TO 32.0 FT.	SAMPLING METHODS: SPLIT SPOON	WELL COMPLETION: ■ SURFACE HOUSING; ☐ STAND PIPE ____ FT.
GROUT: CONCRETE (FOR SETTING MONUMENT)	FROM 0.0 TO 1.0 FT.		

SAMPLES TYPE	SAMPLES RECOVERY (FEET)	SAMPLES PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
									Concrete
								GM	**Silty GRAVEL with sand** Angular gravel with silt and fine sand
S	1.5	10 8 9				6.3		SP	**Poorly graded SAND** Brown medium- to fine- sand with fine rootlets, no odor.
			5						
S	1.5	5 4 6				1.6		SM	**Silty SAND** Brown/orange fine sand and silt mixture, 5% medium sand, no odor.
S	1.5	6 6 7			▽			SP/SM	**Poorly graded SAND with silt** Brown medium- to fine- sand with some silt, no odor.
S	1.5	10 12 13	10			5.7		SP	**Poorly graded SAND** Brown medium sand with 20-30% fine sand, minor silt, no odor.
S	1.5	12 13 18							**Poorly graded SAND** Gray poorly graded medium sand. Isolated small silt pockets and banding 12-20 feet, silt <5% total volume. Very minor to no apparent silt 20-38 feet. Driller suspects wood 25-27 feet.
S	1.5	10 14 21	15			4.1			
S	1.5	3 7 10							
S	1.5	50	20					SP	
S	1.5	60							
			25						
S	1.5	20 20 24							
			30						

Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name PACCAR DATA GAPS **Project Number** 016110.00 **Boring/Well Name** MW-29B

SAMPLES TYPE	SAMPLES RECOVERY (FEET)	SAMPLES PENETRATION RESIST (BLOWS/6 IN)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
S	1.5	9 18 23							
S	1.5	9 21 24							
S	1.5	3 4 12	35						
S	1.5	9 17 15				5.8		SP	
S	1.5	6 12 19						SM	**Silty SAND** Gray fine sand with silt, moderately dense, no odor.
S	1.5	6 6 9	40					SP	**Poorly graded SAND** Gray medium sand, grades to mostly fine sand by 42 feet.
S	1.5	9 15 27						ML	**Sandy SILT** Gray silt with fine sand, moderately dense, no odor.
S	1.5	11 11 13	45						
			50						
			55						
			60						
			65						
			70						

Boring & Well Construction Log

Kennedy/Jenks Consultants

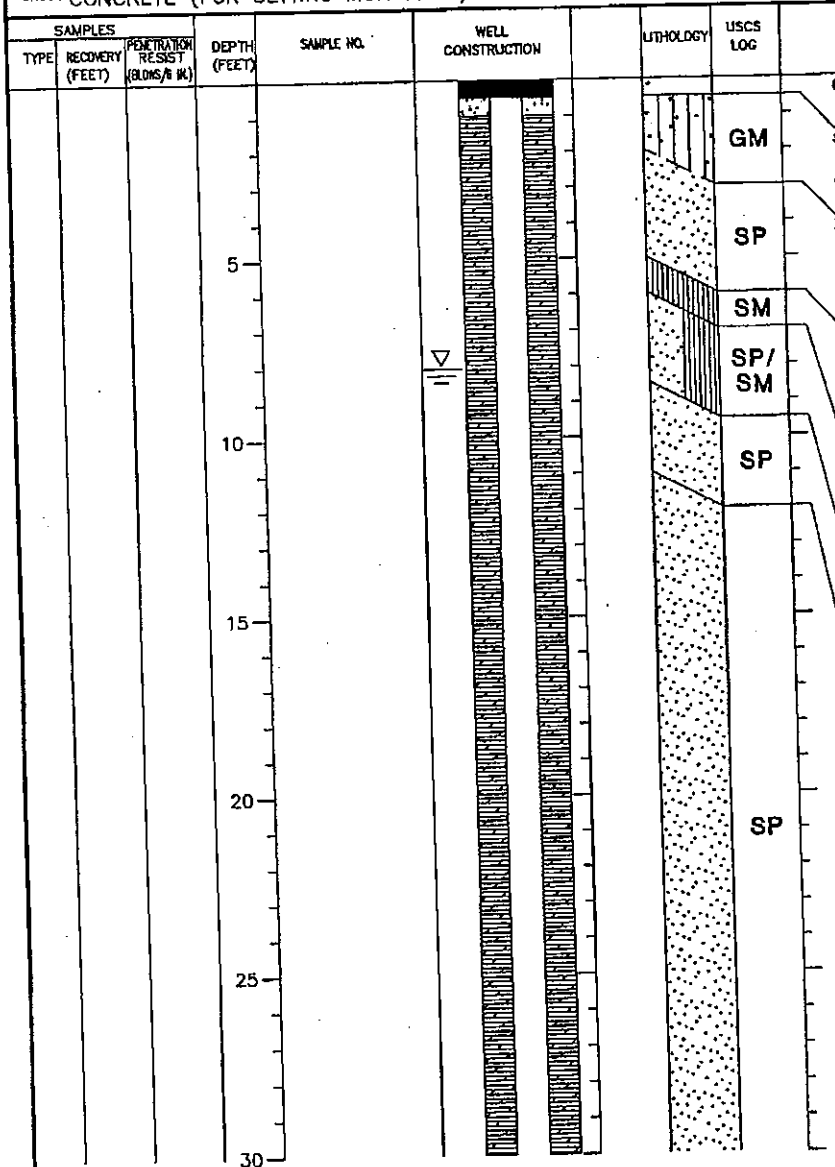
BORING LOCATION	SOUTH OF PLASTICS SHOP NEAR BULKHEAD
DRILLING COMPANY	CASCADE
DRILLER	SCOTT
DRILLING METHOD	HSA
DRILL BIT(S) SIZE	15"/9" OD
ISOLATION CASING	15" OD HSA FLIGHTS (TEMPORARY) FROM 0.0 TO 40.0 FT.
BLANK CASING	2" SCHEDULE 40 PVC PIPE FROM 0.0 TO 49.0 FT.
PERFORATED CASING	2" SCHEDULE 40 PVC PIPE (0.010 SLOT) FROM 49.0 TO 56.0 FT.
SIZE AND TYPE OF FILTER PACK	LAPIS LUSTRE #2/12 MONTEREY SAND FROM 47.0 TO 59.0 FT.
SEAL	PURE GOLD BENTONITE CHIPS FROM 1.0 TO 47.0 FT.
GROUT	CONCRETE (FOR SETTING MONUMENT) FROM 0.0 TO 1.0 FT.

Boring/Well Name MW-29C

Project Name PACCAR DATA GAPS

Project Number 016110.00

ELEVATION AND DATUM	TOTAL DEPTH 59.0
DATE STARTED 03/30/2002	DATE COMPLETED 03/30/2002
INITIAL WATER DEPTH (FT) 8.0	
LOGGED BY DKM	
SAMPLING METHODS SPLIT SPOON	WELL COMPLETION ■ SURFACE HOUSING ☐ STAND PIPE ____ FT.



Concrete

Silty GRAVEL with sand

Angular gravel with silt and fine sand

Poorly graded SAND

Brown medium- to fine- sand with fine rootlets, no odor.

Silty SAND

Brown/orange fine sand and silt mixture, 5% medium sand, no odor.

Poorly graded SAND with silt

Brown medium- to fine- sand with some silt, no odor.

Poorly graded SAND

Brown medium sand with 20-30% fine sand, minor silt, no odor.

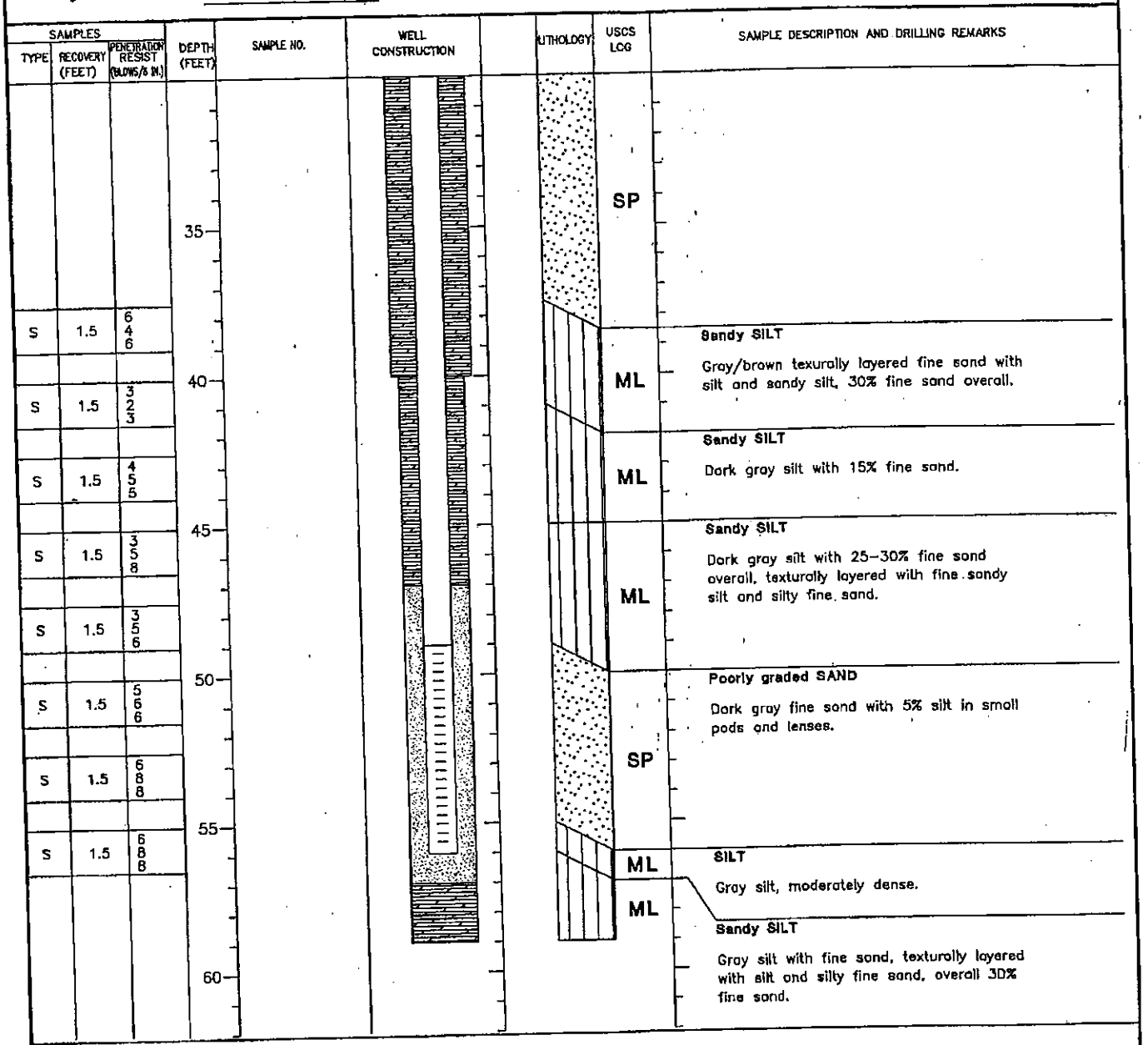
Poorly graded SAND

Gray poorly graded medium sand. Isolated small silt pockets and banding 12-20 feet, silt <5% total volume. Very minor to no apparent silt 20-39 feet. Driller suspects wood 25-27 feet.

Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name PACCAR DATA GAPS **Project Number** 016110.00 **Boring/Well Name** MW-29C



Notes:

1. Lithology above 37.5 feet based on boring MW-29B.

2. 15" OD augers used as temporary isolation casing. A 4-foot thick seal of hydrated bentonite chips was set from 36-40 feet. Drilling below 40 feet was done with 9" OD augers through the center of the 15" OD augers.

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION	FORMER HAZARDOUS WASTE HANDLING AREA
DRILLING COMPANY	CASCADE DRILLING, INC.
DRILLER	BRIAN GOSE
DRILLING METHOD	HOLLOW STEM AUGER
DRILL BIT(S) SIZE:	9-INCH O.D.

		FROM	TO	FT.
ISOLATION CASING	NONE			
BLANK CASING	2-INCH SCHEDULE 40 PVC	0.3	14.3	FT.
PERFORATED CASING	2-INCH SCHEDULE 40 PVC (0.010" SLOT)	14.3	24.3	FT.
SIZE AND TYPE OF FILTER PACK	LONESTAR LAPIS LUSTRE #2/12 SAND	12.0	28.0	FT.
SEAL	BENTONITE CHIPS	1.5	12.0	FT.
GROUT	NATIVE SOIL	28.0	38.0	FT.

Boring/Well Name	MW-30A
Project Name	KENWORTH - SEATTLE
Project Number	956085.03
ELEVATION AND DATUM	9.73
TOTAL DEPTH	42.5
DATE STARTED	04/08/1997
DATE COMPLETED	04/08/1997
INITIAL WATER DEPTH (FT)	12.3
LOGGED BY	DON HANSON
SAMPLING METHODS	2.5" SPLIT SPOONS
WELL COMPLETION	■ SURFACE HOUSING; ▭ STAND PIPE ____ FT.

SAMPLES TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	Hnu	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
								SM	**4 inches asphalt**
									Silty SAND
								SP/SM	Brown fine to medium sand, moist, no odors
			5						**Poorly graded SAND with silt**
S	1.5	23 29 17				0		SP	Dark yellowish brown, fine to medium sand,
									trace of coarse sand, moist, very dense,
S	0.5	10 10 10				2		SP/SM	no odors
			10						**Poorly graded SAND**
S	1.5	20 30 32				2			Dark yellowish brown fine to medium sand
				Water Level 12.3 feet 4/8/97				SM	with a trace of fines, moist, medium dense,
S	1.0	15 25 27							no odors
			15						**Poorly graded SAND with silt**
S	1.2	7 10 15							Dark brown fine sand, a few cobbles, trace
									of wood debris and brick fragments, moist to
S	1.0	8 10 15				2		OL	wet, loose, slight organic odor
			20						**Silty SAND**
S	1.2	8 12 15				2			Dark gray, fine to medium sand with a few
									fine to coarse gravel and cobbles, trace of
S	0.1	6 8 8				7.7			wood debris, wet, medium dense, no odors
			25						**Organic SILT with sand**
S	0.4	11 18 16				1.5		SP	Black, wet, stiff, organic odor, from 18.5
									to 19.5 sand content increases
S		12 18 20				1.5			**Poorly graded SAND**
			30						Very dark gray fine to medium sand, wet,
						1.5			loose, no odors

23': Traces small silty sand nodules, wet, no odors. Sand flowing up into augers

25': grades to mostly med. sand, fewer silt nodules

27': water coming to the surface with soil cuttings

Boring & Well Construction Log — Kennedy/Jenks Consultants

Project Name KENWORTH – SEATTLE **Project Number** 956085.03 **Boring/Well Name** MW-30A

SAMPLES TYPE	SAMPLES RECOVERY (FEET)	SAMPLES PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	Hnu	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
S	0.7	18 20 24				1.5			30': Grades to fi–med sand, trace coarse sand
									33': no coarse sand, no odors
S	0.8	9 19 26				– –		SP	35': traces of black organic silt inclusions (1–2 cm diameter)
			35						
S	1.0	19 20 20				0			
S	1.0	10 12 20				0		ML	**Sandy SILT**
								OL	Grayish brown, sand is mostly fine, moist to wet, very stiff, no odors
			40						
S	1.0	13 25 36				1		SP/ SM	**Organic SILT with sand**
S	1.5					1			Black, sand is mostly fine, wet, very stiff, organic odor
			45						**Poorly graded SAND with silt**
									Dark gray fine to medium sand, wet, medium dense, no odors
									41–42': some silty fine sand layers
			50						

Notes:

1) A bentonite seal was installed from 38 to 42.5 feet.

2) Native soil caved in from 28 to 38 feet during backfilling.

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION	WEST OF FRAME RACKS
DRILLING COMPANY	CASCADE DRILLING, INC.
DRILLER	BRENT MALOW
DRILLING METHOD	HOLLOW STEM AUGER
DRILL BIT(S) SIZE:	9-INCH O.D.
ISOLATION CASING	NONE FROM TO FT.
BLANK CASING	2-INCH SCHEDULE 40 PVC FROM 0.3 TO 13.0 FT.
PERFORATED CASING	2-INCH SCHEDULE 40 PVC (0.010" SLOT) FROM 13.0 TO 23.0 FT.
SIZE AND TYPE OF FILTER PACK	LONESTAR LAPIS LUSTRE #2/12 SAND FROM 10.0 TO 25.0 FT.
SEAL	BENTONITE FROM 1.5 TO 10.0 FT.
GROUT	NONE FROM TO FT.

Boring/Well Name	MW-31A
Project Name	KENWORTH - SEATTLE
Project Number	956085.03
ELEVATION AND DATUM	8.54
TOTAL DEPTH	25.0
DATE STARTED	04/09/1997
DATE COMPLETED	04/09/1997
INITIAL WATER DEPTH (FT)	7.5
LOGGED BY	DON HANSON
SAMPLING METHODS	2.5" SPLIT SPOONS
WELL COMPLETION	■ SURFACE HOUSING ☐ STAND PIPE ____ FT.

SAMPLES TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	Hnu	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
									9 inches pre-cored concrete
								GP/ GM	**Poorly graded GRAVEL with silt and sand** Grayish brown coarse gravel, moist, no odors, fill
			5					ML	**SILT with sand** Yellowish brown, sand is mostly fine, moist, no odors
S	1.2	1 1 6		Water Level 7.5 feet 4/9/97		0		SM	**Silty SAND** Mottled reddish brown and grayish brown fi-med sand interlayered with sandy silt, wet, very loose, no odors
S	1.5	2 2 4	10			0		SP/ SM	**Poorly graded SAND with silt** Grayish brown fi-med sand, wet, very loose, no odors
S	0.8	4 5 4				1			**Poorly graded SAND** Very dark gray fi-med sand, wet, very loose, no odors
S	1.2	4 3 5	15			1			17.5': 7' of heave in augers
S	0.3					0		SP	18.5': grades to mostly medium sand
			20						22': A few coarse sand, saturated, flowing sand. Sample recovery not possible
			25						

Notes:

1) Soil sampling beneath approximately 12.5 feet was ineffective due to heaving sand.

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION	NORTH FIRE ISLE
DRILLING COMPANY	CASCADE DRILLING, INC.
DRILLER	BRENT MALOW
DRILLING METHOD	HOLLOW STEM AUGER
DRILL BIT(S) SIZE	9-INCH O.D.

		FROM	TO	FT.
ISOLATION CASING	NONE			
BLANK CASING	2-INCH SCHEDULE 40 PVC	0.3	13.0	FT.
PERFORATED CASING	2-INCH SCHEDULE 40 PVC (0.010" SLOT)	13.0	23.0	FT.
SIZE AND TYPE OF FILTER PACK	LONESTAR LAPIS LUSTRE #2/12 SAND	10.0	25.0	FT.
SEAL	BENTONITE CHIPS	1.5	10.0	FT.
GROUT	NONE			FT.

Boring/Well Name MW-32A

Project Name KENWORTH - SEATTLE

Project Number 956085.03

ELEVATION AND DATUM: 8.88	TOTAL DEPTH: 25.0
DATE STARTED: 04/09/1997	DATE COMPLETED: 04/09/1997
INITIAL WATER DEPTH (FT): 8.4	
LOGGED BY: DON HANSON	
SAMPLING METHODS: 2.5" SPLIT SPOONS	WELL COMPLETION: ■ SURFACE HOUSING; ▭ STAND PIPE ____ FT.

SAMPLES TYPE	SAMPLES RECOVERY (FEET)	SAMPLES PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	Hnu	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
									7-inches pre-cored concrete
									Silty SAND
									Yellowish brown fine sand, moist, no odors
								SM	4.5': a few interbeded 1-3" thick sandy silt layers
S	1.5	5 5 6	5						5 ft': grades to mottled dark yellowish brown and dark gray, no odors
				Water Level 8.4 feet 4/9/97					
S	1.5	8 7 6	10						**Poorly graded SAND**
									Very dark gray fine sand with a trace of silt and wood debris, wet, loose, no odors
S	1.0	6 6 5							
			15						15.5': grades to mostly medium sand
S	1.0	5 5 4						SP	17': sand begins flowing up the lead auger, making sampling difficult
			20						18': grades to fi-med sand, trace of wood chips, wet, no odors, sand flowing up augers
			25						

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION	NORTH FIRE AISLE
DRILLING COMPANY	CASCADE
DRILLER	JAMES
DRILLING METHOD	HSA
DRILL BIT(S) SIZE	9-INCH OD

	FROM	TO	FT.
ISOLATION CASING			
BLANK CASING 2" SCHEDULE 40 PVC PIPE	0.0	10.0	FT.
PERFORATED CASING 2" SCHEDULE 40 PVC PIPE (0.010 SLOT)	10.0	20.0	FT.
SIZE AND TYPE OF FILTER PACK LAPIS LUSTRE #2/12 MONTEREY SAND	8.0	20.0	FT.
SEAL PURE GOLD BENTONITE CHIPS	1.0	8.0	FT.
GROUT CONCRETE (FOR SETTING MONUMENT)	0.0	1.0	FT.

Boring/Well Name	MW-33A
Project Name	PACCAR DATA GAPS
Project Number	016110.00
ELEVATION AND DATUM	
TOTAL DEPTH	20.0
DATE STARTED	03/14/2002
DATE COMPLETED	03/14/2002
INITIAL WATER DEPTH (FT)	9.0
LOGGED BY	DKM
SAMPLING METHODS	SPLIT SPOON
WELL COMPLETION	■ SURFACE HOUSING ▭ STAND PIPE ____ FT.

SAMPLES TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
								SP	**Concrete** Concrete slab and 2 inches pea gravel. **Poorly graded SAND** Brown poorly graded fine sand, no odor.
S	1.5	3 4 5	5			6.7		ML	**SILT with sand** Orange/brown silt with 5-10% fine sand in bands and pods, no odor.
S	1.5	5 7 9				8.6			
S	1.5	5 4 3	10			9.0		SM	**Silty SAND** Gray to brown silty fine sand, 40% silt, no odor, wet, 50/50 fine and and silt below 13 feet.
S	1.5	10 10 7				10.8			
S	1.5	1 4 5	15			8.1		SP	**Poorly graded SAND** Gray poorly graded medium sand, up to 5% silt, no odor.
S	1.5	50	20						
			25						
			30						

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION	NORTH FIRE AISLE
DRILLING COMPANY	CASCADE
DRILLER	JAMES
DRILLING METHOD	HSA
DRILL BIT(S) SIZE	9-INCH OD
ISOLATION CASING	FROM TO FT.
BLANK CASING	2" SCHEDULE 40 PVC PIPE — FROM 0.0 TO 10.0 FT.
PERFORATED CASING	2" SCHEDULE 40 PVC PIPE (0.010 SLOT) — FROM 10.0 TO 20.0 FT.
SIZE AND TYPE OF FILTER PACK	LAPIS LUSTRE #2/12 MONTEREY SAND — FROM 8.0 TO 20.0 FT.
SEAL	PURE GOLD BENTONITE CHIPS — FROM 1.0 TO 8.0 FT.
GROUT	CONCRETE (FOR SETTING MONUMENT) — FROM 0.0 TO 1.0 FT.

Boring/Well Name	MW-34A
Project Name	PACCAR DATA GAPS
Project Number	016110.00
ELEVATION AND DATUM	
TOTAL DEPTH	21.5
DATE STARTED	03/14/2002
DATE COMPLETED	03/14/2002
INITIAL WATER DEPTH (FT)	9.0
LOGGED BY	DKM
SAMPLING METHODS	SPLIT SPOON
WELL COMPLETION	■ SURFACE HOUSING; ☐ STAND PIPE ____ FT.

SAMPLES TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	OVA	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
							Concrete — Concrete slab and 2 inches pea gravel.
						SP	**Poorly graded SAND** — Brown poorly graded fine sand with some silt, no odor.
S	1.5	2 2 4	5		8.2	ML	**SILT with sand** — Tan/gray mottled orange silt with 5–10% fine sand, moderately dense, no odor.
S	1.5	4 4 6			8.3		**Silty SAND** — Gray to brown silty fine sand, 35–40% silt, no odor, 20–25% silt below 11 feet.
S	1.5	4 4 4	10		9.3	SM	
S	1.5	10 12 14			8.0		
S	1.5	4 4 5	15				
S	1.5	19 33 23				SP	**Poorly graded SAND** — Gray poorly graded medium sand, up to 5% silt, no odor.
S	0.5	6 8 8	20				
			25				
			30				

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION: INSIDE PLASTICS SHOP	**Boring/Well Name** MW-35A
DRILLING COMPANY: CASCADE	DRILLER: JAMES — **Project Name** PACCAR DATA GAPS
DRILLING METHOD: HSA LIMITED ACCESS RIG	DRILL BIT(S) SIZE: 9-INCH OD — **Project Number** 016110.00
ISOLATION CASING	FROM — TO — FT.
BLANK CASING: 2" SCHEDULE 40 PVC PIPE	FROM 0.0 TO 10.0 FT.
PERFORATED CASING: 2" SCHEDULE 40 PVC PIPE (0.010 SLOT)	FROM 10.0 TO 20.0 FT.
SIZE AND TYPE OF FILTER PACK: LAPIS LUSTRE #2/12 MONTEREY SAND	FROM 8.0 TO 20.0 FT.
SEAL: PURE GOLD BENTONITE CHIPS	FROM 1.0 TO 8.0 FT.
GROUT: CONCRETE (FOR SETTING MONUMENT)	FROM 0.0 TO 1.0 FT.

ELEVATION AND DATUM	TOTAL DEPTH: 20.0
DATE STARTED: 03/13/2002	DATE COMPLETED: 03/13/2002
INITIAL WATER DEPTH (FT): 8.5	
LOGGED BY: DKM	
SAMPLING METHODS: SPLIT SPOON	WELL COMPLETION: ■ SURFACE HOUSING; □ STAND PIPE ____ FT.

SAMPLES TYPE	SAMPLES RECOVERY (FEET)	SAMPLES PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
									Concrete
			5					SM	**Silty SAND** Brown fine sand with 30-50% silt, local "layered" texture variation, no odor.
S	1.5	4 4 7	10			8.0		SM	**Silty SAND** Gray/brown fine sand with 30% silt, "layered" texture, coarsens downward slightly, no odor.
S	1.5	11 16 14	15			7.7		SP	**Poorly graded SAND** Gray poorly graded medium sand, up to 5% silt in thin bands in upper 5 feet, no odor.
S	1.5	16 30 25	20						
			25						
			30						

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION	INSIDE PLASTICS SHOP	**Boring/Well Name**	MW-35B
DRILLING COMPANY	CASCADE	DRILLER JAMES	**Project Name** PACCAR DATA GAPS
DRILLING METHOD	HSA LIMITED ACCESS RIG	DRILL BIT(S) SIZE: 9-INCH OD	**Project Number** 016110.00
ISOLATION CASING		FROM TO FT.	ELEVATION AND DATUM / TOTAL DEPTH 40.5
BLANK CASING	2" SCHEDULE 40 PVC PIPE	FROM 0.0 TO 35.0 FT.	DATE STARTED 03/13/2002 / DATE COMPLETED 03/13/2002
PERFORATED CASING	2" SCHEDULE 40 PVC PIPE (0.010 SLOT)	FROM 35.0 TO 40.0 FT.	INITIAL WATER DEPTH (FT) 10.0
SIZE AND TYPE OF FILTER PACK	LAPIS LUSTRE #2/12 MONTEREY SAND	FROM 33.0 TO 40.0 FT.	LOGGED BY DKM
SEAL	PURE GOLD BENTONITE CHIPS	FROM 1.0 TO 33.0 FT.	SAMPLING METHODS: SPLIT SPOON / WELL COMPLETION: SURFACE HOUSING; STAND PIPE ____ FT.
GROUT	CONCRETE (FOR SETTING MONUMENT)	FROM 0.0 TO 1.0 FT.	

SAMPLES TYPE	SAMPLES RECOVERY (FEET)	SAMPLES PENETRATION RESIST (BLOWS/6 IN)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
									Concrete
S	1.5	16 12 12				3.8		SM	**Silty SAND** Brown fine sand with 30–50% silt, local "layered" texture variation, no odor.
S	1.5	4 6 7	5			1.9			
S	1.5	4 8 9				1.5		SM	**Silty SAND** Gray/brown fine sand with 30% silt, "layered" texture, coarsens downword slightly, no odor.
S	1.5	8 11 11	10						
S	1.5	8 12 14							**Poorly graded SAND** Gray poorly graded medium sand, up to 5% silt in thin bands in upper 5 feet, no odor. Driller reports heaving sands 15–35 feet.
S	1.5	10 12 14	15			2.4			
S	0	3 27 50							
S	0	14 15 26	20					SP	
S	1.5	9 27 30				3.9			
S	0	6 7 14	25						
S	1.5	27 50							
			30						

Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name PACCAR DATA GAPS **Project Number** 016110.00 **Boring/Well Name** MW-35B

SAMPLES TYPE	SAMPLES RECOVERY (FEET)	SAMPLES PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
S	0	24 50							
S	0.3	5 5 5	35					SP	
S	1.5	27 50				7.2			
S	1.0	7 15 50	40					ML	**Sandy SILT** Gray sandy silt to silty sand, textural layering, no odor. Upper contact grades over 2 inches, but distinct.
			45						
			50						
			55						
			60						
			65						
			70						

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION	SOUTH OF PLASTICS SHOP		
DRILLING COMPANY	CASCADE	DRILLER	YANCCY
DRILLING METHOD	HSA	DRILL BIT(S) SIZE:	9-INCH OD
ISOLATION CASING		FROM TO FT.	
BLANK CASING	2" SCHEDULE 40 PVC PIPE	FROM 0.0 TO 10.0 FT.	
PERFORATED CASING	2" SCHEDULE 40 PVC PIPE (0.010 SLOT)	FROM 10.0 TO 20.0 FT.	
SIZE AND TYPE OF FILTER PACK	LAPIS LUSTRE #2/12 MONTEREY SAND	FROM 8.0 TO 20.0 FT.	
SEAL	PURE GOLD BENTONITE CHIPS	FROM 1.0 TO 8.0 FT.	
GROUT	CONCRETE (FOR SETTING MONUMENT)	FROM 0.0 TO 1.0 FT.	

Boring/Well Name MW-36A

Project Name PACCAR DATA GAPS

Project Number 016110.00

ELEVATION AND DATUM	TOTAL DEPTH 21.5
DATE STARTED 03/11/2002	DATE COMPLETED 03/11/2002
INITIAL WATER DEPTH (FT) 8.5	
LOGGED BY DKM	
SAMPLING METHODS SPLIT SPOON	WELL COMPLETION ■ SURFACE HOUSING ☐ STAND PIPE ____ FT.

SAMPLES TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
									Concrete
								SM	Concrete with crushed rock base
									Silty SAND
									Light brown silty fine sand, no odor.
S	1.5	4 3 3	5			10.7		SM	**Silty SAND**
									Brown/gray moderately dense sandy silt grading to silty sand, no odor. Silt with some fine sand 2-4 feet; 50/50 mixture of fine sand and silt 4-7 feet; 60% fine sand, 30% silt, 10% medium sand 7-8 feet.
S	1.5	7 11 7	10			12.7			**Poorly graded SAND**
								SP	Brown to gray medium sand, 5-10% silt in small clumps in upper 1 foot, up to 5% silt to 13 feet, minor to no silt below 14 feet. No odor.
S	1.5	12 23 20	15						
S	1.5	6 8 11	20						
			25						
			30						

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION: SOUTH OF PLASTICS SHOP	**Boring/Well Name** MW-36B
DRILLING COMPANY: CASCADE; DRILLER: YANCCY	**Project Name** PACCAR DATA GAPS
DRILLING METHOD: HSA; DRILL BIT(S) SIZE: 9-INCH OD	**Project Number** 016110.00
ISOLATION CASING: FROM TO FT.	ELEVATION AND DATUM; TOTAL DEPTH: 43.5
BLANK CASING: 2" SCHEDULE 40 PVC PIPE — FROM 0.0 TO 37.0 FT.	DATE STARTED: 03/11/2002; DATE COMPLETED: 03/11/2002
PERFORATED CASING: 2" SCHEDULE 40 PVC PIPE (0.010 SLOT) — FROM 37.0 TO 42.0 FT.	INITIAL WATER DEPTH (FT): 8.5
SIZE AND TYPE OF FILTER PACK: LAPIS LUSTRE #2/12 MONTEREY SAND — FROM 35.0 TO 42.0 FT.	LOGGED BY: DKM
SEAL: PURE GOLD BENTONITE CHIPS — FROM 1.0 TO 35.0 FT.	SAMPLING METHODS: SPLIT SPOON; WELL COMPLETION: ■ SURFACE HOUSING, ☐ STAND PIPE ____ FT.
GROUT: CONCRETE (FOR SETTING MONUMENT) — FROM 0.0 TO 1.0 FT.	

SAMPLES TYPE	SAMPLES RECOVERY (FEET)	SAMPLES PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
								SM	**Concrete** Concrete with crushed rock base.
S	1	34 7 8				6.8			**Silty SAND** Light brown silty fine sand, no odor.
S	1.5	3 3 5						SM	**Silty SAND** Brown/gray moderately dense sandy silt grading to silty sand, no odor. Silt with some fine sand 2–4 feet; 50/50 mixture of fine sand and silt 4–7 feet; 60% fine sand, 30% silt, 10% medium sand 7–8 feet.
S	1.5	5 5 5	5			6.3			
S	1.5	3 3 3							
S	1.5	8 9 11			▽				
S	0.5	9 11 8	10			8.1			**Poorly graded SAND** Brown to gray medium sand, 5–10% silt in small clumps in upper 1 foot, up to 5% silt to 13 feet, minor to no silt below 13 feet, some coarse sand 30–35 feet. No odor.
S	1.5	6 8 10							
S	1.5	7 8 10							
S	1.5	7 8 15							
S	1.5	9 17 23	15			7.5			
S	1.5	9 17 22							
S	1.5	9 7 13						SP	
S	1.5	7 22 33	20						
S	1.5	7 9 10				10.6			
S	1.5	3 7 14							
S	1.5	3 7 14	25						
S	1.5	6 6 11							
S	1.5	50							
S	1.5	3 7 19	30						

Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name PACCAR DATA GAPS **Project Number** 016110.00 **Boring/Well Name** MW-36B

SAMPLES TYPE	SAMPLES RECOVERY (FEET)	SAMPLES PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
S	1.5	3 7 12							
S	1.5	15 23 25							
S	1.5	10 20 50							
S	1.0	50	35					SP	
S	1.5	50							
S	1.5	10 13 10						ML	**SILT** Gray dense silt, no odor.
S	1.5	10 11 13	40					SP	**Poorly graded SAND** Gray poorly graded medium sand, some silt 40–41 feet.
S	1.5	12 23 50				9.6		ML	**Sandy SILT** Silt and fine sand mixture, approximately 50/50, moderately dense, no odor.
S	1.5	9 11 16	45						
			50						
			55						
			60						
			65						
			70						

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION	SOUTHWEST BULKHEAD CORNER	**Boring/Well Name**	MW-37A
DRILLING COMPANY	CASCADE	DRILLER	YANCCY
Project Name	PACCAR DATA GAPS		
DRILLING METHOD	HSA	DRILL BIT(S) SIZE:	9-INCH OD
Project Number	016110.00		

	FROM	TO	FT.
ISOLATION CASING			
BLANK CASING: 2" SCHEDULE 40 PVC PIPE	0.0	10.0	
PERFORATED CASING: 2" SCHEDULE 40 PVC PIPE (0.010 SLOT)	10.0	20.0	
SIZE AND TYPE OF FILTER PACK: LAPIS LUSTRE #2/12 MONTEREY SAND	8.0	20.0	
SEAL: PURE GOLD BENTONITE CHIPS	1.0	8.0	
GROUT: CONCRETE (FOR SETTING MONUMENT)	0.0	1.0	

ELEVATION AND DATUM	TOTAL DEPTH: 21.5
DATE STARTED: 03/11/2002	DATE COMPLETED: 03/11/2002
INITIAL WATER DEPTH (FT): 9.0	
LOGGED BY: DKM	
SAMPLING METHODS: SPLIT SPOON	WELL COMPLETION: ■ SURFACE HOUSING; ▭ STAND PIPE ____ FT.

SAMPLES TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
									Concrete Concrete with crushed rock base.
S	1.5	21 17 15				6.9		SP	**Poorly graded SAND** Brown poorly graded medium sand with some fine sand and silt, no odor.
S	1.5	12 11 10	5						**Silty SAND** Brown/gray medium sand with 10–20% silt and some fine sand and fine gravel, up to 40% silt 4–6 feet, layered silt/fine sand/medium sand 10–11 feet, angular rock/brick debris 3.5–4 feet, no odor.
S	1.5	10 10 10				2.7		SM	
S	1.5	70	10			8.3			
S	1.5	18 21 25							**Poorly graded SAND** Gray poorly graded medium sand, some silt in small clumps above 20 feet. No odor.
S	1.5	26 50	15					SP	
S	1.5	26 50							
S	1.5	25 50	20						
			25						
			30						

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION: SOUTHWEST BULKHEAD CORNER	**Boring/Well Name** MW-37B
DRILLING COMPANY: CASCADE; DRILLER: YANCCY	**Project Name** PACCAR DATA GAPS
DRILLING METHOD: HSA; DRILL BIT(S) SIZE: 9-INCH OD	**Project Number** 016110.00

	FROM	TO	FT.
ISOLATION CASING			
BLANK CASING: 2" SCHEDULE 40 PVC PIPE	0.0	35.0	FT.
PERFORATED CASING: 2" SCHEDULE 40 PVC PIPE (0.010 SLOT)	35.0	40.0	FT.
SIZE AND TYPE OF FILTER PACK: LAPIS LUSTRE #2/12 MONTEREY SAND	33.0	40.0	FT.
SEAL: PURE GOLD BENTONITE CHIPS	1.0	33.0	FT.
GROUT: CONCRETE (FOR SETTING MONUMENT)	0.0	1.0	FT.

ELEVATION AND DATUM	TOTAL DEPTH: 40.5
DATE STARTED: 03/12/2002	DATE COMPLETED: 03/12/2002
INITIAL WATER DEPTH (FT): 9.0	
LOGGED BY: DKM	
SAMPLING METHODS: SPLIT SPOON	WELL COMPLETION: ■ SURFACE HOUSING; ☐ STAND PIPE ____ FT.

SAMPLES TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
									Concrete
								SP	Concrete with crushed rock base.
									Poorly graded SAND
									Brown poorly graded medium sand with some fine sand and silt, no odor.
S	1.5	6 6 7	5			4.4			**Silty SAND**
								SM	Brown/gray medium sand with 10–20% silt and some fine sand and fine gravel, up to 40% silt 4–6 feet, layered silt/fine sand/medium sand 10–11 feet, angular rock/brick debris 3.5–4 feet, no odor.
S	1.5	3 4 4	10			5.8			
									Poorly graded SAND
S	1.5	7 13 15	15			9.3			Gray poorly graded medium sand, some silt in small clumps above 20 feet. No odor.
S	1.5	9 11 14	20					SP	
S	1.5	6 12 19	25						
S	1.5	10 24 28	30						

Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name PACCAR DATA GAPS **Project Number** 016110.00 **Boring/Well Name** MW-37B

SAMPLES TYPE	SAMPLES RECOVERY (FEET)	SAMPLES PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
S	1.5	3 24 35							
S	0.5	15 6 7							
S	1.5	3 8 15	35					SP	
S	1.0	18 60							
S	1.5	8 6 7							
S	1.5	5 5 11	40					ML	**SILT with sand** Dark grey silt with fine sand, moderately dense, no odor.
			45						
			50						
			55						
			60						
			65						
			70						

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION	10 FEET EAST OF PILOT WELLS		
DRILLING COMPANY	CASCADE	DRILLER	
DRILLING METHOD	HOLLOW STEM AUGER	DRILL BIT(S) SIZE:	9 INCH OD

	FROM	TO	FT.
ISOLATION CASING			
BLANK CASING: 2-INCH SCHEDULE 40 PVC PIPE	0.0	13.0	FT.
PERFORATED CASING: 2-INCH SCHEDULE 40 PVC PIPE 0.010 SLOT	13.0	23.0	FT.
SIZE AND TYPE OF FILTER PACK: LAPIS LUSTRE #2/12 MONTEREY SAND	11.0	25.0	FT.
SEAL: PURE GOLD BENTONITE CHIPS	25.0 1.0	38.0 11.0	FT.
GROUT: CONCRETE	0.0	1.0	FT.

Boring/Well Name MW-38A

Project Name PACCAR VES PILOT

Project Number 016110.00

ELEVATION AND DATUM	TOTAL DEPTH: 38.0
DATE STARTED: 05/02/2002	DATE COMPLETED: 05/02/2002
INITIAL WATER DEPTH (FT): 8.0	
LOGGED BY: DKM	
SAMPLING METHODS: SPLIT SPOON	WELL COMPLETION: ■ SURFACE HOUSING; □ STAND PIPE ____ FT.

SAMPLES TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	OVA	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
							Concrete
						SW	**Well-graded SAND with gravel**
						SM	Brown sand with 25–30% gravel and some silt, likely fill material.
S	1.5	3 4 5			0		
S	1.5	5 5 7	5	MW-38A-5-5.5	0	ML	**Silty SAND with gravel**
S	1.5	3 2 2		MW-38A-6.5-7	0		Gray silty sand with 5–15% fine to medium gravel.
S	1.5	4 6 7		MW-38A-7		SM	**Sandy SILT**
S	1.5	3 3 2			0.1	ML	Light brown/orange to gray mottled fine sandy silt.
S	1.5	3 5 4	10				**Silty SAND**
S	1.5	5 5 5				SP	Light brown silty fine sand
S	1.5	6 5 4					**SILT with sand**
S	1.5	8 6 9	15				Brown to gray, vaguely layered, silt and fine sand.
							Poorly graded SAND
S	1.5	5 7 10			0.3		Gray to brown poorly graded fine to medium sand with 5–10% silt, silt content decreases with depth.
							Poorly graded SAND
S	1.5	5 6 9	20	MW-38A-20 MW-38A-20.5-21	0.6	SP	Gray poorly graded medium sand, 10–20% coarse sand 25–30 feet bgs, 15–20% fine sand below 30 feet bgs.
S	1.5	7 8 12					
S	1.5	14 12 16	25				
S	1.5	9 5 8			0.3		
			30				

Boring & Well Construction Log

Kennedy/Jenks Consultants

Project Name PACCAR VES PILOT **Project Number** 016110.00 **Boring/Well Name** MW-38A

SAMPLES TYPE	SAMPLES RECOVERY (FEET)	SAMPLES PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
S	1.5	8 11 10						SP	
S	1.5	5 6 5						ML	**Sandy SILT** Gray to brown silt and fine sand, locally interbedded between sandy silt and fine sand with silt.
S	1.5	4 4 8	35						
S	1.5	4 4 6							

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION	15 FEET WEST OF PILOT WELLS
DRILLING COMPANY	CASCADE
DRILLER	
DRILLING METHOD	HOLLOW STEM AUGER
DRILL BIT(S) SIZE	9 INCH OD

	FROM	TO	FT.
ISOLATION CASING			
BLANK CASING 2-INCH SCHEDULE 40 PVC PIPE	0.0	13.0	FT.
PERFORATED CASING 2-INCH SCHEDULE 40 PVC,PIPE 0.010 SLOT	13.0	23.0	FT.
SIZE AND TYPE OF FILTER PACK LAPIS LUSTRE #2/12 MONTEREY SAND	11.0	23.5	FT.
SEAL PURE GOLD BENTONITE CHIPS	1.0	11.0	FT.
GROUT CONCRETE	0.0	1.0	FT.

Boring/Well Name MW-39A

Project Name PACCAR VES PILOT

Project Number 016110.00

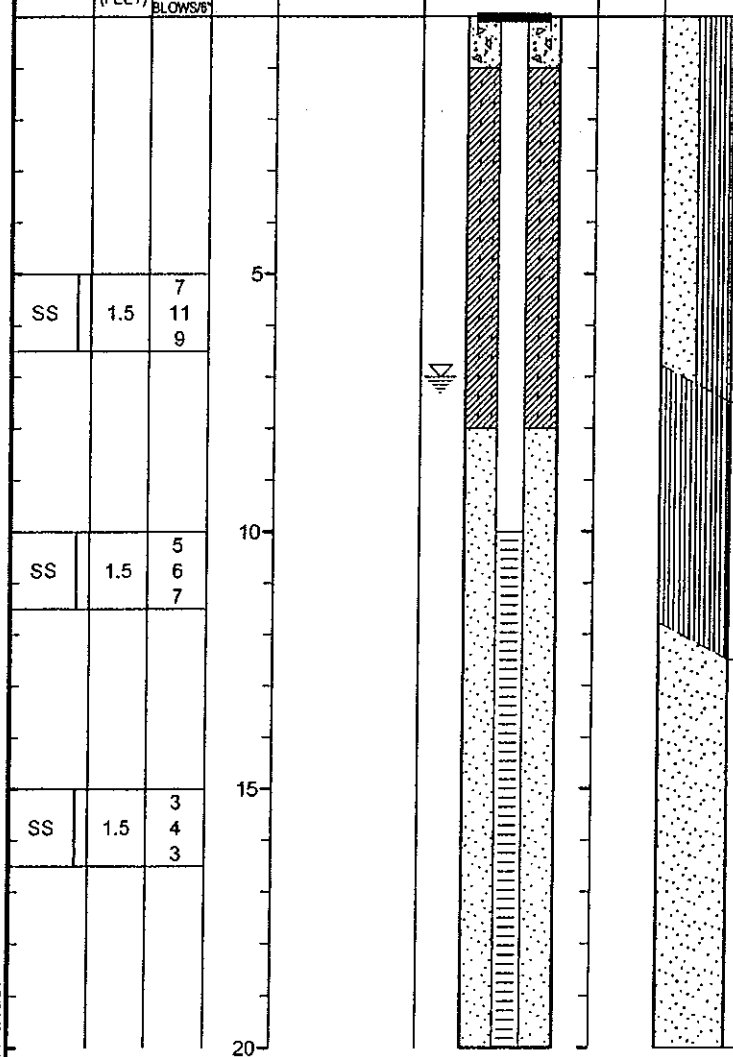
ELEVATION AND DATUM	TOTAL DEPTH 23.5
DATE STARTED 05/02/2002	DATE COMPLETED 05/02/2002
INITIAL WATER DEPTH (FT) 8.0	
LOGGED BY DKM	
SAMPLING METHODS SPLIT SPOON	WELL COMPLETION ■ SURFACE HOUSING ☐ STAND PIPE ____ FT.

SAMPLES TYPE	RECOVERY (FEET)	PENETRATION RESIST (BLOWS/6 IN.)	DEPTH (FEET)	SAMPLE NO.	WELL CONSTRUCTION	OVA	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
									Concrete
								SW/SM	**Well-graded SAND with silt and gravel** Brown to gray mixture of gravel, sand, and silt with minor metal debris, likely fill material.
S	1.5	3 3 4	5			0.9		SM	**Silty SAND** Light brown to gray silty fine sand, some vague layering, 10-30% silt, silt content increases with depth.
S	1.5	2 2 3	10			0			**Poorly graded SAND** Gray poorly graded medium sand, wet, minor silt.
S	1.5	3 4 7	15			0.2		SP	
S	1.5	5 7 7	20			0.2			

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION: North of SVE line		Well Name: MW-40A	
DRILLING COMPANY: Cascade Drilling, Inc.	DRILLER: Andy	Project Name: PACCAR AS/SVE	
DRILLING METHOD(S): HSA	DRILL BIT(S) SIZE: 9-inch	Project Number: 036025.00	
ISOLATION CASING: N/A	FROM N/A TO N/A FT.	ELEVATION AND DATUM	TOTAL DEPTH: 20.0 ft. bgs
BLANK CASING: 2-inch Schedule 40 PVC pipe	FROM 0 TO 10 FT.	DATE STARTED: 2/13/04	DATE COMPLETED: 2/13/04
SLOTTED CASING: 2" schedule 40 PVC pipe, 0.010-slot	FROM 10 TO 20 FT.	INITIAL WATER DEPTH (FT): 7	
SIZE AND TYPE OF FILTER PACK: Lapis Luster #2/12 Monterey Sand (RMC)	FROM 8 TO 20 FT.	LOGGED BY: DKM	
SEAL: Bentonite Chips (Pure Gold Med)	FROM 1 TO 8 FT.	SAMPLING METHODS: Split Spoon	WELL COMPLETION: ■ SURFACE HOUSING ☐ STAND PIPE_____ FT.
GROUT: Concrete (monument set)	FROM 0 TO 1 FT.		



KJ PNW ASW-25-33.GPJ KJ PNW.GDT 9/16/04

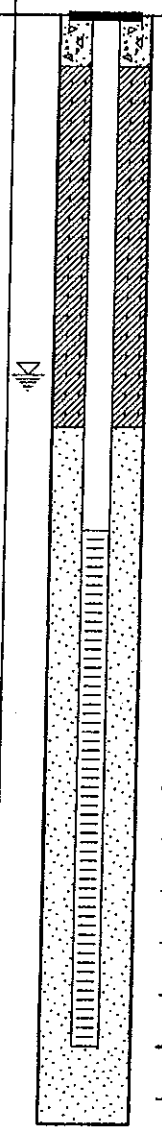
F-40.1
(6-87) (3-88) (8-90)

SHEET 1 OF 1

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION: South of SVE line		Well Name: MW-41A	
DRILLING COMPANY: Cascade Drilling, Inc.	DRILLER: Andy	Project Name: PACCAR AS/SVE	
DRILLING METHOD(S): HSA	DRILL BIT(S) SIZE: 9-inch	Project Number: 036025.00	
ISOLATION CASING: N/A	FROM N/A TO N/A FT.	ELEVATION AND DATUM	TOTAL DEPTH: 21.5 ft. bgs
BLANK CASING: 2-inch Schedule 40 PVC pipe	FROM 0 TO 10 FT.	DATE STARTED: 2/13/04	DATE COMPLETED: 2/13/04
SLOTTED CASING: 2" schedule 40 PVC pipe, 0.010-slot	FROM 10 TO 20 FT.	INITIAL WATER DEPTH (FT): 7	
SIZE AND TYPE OF FILTER PACK: Lapis Luster #2/12 Monterey Sand (RMC)	FROM 8 TO 21.5 FT.	LOGGED BY: DKM	
SEAL: Bentonite Chips (Pure Gold Med)	FROM 1 TO 8 FT.	SAMPLING METHODS: Split Spoon	WELL COMPLETION: ■ SURFACE HOUSING ☐ STAND PIPE ____ FT.
GROUT: Concrete (monument set)	FROM 0 TO 1 FT.		

SAMPLES TYPE	RECOV (FEET)	PENETR. RESIST. BLOWS/6"	DEPTH (FEET)	SAMPLE NUMBER	WELL CONSTRUCTION	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
							SP	**Poorly graded SAND** Brown, poorly graded medium sand, some silt, no odor, no sheen.
SS	1.5	5 5 10	5				ML/ CL	**Clayey SILT** Dark gray, clayey silt, some fine sand, appears layered, medium sand above and below, no chemical odor, no sheen.
							SM	**Silty SAND** Brown to dark gray, ~20-25% silt total with fine sand and medium sand, texturally layered, fine sand, silty fine sand and sandy silt, wet, very sloppy, no odor, no sheen.
SS	1.5	6 10 10	10					
							SP	**Poorly graded SAND** Brown/gray, poorly graded medium sand, up to ~5% silt in clumps, silty sand cuttings, wet, no odor, no sheen.
SS	1.5	6 10 12	15					
SS	1.5	10 21 32	20					

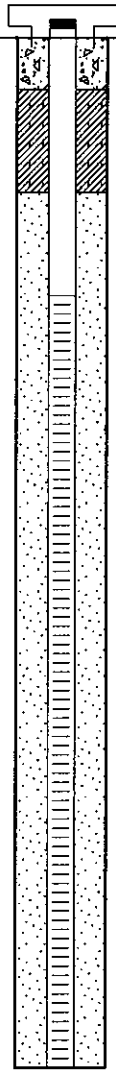
KJ PNW ASW-25-33.GPJ KJ PNW.GDT 9/16/04

F-40.1
(6-87) (3-88) (8-90)

Boring & Well Construction Log

Kennedy/Jenks Consultants

BORING LOCATION: Between SFA-5 & SFA-4		**Well Name**	MW-42A
DRILLING COMPANY: Cascade Drilling, Inc.	DRILLER:	**Project Name**	PACCAR
DRILLING METHOD(S): HSA	DRILL BIT(S) SIZE: 9 inches	**Project Number**	046001.00
ISOLATION CASING: N/A	FROM N/A TO N/A FT.	ELEVATION AND DATUM	TOTAL DEPTH: 20.0 ft. bgs
BLANK CASING: 2" Sched. 40 PVC Pipe	FROM 0 TO 5 FT.	DATE STARTED: 4/26/04	DATE COMPLETED: 4/26/04
SLOTTED CASING: 2" Sched. 40 PVC 0.010 Slot	FROM 5 TO 20 FT.	INITIAL WATER DEPTH (FT): N/A	
SIZE AND TYPE OF FILTER PACK: #2/12 Monterey Sand	FROM 3 TO 20 FT.	LOGGED BY: DKM	
SEAL: Bentonite Chips	FROM 1 TO 3 FT.	SAMPLING METHODS: Split spoon	WELL COMPLETION: ☐ SURFACE HOUSING ■ STAND PIPE N/A FT.
GROUT: Concrete	FROM 0 TO 1 FT.		

SAMPLES TYPE	RECOV. (FEET)	PENETR. RESIST. BLOWS/6"	DEPTH (FEET)	SAMPLE NUMBER	WELL CONSTRUCTION	OVA/PID	LITHOLOGY	USCS LOG	SAMPLE DESCRIPTION AND DRILLING REMARKS
									Approximately 8 inches of concrete.
								SP/ SM	**Poorly graded SAND with silt** Medium brown, poorly graded sand with ~10-15% silt in small clumps, moderately dense, massive, moist, slight odor mainly from ~5-5.5 feet, no sheen.
SS	1.5	10 9 5	5			2.3			
SS	1.5	7 8 8	10			2.1		SP	**Poorly graded SAND** Grey, poorly graded sand, mainly medium sand, minor if any silt, coarsens slightly downwards, moderately dense, wet, no evident odor, no sheen.
SS	1.5	15 15 15	15			1.9			
SS	1.5	8 5 9	20			NA			

KJ PNW PACCAR BORING LOGS SFA.GPJ KJ PNW.GDT 9/10/04

F-40.1
(6-87) (3-88) (8-90)

SHEET 1 OF 1

DEPTH (ft bgs)	USCS SYMBOL	SOIL DESCRIPTION	BLOW COUNT SPT N VALUE	VOLATILE READING (ppm)	GROUNDWATER	TESTING AND LABORATORY DATA
0		Concrete (6 inches).				
	SM	Described from soil cuttings: Dark brown, silty, fine to coarse SAND; moist. (Fill)				
		Driller missed sampling interval. Began sampling at 5 feet bgs.				
5	SM	Loose, brown, silty, fine to coarse SAND, some organics, iron-oxide staining. (Fill) No odor, no discoloration.	6	0.6		MW-44BSB-5'
	SM	Loose, brown to gray, silty, fine to medium SAND, organics (wood chips); moist to wet. Strong petroleum hydrocarbon odor, gray petroleum discoloration.	6 4	>400 >400	▽	MW-44BSB-7.5'
10	PT SM	Organic-rich layer (approximately 6 inches thick). Very strong odor, 50% sheen. Loose to medium dense, dark brown, silty, fine SAND, abundant organics; wet. Very strong odor. Organic-rich, silty SAND. Very strong odor. Olive-brown SILT lenses (< 0.25 inches thick).	6 12 50/6"	55 115		MW-44BSB-10'
		Drilled through an obstruction.		17		
15		Driller reports void from 15 to 16 feet bgs.				
		End of boring at 16 feet bgs. Backfilled with fine bentonite chips with concrete patch at surface.				
20						
25						
30						

BORING METHOD: Hollow Stem Auger
BOREHOLE DIAMETER: 8.0 (in)
DRILL RIG: Hollow Stem Auger
CONTRACTOR: Cascade Drilling
LOGGED BY: A. Speransky

ELEVATION REFERENCE: NA
GROUND SURFACE ELEVATION: NA
CASING ELEVATION: NA
DRILLING DATES: 9/16/2011 - 9/16/2011

REMARKS:
Drilled through unknown pipe.

Redrilled MW-44A (1) to install the well.

ENVIRONMENTAL BORING 9-915-14995L.GPJ AMEC PORTLAND.GDT 12/8/11

8801 Site

9-915-14995L

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11810 North Creek Parkway N
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Tel (425) 368-1000
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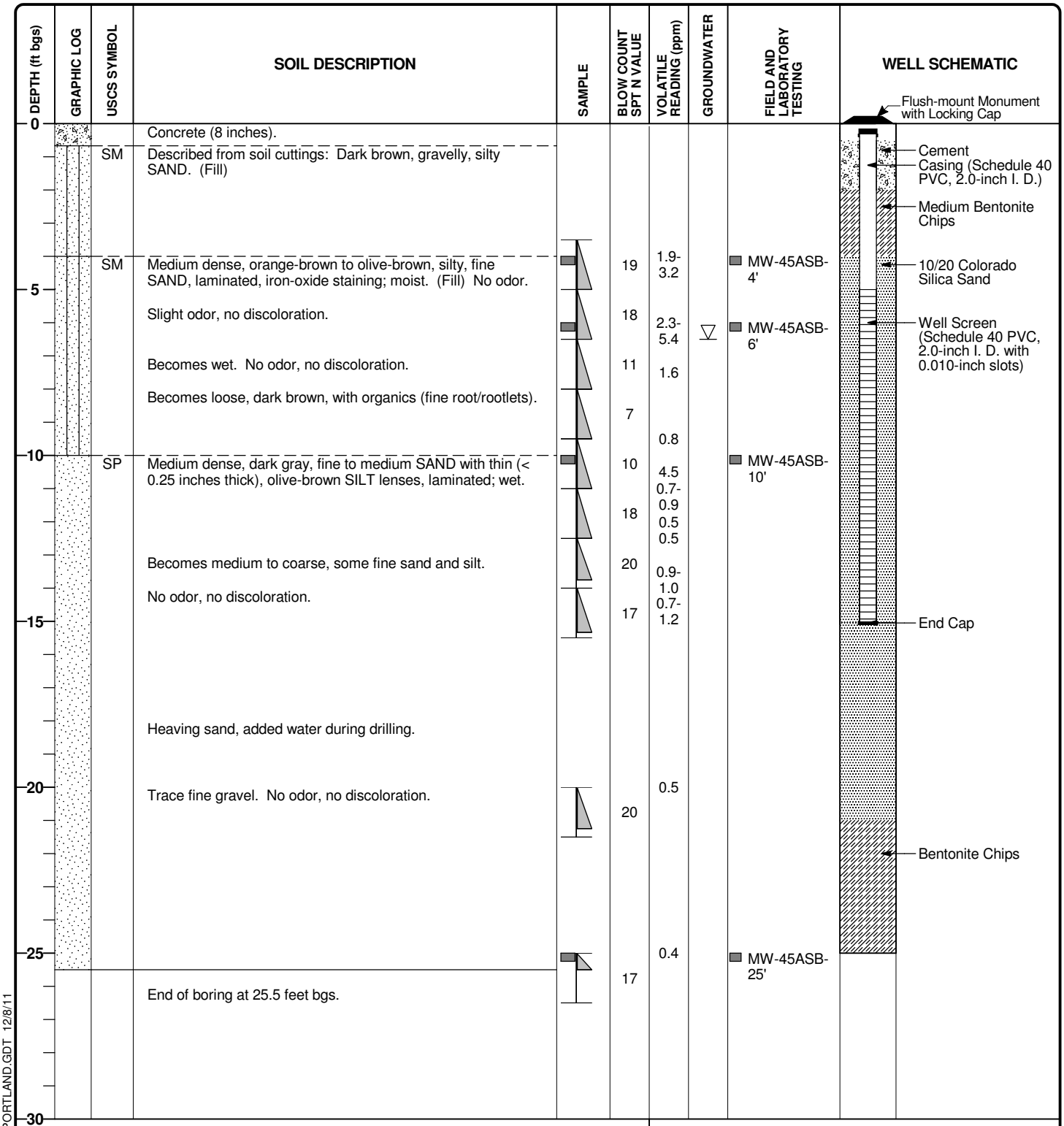
LOG OF BORING MW-44B



BORING METHOD: Hollow Stem Auger
BOREHOLE DIAMETER: 8.0 (in)
DRILL RIG: Hollow Stem Auger
CONTRACTOR: Cascade Drilling
LOGGED BY: A. Speransky

ELEVATION REFERENCE: NA
GROUND SURFACE ELEVATION: NA
CASING ELEVATION: NA
START CARD/TAG ID: /AAF685
DRILLING DATES: 9/21/2011 - 9/21/2011

REMARKS:

ENVR+WELL BORING 9-915-14995L.GPJ AMEC PORTLAND.GDT 12/8/11

8801 Site

9-915-14995L

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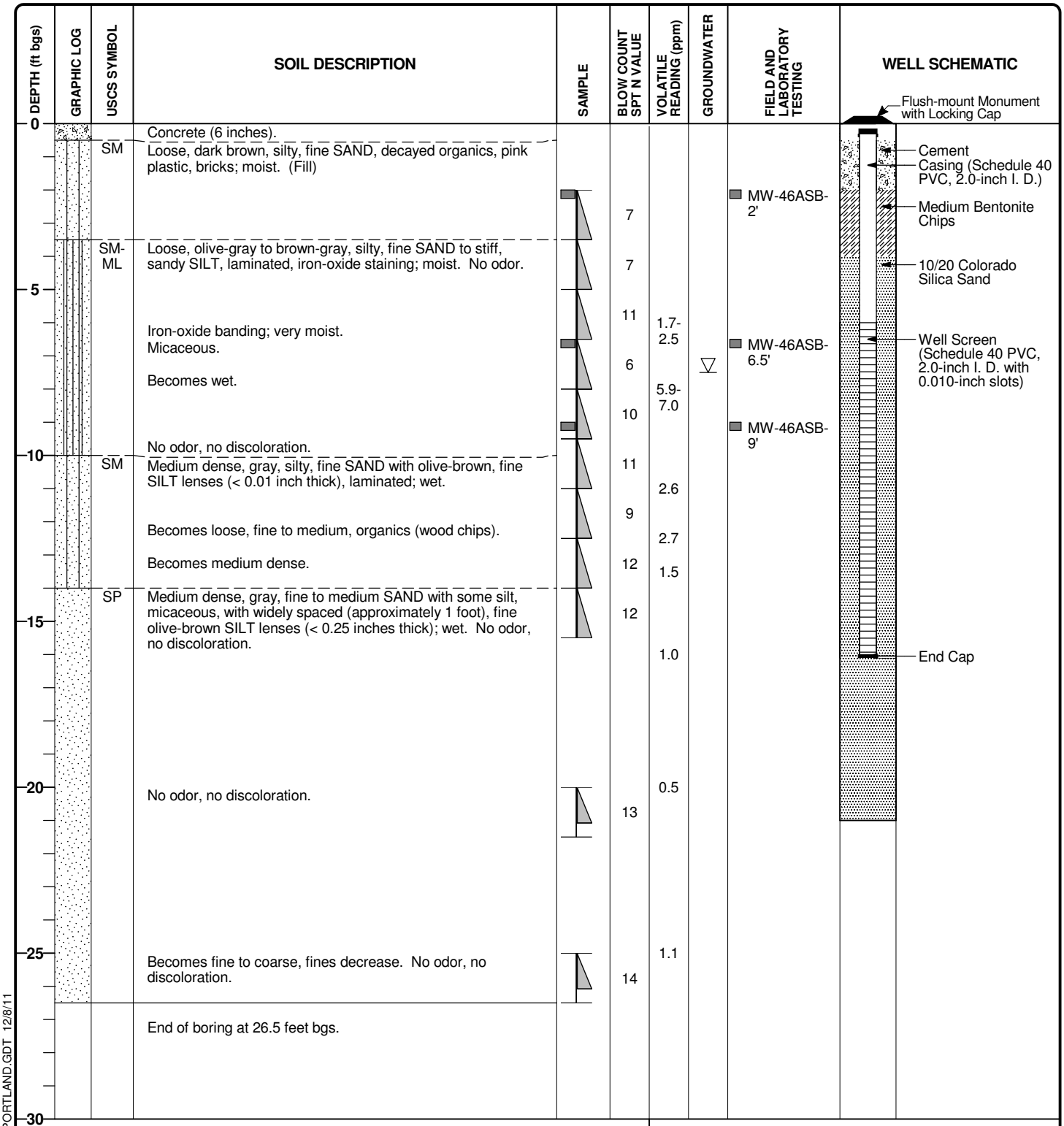
LOG OF BORING MW-45A



BORING METHOD: Hollow Stem Auger
BOREHOLE DIAMETER: 8.0 (in)
DRILL RIG: Hollow Stem Auger
CONTRACTOR: Cascade Drilling
LOGGED BY: A. Speransky

ELEVATION REFERENCE: NA
GROUND SURFACE ELEVATION: NA
CASING ELEVATION: NA
START CARD/TAG ID: /AAF683
DRILLING DATES: 9/15/2011 - 9/15/2011

REMARKS:

ENVR+WELL BORING 9-915-14995L.GPJ AMEC PORTLAND.GDT 12/8/11

8801 Site

9-915-14995L

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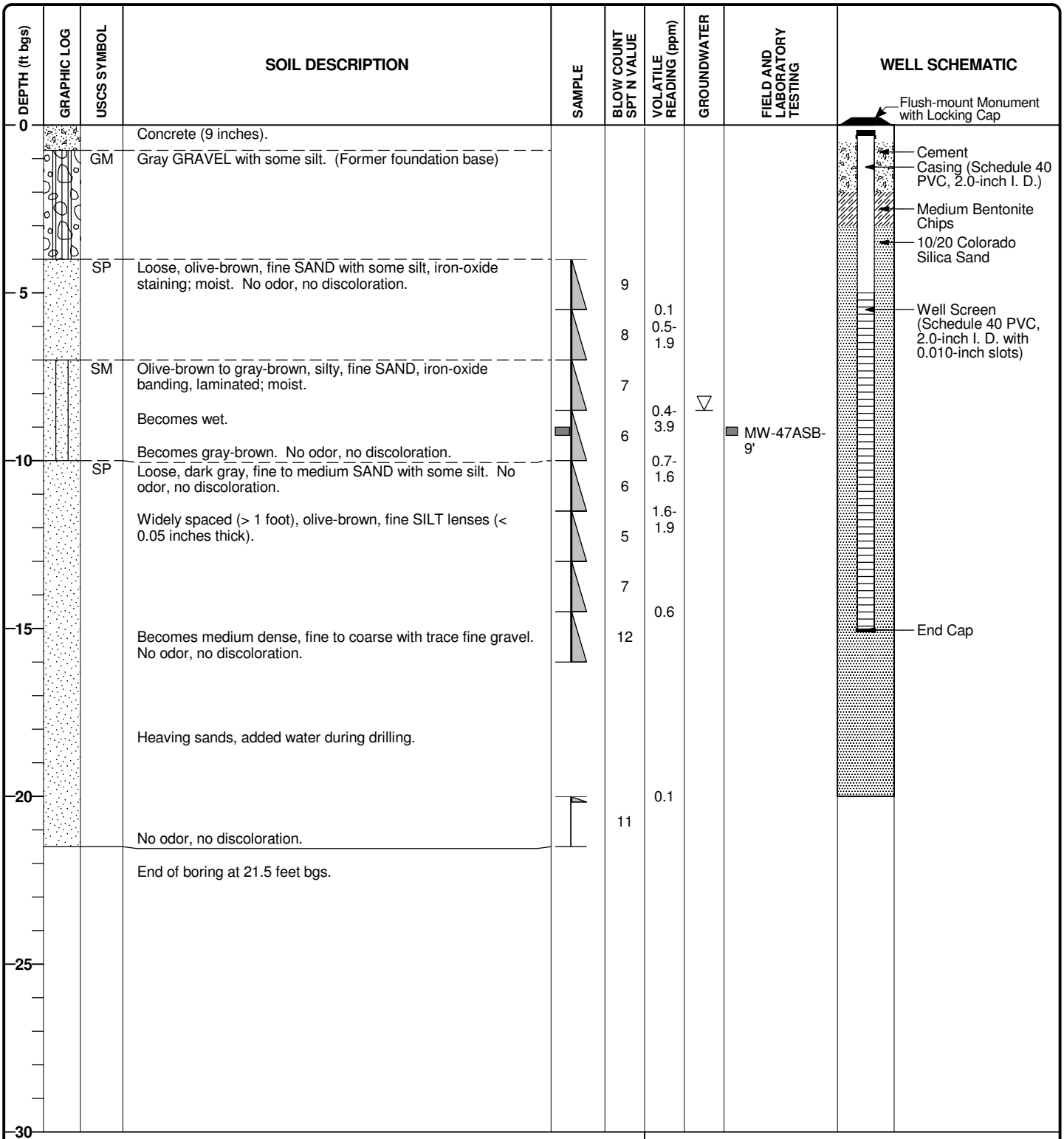
LOG OF BORING MW-46A



BORING METHOD: Hollow Stem Auger
BOREHOLE DIAMETER: 8.0 (in)
DRILL RIG: Hollow Stem Auger
CONTRACTOR: Cascade Drilling
LOGGED BY: A. Speransky

ELEVATION REFERENCE: NA
GROUND SURFACE ELEVATION: NA
CASING ELEVATION: NA
START CARD/TAG ID: NA
DRILLING DATES: 9/16/2011 - 9/16/2011

REMARKS:

ENVR+WELL BORING 9-915-14995L.GPJ AMEC PORTLAND.GDT 12/8/11

8801 Site

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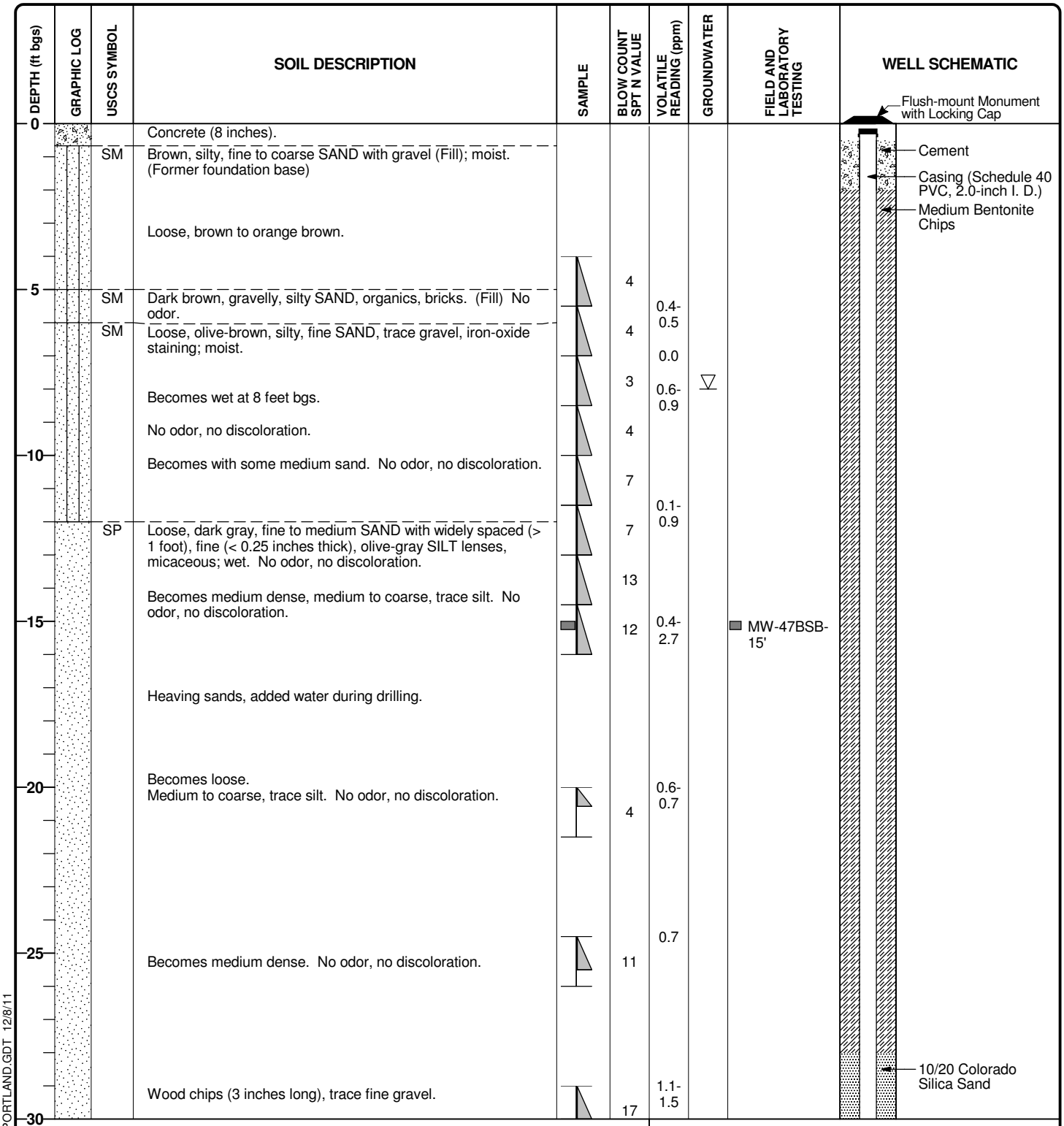
LOG OF BORING MW-47A



BORING METHOD: Hollow Stem Auger
BOREHOLE DIAMETER: 8.0 (in)
DRILL RIG: Hollow Stem Auger
CONTRACTOR: Cascade Drilling
LOGGED BY: A. Speransky

ELEVATION REFERENCE: NA
GROUND SURFACE ELEVATION: NA
CASING ELEVATION: NA
START CARD/TAG ID: NA
DRILLING DATES: 9/19/2011 - 9/19/2011

REMARKS:

ENVR+WELL BORING 9-915-14995L.GPJ AMEC PORTLAND.GDT 12/8/11

8801 Site

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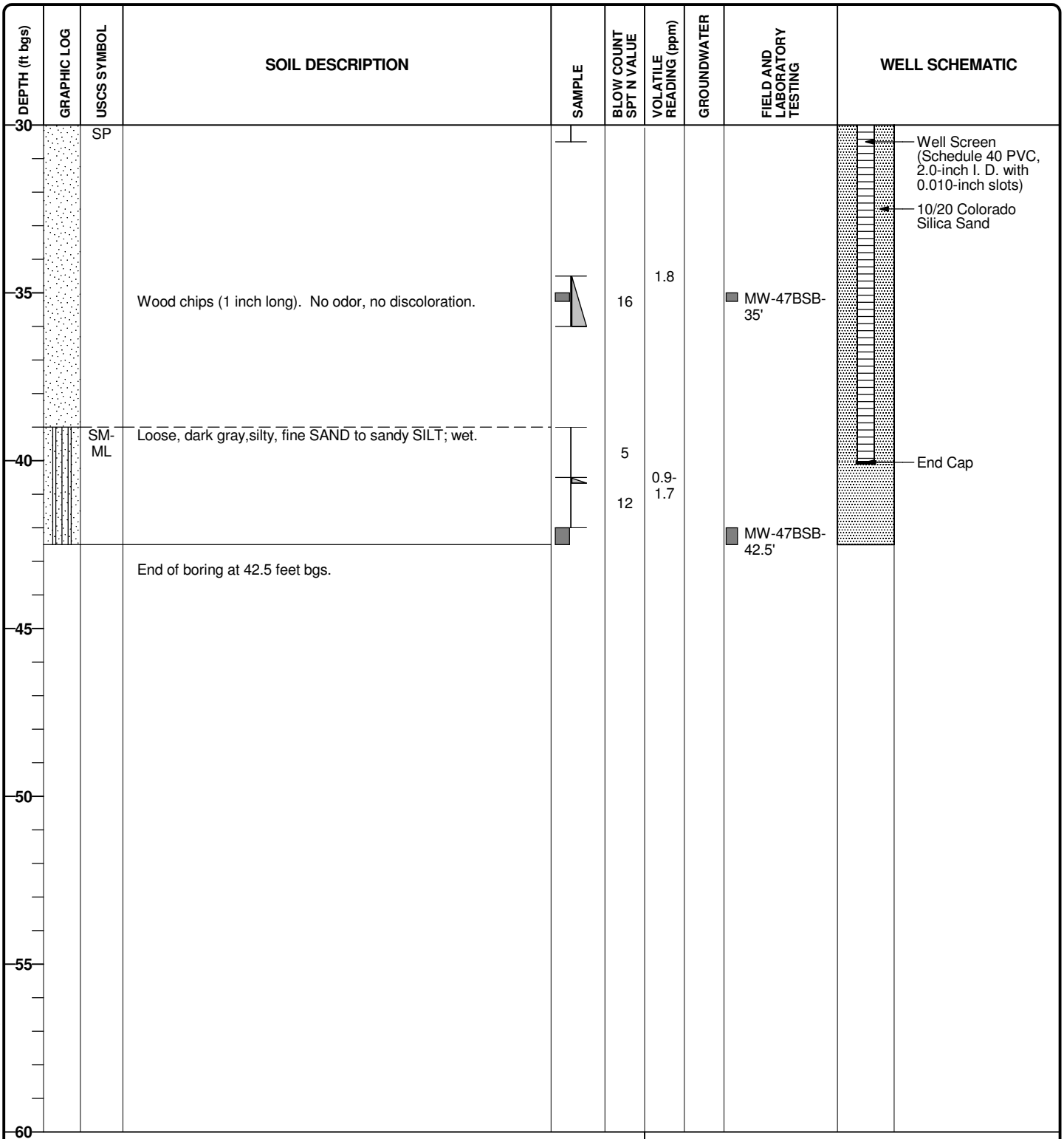
LOG OF BORING MW-47B



BORING METHOD: Hollow Stem Auger
BOREHOLE DIAMETER: 8.0 (in)
DRILL RIG: Hollow Stem Auger
CONTRACTOR: Cascade Drilling
LOGGED BY: A. Speransky

ELEVATION REFERENCE: NA
GROUND SURFACE ELEVATION: NA
CASING ELEVATION: NA
START CARD/TAG ID: NA
DRILLING DATES: 9/19/2011 - 9/19/2011

REMARKS:

ENVR+WELL BORING 9-915-14995L.GPJ AMEC PORTLAND.GDT 12/8/11

8801 Site

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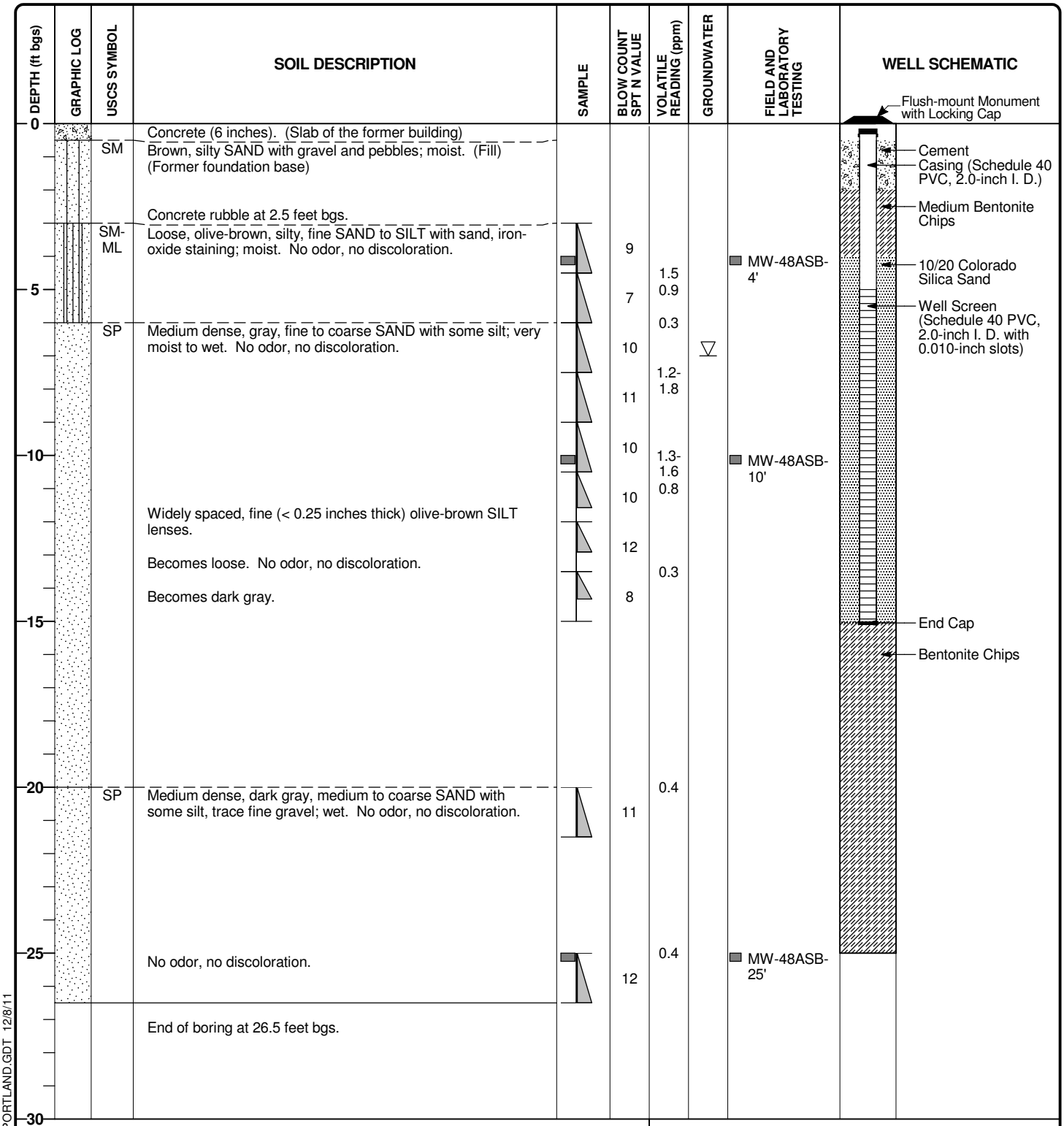
LOG OF BORING MW-47B



BORING METHOD: Hollow Stem Auger
BOREHOLE DIAMETER: 8.0 (in)
DRILL RIG: Hollow Stem Auger
CONTRACTOR: Cascade Drilling
LOGGED BY: A. Speransky

ELEVATION REFERENCE: NA
GROUND SURFACE ELEVATION: NA
CASING ELEVATION: NA
START CARD/TAG ID: /AAF678
DRILLING DATES: 9/15/2011 - 9/15/2011

REMARKS:

ENVR+WELL BORING 9-915-14995L.GPJ AMEC PORTLAND.GDT 12/8/11

8801 Site

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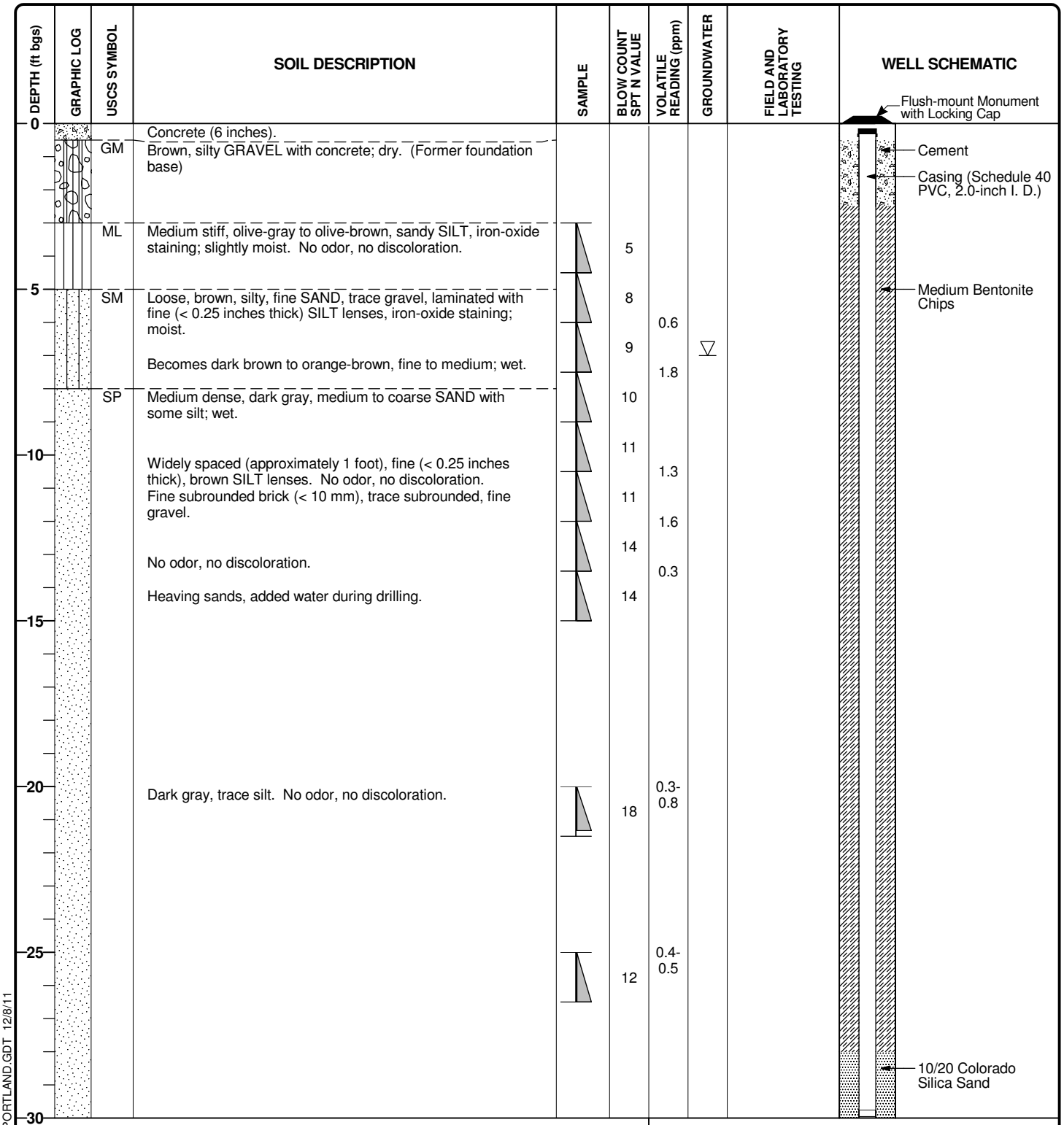
LOG OF BORING MW-48A



BORING METHOD: Hollow Stem Auger
BOREHOLE DIAMETER: 8.0 (in)
DRILL RIG: Hollow Stem Auger
CONTRACTOR: Cascade Drilling
LOGGED BY: A. Speransky

ELEVATION REFERENCE: NA
GROUND SURFACE ELEVATION: NA
CASING ELEVATION: NA
START CARD/TAG ID: /AAF679
DRILLING DATES: 9/15/2011 - 9/15/2011

REMARKS:

ENVR+WELL BORING 9-915-14995L.GPJ AMEC PORTLAND.GDT 12/8/11

8801 Site

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LOG OF BORING MW-48B

DEPTH (ft bgs)	GRAPHIC LOG	USCS SYMBOL	SOIL DESCRIPTION	SAMPLE	BLOW COUNT SPT N VALUE	VOLATILE READING (ppm)	GROUNDWATER	FIELD AND LABORATORY TESTING	WELL SCHEMATIC
30		SP	Becomes fine to medium, silt increases. No odor, no discoloration.		13	1.5-2.1			Well Screen (Schedule 40 PVC, 2.0-inch I. D. with 0.010-inch slots)
									10/20 Colorado Silica Sand
35		ML-SM	Medium dense, dark gray, silty, fine SAND to stiff, sandy SILT; wet. No odor, no discoloration.		16	1.8		MW-48BSB-35'	
40					16	0.8			End Cap
			End of boring at 41.5 feet bgs.						
45									
50									
55									
60									

BORING METHOD: Hollow Stem Auger
BOREHOLE DIAMETER: 8.0 (in)
DRILL RIG: Hollow Stem Auger
CONTRACTOR: Cascade Drilling
LOGGED BY: A. Speransky

ELEVATION REFERENCE: NA
GROUND SURFACE ELEVATION: NA
CASING ELEVATION: NA
START CARD/TAG ID: /AAF679
DRILLING DATES: 9/15/2011 - 9/15/2011

REMARKS:

ENVR+WELL BORING 9-915-14995L.GPJ AMEC PORTLAND.GDT 12/8/11

8801 Site

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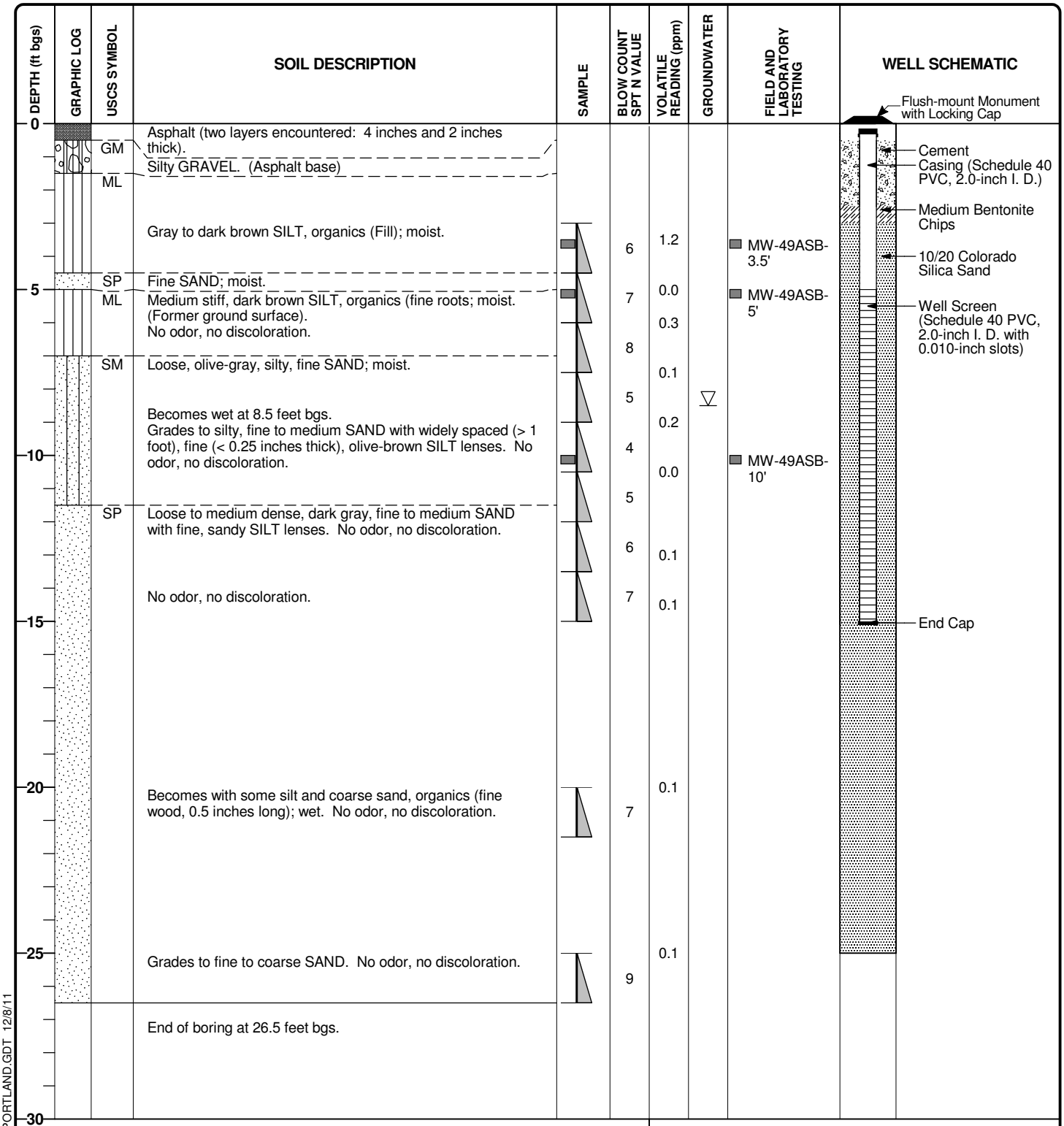
LOG OF BORING MW-48B



BORING METHOD: Hollow Stem Auger
BOREHOLE DIAMETER: 8.0 (in)
DRILL RIG: Hollow Stem Auger
CONTRACTOR: Cascade Drilling
LOGGED BY: A. Speransky

ELEVATION REFERENCE: NA
GROUND SURFACE ELEVATION: NA
CASING ELEVATION: NA
START CARD/TAG ID: NA
DRILLING DATES: 9/19/2011 - 9/19/2011

REMARKS:

ENVR+WELL BORING 9-915-14995L.GPJ AMEC PORTLAND.GDT 12/8/11

8801 Site

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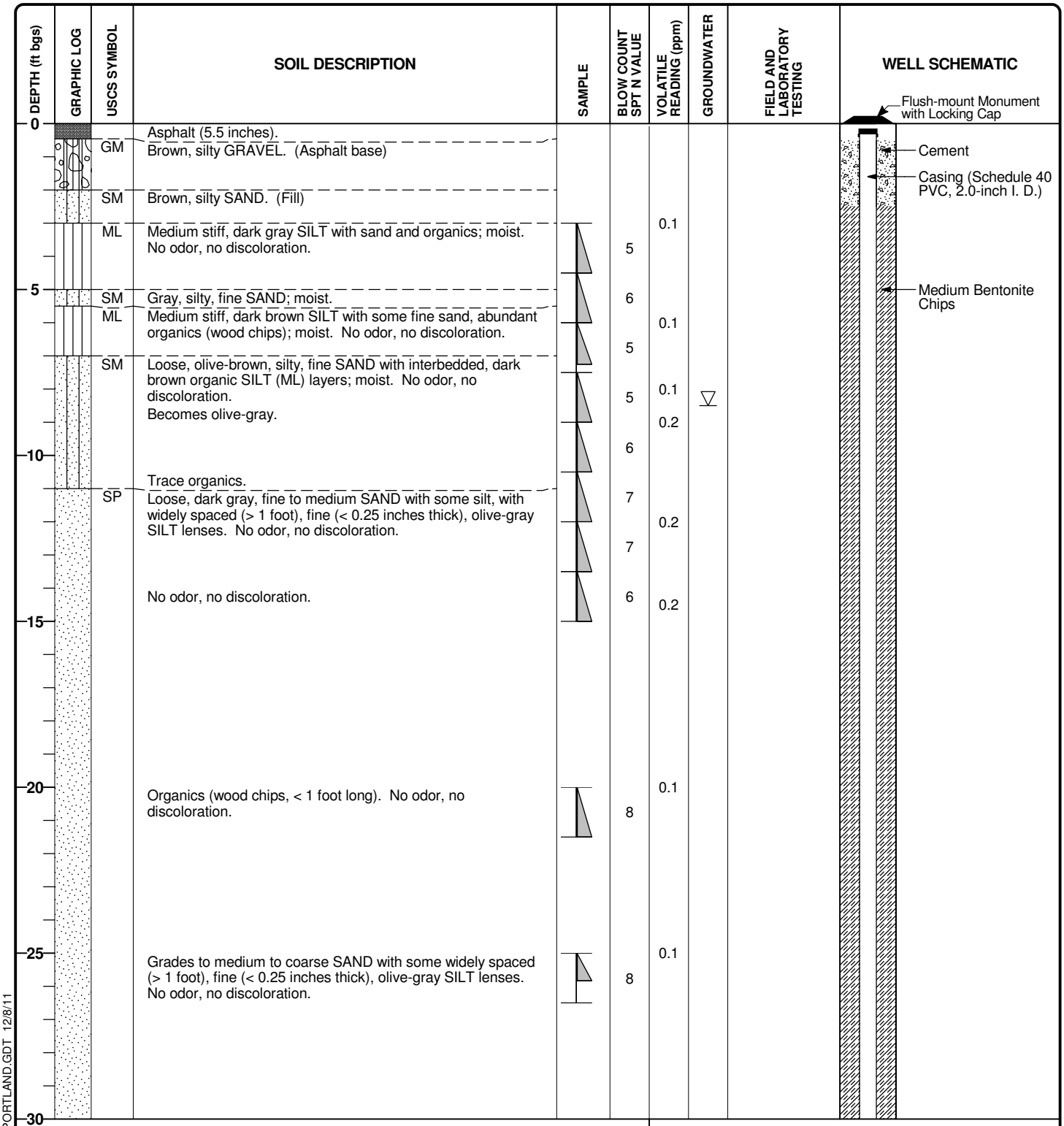
LOG OF BORING MW-49A



BORING METHOD: Hollow Stem Auger
BOREHOLE DIAMETER: 8.0 (in)
DRILL RIG: Hollow Stem Auger
CONTRACTOR: Cascade Drilling
LOGGED BY: A. Speransky

ELEVATION REFERENCE: NA
GROUND SURFACE ELEVATION: NA
CASING ELEVATION: NA
START CARD/TAG ID: /AAF684
DRILLING DATES: 9/16/2011 - 9/16/2011

REMARKS:

ENVR+WELL BORING 9-915-14995L.GPJ AMEC PORTLAND.GDT 12/8/11

8801 Site

9-915-14995L

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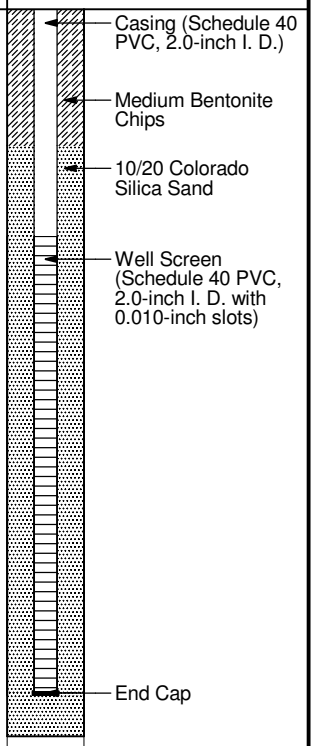
LOG OF BORING MW-49B

DEPTH (ft bgs)	USCS SYMBOL	SOIL DESCRIPTION	BLOW COUNT SPT N VALUE	VOLATILE READING (ppm)	FIELD AND LABORATORY TESTING
30	SP	Becomes medium dense. Heaving sand, added water during drilling. No odor, no discoloration.	11	0.1	
35		Becomes fine to medium SAND with some coarse sand, silt increases. No odor, no discoloration.	16	0.2-3.5	MW-49BSB-35'
40	SM	Medium dense, dark gray, silty, fine to medium SAND with some coarse sand, trace fine organics, micaceous; wet. No odor, no discoloration.	18	0.7-1.0	MW-49BSB-40'
45	ML-SM	Stiff, dark gray SILT to medium dense, silty, fine SAND; wet. No odor, no discoloration.	19	0.7-1.7	MW-49BSB-46'
50		End of boring at 46.5 feet bgs.			
55					
60					

WELL SCHEMATIC



BORING METHOD: Hollow Stem Auger
BOREHOLE DIAMETER: 8.0 (in)
DRILL RIG: Hollow Stem Auger
CONTRACTOR: Cascade Drilling
LOGGED BY: A. Speransky

ELEVATION REFERENCE: NA
GROUND SURFACE ELEVATION: NA
CASING ELEVATION: NA
START CARD/TAG ID: /AAF684
DRILLING DATES: 9/16/2011 - 9/16/2011

REMARKS:

ENVR+WELL BORING 9-915-14995L.GPJ AMEC PORTLAND.GDT 12/8/11

8801 Site

9-915-14995L

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LOG OF BORING MW-49B

ATTACHMENT 3: ANALYTICAL LIMITS OF DETECTION PROJECT REMEDIATION LEVELS - GROUNDWATER

Attachment 3

Analytical Limits of Detection and Project Remediation Levels – Groundwater

Attachment 3: Analytical Limits of Detection - Groundwater

Analyte	CAS	Analytical Resources, Inc. Method	MDL	RL[2]	Project Criteria Remediation Level	Project Criteria Cleanup Level
Metals						
Arsenic (total)	7440-38-2	EPA 200.8	4.70E-03	5.00E-02		8
Copper	7440-50-8	EPA 200.8	7.00E-04	2.00E-03	--	8
Polychlorinated Biphenyls (PCBs)						
PCB - Aroclor 1016	12674-11-2	8082	2.48E-03	1.00E-02	--	0.000007*
PCB - Aroclor 1221	11104-28-2	8082	2.48E-03	1.00E-02	--	0.000007*
PCB - Aroclor 1232	11141-16-5	8082	2.48E-03	1.00E-02	--	0.000007*
PCB - Aroclor 1242	53469-21-9	8082	2.48E-03	1.00E-02	--	0.000007*
PCB - Aroclor 1248	12672-29-6	8082	2.48E-03	1.00E-02	--	0.000007*
PCB - Aroclor 1254	11097-69-1	8082	2.48E-03	1.00E-02	--	0.000007*
PCB - Aroclor 1260	11096-82-5	8082	2.76E-03	1.00E-02	--	0.000007*
Total PCB Congeners	--	1668	2.00E-05	4.89E-05	--	--
Volatile Organic Compounds (VOCs)						
Benzene	71-43-2	8260	3.00E-02	2.00E-01	--	--
1,1-Dichloroethane	75-34-3	8260	5.00E-02	2.00E-01	--	11
1,1-Dichloroethylene	75-35-4	8260	5.00E-02	2.00E-01	--	--
cis-1,2-Dichloroethylene	156-59-2	8260	4.00E-02	2.00E-01	--	--
Ethylbenzene	100-41-4	8260	4.00E-02	2.00E-01	--	--
Tetrachloroethene (PCE)	127-18-4	8260	5.00E-02	2.00E-01		2.9
Toluene	108-88-3	8260	4.00E-02	2.00E-01	--	--
Trichloroethene (TCE)	79-01-6	8260	5.00E-02	2.00E-01	5/1[3]	0.7
Vinyl chloride	75-01-4	8260	6.00E-02	2.00E-01	1/0.5[3]	0.18
m-Xylenes	179601-23-1	8260	5.00E-02	4.00E-01	--	--
m,p-Xylenes	179601-23-1	8260	5.00E-02	4.00E-01	--	--
o-Xylene	136777-61-2	8260	3.00E-02	2.00E-01	--	--
Xylenes, Total	1330-20-7	8260	9.00E-02	6.00E-01	--	--
Carcingenic Polycyclic Aromatic Hydrocarbons (PAHs) and Bis(2-ethylhexyl)phthlate						
Benzo(a)anthracene	56-55-3	8270-SIM	8.00E-04	1.00E-02	--	0.000016*
Benzo(b)fluoranthene	205-99-2	8270-SIM	5.00E-04	1.00E-02	--	0.000016*
Benzo(k)fluoranthene	207-08-9	8270-SIM	3.00E-03	1.00E-02	--	0.000016*
Benzo(a)pyrene	50-32-8	8270-SIM	2.00E-03	1.00E-02	--	0.000016*
Chrysene	218-01-9	8270-SIM	9.00E-04	1.00E-02	--	0.000016*
Dibenz(a,h)anthracene	53-70-3	8270-SIM	1.00E-03	1.00E-02	--	0.000016*
Indeno(1,2,3-cd)pyrene	193-39-5	8270-SIM	1.00E-03	1.00E-02	--	0.000016*
Bis(2-ethylhexyl)phthalate	117-81-7	8270-SIM	2.00E-01	2.00E-01	--	0.046
Total Petroleum Hydrocarbon Compounds						
Gasoline	--	NWTPH-Gx	5.74E+01	2.50E+02	--	1,000
Diesel range organics	--	NWTPH-Dx	2.17E+01	1.00E+02	--	500
Heavy Oil	--	NWTPH-Dx	4.43E+01	2.00E+02	--	500

NOTES:
1 Laboratory reporting limits were compared to the most stringent groundwater preliminary cleanup level (PCUL) for nonpotable groundwater provided by Ecology (June 2018).
2 The RL represents the level of the lowest calibration standard; the RL may not always be achievable.
3 The remediation level for trichloroethylene and vinyl choride is dependent upon the on-site location.
* = based on total value rather than individual value.
Units are in micrograms per liter.
Analytical method selections may be modified to best meet objective of reaching screening levels.

-- = not available; D105CAS = Chemical Abstracts Service; Ecology PCUL = Ecology Preliminary Cleanup Level; MDL = method detection limit; NE = not established; NWTPH = Northwest Total Petroleum Hydrocarbons; RL - reporting limit; SIM = selected ion monitoring

ATTACHMENT 4: ANALYTICAL LIMITS OF DETECTION AND PROJECT REMEDIATION LEVELS – SOIL

Attachment 4

Analytical Limits of Detection – Soil

Attachment 4: Analytical Limits of Detection - Soil

Analyte	CAS	Fremont Analytical Incorporated			Project Criteria	
		Method	MDL	RL[2]	Remediation Level	Cleanup Level
Metals						
Arsenic (total)	7440-38-2	6020	5.00E-04	5.00E+00	14.6	7.3
Barium	7440-39-3	6020	7.00E-05	3.00E-01	--	--
Cadmium	7440-43-9	6020	3.00E-05	2.00E-01	--	5.1
Chromium, total (or III)	7440-47-3	6020	1.00E-04	5.00E-01	--	2,600
Copper	7440-50-8	6020	7.00E-05	2.00E-01	250	36
Lead	7439-92-1	6020	2.00E-04	2.00E+00	--	250
Mercury (elemental)	7439-97-6	7471	5.25E-03	2.50E-02	--	--
Nickel	7440-02-0	6020	3.00E-04	1.00E+00	--	--
Selenium	7782-49-2	6020	5.00E-04	5.00E+00	--	--
Silver	7440-22-4	6020	5.00E-05	3.00E-01	--	--
Zinc	7440-66-6	6020	1.60E-01	1.00E+00	--	--
Dioxins/Furans						
Total Dioxins/Furans TEQ	--	1613	2.33 E-6	1.0 E-6	--	5.20E-06
Polychlorinated Biphenyls (PCBs)						
PCB - Aroclor 1016	12674-11-2	8082	8.00E-03	2.00E-02	0.5	0.0000022*
PCB - Aroclor 1221	11104-28-2	8082	8.00E-03	2.00E-02	0.5	0.0000022*
PCB - Aroclor 1232	11141-16-5	8082	8.00E-03	2.00E-02	0.5	0.0000022*
PCB - Aroclor 1242	53469-21-9	8082	8.00E-03	2.00E-02	0.5	0.0000022*
PCB - Aroclor 1248	12672-29-6	8082	8.00E-03	2.00E-02	0.5	0.0000022*
PCB - Aroclor 1254	11097-69-1	8082	8.00E-03	2.00E-02	0.5	0.0000022*
PCB - Aroclor 1260	11096-82-5	8082	8.00E-03	2.00E-02	0.5	0.0000022*
Volatile Organic Compounds (VOCs)						
Tetrachloroethene (PCE)	127-18-4	8260	2.60E-04	1.00E-03	5	0.0016
Trichloroethene (TCE)	79-01-6	8260	2.10E-04	1.00E-03	5	0.001
Vinyl chloride	75-01-4	8260	2.40E-04	1.00E-03	5	0.001
Polycyclic Aromatic Hydrocarbons						
Benzo(a)anthracene	56-55-3	8270-SIM	7.00E-05	5.00E-04	0.6	0.000016*
Benzo(b)fluoranthene	205-99-2	8270-SIM	7.00E-05	5.00E-04	0.6	0.000016*
Benzo(k)fluoranthene	207-08-9	8270-SIM	1.00E-04	5.00E-04	0.6	0.000016*
Benzo(a)pyrene	50-32-8	8270-SIM	9.00E-05	5.00E-04	0.6	0.000016*
Chrysene	218-01-9	8270-SIM	5.20E-03	2.00E-02	0.6	0.000016*
Dibenz(a,h)anthracene	53-70-3	8270-SIM	1.00E-04	5.00E-04	0.6	0.000016*
Indeno(1,2,3-cd)pyrene	193-39-5	8270-SIM	9.00E-05	5.00E-04	0.6	0.000016*
Total Petroleum Hydrocarbon						
Gasoline	--	NWTPH-Gx	2.50E+00	5.00E+00	--	250
Diesel range organics	--	NWTPH-Dx	2.50E+01	5.00E+01	--	--
Heavy Oil	--	NWTPH-Dx	5.00E+01	1.00E+02	4,000	2,000

NOTES:

1 Laboratory reporting limits were compared to the most stringent soil preliminary cleanup level (PCUL) for nonpotable groundwater provided by Ecology (June 2018).

2 The RL represents the level of the lowest calibration standard; the RL may not always be achievable.

Units are in milligrams per kilogram

Analytical method selections may be modified to best meet objective of reaching screening levels. Preperation methods are not included.

* = based on total value rather than individual value.

-- = not available; CAS = Chemical Abstracts Service; Ecology PCUL = Ecology Preliminary Cleanup Level; MDL = method detection limit; NE = not established; NWTPH = Northwest Total Petroleum Hydrocarbons; RL = reporting level; SIM = selected ion monitoring

ATTACHMENT 5: SAMPLE CONTAINERS, PRESERVATIVES, AND HOLDING TIMES

Attachment 5

Sample Containers, Preservatives, and Holding Times

Attachment 5: Sample Containers, Preservatives, and Holding Times

Method	Analysis	Container[a] Type	Size	Preservation	Holding Time
Soil Samples					
EPA 8082	PCB aroclors	Glass	8 oz.	Cool 0 - 6°C	Unlimited
EPA 2020	Metals[b]	Glass	4 oz.	Cool 0 - 6°C	180 days
EPA 7471	Mercury	Glass	4 oz.	Cool 0 - 6°C	28 days
EPA 8270	SVOCs	Glass	8 oz.	Cool 0 - 6°C	14 days
EPA 8260	VOCs	Glass	8 oz./3 x 40 ml	MeOH(1); NaHSO4(2), Cool 0 - 6°C	14 days
NWTPH-G	TPH - Gasoline	Glass	8 oz./2 x 40 ml	MeOH, Cool 0 - 6°C	14 days
NWTPH-Dx	TPH - Diesel and Residual Range	Glass	8 oz.	Cool 0 - 6°C	14 days
EPA 1613	Dioxin/furan	Glass	4 oz.	Cool 0 - 6°C	365 days
Groundwater Samples					
EPA 200.8	Total Metals[b]	HDPE	500 mL	HNO3, Cool 0 - 6°C	180 days
EPA 7470	Total Mercury	HDPE	500 mL	HNO3, Cool 0 - 6°C	28 days
EPA 200.8	Dissolved Metals[b]	HDPE	500 mL	HNO3, Cool 0 - 6°C	180 days
EPA 7470	Dissolved Mercury	HDPE	500 mL	HNO3, Cool 0 - 6°C	28 days
EPA 8082	PCB aroclors	Amber Glass	2 x 500 mL	Cool 0 - 6°C	7 days
EPA 1668	PCB congeners	Amber Glass	2 x 500 mL	Cool 0 - 6°C	365 days
EPA 8260	VOCs	Glass Vial	3 x 40 mL	HCL, Cool 0 - 6°C	14 days
EPA 8270	SVOCs/PAHs	Amber Glass	2 x 500 mL	Cool 0 - 6°C	7 days
NWTPH-G	TPH - Gasoline	Glass Vial	2 x 40 mL	HCL, Cool 0 - 6°C	14 days
NWTPH-Dx	TPH - Diesel and Residual Range	Amber Glass	2 x 500 mL	Cool 0 - 6°C	7 days
EPA 300.0	Nitrate, nitrite, sulfate	Glass	250 mL	Cool 0 - 6°C	24 hours
EPA SM4500	Sulfite	Glass	250 mL	EDTA, Cool 0 - 6°C	6 hours
EPA SM3500	Ferrous iron	Amber Glass	250 mL	HCL, Cool 0 - 6°C	24 hours
EPA 200.8	Manganese ion	HDPE	500 mL	HNO3, Cool 0 - 6°C	180 days
RSK-175	Methane	Glass Vial	2 x 40 mL	Cool 0 - 6°C	7 days
Soil Vapor Samples					
EPA TO-15	Volitile organic compounds*	Summa Canister	1 x 6 liter	None	30 days

NOTES:

* Analysis includes tetrachloroethene, trichloroethene, 1,1-dichloroethene, cis-1,2-dichloroethene, and vinyl chloride

a The size and number of containers may be modified by the analytical laboratories.

b Metals include arsenic, barium, cadmium, chromium, copper, lead, nickel, selenium, silver, and zinc.

c Dissolved metals collected in unpreserved bottles. Upon receipt at lab, samples to be filtered and preserved.

°C = degrees Celsius; Dx = diesel-extended; EDTA = ethylenediaminetetraacetic acid; EPA = U.S. Environmental Protection Agency; G = gasoline; HCL = hydrochloric acid; HDPE = high density polyethylene; HNO3 = nitric acid; MeOH = methanol; mL = milliliters; NAHSO4 = sodium bisulfate; NaOH = sodium hydroxide; NWTPH = Northwest Total Petroleum Hydrocarbons; oz. = ounce; PAH = polycyclic aromatic hydrocarbons; PCB = polychlorinated biphenyls; SVOCs = semi-volatile organic compounds; TPH = total petroleum hydrocarbons; VOCs = volatile organic compounds

PREPARED FOR:
PACCAR Inc

BY:
Shannon & Wilson
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HEALTH AND SAFETY PLAN

Compliance Monitoring Plan

8801 East Marginal Way S., Tukwila, Washington
Agreed Order No. 6069

SHANNON & WILSON

March 15, 2021

Shannon & Wilson No: 21-1-12567-031

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HEALTH AND SAFETY PLAN
SITE HEALTH AND SAFETY PLAN ACKNOWLEDGEMENT

Shannon & Wilson

I understand and agree to abide by the provisions as detailed in the Shannon & Wilson's Health and Safety Plan detailed in this document. Failure to comply with these provisions may lead to disciplinary action, which may include dismissal from the work site and termination of employment.

We, the undersigned, have reviewed this plan, are familiar with its contents, and agree to abide by all the provisions herein:

_____	_____
Signature	Date
_____	_____
Signature	Date
_____	_____
Signature	Date
_____	_____
Signature	Date
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Signature	Date

ACRONYMS

CFR	Code of Federal Regulations
CMP	Compliance Monitoring Plan
CRZ	Contamination Reduction Zone
dBA	decibels
DOSH	Washington State Department of Occupational Safety and Health
EZ	Exclusion Zone
HASP	Health and Safety Plan
HRI	Heat-Related Illness
IDW	investigation-derived waste
LNAPL	light nonaqueous phase liquid
mg/m^3	milligrams per meter cubed
OSHA	Occupational Safety and Health Administration
PCB	polychlorinated biphenyl
PID	photoionization detector
PM	Project Manager
PPE	personal protective equipment
ppm	parts per million
SSO	Site Safety Officer
SZ	Support Zone
the Site	8801 East Marginal Way South, Tukwila, Washington
VOCs	volatile organic compounds
WAC	Washington Administrative Code

HEALTH AND SAFETY CONTACT INFORMATION

SITE LOCATION:	8801 East Marginal Way South Tukwila, WA
PROJECT MANAGER:	Meg Strong, Shannon & Wilson (206) 695-6787 (office) (425) 864-2096 (mobile)
HEALTH AND SAFETY MANAGER:	Neal McCulloch, Shannon & Wilson (206) 695-6789 (office) (206) 799-2068 (mobile)
SITE SAFETY OFFICER:	Christian Canfield, Shannon & Wilson (206) 695-6716 (office) (206) 714-7637 (mobile)
FACILITY REPRESENTATIVE:	Bridget Fisher (213) 330-6287 (mobile)
NEAREST WALK-IN CLINIC:	U.S. HealthWorks 3223 1st Avenue South, Seattle, WA (206) 624-3651
NEAREST HOSPITAL:	Harborview Medical Center 325 9th Avenue, Seattle, WA (206) 744-3000

1 INTRODUCTION

This Health and Safety Plan (HASP) has been prepared to address health and safety considerations for the proposed activities outlined within the Compliance Monitoring Plan (CMP). This HASP and a Sampling and Analysis Plan are included as appendices to the CMP.

This HASP addresses the conduct of Shannon & Wilson's employees. Contractors procured by Shannon & Wilson for the project will provide their own HASP, which will be reviewed by us for compliance with site requirements.

The proposed activities are to be conducted at the facility located at 8801 East Marginal Way South, Tukwila, Washington (the Site). A Site Map is provided as Attachment A. The site is owned and operated by CenterPoint. The activities are being completed on behalf of PACCAR Inc.

2 SCOPE OF WORK

The scope of work, as outlined in the CMP, consists of remedial excavations, well decommissioning, well installation, groundwater sampling, remedial injections, and sub-slab vapor sampling.

This HASP will cover activities outlined within the CMP. This HASP will be revised to address the specific health and safety concerns related to activities outside the scope of work. Such work cannot be initiated until a revised HASP has been updated and approved.

3 SITE CHARACTERISTICS

The upland portion of the 8801 site occupies 24.30 acres on the east bank of the Lower Duwamish Waterway and is relatively flat, with a ground surface elevation of approximately 20 feet above mean sea level.

CenterPoint plans to redevelop the property. The redevelopment is slated for late 2019 through 2021. The redevelopment plans include demolition of the existing buildings except the smaller warehouse on the west end of the 8801 property which houses the aboveground infrastructure for the existing air sparging/soil vapor extraction system. Redevelopment plans include construction of an approximately 414,400-square-foot building for industrial use and trailer storage. The design of the building includes importing fill to raise the floor level approximately 4 feet above existing grade to allow direct truck loading.

4 PERSONNEL ASSIGNMENTS

4.1 Project Manager (PM)

The PM is responsible for the overall management of the project, including safety, quality, and production. He/She is responsible to schedule, review, certify, and manage all submittals, including those of subcontractors, fabricators, suppliers, and purchasing agents, with attention to safety and health aspects of performance and procurement. The PM oversees the environmental/industrial hygiene and atmospheric testing performed by field personnel and outside testing laboratories. The PM has full authority to stop work due to health and safety deficiencies.

4.2 Site Safety Officer (SSO)

The SSO will be responsible for implementation of the HASP during all investigation activities. The SSO will ensure that field teams utilize all safety practices, and that during emergency situations, appropriate procedures are immediately and effectively initiated. He/She will also be responsible for the control of specific field operations and all related activities such as personnel decontamination, monitoring of worker heat or cold stress, distribution of safety equipment, and conformance with all other procedures established by the HASP. The SSO has full stop-work authority due to safety and health deficiencies. The SSO's primary responsibility is to provide the appropriate monitoring to ensure the safe conduct of field operations.

4.3 Field Team Members

The field team members (field personnel) are responsible for conducting their assigned work duties in a safe and healthy manner and following the procedures established in the site-specific HASP. Field personnel have full authority to stop work due to safety and health deficiencies.

5 TRAINING REQUIREMENTS

All personnel conducting site work involving intrusive activities where the potential exists for exposure to contaminated soils or groundwater (drilling, sampling, excavation, etc.) shall have completed 40 hours of classroom-style health and safety training and three days of on-site training, as required by the Occupational Safety and Health Administration (OSHA) 29 Code of Federal Regulations (CFR) 1910.120 and Washington Administrative Code (WAC) 296-843.

All supervisory personnel, including the Health and Safety Manager, will have received an additional eight hours of training as required for management of personnel and activities associated with hazardous waste site activities covering at a minimum the following topics: the employer's health and safety program, personal protective equipment (PPE) program, spill containment program, and health hazard monitoring procedures and techniques. Employees will also receive a minimum of eight hours' refresher training annually. Copies of current training certificates will be maintained in the Shannon & Wilson Corporate office.

5.1 Site-Specific Training

All on-site personnel will complete a site-specific initial training session or briefing, conducted by the SSO, prior to commencement of the project and/or entering the site. The training session should be of sufficient duration to ensure that they are familiar with site-specific hazards, protective equipment, site control, decontamination, emergency procedures, and security procedures. Elements to be covered as part of the site-specific training include:

- Personnel responsibilities;
- Site hazards and controls;
- Use of PPE;
- Action levels for upgrading/downgrading levels of PPE;
- Work practices by which the employee can minimize risks from hazards;
- Safe use of engineering controls and equipment on site;
- Medical surveillance requirements, including recognition of symptoms and signs that might indicate overexposure to hazards;
- Site-specific hazardous procedures (i.e., intrusive activities, etc.);
- Emergency information, including local emergency response team phone numbers, route to nearest hospital, and emergency response procedures; and
- Content and implementation of the HASP.

All training will be documented as to the contents of the training and personnel in attendance and kept in the project files.

5.2 Daily Safety Meeting

In addition to the initial site briefing conducted at the commencement of the project, supplemental brief safety meetings shall be conducted by the SSO to discuss potential health and safety hazards associated with upcoming tasks, and necessary precautions to be taken.

Daily safety meetings will be completed prior to the beginning of each day's work and documented on a Daily Safety Meeting Log, provided as Attachment B.

5.3 Visitor Training

All visitors to the site will be required to check in with the PM/SSO. Depending on the purpose of their visit, the visitors will receive an orientation briefing from the PM/SSO, which will include site-specific hazards, ways to protect themselves from these hazards, locations of first aid and emergency equipment, and the emergency response procedures.

6 MEDICAL SURVEILLANCE

All field personnel must meet the medical monitoring requirements of 29 CFR 1910.120. The regulations require that employers implement a medical monitoring program consistent with paragraph (f) of this standard, which states that a medical examination will be completed for each employee prior to employment, annually thereafter (minimum), and as a follow-up to injuries or overexposures, and upon termination of their employment with the company. Employees who must receive medical examinations include those who wear a respirator for 30 or more days a year, and those who are or may be exposed to hazardous substances at or above permissible exposure levels, regardless of respirator use, for 30 days or more a year.

Any personnel injured or suspected of being injured as a result of an uncontrolled release of a hazardous substance or energy, or other emergency situation, will be given a medical evaluation as soon as possible thereafter.

Shannon & Wilson's employee medical records are available upon request from the Human Resources Manager, with the employee's permission. The SSO will confirm medical certification to work and wear respiratory protection and keep a copy of the certification (containing certifying physician's signature) in the personnel files in the Seattle office. Physical examination forms shall be released only with the individual employee's approval.

7 HAZARD ASSESSMENT AND RISK ANALYSIS

A summary of the activity hazard analysis is provided as Exhibit 7-1.

Exhibit 7-1: Activity Hazard Analyses

	Activity	Potential Hazards	Recommended Controls
1.	Driving to, on, and from the site	Vehicle breakdown/flat tire Getting lost Rough terrain Accident Severe weather	Equip vehicle with emergency supplies/spare tire. Have a map with directions to the site. Wear appropriate clothing for the weather. Wear seat belts at all times while vehicle is in motion Only licensed drivers allowed to operate vehicles. Obey all traffic rules. Do not drive over large holes, rocks, or down steep embankments. Avoid driving in severe weather, if possible. If not, reduce speed and turn on headlights.
2.	Site reconnaissance	Severe weather Slips, trips, and falls Contact with dead animals Bites from snakes or insects	Wear appropriate clothing for the weather. Avoid site reconnaissance during severe weather conditions. Stop work if potential for thunderstorms or winter storms. Be aware of surroundings and use caution when moving around the site. Stay away from snake or insect breeding habitats. Wear proper PPE and insect repellant. Stay away from animal carcasses unless wearing proper PPE. Use proper hygiene.
3.	Vegetation clearing	Contact with rotating machinery and sharp blades from scythe Contact with potentially contaminated soil Noise Fires and/or explosions Electrical hazards Trips and falls	Personnel should not wear rings, loose-fitting clothes, straps, draw strings, etc. Safety guard for “weed-eater” should be in place. Emergency shut-off should be inspected daily to ensure proper functioning. Site personnel must wear appropriate PPE, including heavy gloves and safety glasses to protect from blackberries. Hearing protection must be used. Fuel will be stored in approved containers. A 2A10BC fire extinguisher must be in the vehicle. A first aid kit must be at the site. Wear appropriate clothing for the weather. Stop work if potential for thunderstorms or winter storms. Be aware of surroundings and use caution when moving around the site. Site personnel will exercise care when working next to a hill slope.
4.	Collect surface and subsurface soil samples	Contact with potentially contaminated soil Inhalation of volatile gases Bites from insects Contact with dead animals Severe weather Back injury	Wear appropriate PPE, including nitrile gloves, work clothes, and safety glasses. Conduct air monitoring and remain upwind whenever possible. Wear appropriate clothing for the weather. Stop work if potential for thunderstorms or winter storms. Be aware of surroundings and use caution when moving around the site. Stay away from snake or insect breeding habitats. Wear proper PPE and insect repellant. Stay away from animal carcasses unless wearing proper PPE. Use proper hygiene. Use proper lifting techniques or request assistance.

	Activity	Potential Hazards	Recommended Controls
5.	Collect water samples	Contact with potentially contaminated water Inhalation of volatile gases Bites from insects Contact with dead animals Severe weather Potential fire or explosion hazards	Wear appropriate PPE, including nitrile gloves, work clothes, and safety glasses. Conduct air monitoring and remain upwind whenever possible. Wear appropriate clothing for the weather. Stop work if potential for thunderstorms or winter storms. Be aware of surroundings and use caution when moving around the site. Stay away from snake or insect breeding habitats. Wear proper PPE and insect repellant. Stay away from animal carcasses unless wearing proper PPE. Use proper hygiene. When using the generator, do not stage it in an area of dry vegetation or if elevated PID measurements are being detected.
6.	Decontaminate equipment	Contact with potentially contaminated decontamination solutions	Wear appropriate PPE, including nitrile gloves, work clothes, and safety glasses.
7.	Field screening of samples	Contact with potentially contaminated soil or sediment	Wear appropriate PPE, including nitrile gloves, work clothes, and safety glasses.
8.	Sample packaging	Back strain	When possible, two people will handle heavy sample coolers, or multiple coolers containing fewer sample containers will be used.
9.	Handle investigation-derived waste drums	Back strain	Use proper drum handling procedures and equipment.
10.	Mobilize drill rig	General health and safety Trips and falls Contact with equipment Traffic control zones	Ensure that subcontractor employees have been informed of the contents of the site-specific Health and Safety Plan. Communicate drilling hazards to all field personnel. Assure that qualified drillers are operating rig. Assure that drillers have a written rig inspection program. Assure that drillers have another required written program. Provide adequate storage for tools, augers, pipe, etc. Keep platforms free of tools, debris, and slick substances such as mud and grease. Drillers must not climb the mast/derrick unless they wear fall protection. Keep clear from the rear and sides of the rig or equipment (except drillers). Lower and level the jack pods before raising the mast/derrick. Lock the mast/derrick into place before drilling. Make sure traffic control zones are established and personnel are aware of perimeter distances.

Activity	Potential Hazards	Recommended Controls
11. Perform drilling operations	Contact with rotating machinery, cables, pulleys, etc. Contact with potentially contaminated soil, groundwater, or free product Noise Fires and/or explosions Electrical hazards Trips and falls	Drillers should not wear rings, loose-fitting clothes, straps, draw strings, etc. Broken, cut, or frayed wires on the rig should be replaced. Pulleys must operate freely, and cable guards must be in place. Pulleys will be proper size for cable diameter. Emergency shut-off should be inspected daily to ensure proper functioning. Site personnel must wear appropriate PPE, including nitrile gloves and safety glasses. Monitor breathing and perimeter zones with a PID. Remain upwind of activities. Hearing protection must be used. Fuel will be stored in approved containers. A 2A10BC fire extinguisher must be on the rig. A first aid kit must be at the site. All utilities must be located prior to drilling operations. In the event of an electrical storm, drilling operations must be shut down and workers must move to a safe location. Mast/derrick must be kept a minimum of 15 feet from overhead power lines at all times. Borings will be placed a minimum of 2 feet from hill slope. Site personnel will exercise care when working next to a hill slope.

NOTE:
PID = photoionization detector

Hazards associated with this HASP can be grouped into three main categories: (a) chemical, (b) physical, and (c) biological.

7.1 Chemical Hazards

Chemical hazards identified for the subject property in air may include the following:

- Metals,
- Petroleum hydrocarbons,
- Volatile organic compounds (VOCs),
- Semi-VOCs, and
- Polychlorinated biphenyls (PCBs).

The primary routes of exposure for these contaminants are the inhalation of vapors, gases, or particulate; inhalation of contaminated soil particulate; direct skin contact with contaminated media; or the accidental ingestion of contaminated soil or water. Use of proper PPE, awareness, and air monitoring, when necessary, will reduce the potential for

exposure. Periodic evaluation of the hazards associated with different work tasks and the determination for any changes will be made by the SSO, with concurrence from the PM.

An assessment of the chemical hazards as well as a discussion of symptoms are provided in Exhibit 7-2. Safety Data Sheets are provided in Attachment C. Air monitoring and respiratory protection are discussed within Section 9.1.

Exhibit 7-2: Chemical Hazards Assessment

Chemical Hazard	TLV/PEL	Route of Exposure	Signs and Symptoms
Petroleum Hydrocarbons (based on gasoline)	PEL-TWA = 300 ppm STEL = 500 ppm	Eye, Skin, Inhalation, Ingestion	Irritated eyes, skin, and mucous membranes; dermatitis; headache, fainting, blurred vision, dizziness, slurred speech, confusion, and convulsions; chemical pneumonia (aspiration); possible liver, kidney damage; carcinogen.
Polychlorinated Biphenyls	TLV = 0.5 mg/m^3 (skin) STEL = 5 mg/m^3	Inhalation, Skin, Ingestion, Eye	Skin and eye irritation on contact. Chloracne. Liver damage. Possible carcinogen. Headaches or numbness may occur if ingested.
Heavy Metals	TLV varies depending on the metal present	Skin, Ingestion, Eye	Skin and eye irritation, dermatitis, headache, and nausea. Ingestion can result in liver or kidney damage.
Volatile Organic Compounds (VOCs)	TLV varies depending on the VOC present	Inhalation, Skin, Ingestion, Eye	Irritated eyes, skin, nose, respiratory system; narcosis, headache, nausea, staggered gait, fatigue; anorexia; anesthesia, central nervous system depression, dermatitis; some may be carcinogens.
Polynuclear Aromatic Hydrocarbons (PAHs)	TLV varies depending on the PAH present	Skin, Ingestion, Eye	Irritated eyes, skin, upper respiratory, mucous membranes; dermatitis, headache, bronchitis, hyper pigmentation of skin; possible liver, kidney damage; some may be carcinogens.

NOTES:

mg/m^3= milligrams per meter cubed; PEL = permissible exposure limit; ppm = parts per million (milligrams per liter [mg/L]); STEL = 15-minute short-term exposure; TLV = threshold limit value; TWA = time-weighted average

7.2 Physical Hazards

Risk of exposure to physical hazards varies from task to task and often with the time of the year. Shannon & Wilson has developed a series of standard operating procedures for these

physical hazards, which are provided within the Corporate HASP. Additional site hazard controls are discussed in Section 9.1.6. Field personnel shall follow these procedures while performing their specific work tasks. Exhibit 7-3 contains a summary of potential effects from physical hazards.

Exhibit 7-3: Physical Hazards and Effects

Physical Hazard	Effect
Noise	Hearing loss/disruption of communication
Rain/Humidity/Cold/Ice/Snow/ Lightning/Wind/Flood	Slips and falls/vehicle accident risk increase/instruments malfunction/electrocution/falling objects
Electrical	Electrical units used in wet environments
Ambient Heat	Heat rash/cramps/exhaustion/heatstroke
Cold	Hypothermia/frostbite
Heavy/Manual Lifting	Back strain/abdomen/arm/leg muscle/joint injury
Rough Terrain	Vehicle accidents/slips/trips/falls
Unsafe Structures	Electrical buildings where polychlorinated biphenyl-containing equipment may have been located
Debris and Building Materials	Slips/trips/falls/punctures/cuts/fires/biological hazards
Biological Hazards	Insects, bears, cougars, poisonous plants
Traffic	Struck by vehicle/collision
Fire or Explosion Hazard	Burns
Materials Handling	Back injury/crushing from load shifts

The physical hazards identified at this site include the following:

7.2.1 Vehicular Traffic

All vehicular traffic routes that could impact worker safety must be identified and the locations communicated to field personnel. Whenever necessary, barriers or other methods must be established to prevent injury from moving vehicles. OSHA requirements for working in or around vehicular traffic must be communicated to and followed by all personnel. Safe practices for working within facilities with heavy vehicular traffic are discussed in more detail within Section 9.1.8.

7.2.2 Slips, Trips, and Falls

Slips, trips, and falls are of concern while working, especially in wet conditions. Personnel must be aware of their surroundings while moving about the site. Pathways and work areas must be kept free of debris and supplies to prevent unsafe walking and working conditions. Changes in elevation such as ruts, holes, broken pavement, or berms should be

pointed out to all field personnel. If possible, potential slip, trip, and fall areas should be marked with bright flagging or a similar type of marker.

When water is used during any of the work tasks, care must be taken to avoid creating muddy or slippery conditions. If slippery conditions are unavoidable, barriers and warning signs must be used to warn of these dangers. Additional strategies to minimize the occurrence of slips, trips, and falls are provided in Section 9.1.9.

7.2.3 Mechanical and Heavy Equipment Operations

Extreme caution must be taken by all personnel working around mechanical equipment, pumps, and heavy equipment such as an excavator or drill rig. Only authorized personnel should be allowed in the vicinity of such equipment. All personnel must avoid standing within the turning radius of the equipment or below any suspended load. Loose clothing, jewelry, long hair, or other items that have the potential to come in contact with rotating/operating equipment are prohibited. Job sites must be kept as clean and orderly as possible to prevent unsafe walking and working conditions.

When water is used, care must be taken to avoid creating muddy or slippery conditions. If slippery conditions are unavoidable, barriers and warning signs must be used to warn personnel of these dangers.

All equipment must be maintained in good working order and be operated in a safe manner. Heavy equipment must have audible back-up alarms, rollover protection, seatbelts, and be equipped with a fire extinguisher. Shannon & Wilson personnel shall not work near equipment they judge to be unsafe due to deterioration, missing parts, obvious defects, or improper operation.

7.2.4 Electrical Hazards

OSHA regulations require that employees who may be exposed to or required to work near electrical equipment be trained to recognize the associated hazards and use the appropriate control methods. Field personnel that will be required to perform such tasks will be properly trained in accordance with OSHA regulations prior to performing their tasks.

In addition, the following guidelines will be followed by all personnel while they are on site. All extension cords used for portable tools or other equipment must be designated for hard or extra usage and be three-wire pronged. All 120-volt, single-phase 15- and 20-ampere receptacle outlets located in areas of moisture or where water contact may occur must be equipped with a ground-fault circuit interrupter. Temporary lighting lamps for general

illumination must be protected from accidental breakage and metal case sockets must be grounded.

7.2.5 Heat Stress

Heat stress at work can cause physical discomfort, loss of efficiency and attention to safety, and personal injury. Age, weight, degree of physical fitness, degree of acclimatization, metabolism, use of alcohol or drugs, and a variety of medical conditions such as hypertension all affect a person's sensitivity to heat. The type of clothing worn must be considered. Prior heat injury predisposes an individual to additional injury.

The fluid loss and dehydration resulting from physical activity puts outdoor laborers at particular risk. Certain medications predispose individuals to heat stress, such as drugs that alter sweat production (antihistamines, anti-psychotics, antidepressants) or interfere with the body's ability to regulate temperature. Persons with heart or circulatory diseases or those who are on low-salt diets should consult with their physicians prior to working in hot environments.

It is difficult to predict just who will be affected and when, because individual susceptibility varies. In addition, environmental factors include more than the ambient air temperature. Radiant heat, air movement, conduction, and relative humidity all affect an individual's response to heat.

All personnel must be instructed on the symptoms of the primary heat-related disorders and how to minimize their chances of becoming affected by them. These disorders, their symptoms, and first-aid measures are briefly outlined below:

- Fainting (Heat Syncope): Victims usually recover quickly after a brief period of lying down. Moving around, rather than standing still, will usually reduce the possibility of fainting.
- Heat Rash: Decreased ability to tolerate heat, raised red vesicle on affected areas, and clothes that chafe. Maintain good personal hygiene and use drying powders or lotions.
- Heat Cramps: Muscle spasms and pain in the extremities and abdomen. Rest in cool area and drink plenty of fluids. If pain persists, seek medical attention.
- Heat Exhaustion: Shallow breathing; pale, cool, moist, clammy skin; profuse sweating; dizziness; lassitude; and fainting. Rest in a cool area and drink plenty of fluids. Get medical attention prior to returning to work.
- Heat Stroke: Red, hot, dry skin; no perspiration; nausea; dizziness; confusion; strong rapid pulse; coma. Cool victim immediately with cool or cold water. Seek immediate medical attention.

At a minimum, personnel wearing non-breathable clothing at temperatures greater than 70 degrees Fahrenheit (F) should take a break every one to two hours and drink plenty of fluids. The intake of an average of one quart of fluids per hour is recommended. A cool or shaded rest area should be provided. Detailed operating procedures and guidelines to prevent heat-related disorders are provided in Section 9.1.10 of this plan.

7.2.6 Cold Stress

Field personnel will be instructed on the signs and symptoms and the prevention of cold-related disorders prior to performing specific work tasks. The two major effects of cold stress are frostbite and hypothermia. These disorders, their symptoms, and first-aid measures are outlined briefly below:

- Frostnip: Occurs when the face or extremities are exposed to a cold wind, causing the skin to turn white. Frostnip is considered a minor condition with no permanent damage, as long as the human tissue is warmed up in time. If not, the condition can progress to frostbite.
- Frostbite: Sudden blanching of the skin progressing to skin with a waxy or white appearance that is firm to the touch, but the tissue beneath the skin is resilient to the touch.
- Hypothermia: The symptoms of systematic hypothermia are exhibited as follows: (a) shivering; (b) apathy, listlessness, and (sometimes) rapid cooling of the body to less than 90 degrees F; (c) unconsciousness, glassy stare, slow pulse, and slow respiratory rate; (d) freezing of the extremities; and (e) death.
- Trench Foot: Swelling of the foot caused by long continuous exposure to cold without freezing, combined with persistent dampness or immersion in water. Edema (swelling), tingling, itching, and severe pain occurs, followed by blistering, necrotic tissue, and ulcerations.
- Chilblains: Similar symptoms as trench foot, except that other areas of the body are impacted. The cold exposure damages capillary beds in the skin, which in turn can cause redness, itching, blisters, and inflammation.
- Raynaud's Phenomenon: The abnormal constriction of the blood vessels of the finger on exposure to cold temperatures, resulting in blanching of the fingertips. Numbness, itching, tingling, or a burning sensation may occur during related attacks. The disease is also associated with the use of vibrating hand tools in a condition sometimes called White Finger Disease. Persistent cold sensitivity, ulceration, and amputations can occur in severe cases.

Personnel will monitor themselves and other team members for signs of cold stress. If temperatures fall below 20 degrees F, as measured by the wind chill index, thermal clothing may be required. Field activities will be curtailed if equivalent wind chill temperatures are

less than zero degrees F unless operations are of an emergency nature. Section 9.1.11 of this plan provides detailed operating procedures and guidelines for working in cold temperature extremes.

7.2.7 Noise

Heavy equipment or operating machinery may produce noise levels that exceed 85 decibels (dBA) scale for personnel working in or around these areas. Thus, hearing protection must be worn by personnel exposed to noise levels of 85 dBA or greater. Noise measurements, if conducted, should be performed with sound level meters in slow response mode, or with noise dosimeters having a beginning collection point established at 80 dBA. A general guideline to follow is if a conversation cannot be held with a person 4 feet from you without raising your voice, the noise levels are too high and hearing protection should be worn. Anyone within a 20-foot radius of heavy equipment or machinery in operation will wear hearing protection.

7.2.8 Heavy Lifting

The use of some sampling equipment involves heavy lifting. To assure personnel safety, the following lifting guidelines will be employed at the site:

- If available, use mechanical equipment to move heavy objects.
- If possible, use two individuals to lift heavy objects, such as sample coolers that are filled with samples.
- Establish steady footing when lifting the load.
- Spread feet no wider than shoulder width when lifting.
- Use only one person to give commands when conducting team-lifting activities.

Back injury prevention is discussed in more detail within Section 9.1.12.

7.2.9 Unsafe Structures

As part of the fieldwork, personnel may enter site structures to collect samples. Because the poor condition of some structures, prior to entering any structure, field personnel will perform a cursory evaluation of the structure's exterior to determine if the building is safe to enter. Personnel will not enter any structure that is deemed to be unsafe.

7.2.10 Confined Spaces

OSHA defines a confined space as an area that is large enough for an employee to enter fully, not designed for continuous occupancy, and has a limited or restricted means of entry or exit. Confined spaces may exist at the worksite. Field personnel will inspect their work

area prior to entering to determine the presence of confined spaces. Field personnel will not enter any confined spaces.

7.2.11 Drowning Hazard

Personnel may be required to work near or over deep bodies of water. Personnel must be aware of their surroundings at all times in order to avoid the hazards involved with drowning. Field personnel will perform a cursory inspection of the work site prior to commencing work in order to determine the need for additional controls associated with this hazard. Safe practices for working near or over water are discussed in more detail within Section 9.1.13.

7.3 Biological Hazards

The plant, animal, and/or microbial hazards most likely to be encountered by field personnel include animal bites, insect stings, or contact with irritant plants. Stinging insects, primarily bees and wasps, are prevalent during the warmer months. Stings are usually more of a nuisance than an immediate danger for most people, with the results of being stung including localized swelling, itching, and minor pain. The risk to these hazards will vary depending on the time of year and specific task performed.

8 SITE CONTROL

The purpose of site control is to minimize the health and safety risks to field personnel and the general public by means of establishing work zones and control procedures. Due to the nature and the anticipated chemicals of potential concern that may be encountered during the investigation, airborne exposures to lead is to be monitored. The establishment of the three work zones as described by OSHA and U.S. Environmental Protection Agency hazardous waste regulations does not appear warranted, except as discussed within Section 12. Since field personnel will wear disposable PPE while they are performing the general reconnaissance and sampling activities, decontamination stations will not be required unless non-disposable equipment or tools will be used in support of these activities. Necessary first-aid equipment will be located within the support vehicle. This area (Support Zone) is considered to be uncontaminated; thus, personnel shall remove any PPE that has come into contact with hazardous waste or materials prior to entering this zone.

While conducting fieldwork, field personnel will identify an immediate work zone around their work area. Depending on the location and available room, this zone may be demarcated with tape or cones.

8.1 Communications

A critical element to ensure site control and safety to both on-site and field personnel will be open-line communications. The written and visual symbols may include:

- Written notification regarding schedules and activities to be conducted,
- Hand signals between work crews,
- Visual/physical barriers notifying personnel of areas of hazards, and
- Security fencing.

The audible communications for field personnel and between on-site and field personnel will include:

- Telephone, and
- Air horn.

8.2 Buddy System

When conditions present a risk to personnel (both physical and chemical), the buddy system will be implemented. A buddy system requires two people to work as a team, each looking out for the other. Buddies must maintain continuous line-of-sight contact with one another and can physically assist should rescue be necessary.

9 SAFETY PRACTICES AND HAZARD CONTROLS

General worker safety gear, such as steel-toed boots, hardhat, hearing protection, and safety glasses or goggles, will be worn at all times by personnel working around heavy equipment. Additional PPE (gloves, neoprene boots, etc.) shall be available for emergency use or for use on work tasks where this level of PPE has been selected for personnel safety.

Eating, drinking, smoking, and horseplay shall be strictly prohibited inside the Exclusion Zone (EZ). Inspections shall be made at the discretion of the SSO. Inspections will be conducted of all emergency response equipment, such as eyewash and first aid kits, and to ensure that fire extinguishers are available for use. Working upwind from wells helps to avoid exposure to vapors and contaminated dust. Intrinsically safe portable fans may be deployed if necessary.

Some activities require special safety considerations compared to routine tasks, such as vegetation clearing, handling of hazardous materials, and working over water. These tasks

shall be performed in accordance with this HASP and the applicable regulatory requirements.

Washing facilities will be established on site or near the site. All personnel shall be informed of the location of these facilities. If necessary, mobile washing facilities will be established in the support vehicle and will consist of water, soap, means of drying, and receptacles for waste. An adequate supply of drinking water will be available near work areas. Water coolers or water bottles will be clearly marked as to their contents. Toilet facilities are available nearby.

Field operations shall be conducted in accordance with the minimum safety practices described below required for all Shannon & Wilson employees on all projects.

9.1 Chemical Hazards

9.1.1 General Practices for Hazardous Waste Sites

- Shannon & Wilson field personnel are to be thoroughly briefed on the anticipated hazards, equipment requirements, safety practices, emergency procedures, and communications methods, both initially and in daily briefings.
- At sites with known or suspected contamination, appropriate work areas for field personnel support, contaminant reduction, and exclusion will be designated and maintained.
- Eating, drinking, chewing gum or tobacco, smoking, or any practice that increase the probability of hand-to-mouth transfer and ingestion of materials is prohibited in any area where the possibility of contamination exists.
- Hands must be thoroughly washed when leaving a contaminated or suspected contaminated area before eating, drinking, or any other activities.
- Contaminated protective equipment shall not be removed from the work area until it has been properly decontaminated or containerized on site.
- Avoid activities that may cause dust. Removal of materials from protective clothing or equipment by blowing, shaking, or any means that may disperse materials into the air is prohibited.
- All field personnel will, whenever possible, remain upwind of drilling rigs, open excavations, boreholes, etc.
- Field personnel are specifically prohibited from entering into excavations, trenches, or other confined spaces deeper than 4 feet. Unattended boreholes must be properly covered or otherwise protected.

- When collecting LNAPL samples, Tyvek overalls and boot covers will be used as a protective outer layer. If the LNAPL damages the Tyvek overall, a higher grade overall such as Saranex will be used.

9.1.2 Personnel Decontamination

Decontamination requirements will be established prior to site work on a case-by-case basis. The SSO will be responsible for determining these requirements.

Direct contact with pure contaminants is not anticipated. Instead, a more likely scenario is physical contact with materials such as decontamination water used for cleaning sampling supplies. Disposal PPE will be worn by field personnel performing general field investigation and decontamination activities. For protection, simple personnel decontamination will be performed near the work area using the following steps:

Step 1: Remove outer boot covers or wipe down boots.
Step 2: Remove hardhat and outer coveralls or Tyvek and wipe clean.
Step 3: Remove gloves.
Step 4: Depart the work area.
Step 5: Wash hands and face before drinking, eating, or smoking.

Because gross contamination is not anticipated, all disposable PPE shall be placed into heavy-duty plastic bags and disposed of with the general refuse. If it is determined that a location has the potential to be or is suspected to be heavily contaminated such that the establishment of three zones is required based on the hazards present, all personnel and portable equipment used in the work zone shall be subject to a thorough decontamination process. All reusable boots and gloves will be decontaminated using soap and water solution and scrub brushes, or simple removal and disposal, if the PPE is disposable. All wastewater generated during decontamination procedures will be stored on site in 55-gallon drums for subsequent disposal pending the associated analytical results. All disposable PPE will be disposed of in a trash bag. If necessary, disposal of decontamination wastes will be through certified disposal transporters/operators per the waste characteristics.

9.1.3 Sampling Equipment Decontamination

Before daily use, all portable monitoring equipment will be bagged or contained in such a way as to allow for simple decontamination procedures. Exposed parts shall be cleaned with wet cloths and/or alcohol wipes.

Sampling equipment will be decontaminated. The following procedures will be used to decontaminate equipment:

- Dislodge gross contamination from sampling utensils.

- Scrub with appropriate brush in a phosphate-free detergent.
- Rinse with tap water.
- Rinse with deionized water.
- Rinse with methyl alcohol (only if required based on contaminants present).
- Air dry.

9.1.4 Air Monitoring

Air monitoring will take place using a photoionization detector (PID) to detect VOCs and air monitoring cassettes to monitor lead.

9.1.4.1 Lead Air Monitoring

Air monitoring to sample for lead will take place during remedial excavation activities at Area 5. When soil containing lead is disturbed during excavation activities, an evaluation must be made as to whether or not workers are exposed to concentrations in air in excess of the action level of 0.03 milligram per cubic meter (mg/m^3). If the action level is exceeded, requirements for training, medical monitoring, and air sampling are triggered. If the permissible exposure level of 0.05 mg/m^3 is exceeded, additional requirements must be met, including use of respiratory protection equipment. Information pertaining to worker safety and health is in OSHA 29 CFR 1926.62.

A minimum of one employee per each job classification per day of excavation will wear a personal sampling pump and cassette. The sample shall be representative of one 8-hour shift. Samples shall be submitted on a rushed turnaround time to an analytical laboratory for results. If the action level is exceeded, personal protective equipment and work practices shall be reevaluated.

Perimeter air monitoring will take place downwind of the remedial excavations. Similarly to personnel air monitoring, samples will be representative of one 8-hour work day. Samples shall be submitted on a rushed turnaround time to an analytical laboratory for results.

Lead samples will be analyzed by NVL Laboratories in Seattle, Washington. Samples will be analyzed by NIOSH 7082 Flame Atomic Absorption method.

9.1.4.2 Volatile Organic Compound (VOC) Air Monitoring

Air monitoring using a PID will be conducted when well monument lids are opened, an odor is detected, during excavations, or LNAPL is present. The instrument will provide real-time measurements of airborne contaminant concentrations and provide the site

workers with an additional level of protection against exposure to contaminants. The meter will be calibrated in accordance with the manufacturer's guidelines on a daily basis prior to the start of that day's field activities.

An action level of 5.0 parts per million (ppm) sustained for one minute in the worker's breathing zone has been established for this project. If PID readings exceed this established action level, the area may have to be evacuated for a period of time to allow levels to return to below action levels, alternative engineering controls may be implemented to lower the levels such as keeping all field personnel upwind of the borehole, or an upgrade to Modified Level C PPE will be required, which includes the use of respirators. If sustained elevated PID readings are obtained during the fieldwork, personnel will evaluate whether they are due to an external source such as a generator or vehicle or if the elevated readings are due to the presence of site contamination.

9.1.5 Respiratory Protection

- The Shannon & Wilson Respiratory Protection Program will be followed whenever a respirator is required.
- Field personnel must use the "buddy system" when wearing any respiratory protective devices. Communications between members must be maintained at all times. Emergency communications shall be prearranged in case unexpected situations arise. Visual contact must be maintained between pairs on site, and team members should stay close enough to assist each other in the event of an emergency.
- Personnel should be cautioned to inform each other of subjective symptoms of chemical exposure such as headache, dizziness, nausea, and irritation of the respiratory tract.
- No excessive facial hair that interferes with a satisfactory fit of the facepiece-to-face seal will be allowed on personnel required to wear respiratory protective equipment.
- The selection, use, and maintenance of respiratory protective equipment shall meet the requirements of established Shannon & Wilson procedures, recognized consensus standards (American Industrial Hygiene Association, American National Standards Institute, and National Institute for Occupational Safety and Health), and shall comply with the requirements set forth in 29 CFR 1910.134 and WAC 296-841.

9.1.6 Physical Hazards

9.1.7 Safe Driving

Operators of vehicles on company business must:

- Evaluate conditions of the vehicle and observe deficiencies of the vehicle before commencing operation.

- Driver must be in possession of a valid driver's license.
- Wear seat belts/available safety restraint systems in all vehicles.
- Drive defensively, be courteous, and obey all traffic rules and regulations.
- Do not exceed posted speed limits.
- Do not pick up hitchhikers.
- Do not use cell phones while driving.
- Under no circumstances should a Shannon & Wilson employee operate a vehicle while under the influence of intoxicating beverages, drugs, or other substances.
- Operate the vehicle at a SAFE speed in cases of inclement weather, heavy traffic, or other road hazards. Be especially aware of the hazards of black ice, particularly on bridges and overpasses.
- Remove keys and lock unattended vehicles.

All accidents involving a vehicle being operated on business, regardless of circumstances or severity, will be reported to the PM within 24 hours. It is important to note that this is done not to find fault, but to analyze specific incidents for future accident prevention.

9.1.8 Facility/Traffic

Cargo/transfer terminal sites and other work sites with high traffic flow and limited visibility present a significant hazard to Shannon & Wilson field staff. Since this is an area of extremely high risk, it is important that the following health and safety policies and procedures are followed. While visual devices are generally effective, the use of a structural barrier (such as a company vehicle) is a more effective method of protection should a vehicle driver fail to see an employee. Barriers shall be used on work sites when it is possible to do so without adversely affecting the project work or other client considerations. Employees are reminded to maintain a high degree of awareness of moving vehicles on the site. The following guidelines concerning traffic warning devices should be followed when working in traffic flow areas:

- Meet with the Facility Manager at the start of fieldwork to discuss equipment and personnel access to the work area;
- Obtain any facility-related emergency information, i.e., facility alarms, response phone numbers, evacuation areas, and special hazards;
- High-visibility vests shall be worn by employees when working around traffic flow areas. Ensure that there is a clear line of sight between approaching traffic and the work area;

- Orange cones are typically used to direct traffic flow on roadways but are not always appropriate as a flagging device on Shannon & Wilson project sites. Due to the low height, a cone can be easily overlooked, especially when a motorist is backing up. Tubular markers at least 4 feet high with flags attached at the top are more visible. Alternatively, a Type I barricade with flagging at the top may be used. One option often used with cones is to place an object on the cones that will make noise if struck by a car; and
- When two or more Shannon & Wilson employees are together on a site and a site-specific activity has a high risk of impact from vehicular traffic, one employee shall act as a look-out for the other employee performing the specific work activity.

9.1.9 Slip/Trip/Hit/Fall Hazards

Slip/trip/hit and fall injuries are the most frequent of all injuries to workers. They occur for a wide variety of reasons, but can be minimized by the following prudent practices:

- Spot check the work area to identify hazards;
- Establish and utilize a pathway that is most free of slip and trip hazards;
- Beware of trip hazards such as wet floors, slippery surfaces, and uneven surfaces or terrain;
- Carry loads that you can see over;
- Keep work area clean and free of clutter, especially in storage rooms and walkways;
- Communicate hazards to on-site personnel;
- Secure all loose clothing and ties, and remove jewelry while around machinery;
- Report and/or remove hazards; and
- Keep a safe buffer zone between workers using equipment and tools.

9.1.10 Heat Stress

The Washington State Department of Occupational Safety and Health (DOSH) regulates heat-related illness in WAC 296-62. DOSH defined Heat-Related Illness (HRI) triggers based on the type of clothes worn, ambient temperature, and whether the work is conducted in sun or shade. Exhibit 9-1 provides trigger conditions at which provisions of the HRI rule become mandatory.

Exhibit 9-1: DOSH Heat-Related Illness Trigger Conditions

Type of Clothes Worn	Work in Direct Sun	Work in Shade
Work clothes (standard construction clothes)	89°F	96°F

Double-layer woven clothes (coveralls over work clothes)	77°F	87°F
Vapor barrier (Tyvek, etc.)	52°F	62°F

NOTE:
°F = degrees Fahrenheit

The HRI rule includes requirements for a written procedure, water on site, and training of staff and supervisors.

Written Procedures. The employer must establish, implement, and maintain written procedures to reduce to the extent feasible the risks of heat-related illness that include the following elements:

- Identification and evaluation of temperature, humidity, and other environmental factors associated with heat-related illness
- Provisions to reduce to the extent feasible the risks of heat-related illness that include the following elements:
  - The provision of rest breaks as needed to reduce to the extent feasible the risks of heat-related illness.
  - Encourage frequent consumption of water.
  - Procedures for responding to signs or symptoms of possible heat-related illness and accessing medical aid.
  - Employees are responsible for monitoring their own personal factors for heat-related illness, including ensuring they consume adequate water.

Drinking Water. Drinking water must be provided and made readily available in sufficient quantity to provide at least one quart per employee per hour. Employers may begin the shift with smaller quantities of drinking water if they have effective procedures for replenishment during the shift as needed to allow employees to drink one quart or more per hour.

Training. Training in the following topics must be provided to all employees who may be exposed to a heat-related illness hazard.

- The environmental factors that contribute to the risk of heat-related illness;
- General awareness of personal factors that may increase susceptibility to heat illness including, but not limited to, an individual's age, degree of acclimatization, medical conditions, water consumption, alcohol consumption, caffeine consumption, nicotine use, and use of prescription and nonprescription medications that affect hydration or other physiological responses to heat;
- The employer's procedures for identifying, evaluating, and controlling exposure;

- The importance of removing PPE that increases exposure to heat-related illness hazards during all breaks when feasible;
- The importance of frequent consumption of small quantities of water. One quart or more over the course of an hour may be necessary when the work environment is hot and employees may be sweating more than usual in the performance of their duties;
- The importance of acclimatization;
- The different types of heat-related illness and the common signs and symptoms of heat-related illness;
- The importance of immediately reporting to the employer, directly or through the employee's supervisor, symptoms or signs of heat illness in themselves, or in co-workers;
- The employer's procedures for responding to symptoms of possible heat-related illness, including how emergency medical services will be provided should they become necessary; and
- The purpose and requirements of this standard.

Prior to supervising employees who are working in conditions that may present heat-related illness hazards, supervisors must have training on the following topics:

- The procedures the supervisor is to follow to implement the HRI rule;
- The procedures the supervisor is to follow when an employee exhibits signs or symptoms consistent with possible heat-related illness, including emergency response procedures;
- Procedures for moving employees to a place where they can be reached by an emergency medical service provider, if necessary; and
- How to provide clear and precise directions to the emergency medical provider who needs to find the work site.

9.1.11 Cold Stress

To reduce adverse health effects from cold exposure, adopt the following work practices:

- Provide adequate dry insulating clothing to maintain core temperature above 98.6 degrees F to workers if work is performed in air temperature below 40 degrees F. Wind chill cooling rates and the cooling power of air are critical factors. The higher the wind speed and the lower the temperature in the work area, the greater the insulation value of the protective clothing required.
- If the air temperature is 32 degrees F or less, hands should be protected by gloves or mittens.

- If available clothing does not give adequate protection to prevent cold injury, work should be modified or suspended until adequate clothing is made available, or until weather conditions improve.
- Use heated warming shelters available nearby (e.g., on-site trailer) at regular intervals, the frequency depending on the severity of the environmental exposure. When entering the heated shelter, remove the outer layer of clothing and loosen the remainder of clothing to permit heat evaporation or change to dry work clothing.
- Provide warm, sweet drinks (e.g., hot chocolate) and soups at the work site for calorie intake and fluid volume. Limit the intake of coffee because of the diuretic and circulatory effects of caffeine.
- Include the weight and bulk of clothing in estimating the required work performance and weights to be lifted by the worker.
- Implement a buddy system in which workers are responsible for observing fellow workers for early signs and symptoms of cold stress.
- Employees that are not acclimatized should not work full time in cold until they become accustomed to the working conditions and required protective clothing.

Exhibit 9-2 describes the cooling power of wind on exposed flesh. This information can be used as a guide for determining equivalent chill temperatures when the wind is present in cold environments.

Exhibit 9-2: Wind Chill Factors

Estimated Wind Speed (in mph)	Actual Temperature Reading (^{0}F)											
	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
	Equivalent Chill Temperature (^{0}F)											
Calm	50	40	30	20	10	0	-10	-20	-30	-40	-50	-60
5	48	37	27	16	6	-5	-15	-26	-36	-47	-57	-68
10	40	28	16	4	-9	-24	-33	-46	-58	-70	-83	-95
15	36	22	9	-5	-18	-32	-45	-58	-72	-85	-99	-112
20	32	18	4	-10	-25	-39	-53	-67	-82	-96	-110	-121
25	30	16	0	-15	-29	-44	-59	-74	-82	-104	-118	-133
30	28	13	-2	-18	-33	-48	-63	-79	-94	-109	-129	-140
35	27	11	-4	-20	-35	-51	-67	-82	-98	-113	-129	-145
40	26	10	-6	-21	-37	-53	-69	-85	-100	-116	-132	-148
(Wind speeds greater than 40 mph have little additional effect)	LITTLE DANGER In less than an hour with dry skin. Maximum danger of false sense of security.				INCREASING DANGER Danger from freezing of exposed flesh within one minute.			GREAT DANGER Flesh may freeze within 30 seconds.				

Trench foot may occur at any point on this chart.

NOTES:

* Developed by U.S. Army Research Institute of Environmental Medicine, Natick, Massachusetts.

°F = degrees Fahrenheit; mph = miles per hour

Field personnel will observe work and warming regimen as shown in Exhibit 9-3.

Exhibit 9-3: Cold Weather Work/Warm-Up Regimen

Air Temperature - Sunny Sky		No Noticeable Wind		5 mph Wind		10 mph Wind		15 mph Wind		20 mph Wind	
^{0}C (approx.)	^{0}F (approx.)	Maximum Work Period	Number of Breaks	Maximum Work Period	Number of Breaks	Maximum Work Period	Number of Breaks	Maximum Work Period	Number of Breaks	Maximum Work Period	Number of Breaks
-26 to -28	-15 to -19	(Norm Breaks) 1		(Norm Breaks) 1		75 min.	2	55 min.	3	40 min.	4
-29 to –31	-20 to -24	(Norm Breaks) 1		75 min.	2	55 min.	3	40 min.	4	30 min.	5
-32 to –34	-25 to -29	75 min.	2	55 min.	3	40 min.	4	30 min.	5	non-emergency work should cease	
-35 to –37	-30 to -34	55 min.	3	40 min.	4	30 min.	5	non-emergency work should cease		non-emergency work should cease	
-38 to –39	-35 to -39	40 min.	4	30 min.	5	non-emergency work should cease		non-emergency work should cease		non-emergency work should cease	
-40 to –42	-40 to -44	30 min.	5	non-emergency work should cease		non-emergency work should cease		non-emergency work should cease		non-emergency work should cease	
-43 and below	-45 and below	non-emergency work should cease		non-emergency work should cease		non-emergency work should cease		non-emergency work should cease		non-emergency work should cease	

NOTES:

* Developed by the American Conference of Governmental Industrial Hygienists.
°C = degrees Celsius; °F = degrees Fahrenheit; min. = minute; mph = miles per hour

9.1.12 Back Injury Prevention

Back injuries on the job are costing employers in the U.S.A. approximately $6.5 billion annually. Eight out of ten people will suffer a back injury during their life time, either on or off the job. Many of these injuries could be prevented by adhering to the following proper lifting concepts:

- **Keep the load close to the body.** Arrange tasks so that the load will be close to the body and at a proper and safe height that will not require bending or stooping. Tighten stomach muscles to offset the force of the load.

- **Keep the load within reach.** Try to arrange tasks to eliminate handling loads below 20 inches or above 50 inches. Try to keep the lifting zone between your shoulders and the knuckles.
- **Control the load size.** Loads that extend beyond 16 inches in front of the body put excessive lifting stress on the body and should be handled by two people or lifting aids should be employed.
- **Maintain proper alignment of body.** The task should be designed so that twisting of the body is minimized or eliminated. Twisting while carrying a load increases injury potential significantly.
- **Lift with your legs.** Your leg muscles are the strongest in your body. Always bend your knees and use your leg muscles when you go toward the floor whether you have a load or not. Do not bend at your waist if it can be avoided.
- **Balance your load if possible.** An evenly balanced load is much easier and much safer to handle than an off-balance load. Grasp the object at opposite corners if possible.
- **Avoid excessive weights if possible.** Mechanical aids should be used for loads that are greater than those which can be handled safely by one person.
- **Lift in a comfortable manner.** Workers should use a lifting position that feels comfortable for them; however, they should bend their knees and keep their back as straight as possible when performing a lift. Your feet should be shoulder-width apart in order to get the best footing possible.
- **Lift smoothly and gradually.** Quick jerking lifting motions increase sudden and abrupt stress to the back. This type of aggressive movement can affect the discs, muscles, and the ligaments. A well-controlled and smooth lifting motion will reduce the likelihood of injury.
- **Most importantly, think before lifting.**

In addition to these lifting techniques, it is also important to implement the proper carrying techniques as follows:

- **Eliminate carrying where possible.** If possible, conveyors, trucks, small loaders, and other mechanical equipment should be considered. Carts and dollies should be employed when surface conditions permit. Surface conditions can be altered with plywood or other materials.
- **Use two-handed carries where possible.** Using a two-handed carry method helps to balance the load and even out the body stress.
- **Keep the load close to the body.** Keeping the load in close and lifting in as erect a position as possible helps to reduce the stress to the lower spine.

- **Keep your arms straight.** Less stress is created on the muscles and ligaments when your arms are kept straight during a carry. Contraction of the muscles will quickly increase fatigue and the possibility of an accident.
- **Balance the load.** A balanced load is similar to the two-handed carry. The load is evenly distributed across the body and the stress is also evenly shared.
- **Avoid carrying any material on stairs.** Carrying on stairs will obstruct your vision and increase the likelihood of slip and fall. The bumping of the load on your leg as you climb or descend increases the chance of an injury.
- **Reduce the weight if possible.** When the weight of the lifts is high, look for ways to reduce the weight. Use smaller containers, put less in containers, indicate fill levels, and locate lighter containers.
- **Use handles.** Make the task easier by adding handles where possible. If numerous repetitions are required, it may be possible to design a handled device to accommodate a two-handed carrying task.

In addition to these lifting and carrying techniques, it is also important to consider pushing and pulling tasks:

- **Eliminate manual pushing and pulling where possible.** Look at those tasks that are repeated often to see if they can be modified or altered in a way that reduces pushing and pulling. Consider mechanical aids, powered conveyors, gravity slides, and chutes.
- **Reduce the necessary force.** Force required is a function of weight, gravity, and friction. Look for opportunities to reduce these factors. Improved bearings, larger wheels, reduced weight, improved rolling surfaces, lubrication, and improved regular maintenance are all opportunities for reducing work force and stress.
- **Push load instead of pulling.** Studies indicate that pushing loads rather than pulling them is the safest approach. There is less stress on muscles, joints, and ligaments. As in lifting, pushing pressure should be applied firmly, but gradually. Avoid aggressive impacts.

There are also a number of guidelines to follow when addressing tasks that involve shoveling operations:

- **Choose correct shovel type.** The shovel should be appropriate for the material and the project. Light, loose, and fluffy materials should be handled with a scoop-type shovel. A smaller shovel like a spade should be used for more dense material.
- **Use a long-handled shovel.** A long-handled shovel should be provided to avoid stooping during shoveling activities. Take the time to obtain the correct tool for the job.
- **Maintain load to 10 pounds per shovelful.** The general rule of thumb for the average work situation is 10 pounds per shovel load. Work performed is a function of repetition

and load. Increasing shovel loads will increase fatigue as repetitions increase and it will also increase the potential for injury.

Drum handling operations can be made safer by considering the following techniques:

- **Use a drum cart where feasible.** A four-wheel cart is preferred for drum handling because it is more stable, better latched, and has a better handle positioning. In addition, it is more easily tipped back and held in place when the drums are loaded.
- **Do not rotate from horizontal to vertical unless nearly empty.** Only empty or nearly empty drums should be rotated from horizontal to vertical. A tipster or forklift with a proper drum handling attachment is the preferred method.
- **Use handling equipment for moving drums from one level to another.** Whenever possible, pallets, scales, and conveyors should be recessed in the floor to avoid raising drums to another level. If not, drums should be handled on a low platform or an incline adapter should be provided.
- **Limit drum weight to 450 to 500 pounds.** Regardless of the material involved, drums should only be filled to a maximum weight of 700 pounds. Drums over 300 pounds shall not be handled by hand. Use of mechanical equipment is required. *(Example: water = 8.6 lb per gallon x 52 gallons = 447.2 lbs)*
- **Limit travel distance to 30 feet.** The other general guideline regarding drum handling involves keeping drum transport to a maximum of 30 feet.

9.1.13 Drowning Prevention

To assure personnel safety, the following guidelines will be employed when the threat of drowning exists at the site:

- Do not work alone.
- Wear a U.S. Coast Guard-approved personal flotation device (PFD-Type III).
- Check weather reports to confirm safe working conditions (avoid storms).
- Take care when exiting and entering the boat from land or barge.
- Make sure the barge or boat is securely anchored at the work location.
- If possible, use two individuals to lift heavy objects, such as sample coolers that are filled with samples.
- Stop work if water conditions become hazardous (e.g., high swells, storms, etc.)

9.2 Biological Hazards

Animal bites, especially in remote areas, always pose a risk. This can be minimized by being observant and not approaching animals exhibiting unusual behavior. Avoiding

contact with poison ivy, poison oak, or poison sumac, where present, will minimize the hazards from poisonous plants. Ways to reduce potential exposures to microbial hazards include using proper sanitation prior to eating or drinking liquids and limiting eating or drinking to areas outside the EZ. Treatment of stings can be handled by basic first-aid treatment. However, if personnel are allergic to bees or wasps, they should make this known to co-workers and have prescribed medication available while they are on site so that appropriate action can be taken. If a rodent nest or fecal pile is found, the area should be sprayed/soaked with bleach (again, a respirator and gloves should be worn). The materials used to perform the disinfecting of the area should also be disposed of in a dumpster. Personnel should be aware of their surroundings and wear the appropriate work clothing to minimize the amount of exposed skin.

10 PERSONAL PROTECTIVE AND SAFETY EQUIPMENT

The level of protection required to ensure the health and safety of field personnel will be determined by the SSO based on the specific site activities, available instrumentation readings, and professional experience and judgment. Based on the specific tasks associated with the work plan, field personnel shall wear Modified Level D PPE, depending on the task. Higher levels of PPE are not currently anticipated for this project. However, the Health and Safety Manager and SSO will adjust the level of PPE required for a specific work task, as necessary.

The Health and Safety Manager, in conjunction with the SSO, will establish action levels for minimum levels of protection for each area of the site where investigation activities will occur. The action levels will remain the same, but the level of protection may change due to changing site conditions.

10.1 Modified Level D Protection

Modified Level D PPE will be the initial requirement for all scoped tasks associated with the work plan. The Health and Safety Manager and SSO will upgrade and/or change the level of PPE as field conditions warrant. Modified Level D PPE includes the following:

- Coveralls or work clothes (dictated by weather).
- Tyvek coveralls (optional).
- Gloves (outer), chemical/liquid-resistant when there is a potential for wet work or contact with contaminated materials.
- Gloves (inner), chemical/liquid-resistant (surgical nitrile) when there is a potential to contact contaminated materials.

- Leather safety boots/shoes with chemical-resistant soles and steel-toed shanks when necessary.
- Safety glasses.
- Chemical-resistant boot covers when chemical hazards are present.
- Chemically protective safety boots as an alternative to leather boots with boot covers.
- Hardhat (with splash shield during high splash activities) and safety glasses.
- Hearing protection (where appropriate).

Use of Tyvek coveralls on site where work functions preclude splashes of chemicals or long-term contact with contaminated soil or water will be at the discretion of the SSO.

10.2 Unknown Environments

The requirement of field personnel entering unknown environments is not anticipated as part of the scope of work for this delivery order. If an unknown environment is encountered, personnel shall not enter the area until the chemical or physical hazards in the area can be identified and measures taken to reduce or eliminate those hazards.

10.3 Considerations for Selecting Levels of Protection

Factors to be considered in selecting the appropriate level of PPE include heat and cold stress; air-monitoring results; chemical, physical, and biological hazards associated with the task; routes of exposure; and weather conditions. The Health and Safety Manager will determine the level of PPE required for the specific work task following an evaluation of these factors. The SSO will be responsible for ensuring that all field personnel adhere to the PPE requirements. Based on existing information and data for the activities to be performed, modified Level D PPE will be the initial requirement for all scoped tasks. Exposure to elevated airborne concentrations of contaminants above the respective permissible exposure levels is considered to be low for the work. However, if site conditions, field activities, or air-monitoring results indicate the need for respiratory protection during other field activities, the SSO and the Health and Safety Manager will evaluate the initial activities to be performed by site personnel, and if necessary, modifications to the PPE requirements will be implemented.

10.4 Personnel Protective Equipment (PPE) for Visiting Personnel

Site visitors will be required to have the appropriate PPE prior to site entry. No personnel will be allowed to enter the site if they do not have the appropriate PPE.

10.5 PPE Inspections

All PPE shall be inspected prior to, during, and after use. Inspectors will look for rips, tears, discolorations that may indicate bleed-through of chemicals, delamination, or any other signs of wear or degradation that would affect the effectiveness of protection. PPE will be stored in a manner that prevents degradation and is consistent with the manufacturer's instructions. Consideration should be given to ultra-violet damage, inability to dry/air-out, and unnecessary folds/creases. The SSO or the Health and Safety Manager will determine the need to repair or replace PPE.

10.6 Safety Equipment

Basic emergency and first aid equipment will be available in the support vehicle. All field personnel will be informed of the locations of the safety equipment and the proper use of the equipment. For the duration of the work plan, weekly inspections of the safety equipment will be performed by the SSO.

11 EMERGENCY RESPONSE AND CONTINGENCY PROCEDURE

This section describes contingencies and emergency planning procedures to be implemented during the work plan. All incidents will be dealt with in a manner to minimize health risks to field personnel and the surrounding environment. In the event of an incident, the following procedures shall be completed at a minimum:

- First aid and other appropriate initial action will be administered by properly trained personnel closest to the incident. This assistance will be conducted in a manner to assure individuals rendering assistance are not placed in a situation of unacceptable risk.
- All incidents will be reported to and documented by the SSO, who is responsible for coordinating the emergency response in an efficient, rapid, and safe manner. The SSO will perform emergency equipment inspections to check that standard equipment is available on site to address likely emergencies.
- In the event of an accident or emergency, all workers on site are responsible to conduct themselves in a mature, calm manner to avoid spreading danger to themselves, the surrounding workers, or the community in general.

The initial response to any emergency will be to protect human health and safety. Secondary response to the emergency will be identification, containment, treatment, and disposal of contaminated materials. The local Fire Department will be called in all situations in which fires or explosions have occurred by dialing 911.

All field personnel will have access to the contact list provided in this HASP. If an emergency occurs that requires outside agency assistance or notification, site employees are instructed never to leave an emergency notification on an answering machine, but rather call the 24-hour emergency answering service number if no one answers the primary number.

Potential incidents fall under four general classifications: (a) worker injury or illness; (b) fire or explosion; (c) severe weather conditions such as tornado and lightning storms; and (d) chemical releases to the atmosphere, soil, or surface water.

11.1 Worker Injury or Illness

If a non-life-threatening/serious injury occurs, the local hospital will be contacted for assistance prior to transporting the victim(s). The local hospital is Harborview Medical Center. Address and contact information are located prior to Section 1.0. A copy of a map showing the directions from the site to the Hospital is provided as Attachment D.

In the event of a medical emergency, personnel will take direction from the SSO (or alternate team leader if the SSO is injured), notify the appropriate emergency organization, and implement the following procedures:

- Call 911.
- Identify location, request medical assistance, and provide name and telephone number.
- Notify Shannon & Wilson's Health and Safety Manager and file an accident report.

11.2 Fire or Explosion

In the event of an emergency that necessitates the evacuation of the site, such as a fire or severe weather, field personnel will implement the following procedures:

- Field personnel will be alerted by sounding a portable horn, radio contact, or direct verbal means. (When air horns are used, two sustained blasts followed by one or two blasts will notify all personnel to exit.)
- Personnel in the work zone may or may not perform field decontamination prior to leaving the work zone, depending on the nature of the incident requiring the evacuation.
- Concurrent with the evacuation of field personnel, notification will be immediately made by dialing 911, indicating location of the incident, and providing information to local responders.

Immediately following an evacuation, a head count will be taken. Upon his/her arrival, the SSO, or his designated alternate will advise the fire commander of the location, nature, and identification of the hazardous materials on site.

11.3 Severe Weather

When a severe storm warning has been issued or when a lightning storm occurs, the information will be immediately relayed to all field personnel who shall be notified to stand by for emergency procedures. After the storm warning is cancelled and the storm passes, the SSO will inspect all on-site equipment to ensure its readiness for operation. If any equipment has been damaged, the work will not be restarted until the equipment has been repaired or replaced.

If the SSO's inspection indicates that a fire, explosion, or release has occurred as the result of a severe weather condition, he/she will follow the appropriate procedures outlined in this section.

In regard to lightning, personnel will follow the "30/30 rule," which states that personnel will seek appropriate shelter when working outdoors if thunder is heard less than 30 seconds after the strike is seen. Personnel who have sheltered may resume working 30 minutes after the last thunder is heard.

11.4 Chemical Release/Spill Containment Program

The objective of this part of the HASP is to meet the requirements of 29 CFR 1910.120(b)(4)(ii)(j).

11.4.1 Spill Prevention

All hazardous substances will be stored in secure locations in containers of suitable type, properly labeled, with tight-fitting lids. Any investigation-derived wastewater or free product will be stored in 55- or 16-gallon drums until properly disposed of. Spill containment drip pans and duck ponds will be utilized, when applicable, to contain small leaks during sampling activities and transfer.

11.4.2 Large Spill Response

The primary spill response kit is located in the support vehicle. The kit contains absorbent pads, shovels, and personal safety equipment. In the event of a spill of a hazardous substance, immediate action will be taken by all personnel present. The following actions will be taken in the event of a spill, when applicable:

- Attend to significantly injured personnel.

- Stop the source (e.g., shut off a pump, stand up fallen container).
- Control the spill by berming, ditching, or immediately absorbing the substance.
- Report spill to the SSO, PM, the Health and Safety Manager, and applicable regulating agencies.

If the PM determines that clean up can be performed safely with project personnel, the SSO may act as the spill team leader and designate required procedures. Before work begins, the SSO must conduct a hazard identification and assessment with response personnel. The following must be discussed and established:

- Levels of PPE and safety procedures.
- Safety and work zones.
- All steps of the response activities.
- Most effective procedures for cleanup.
- Means of containment.
- Decontamination procedures.
- Emergency decontamination.

11.5 Post-Incident Follow-Up

The PM or SSO must implement the necessary steps to ensure that the incident is properly documented and that the emergency response equipment is replenished. The PM must direct the necessary corrective actions to present recurrence and evaluate the response. As appropriate (for example spills), responses actions will be documented in post action report (performance or compliance).

11.6 Security

During activation of the emergency procedures, the SSO or designated representative will control access to the area of the remediation or monitoring project work, coordinate with any other site managers and maintain a security incident log that will include at a minimum:

- Time of entry
- Expected exit time
- Task being performed
- Location of task
- Rescue and response equipment used

- Protective equipment used

12 REMEDIAL HOTSPOT EXCAVATION WORK AREAS

The work plan includes collection of soil samples within hotspot excavations where soil exceeds the project RL and is being removed. Activities completed within these areas require the use of additional measures to ensure that worker safety is protected, and that the field activities do not result in the contamination of previously uncontaminated areas. The following sections summarize additional site control, site preparation, communication, PPE, and decontamination and disposal procedures for investigation activities to be completed within the hotspot excavation areas.

All field staff should be sufficiently trained in the standard guidelines for the field activities they intend to use and should review and understand these procedures prior to going into the field. It is the responsibility of the field staff to review the standard guidelines with the field manager or project manager and identify any deviations from these guidelines prior to field work.

12.1 Site Control

Access to the work site will be restricted to designated personnel. To reduce the accidental spread of hazardous substances by workers or equipment from the contaminated area to the clean area, zones should be delineated on the site where different types of operations will occur, and the flow of personnel among the zones should be controlled. The establishment of work zones will help ensure that: personnel are properly protected against the hazards present where they are working, work activities and contamination are confined to the appropriate areas, and personnel can be located and evacuated in an emergency.

The area hotspot excavation areas will be separated as needed to meet operational and safety objectives. It is intended that the area be separated by the use of cones and tape into zones as follows:

- EZ, the contaminated area.
- Contamination Reduction Zone (CRZ), the area where decontamination takes place.
- Support Zone (SZ), the uncontaminated area where workers should not be exposed to hazardous conditions.

Movement of personnel and equipment among these zones should be minimized and restricted to specific Access Control Points to prevent cross-contamination from contaminated areas to clean areas.

An EZ/CRZ, and SZ will be set up for work being conducted within the limits of the work area. The full area designated for where hotspot excavation work will be undertaken is the EZ. Only authorized personnel shall be permitted access to the EZ/CRZ. Staff will decontaminate all equipment and gear as necessary prior to exiting the CRZ. Staff will take care to prevent the transport of contaminated soils during decontamination.

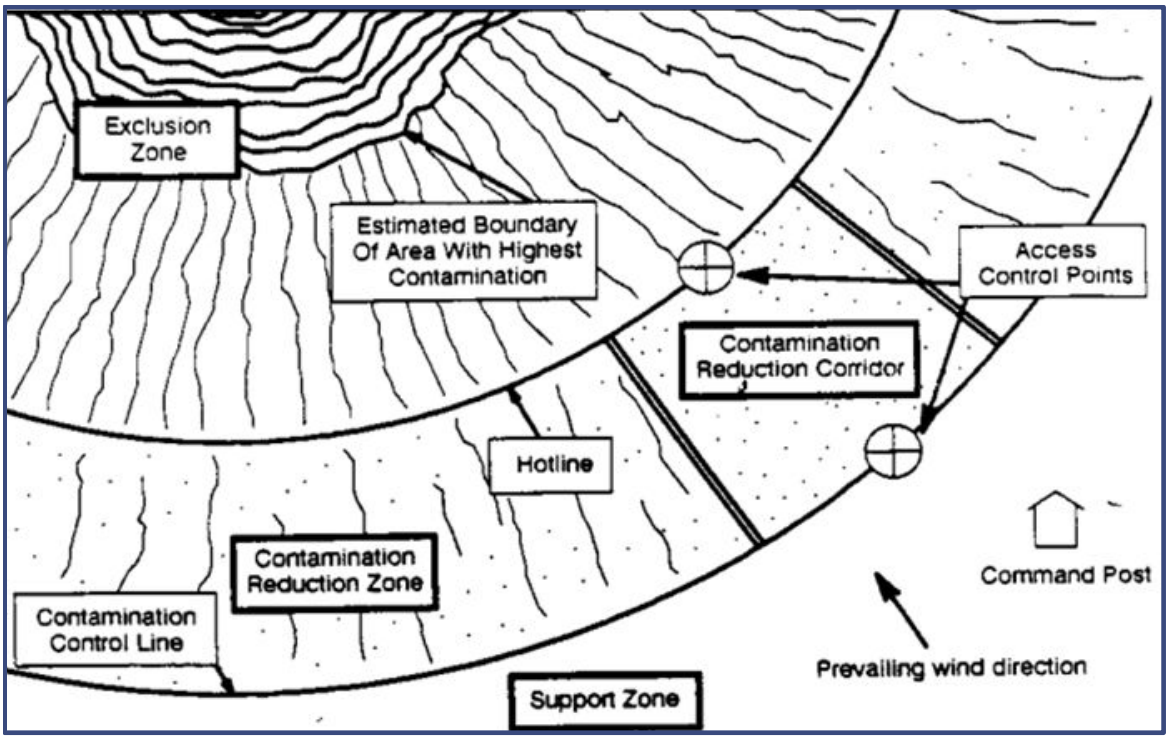

Exhibit 12-1: Illustration of Typical Work Zones

Provided by OSHA.gov

12.1.1 Exclusion Zone (EZ)

The EZ is the area where the hotspot excavations are occurring. The primary activities performed in the EZ are:

- Excavation work.

The personnel working in the EZ may include the field team members, the SSO, the PM, and specialized personnel such as heavy equipment operators. All personnel within the EZ should wear appropriate PPE (Section **Error! Reference source not found.**).

12.1.2 Contamination Reduction Zone (CRZ)

The CRZ is the transition area between the contaminated area and the clean area. This zone is designed to reduce the probability that the clean SZ will become contaminated or affected

by other site hazards. The distance between the EZ and SZ provided by the CRZ, together with decontamination of workers and equipment, limits the physical transfer of hazardous substances into clean areas. The boundary between the CRZ and the EZ is called the Hotline. The degree of contamination in the CRZ decreases as one moves from the Hotline to the SZ, due both to the distance and the decontamination procedures. At many of the excavations the two zones will be merged due to site constraints, except in entrance area where sufficient space will be maintained to allow for decontamination.

Decontamination procedures take place in a designated area within the CRZ. Two lines of decontamination stations should be set up within the Contamination Reduction Corridor: one for personnel and one for heavy equipment. Access into and out of the CRZ from the EZ is through the Access Control Point. The equipment will only enter and exit once at the beginning and end of the excavation work.

Personnel entering the CRZ shall be required to wear the personal protective clothing and equipment prescribed for working in the CRZ. To reenter the SZ, workers should remove any protective clothing and equipment worn in the CRZ and leave through the personnel exit Access Control Point.

The CRZ must be well designed to facilitate:

- Decontamination of equipment, Personnel Decontamination Station operators, and personnel.
- Emergency response: first-aid equipment (such as bandages, blankets, eye wash, splints, and water); and containment equipment (absorbent and fire extinguisher).
- Equipment resupply: personal protective clothing and equipment (such as booties and gloves), sampling equipment (such as bottles and jars), and tools.
- Sample packaging and preparation for onsite or offsite laboratories.
- Worker temporary rest area: Water and other potable liquids should be clearly marked and stored properly to ensure that all glasses and cups are clean. Wash facilities should be located near drinking facilities to allow employees to wash before drinking. Drinking, and washing, should be located in a safe area where protective clothing can be removed.
- Drainage of water and other liquids that are used during decontamination.

Personnel within the CRZ should be required to maintain internal communications; line-of-sight contact with work parties; work party monitoring (e.g., fatigue, heat stress, and hypothermia); and site security.

12.1.3 Support Zone (SZ)

The SZ is the location of the administrative and other support functions needed to keep the operations in the EZ and CRZ running smoothly. Any function that need not or cannot be performed in a hazardous or potentially hazardous area is performed here. The Command Post Supervisor should be present in the SZ. Other personnel present will depend on the functions being performed, and may include the field team members who are preparing to enter or who have returned from the EZ.

Personnel may wear standard PPE (10.1) within this zone. Any potentially contaminated clothing, equipment, and samples must remain in the CRZ until decontaminated.

SZ personnel are responsible for alerting the proper agency in the event of an emergency. All emergency telephone numbers, evacuation route maps, and vehicle keys should be kept in the SZ.

When setting up support facilities, consider factors such as:

- Accessibility. Topography, open space available, locations of highways and railroad tracks, and ease of access for emergency vehicles.
- Resources. Adequate roads, power lines, telephones, shelter, and water.
- Visibility. Line-of-sight to all activities in the EZ.
- Wind direction. Upwind of the EZ, if possible. If upwind locations are not feasible due to fencing or structures, the best cross-wind location should be selected.
- Distance. As far from the EZ as practicable.

12.2 Site Preparation

Time and effort must be spent in preparing a site to ensure that worker safety is protection, field activities go smoothly, that the field activities do not result in the contamination of previously uncontaminated areas, and that contamination is not transported outside of the EZ. Safety measures should be afforded the same level of care at this stage as during other field activities. Proper site preparation includes:

- Arrange traffic control signage to ensure safe and efficient operations.
- Eliminate physical hazards from the work area as much as possible, including:
  - Ignition sources in flammable hazard areas.
  - Exposed or ungrounded electrical wiring, and low overhead wiring that may entangle equipment.
  - Sharp or protruding edges, such as glass, nails, and torn metal, which can puncture protective clothing and equipment and inflict puncture wounds.

  - Debris, holes, loose steps or flooring, protruding objects, slippery surfaces, or unsecured railings, which can cause falls, slips, and trips.
  - Unsecured objects, such as bricks and gas cylinders, near the edges of elevated surfaces, such as catwalks, roof tops, and scaffolding, which may dislodge and fall on workers.
  - Debris and weeds that obstruct visibility.
- Provide adequate illumination for work activities. Equip any temporary lights with guards to prevent accidental contact.

The hotline should be clearly marked by lines, placards, hazard tape and/or signs; or enclosed by physical barriers, such as chains, fences, or ropes. Access Control Points should be established at the periphery of the EZ to regulate the flow of personnel and equipment into and out of the zone and to help verify that proper procedures for entering and exiting are followed. If feasible, separate entrances and exits should be established to separate personnel and equipment movement into and out of the EZ. The following steps describe how to establish the hotline:

- Visually survey the immediate site vicinity.
- Evaluate the results of previously collected soil and water samples.
- Consider the physical area necessary for site operations.
- Consider meteorological conditions and the potential for contaminants to be blown from the area.
- Secure or mark the hotline.
- Modify its location, if necessary, as more information becomes available.

12.3 Communication

All site work will occur in teams and the primary means of communication on-site and with off-site contacts will be via cell phones. An agreed-upon system of alerting via air horns and/or vehicle horns may be used around heavy equipment to signal an emergency if shouting is ineffective. Any emergencies or significant incident situations will be immediately reported the PM.

12.4 Equipment Decontamination

Particulate matter and surface film will be removed using a brush. If necessary, the excavation equipment will use the truck wash to remove additional soil prior to transport off site.

ATTACHMENT A: SITE MAP

Attachment A

Site Map

BOEING THOMPSON PROPERTY

NORTH OUTFALL (NO. 1)

SHEET PILE WALL

FORMER FIBERGLASS SHOP

FORMER STORM - MIDDLE OUTFALL (CLOSED 2004)

OFF-HWY BUILDING

DEMOLISHED

PARTITION

WALL

DEMOLISHED

AS/SVE System

FORMER BOILER HOUSE

WATER TOWER

NORTH FIRE AISLE

WAREHOUSE

CENTER CORE

METAL RINSE DIP TANKS

MAIN LINE DYNOMOMETER

FRAME TURN-OVER FIXTURE

CAB WASH

CAB PRIME

PAINT BOOTH

OVEN

NORTH PAINT BOOTH

SOUTH PAINT BOOTH

OVEN

PAINT MIX AREA

MEDICAL CENTER

CHASSIS PAINT BOOTH

OVEN

SOUTH FIRE AISLE

FORMER ADMINISTRATION BUILDING

EAST MARGINAL WAY

DUWAMISH WATERWAY

Wall Extends Back Onto Property

SEEP 4

SEEP 3

SEEP 2

SEEP 1

SEEP 6

CENTRAL OUTFALL (NO.2) (FORMER 8801 SOUTH OUTFALL)

RIP RAP

SEEP 5

FORMER SOUTHWEST STORAGE AREA

FORMER MONSANTO PARCEL

KING COUNTY STORM DRAIN LINE

ESTIMATED LOCATION OF FORMER DUWAMISH RIVER SHORELINE

CONTAINER PROPERTIES LLC

(INSURANCE AUTO AUCTIONS INCORPORATED VEHICLE STORAGE ON BOTH 8801 AND CONTAINER PROPERTIES PARCELS)

MUSEUM OF FLIGHT

N

NOTE

Figure adapted from AMEC *14995-L-32.dwg* dated 05/2013, and *14995-L-16.dwg* dated November 2010.

LEGEND

Existing Buildings

Former Buildings

AS/SVE Air Sparge/Soil Vapor Extraction

0 120 240

Scale in Feet

8801 East Marginal Way South
Tukwila, Washington

KEY PROPERTY FEATURES

May 2019 21-1-12567-014

SHANNON & WILSON, INC. GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

FIG. 2

Filename: J:\21\12567\014\21-1-12567-014 Key Site Features.dwg Layout: Figure 2 Date: 05-01-2019 Login: jrs

ATTACHMENT B: DAILY SAFETY MEETING LOG

Attachment B

Daily Safety Meeting Log

SHANNON & WILSON, INC.
GEOTECHNICAL AND ENVIRONMENTAL CONSULTANTS

DAILY SAFETY MEETING LOG

JOB NAME: _____ JOB NO: _____ BORING NO: _____

LOCATION: _____ DATE: / / TIME: :

SUBCONTRACTOR: _____ S&W REP: _____ S&W PM: _____

WORK DESCRIPTION: _____

CHECK APPLICABLE HAZARDS: Heavy Equipment ☐, Vehicles ☐, Overhead ☐, Tools ☐, Temperature ☐, Lifting ☐ (Use Mechanical Means Instead), Site Housekeeping ☐ (Clear Walkways to Prevent Slips, Trips, Falls), Awkward Work Area ☐, Public ☐, Security ☐, Plants ☐, Animals ☐, Noise ☐, Vibration ☐, Dust ☐, Radiation ☐, UV exposure ☐, Repetitive Motion ☐, Suspected Contamination ☐, Chemical Exposure ☐, Flammable/Explosive ☐

OTHER HAZARDS: _____

EQUIPMENT ON SITE: _____

DOCUMENTATION:	Present	PPE:	Present
SSHSP On Site?	☐	Boots - Safety Toe / Other	☐
Hospital Map On Site?	☐	Safety Glasses	☐
Fall Protection Plan On Site?	☐	Vest - Class II / Class III	☐
Respiratory Protection Plan On Site?	☐	Hard Hat	☐
Confined Space Entry Plan On Site?	☐	Ear - Plugs / Muffs / Both	☐
Traffic Control Plan?	☐	Gloves - Type: _____	☐
Other Plan? _____	☐	Face Shield	☐
Current Fit Test?	☐	Respirator	☐
Cards/Certs Required? *List Below*		Other PPE? *List Below*	

Hazards & Controls Discussed? ☐ Need to Update SSHSP? ☐

My signature below confirms that the above hazards, controls and plans have been discussed and that I understand them.

PRINT NAME	SIGNATURE	COMPANY	HAS ALL CARDS	PPE On?
			☐	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐
			☐	☐

This form is only intended for Shannon & Wilson, Inc. employees and S&W subcontractors.

ATTACHMENT C: SAFETY DATA SHEETS

Attachment C

Safety Data Sheets

Right to Know Hazardous Substance Fact Sheet

Common Name: **ARSENIC**

Synonyms: Gray Arsenic; Arsen

Chemical Name: Arsenic

Date: June 1998 Revision: April 2008

CAS Number: 7440-38-2

RTK Substance Number: 0152

DOT Number: UN 1558

EMERGENCY RESPONDERS >>>> SEE BACK PAGE

Description and Use

Arsenic is a silver-gray or white metallic, odorless, brittle solid. It is used as an alloying agent for heavy metals, and in solders, medicines and herbicides.

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	4	-
FLAMMABILITY	0	-
REACTIVITY	0	-
CARCINOGEN POISONOUS GASES ARE PRODUCED IN FIRE		

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

Reasons for Citation

- **Arsenic** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, NTP, DEP, IARC, IRIS and EPA.
- This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while rinsing. Seek medical attention.

Skin Contact

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Inhalation

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

- **Arsenic** can affect you when inhaled and may be absorbed through the skin.
- **Arsenic** is a CARCINOGEN and may cause reproductive damage. HANDLE WITH EXTREME CAUTION.
- Skin contact can cause irritation, burns, rash and loss of pigment
- Eye contact can cause irritation and burns.
- Inhaling **Arsenic** can irritate the nose and throat and can cause an ulcer or hole in the "bone" (septum) dividing the inner nose.
- Exposure to **Arsenic** can cause weakness, poor appetite, nausea, vomiting, headache, and even death.
- **Arsenic** may damage the nervous system and the liver.
- **Arsenic** is a noncombustible solid, but when in *dust* or *fine powder* form it can EXPLODE when exposed to heat, flame or hot surfaces.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **0.01 mg/m^3** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **0.002 mg/m^3**, which should not be exceeded at any time.

ACGIH: The threshold limit value (TLV) is **0.01 mg/m^3** averaged over an 8-hour workshift.

- **Arsenic** is a CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects
The following acute (short-term) health effects may occur immediately or shortly after exposure to **Arsenic**:

- Skin contact can cause irritation, burns, rash and loss of pigment.
- Eye contact can cause irritation, burns and red, watery eyes.
- Inhaling **Arsenic** can irritate the nose and throat causing coughing and wheezing.
- Exposure to **Arsenic** can cause weakness, poor appetite, nausea, vomiting, headache, muscle cramps and even death.

Chronic Health Effects
The following chronic (long-term) health effects can occur at some time after exposure to **Arsenic** and can last for months or years:

Cancer Hazard
- **Arsenic** is a CARCINOGEN in humans. It has been shown to cause skin and lung cancer.
- Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard
- Chronic **Arsenic** exposure has been associated with spontaneous abortions and still births.
- There is limited evidence that **Arsenic** is a teratogen in animals. Until further testing has been done, it should be treated as a possible teratogen in humans.

Other Effects
- Repeated skin contact can cause thickened skin and/or patchy areas of darkening and loss of pigment. Some persons may develop white lines on the nails.
- Long-term exposure can cause an ulcer or hole in the "bone" (septum) dividing the inner nose, hoarseness and sore eyes.
- **Arsenic** may damage the nervous system causing numbness, "pins and needles," and/or weakness in the hands and feet.
- **Arsenic** may damage the liver.

Medical

Medical Testing
Before first exposure and every 12 months thereafter, OSHA requires your employer to provide (for persons exposed to greater than **0.005 mg/m^3** of *Arsenic*) a work and medical history and exam which shall include:

- Chest x-ray
- Exam of the nose, skin and nails
- Test for urine **Arsenic**. This is most accurate at the end of the workday. Eating shellfish or fish may elevate **Arsenic** levels for up to two days. At NIOSH recommended exposure levels, urine **Arsenic** should not be greater than **100 micrograms per liter** of urine.

After suspected overexposure, repeat these tests and consider exam of the nervous system and liver function tests. Also examine your skin periodically for abnormal growth. Skin cancer from **Arsenic** can be easily cured when detected early.

OSHA requires your employer to provide you and your doctor with a copy of the OSHA *Inorganic Arsenic* Standard (29 CFR 1910.1018).

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures
- More than light alcohol consumption can cause liver damage. Drinking alcohol may increase the liver damage caused by **Arsenic**.

Conditions Made Worse By Exposure
- May scientists believe that skin changes such as thickening and pigment changes make those skin areas more likely to develop skin cancer.

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Specific engineering controls are required for this chemical by OSHA. Refer to the OSHA *Inorganic Arsenic* Standard (29 CFR 1910.1018).
- Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.
- Use a high efficiency particulate air (HEPA) filter when vacuuming. Do not use a standard shop vacuum.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- Avoid skin contact with **Arsenic**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend *Nitrile*, *Natural Rubber* or *Silver Shield®* for gloves and DuPont *Tyvek®*, or the equivalent, as protective materials for clothing.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear impact resistant eye protection with side shields.
- Wear a face shield with goggles when working with corrosive, high irritating or toxic substance.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure not higher than **0.1 mg/m^3**, use a half-mask air purifying respirator equipped with high efficiency filters.
- Where the potential exists for exposure not higher than **0.5 mg/m^3**, use a full facepiece, air purifying respirator with high efficiency filters.
- Where the potential exists for exposure not higher than **5 mg/m^3**, use any powered-air purifying respirator with high efficiency filters or a half-mask supplied-air respirator operated in a positive pressure mode.
- Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Arsenic**, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Exposure to **5 mg/m^3** is immediately dangerous to life and health. If the possibility of exposure above **5 mg/m^3** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- **Arsenic** is noncombustible, however, **Arsenic** *dust* or *fine powder* can explode when exposed to heat, flame or hot surfaces.
- Use dry chemical, CO_2, water spray or foam as extinguishing agents.
- POISONOUS GASES ARE PRODUCED IN FIRE, including *Arsenic Oxides.*
- Use water spray to keep fire-exposed containers cool.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Arsenic** is spilled, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Collect powdered material in the most convenient and safe manner, or use a HEPA-filter vacuum for clean-up, and deposit in sealed containers.
- Ventilate area of spill after clean-up is complete.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Arsenic** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Arsenic** you should be trained on its proper handling and storage.

- A regulated, marked area should be established where **Arsenic** is handled, used or stored as required by the OSHA *Inorganic Arsenic* Standard (29 CFR 1910.1018).
- **Arsenic** reacts with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) to cause fires and explosions.
- **Arsenic** reacts with ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC) and HYDROGEN GAS to produce toxic *Arsine gas*.
- **Arsenic** is not compatible with *powdered* METALS (such as ZINC, LITHIUM, RUBIDIUM and PLATINUM); BROMINE AZIDE; LEAD MONOXIDE; and MERCURY OXIDE.
- Store in tightly closed containers in a cool, well-ventilated area away from COMBUSTIBLES and HEAT.
- DO NOT store in metal tanks.

Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Acute Exposure Guideline Levels (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

CFR is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values are intended to provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database maintained by federal EPA. The database contains information on human health effects that may result from exposure to various chemicals in the environment.

LEL or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

PIH is a DOT designation for chemicals which are Poison Inhalation Hazards.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **ARSENIC**

Synonyms: Gray Arsenic; Arsen
CAS No: 7440-38-2
Molecular Formula: As
RTK Substance No: 0152
Description: Silver-gray or white metallic, odorless, brittle solid

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
4 - Health **0 - Fire** **0 - Reactivity** **DOT#:** UN 1558 **ERG Guide #:** 152 **Hazard Class:** 6.1 (Poison)	**Arsenic** is noncombustible, however, *Arsenic dust* or *fine powder* can explode when exposed to heat, flame or hot surfaces. Use dry chemical, CO_2, water spray or foam as extinguishing agents. POISONOUS GASES ARE PRODUCED IN FIRE, including *Arsenic Oxides*. Use water spray to keep fire-exposed containers cool.	**Arsenic** reacts with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) to cause fires and explosions. **Arsenic** reacts with ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC) and HYDROGEN GAS to produce toxic *Arsine gas*. **Arsenic** is not compatible with *powdered* METALS (such as ZINC, LITHIUM, RUBIDIUM and PLATINUM); BROMINE AZIDE; LEAD MONOXIDE; and MERCURY OXIDE.

SPILL/LEAKS

Isolation Distance:

Spills: 25 to 50 meters (75 to 150 feet)

Fire: 800 meters (1/2 mile)

Moisten spilled material first or use a HEPA-filter vacuum for clean-up.

DO NOT wash into sewer.

Toxic to aquatic organisms.

PHYSICAL PROPERTIES

Odor Threshold:	Odorless
Flash Point:	Noncombustible solid
Vapor Pressure:	1 mm Hg at 701°F (372°C)
Specific Gravity:	5.7 (water = 1)
Water Solubility:	Insoluble
Boiling Point:	1,350°F (613°C)
Ionization Potential:	9.87 eV
Molecular Weight:	74.9

EXPOSURE LIMITS

OSHA:	0.01 mg/m^3, 8-hr TWA
NIOSH:	0.002 mg/m^3, 15-min Ceiling
ACGIH:	0.01 mg/m^3, 8-hr TWA
IDLH:	5 mg/m^3

PROTECTIVE EQUIPMENT

Gloves:	Natural Rubber, Nitrile or Silver Shield®
Coveralls:	DuPont Tyvek®
Respirator:	<0.1 mg/m^3 - Full facepiece APR with High efficiency filter <0.5 mg/m^3 -Supplied air

HEALTH EFFECTS

Eyes:	Irritation, burns, red and watery eyes
Skin:	Irritation, burns, itching, rash and loss of pigment
Inhalation:	Nose and throat irritation with coughing, wheezing and hoarseness
Chronic:	Weakness, headache, nausea, vomiting, and muscle cramps Cancer (skin and lung) in humans

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn. Seek medical attention.

Quickly remove contaminated clothing and wash contaminated skin with large amounts of soap and water.

Begin artificial respiration if breathing has stopped and CPR if necessary.

Transfer to a medical facility.

Right to Know Hazardous Substance Fact Sheet

Common Name: **BENZENE**

Synonyms: Benzin; Benzol; Phenyl Hydride

Chemical Name: Benzene

Date: January 2001 Revision: October 2008

CAS Number: 71-43-2

RTK Substance Number: 0197

DOT Number: UN 1114

Description and Use

Benzene is a clear, colorless liquid with a sweet *Petroleum*-like odor. It is used as a solvent and in making plastics, resins dyes and pesticides. It is also found in *Gasoline*.

- **ODOR THRESHOLD= 12 ppm**
- Odor thresholds vary greatly. Do not rely on odor alone to determine potentially hazardous exposures.

Reasons for Citation

- **Benzene** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, NTP, DEP, IARC, IRIS, NFPA and EPA.
- This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while rinsing.

Skin Contact

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Inhalation

- Remove the person from exposure
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

EMERGENCY RESPONDERS >>>> SEE BACK PAGE

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	4	2
FLAMMABILITY	-	3
REACTIVITY	-	0

CARCINOGEN
FLAMMABLE
POISONOUS GASES ARE PRODUCED IN FIRE
CONTAINERS MAY EXPLODE IN FIRE

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

- **Benzene** can affect you when inhaled and by passing through the skin.
- **Benzene** is a CARCINOGEN and MUTAGEN. HANDLE WITH EXTREME CAUTION.
- **Benzene** can irritate the skin and eyes with drying and scaling of the skin.
- Inhaling **Benzene** can irritate the nose and throat.
- **Benzene** can cause headache, dizziness, nausea and vomiting. Convulsions and coma, or sudden death from irregular heartbeat, may follow high exposure.
- Repeated exposure can cause damage to the blood cells (aplastic anemia).
- **Benzene** is a FLAMMABLE LIQUID and a DANGEROUS FIRE HAZARD.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **1 ppm** averaged over an 8-hour workshift and **5 ppm**, not to be exceeded during any 15-minute work period.

NIOSH: The recommended airborne exposure limit (REL) is **0.1 ppm** averaged over a 10-hour workshift and **1 ppm**, not to be exceeded during any 15-minute work period.

ACGIH: The threshold limit value (TLV) is **0.5 ppm** averaged over an 8-hour workshift and **2.5 ppm** as a STEL (short-term exposure limit).

- **Benzene** is a CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects
The following acute (short-term) health effects may occur immediately or shortly after exposure to **Benzene**:

- Contact can irritate the skin and eyes.
- Inhaling **Benzene** can irritate the nose and throat causing coughing and wheezing.
- **Benzene** can cause headache, dizziness, lightheadedness, nausea and vomiting. Convulsions and coma, or sudden death from irregular heartbeat, may follow high exposure.

Chronic Health Effects
The following chronic (long-term) health effects can occur at some time after exposure to **Benzene** and can last for months or years:

Cancer Hazard
- **Benzene** is a CARCINOGEN in humans. It has been shown to cause leukemia.
- Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard
- There is limited evidence that **Benzene** is a teratogen in animals. Until further testing has been done, it should be treated as a possible teratogen in humans.

Other Effects
- **Benzene** can cause drying and scaling of the skin.
- Repeated exposure can cause damage to the blood cells (aplastic anemia).

Medical

Medical Testing
Before first exposure and every 12 months thereafter, OSHA requires your employer to provide (for persons exposed to greater than **0.5 ppm** of *Benzene*) a work and medical history and exam, which shall include:

- Thorough physical examination
- Complete blood count (CBC)
- Any other tests determined necessary by the examining physician

OSHA requires your employer to provide you and your doctor with a copy of the OSHA *Benzene* Standard (29 CFR 1910.1028).

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Specific engineering controls are required for this chemical by OSHA. Refer to the OSHA *Benzene* Standard (29 CFR 1910.1028).
- Before entering a confined space where **Benzene** may be present, check to make sure that an explosive concentration does not exist.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- Avoid skin contact with **Benzene**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend Polyvinyl Alcohol, Silver Shield®/4H®, Viton and Fluoroelastomer for gloves and Tychem® CPF 3, F, BR, LV, Responder®, and TK; Zytron® 300; and ONESuit® TEC, or the equivalent, as protective materials for *Hydrocarbons, Aromatic.*
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear indirect-vent, impact and splash resistant goggles when working with liquids.
- Wear non-vented, impact resistant goggles when working with fumes, gases, or vapors.
- Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.
- Do not wear contact lenses when working with this substance.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **0.5 ppm**, use a NIOSH approved full facepiece respirator with an organic vapor cartridge. Increased protection is obtained from full facepiece powered-air purifying respirators.
- Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Benzene**, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential exists for exposure over **5 ppm**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- Exposure to **500 ppm** is immediately dangerous to life and health. If the possibility of exposure above **500 ppm** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- **Benzene** is a FLAMMABLE LIQUID.
- Use dry chemical, CO_2, water spray or foam as extinguishing agents.
- Use water as fog, as spray may be ineffective and may scatter and spread fire.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- CONTAINERS MAY EXPLODE IN FIRE.
- Use water spray to reduce vapors and keep containers cool.
- Vapors may travel to a source of ignition and flash back.
- Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Benzene** is spilled or leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers.
- Ventilate area of spill or leak.
- Keep **Benzene** out of confined spaces, such as sewers, because of the possibility of an explosion.
- Use water spray to reduce vapors and keep containers cool.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Benzene** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Benzene** you should be trained on its proper handling and storage.

- A regulated, marked area should be established where **Benzene** is handled, used or stored as required by the OSHA *Benzene* Standard (29 CFR 1910.1028).
- **Benzene** reacts violently or explosively with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC).
- **Benzene** ignites on contact with CHROMIC ANHYDRIDE.
- **Benzene** is not compatible with LIQUID OXYGEN, HYDROGEN, and RANEY NICKEL.
- Store in tightly closed containers in a cool, well-ventilated area away from AIR and HEAT.
- **Benzene** attacks some RUBBER, COATINGS and PLASTICS.
- Sources of ignition, such as smoking and open flames, are prohibited where **Benzene** is used, handled, or stored.
- Metal containers involving the transfer of **Benzene** should be grounded and bonded.
- Use explosion-proof electrical equipment and fittings wherever **Benzene** is used, handled, manufactured, or stored.
- Use only non-sparking tools and equipment, especially when opening and closing containers of **Benzene**.

Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Acute Exposure Guideline Levels (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

CFR is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values are intended to provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database maintained by federal EPA. The database contains information on human health effects that may result from exposure to various chemicals in the environment.

LEL or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

PIH is a DOT designation for chemicals which are Poison Inhalation Hazards.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **BENZENE**

Synonyms: Benzin; Benzol; Phenyl Hydride
CAS No: 71-43-2
Molecular Formula: C_6H_6
RTK Substance No: 0197
Description: Clear, colorless liquid with a sweet *Petroleum*-like odor

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
4 - Health **3 - Fire** **0 - Reactivity** **DOT#:** UN 1114 **ERG Guide #:** 130 **Hazard Class:** 3 (Flammable)	FLAMMABLE LIQUID Use dry chemical, CO_2, water spray or foam as extinguishing agents. Use water as fog, as spray may be ineffective and may scatter and spread fire. POISONOUS GASES ARE PRODUCED IN FIRE. CONTAINERS MAY EXPLODE IN FIRE. Use water spray to reduce vapors and keep containers cool. Vapors may travel to a source of ignition and flash back. Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source.	**Benzene** reacts violently or explosively with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC). **Benzene** ignites on contact with CHROMIC ANHYDRIDE. **Benzene** is not compatible with LIQUID OXYGEN, HYDROGEN, and RANEY NICKEL.

SPILL/LEAKS

Isolation Distance:
Small Spill: 30 meters (100 feet)
Large Spill: 60 meters (200 feet)
Fire: 800 meters (1/2 mile)
Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit in sealed containers.
Keep **Benzene** out of confined spaces, such as sewers, because of the possibility of an explosion.
DO NOT wash into sewer.
Benzene is very toxic to aquatic organisms.

PHYSICAL PROPERTIES

Odor Threshold:	12 ppm
Flash Point:	12°F (-11°C)
LEL:	1%
UEL:	8%
Auto Ignition Temp:	928° to 1,076°F (498° to 580°C)
Vapor Density:	2.7 (air = 1)
Vapor Pressure:	75 mm Hg at 68°F (20°C)
Specific Gravity:	0.88 (water = 1)
Water Solubility:	Slightly soluble
Boiling Point:	176°F (80°C)
Freezing Point:	42°F (6°C)
Ionization Potential:	9.24 eV
Molecular Weight:	78.1

EXPOSURE LIMITS

OSHA:	1 ppm, 8-hr TWA; 5 ppm, 15-min STEL
NIOSH:	0.1 ppm, 10-hr TWA; 1 ppm, 15-min STEL
ACGIH:	0.5 ppm, 8-hr TWA; 2.5 ppm, 15-min STEL
IDLH:	500 ppm ERPG-1: 50 ppm; ERPG-2: 150 ppm EPRG-3: 1,000 ppm

PROTECTIVE EQUIPMENT

Gloves:	Polyvinyl Alcohol, Silver Shield®/4H®, Viton and Fluoroelastomer (>8-hr breakthrough)
Coveralls:	Tychem® CPF 3, F, BR, LV, Responder®, and TK; Zytron® 300; and ONESuit® TEC (>8-hr breakthrough for *Hydrocarbons, Aromatic*)
Respirator:	>0.5 ppm - Supplied air or SCBA

HEALTH EFFECTS

Eyes:	Irritation
Skin:	Irritation
Inhalation:	Nose and throat irritation with coughing and wheezing Headache, dizziness, convulsions and coma
Chronic:	Cancer (leukemia) in humans

FIRST AID AND DECONTAMINATION

Remove the person from exposure.
Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.
Quickly remove contaminated clothing and wash contaminated skin with large amounts of soap and water.
Begin artificial respiration if breathing has stopped and CPR if necessary.
Transfer promptly to a medical facility.

October 2008

Right to Know Hazardous Substance Fact Sheet

Common Name: **BENZO(a)PYRENE**

Synonyms: 3,4-Benzopyrene; B[a]P

Chemical Name: Benzo[a]pyrene

Date: July 1998 Revision: October 2007

CAS Number: 50-32-8

RTK Substance Number: 0207

DOT Number: UN 3077

EMERGENCY RESPONDERS >>>> SEE BACK PAGE

Description and Use

Benzo(a)pyrene is a pale yellow, crystalline solid or powder with a faint aromatic odor. In its pure form it is used as a laboratory reagent. It also forms as a gaseous by-product when certain carbon substances burn, such as coal tar chemicals, and is found in cigarette smoke.

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	3	-
FLAMMABILITY	1	-
REACTIVITY	0	-

CARCINOGEN
POISONOUS GASES ARE PRODUCED IN FIRE

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

Reasons for Citation

- **Benzo(a)pyrene** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, NTP, DEP, IARC, IRIS, and EPA.
- This chemical is on the Special Health Hazard Substance List.

- **Benzo(a)pyrene** can affect you when inhaled and by passing through the skin.
- **Benzo(a)pyrene** is a CARCINOGEN. HANDLE WITH EXTREME CAUTION.
- **Benzo(a)pyrene** may damage the developing fetus.
- Contact can irritate and burn the eyes.
- **Benzo(a)pyrene** can irritate the skin causing a rash or burning feeling on contact.
- Repeated exposure can cause thickening and darkening of the skin.
- Except in laboratories, **Benzo(a)pyrene** is usually found mixed with other "coal tar pitch" chemicals.
- *For more information, consult the Right to Know Hazardous Substance Fact Sheets on COAL TAR PITCH, CREOSOTE, CHRYSENE, and ANTHRACENE.*

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while rinsing.

Skin Contact

- Remove contaminated clothing. Wash contaminated skin with soap and water.

Inhalation

- Remove the person from exposure.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **0.2 mg/m^3** (as *Coal Tar Pitch Volatiles*) averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **0.1 mg/m^3** (as the *Cyclohexane-extractable fraction*) averaged over a 10-hour workshift.

ACGIH: Recommends that exposure by all routes be controlled to levels as low as possible.

- **Benzo(a)pyrene** is a PROBABLE CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects
The following acute (short-term) health effects may occur immediately or shortly after exposure to **Benzo(a)pyrene**:

- Contact can irritate and burn the eyes.
- **Benzo(a)pyrene** can irritate the skin causing a rash or burning feeling on contact. Exposure to a combination of sunlight and this chemical can increase these effects.

Chronic Health Effects
The following chronic (long-term) health effects can occur at some time after exposure to **Benzo(a)pyrene** and can last for months or years:

Cancer Hazard
- **Benzo(a)pyrene** is a PROBABLE CARCINOGEN in humans. There is some evidence that is causes stomach, skin, lung, blood, spleen, pancreas, and mammary cancer in animals.
- Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard
- **Benzo(a)pyrene** may damage the developing fetus.
- There is limited evidence that **Benzo(a)pyrene** may damage the male and female reproductive systems.

Other Effects
- Repeated exposure can cause thickening and darkening of the skin and warts.

Medical

Medical Testing
There is no special test for this chemical. However, seek medical attention if illness occurs or overexposure is suspected.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures
- Sunlight may cause a rash to develop in people exposed to **Benzo(a)pyrene** and increases the risk of skin cancer.
- Tobacco smoke also contains **Benzo(a)pyrene**. Smoking may increase the risk of lung cancer with exposure to **Benzo(a)pyrene.**

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.

- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Use a Class I, Type B, biological safety hood when working with **Benzo(a)pyrene** in a laboratory.
- Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.
- Use a high efficiency particulate air (HEPA) filter when vacuuming. Do not use a standard shop vacuum.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- Avoid skin contact with **Benzo(a)pyrene**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend DuPont *Tychem® CPF-2*, *SL*, *CPF-4* and *Responder®* as protective materials for clothing.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear eye protection with side shields or goggles.
- Do not wear contact lenses when working with this substance.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **0.1 mg/m^3**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- Exposure to **80 mg/m^3** (as *Coal Tar Pitch Volatiles*) is immediately dangerous to life and health. If the possibility of exposure above **80 mg/m^3** (as *Coal Tar Pitch Volatiles*) exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- **Benzo(a)pyrene** may burn, but does not readily ignite.
- Use dry chemical, CO_2, water spray or foam as extinguishing agents.
- POISONOUS GASES ARE PRODUCED IN FIRE.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Benzo(a)pyrene** is spilled, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Moisten spilled material first to reduce dust or use a HEPA-filter vacuum for clean-up.
- Ventilate and wash area after clean-up is complete.
- It may be necessary to contain and dispose of **Benzo(a)pyrene** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP), Nuclear Regulatory Commission (NRC) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Benzo(a)pyrene** you should be trained on its proper handling and storage.

- A regulated, marked area should be established where **Benzo(a)pyrene** is handled, used, or stored.
- **Benzo(a)pyrene** reacts with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).
- Store in tightly closed containers in a cool, well-ventilated area.
- Sources of ignition, such as smoking and open flames, are prohibited where **Benzo(a)pyrene** is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

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New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

BENZO(a)PYRENE

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NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

PIH is a DOT designation for chemicals which are Poison Inhalation Hazards.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

NJ Health
New Jersey Department of Health

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **BENZO(a)PYRENE**

Synonyms: 3,4-Benzopyrene; B[a]P
CAS No: 50-32-8
Molecular Formula: $C_{20}H_{12}$
RTK Substance No: 0207
Description: Pale yellow, crystalline solid or powder

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
3 - Health **1 - Fire** **0 - Reactivity** **DOT#:** UN 3077 **ERG Guide #:** 171 **Hazard Class:** 9 (Miscellaneous Hazardous Materials)	**Benzo(a)pyrene** may burn, but does not readily ignite. Use dry chemical, CO_2, water spray or foam as extinguishing agents. POISONOUS GASES ARE PRODUCED IN FIRE.	**Benzo(a)pyrene** reacts with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) to cause fires and explosions.

SPILL/LEAKS

Isolation Distance: 50 meters (150 feet)

Moisten spilled material first or use a HEPA-filter vacuum for clean-up.

Toxic to aquatic organisms.

PHYSICAL PROPERTIES

Odor Threshold:	Faint aromatic odor
Flash Point:	No information
Specific Gravity:	1.35
Vapor Density:	8.7 (air = 1)
Vapor Pressure:	5.49 X 10^9 mm Hg at 77°F (25°C)
Water Solubility:	Insoluble
Boiling Point:	590° - 594°F (310° - 312°C)
Melting Point:	347° - 354 F (175 ° - 179°C)

EXPOSURE LIMITS

OSHA:	0.2 mg/m^3, 8-hr TWA
NIOSH:	0.1 mg/m^3, 10-hr TWA
ACGIH:	lowest level possible
IDLH LEVEL:	80 mg/m^3 (as *Coal Tar Pitch Volatiles*)

PROTECTIVE EQUIPMENT

Gloves:	No information
Coveralls:	DuPont Tychem®, CPF-2, SL, CPF-4, Responder® (all >8-hr permeation time)
Boots:	No information
Respirator:	>0.1 mg/m^3 - Supplied air

HEALTH EFFECTS

Eyes:	Irritation and burns
Skin:	Irritation, rash and burning feeling
Chronic:	Cancer (stomach, skin, lung, blood, spleen, pancreas, and mammary) in animals. May affect the developing fetus Thickening and darkening of the skin and warts

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.

Remove contaminated clothing and wash contaminated skin with soap and water.

Transfer to a medical facility.

Right to Know
Hazardous Substance Fact Sheet

Common Name: **CADMIUM**

Synonyms: None

Chemical Name: Cadmium

Date: December 1999 Revision: December 2007

CAS Number: 7440-43-9

RTK Substance Number: 0305

DOT Number: UN 2570

EMERGENCY RESPONDERS >>>> SEE BACK PAGE

Description and Use

Cadmium is a soft, blue-white solid, gray-black metal, or gray or white powder. It is used in silver solder, making batteries and metal plating, for plastics and pigments, and as a catalyst. It is a byproduct of *Zinc* production.

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	4	-
FLAMMABILITY	3	-
REACTIVITY	1	-

CARCINOGEN
TERATOGEN
FLAMMABLE DUST OR POWDER
POISONOUS GASES ARE PRODUCED IN FIRE
CONTAINERS MAY EXPLODE IN FIRE

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

Reasons for Citation

- **Cadmium** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, NTP, DEP, IARC, IRIS and EPA.
- This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact
- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while rinsing.

Skin Contact
- Remove contaminated clothing and wash contaminated skin with soap and water.

Inhalation
- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.
- Medical observation is recommended for 24 to 48 hours after overexposure, as pulmonary edema may be delayed.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222
CHEMTREC: 1-800-424-9300
NJDEP Hotline: 1-877-927-6337
National Response Center: 1-800-424-8802

- **Cadmium** can affect you when inhaled.
- **Cadmium** is a CARCINOGEN and a TERATOGEN. HANDLE WITH EXTREME CAUTION.
- Contact can irritate the skin and eyes.
- Exposure to **Cadmium** may cause a flu-like illness called *metal fume fever*.
- **Cadmium** can cause nausea, vomiting, diarrhea and abdominal pain.
- Inhaling **Cadmium** can irritate the lungs. Higher exposures may cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency.
- Repeated low exposures can cause liver and kidney damage, anemia and loss of smell.
- **Cadmium** *dust* or *powder* is FLAMMABLE and EXPLOSIVE and may ignite spontaneously in air or when exposed to heat.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **0.005 mg/m^3** averaged over an 8-hour workshift.

NIOSH: Recommends that exposure to occupational carcinogens be limited to the lowest feasible concentration.

ACGIH: The threshold limit value (TLV) is **0.01 mg/m^3** (as *total particulates*), and **0.002 mg/m^3** (as the *respirable fraction*), averaged over an 8-hour workshift.

- **Cadmium** is a CARCINOGEN and TERATOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.

Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects
The following acute (short-term) health effects may occur immediately or shortly after exposure to **Cadmium**:

- Contact can irritate the skin and eyes.
- Exposure to **Cadmium** may cause *"metal fume fever."* This is a flu-like illness with symptoms of metallic taste in the mouth, headache, fever and chills, aches, chest tightness and cough. The symptoms may be delayed for several hours after exposure and usually last for a day or two.
- **Cadmium** can cause nausea, vomiting, diarrhea and abdominal pain.
- Inhaling **Cadmium** can irritate the lungs causing coughing and/or shortness of breath. Higher exposures may cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.

Chronic Health Effects
The following chronic (long-term) health effects can occur at some time after exposure to **Cadmium** and can last for months or years:

Cancer Hazard
- **Cadmium** is a CARCINOGEN in humans. It has been shown to cause lung and prostate cancer.
- Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard
- **Cadmium** is a PROBABLE TERATOGEN in humans.
- **Cadmium** may damage the male reproductive system (testes) and affect the female reproductive cycle.

Other Effects
- **Cadmium** can irritate the lungs. Repeated exposure may cause bronchitis to develop with coughing, phlegm, and/or shortness of breath.
- Repeated low exposures can cause liver and kidney damage.
- **Cadmium** can cause anemia, loss of sense of smell (anosmia) and/or discoloration of teeth.

Medical

Medical Testing
Before first exposure and every 12 months thereafter, OSHA requires your employer to provide (for persons exposed to greater than or equal to **0.0025 mg/m^3** of *Cadmium*) a work and medical history and exam which shall include:

- Blood test for **Cadmium** (levels should be less than **5 micrograms per liter** of whole blood)
- Urine test for **Cadmium** (levels should be less than **3 micrograms per liter** of urine)
- Urine test for Beta-2 microglobulin to detect kidney damage
- Liver and kidney function tests
- Lung function tests
- Complete blood count

If symptoms develop or overexposure is suspected, the following is recommended:

- Consider chest x-ray after acute overexposure

OSHA requires your employer to provide you and your doctor with a copy of the OSHA *Cadmium* Standards (29 CFR 1910.1027 and 1926.1127).

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures

- Smoking can cause heart disease, lung cancer, emphysema, and other respiratory problems. It may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.
- More than light alcohol consumption can cause liver damage. Drinking alcohol may increase the liver damage caused by **Cadmium**.
- Cigarette smoke contains some **Cadmium**. Because it is hard for the body to eliminate **Cadmium,** it tends to build up in the body. Any workplace exposure adds to these levels.

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Specific engineering controls are required for this chemical by OSHA. Refer to the OSHA *Cadmium* Standards (29 CFR 1910.1027 and 1926.1127).
- Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.
- Use a high efficiency particulate air (HEPA) filter when vacuuming. Do not use a standard shop vacuum.
- Before entering a confined space where **Cadmium** *dust* or *powder* may be present, check to make sure that an explosive concentration does not exist.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- Avoid skin contact with **Cadmium**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend *Nitrile* or *Neoprene* for gloves and DuPont *Tyvek*® as protective material for clothing.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear eye protection with side shields or goggles.
- Do not wear contact lenses when working with this substance.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure less than or equal to **0.05 mg/m^3**, use a NIOSH approved air-purifying, particulate filter respirator with an N100, R100 or P100 filter.
- Where the potential exists for exposure less than or equal to **0.250 mg/m^3**, use a NIOSH approved full facepiece air-purifying respirator with high-efficiency filters. Even greater protection is provided by a powered-air purifying respirator.
- Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Cadmium**, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential exists for exposure over **5 mg/m^3**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

- Exposure to **9 mg/m^3** (*dust* or *fume*) is immediately dangerous to life and health. If the possibility of exposure above **9 mg/m^3** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- **Cadmium** *dust* or *powder* is FLAMMABLE and EXPLOSIVE and may ignite spontaneously in air or when exposed to heat.
- Use dry chemicals appropriate for extinguishing metal fires.
- DO NOT USE water, foam, CO_2 or Halons.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- CONTAINERS MAY EXPLODE IN FIRE.
- Use water spray to keep fire-exposed containers cool.
- **Cadmium** *powder* may ignite combustibles (wood, paper and oil).

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Cadmium** is spilled, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Moisten *powdered* spilled material first or use a HEPA-filter vacuum for clean-up.
- Collect solid material in the most convenient and safe manner and deposit in sealed containers.
- Ventilate and wash area after clean-up is complete.
- It may be necessary to contain and dispose of **Cadmium** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Cadmium** you should be trained on its proper handling and storage.

- A regulated, marked area should be established where **Cadmium** is handled, used or stored as required by the OSHA *Cadmium* Standards (29 CFR 1910.1027 and 1926.1127).
- **Cadmium** reacts with STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC) to form flammable and explosive *Hydrogen gas*.
- **Cadmium** *dust* or *powder* reacts with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); HYDROGEN AZIDE; AMMONIUM NITRATE; AMMONIA; POTASSIUM; ZINC; SULFUR; SELENIUM; and TELLURIUM to cause fires and explosions.
- Sources of ignition, such as smoking and open flames, are prohibited where **Cadmium** *powder* is used, handled, or stored.
- Metal containers involving the transfer of **Cadmium** *powder* should be grounded and bonded.
- Use explosion-proof electrical equipment and fittings wherever **Cadmium** *powder* is used, handled, manufactured, or stored.
- Store **Cadmium** *powder* under *Nitrogen*.

Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Acute Exposure Guideline Levels (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

CFR is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values are intended to provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database maintained by federal EPA. The database contains information on human health effects that may result from exposure to various chemicals in the environment.

LEL or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

PIH is a DOT designation for chemicals which are Poison Inhalation Hazards.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **CADMIUM**

Synonyms: None
CAS No: 7440-43-9
Molecular Formula: Cd
RTK Substance No: 0305
Description: Soft, blue-white solid, gray-black metal, or gray or white powder

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
4 - Health **3 - Fire** **1 - Reactivity** **DOT#:** UN 2570 **ERG Guide #:** 154 **Hazard Class:** 6.1 (Poison)	Use dry chemicals appropriate for extinguishing metal fires. DO NOT USE water, foam, CO_2 or Halons. POISONOUS GASES ARE PRODUCED IN FIRE. CONTAINERS MAY EXPLODE IN FIRE Use water spray to keep fire-exposed containers cool. **Cadmium** *powder* may ignite combustibles (wood, paper and oil).	**Cadmium** reacts with STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC) to form flammable and explosive *Hydrogen gas*. **Cadmium** *dust* or *powder* reacts with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); HYDROGEN AZIDE; AMMONIUM NITRATE; AMMONIA; POTASSIUM; ZINC; SULFUR; SELENIUM; and TELLURIUM to cause fires and explosions.

SPILL/LEAKS

Isolation Distance: 25 meters (75 feet)

Moisten *powdered* spilled material first or use a HEPA-filter vacuum for clean-up.

Collect solid material in the most convenient and safe manner and deposit in sealed containers.

DO NOT wash into sewer.

PHYSICAL PROPERTIES

Odor Threshold:	None
Flash Point:	Non-combustible solid, flammable powder/dust
Vapor Pressure:	0 mm at Hg 68°F (20°C)
Specific Gravity:	8.65
Water Solubility:	Insoluble
Melting Point:	610°F (321°C)
Boiling Point:	1,409°F (765°C)
Molecular Weight:	112.4

EXPOSURE LIMITS

OSHA:	0.005 mg/m^3, 8-hr TWA
NIOSH:	Lowest feasible concentration
ACGIH:	0.01 mg/m^3, 8-hr TWA (total particulates) 0.002 mg/m^3, 8-hr TWA (respirable fraction)
IDLH LEVEL:	9 mg/m^3 (dust or fume)

PROTECTIVE EQUIPMENT

Gloves:	Nitrile or Neoprene
Coveralls:	DuPont Tyvek®
Respirator:	>0.005 mg/m^3 - APR with High efficiency filters >5 mg/m^3 - Supplied air

HEALTH EFFECTS

Eyes:	Irritation
Skin:	Irritation
Inhalation:	Lung irritation with coughing and/or shortness of breath Nausea, vomiting, Headache, fever and chills, aches and chest tightness
Chronic:	Carcinogen (lung and prostate) in humans Teratogen in humans

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.

Remove contaminated clothing and wash contaminated skin with soap and water.

Begin artificial respiration if breathing has stopped and CPR if necessary.

Transfer to a medical facility.

Medical observation is recommended as symptoms may be delayed.

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **CHROMIUM**

Synonyms: Chrome; Metallic Chromium
CAS No: 7440-47-3
Molecular Formula: Cr
RTK Substance No: 0432
Description: Hard, gray, odorless solid with a metallic luster

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
2 - Health **3 - Fire** **0 - Reactivity** **DOT#:** UN 3089 **ERG Guide #:** 170 **Hazard Class:** 4.1 (Flammable Solid)	Extinguish fire using an agent suitable for type of surrounding fire. **Chromium** itself does not burn. **Chromium** in *powder* form is FLAMMABLE and a DANGEROUS FIRE HAZARD. It may also spontaneously explode in air. Use dry sand or dry chemical extinguishing agents to fight **Chromium** *powder* fires. POISONOUS GASES ARE PRODUCED IN FIRE. CONTAINERS MAY EXPLODE IN FIRE. DO NOT get water inside container.	**Chromium** may react violently or explosively with AMMONIUM NITRATE; CARBON DIOXIDE ATMOSPHERES; BROMINE PENTAFLUORIDE; LITHIUM; NITROGEN OXIDES; and SULFUR DIOXIDE. **Chromium** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); STRONG ACIDS (such as HYDROCHLORIC and SULFURIC); and ALKALI METALS (such as SODIUM and POTASSIUM).

SPILL/LEAKS

Isolation Distance:

Spill: 25 meters (75 feet)

Fire: 800 meters (1/2 mile)

Moisten spilled material first or use a HEPA-filter vacuum for clean-up and place into sealed containers for disposal.

Keep **Chromium** *powder* out of confined spaces, such as sewers, because of the possibility of an explosion.

DO NOT wash into sewer.

PHYSICAL PROPERTIES

Odor Threshold:	Odorless
Flash Point:	Noncombustible solid, Flammable *powder*
Vapor Pressure:	<0 mm Hg at 68°F (20°C) (approximate)
Specific Gravity:	7.2 (water = 1)
Water Solubility:	Insoluble
Boiling Point:	4,788°F (2,642°C)
Melting Point:	3,452°F (1,900°C)
Molecular Weight:	52

EXPOSURE LIMITS

OSHA:	1 mg/m^3, 8-hr TWA
NIOSH:	0.5 mg/m^3, 8-hr TWA
ACGIH:	0.5 mg/m^3, 8-hr TWA
IDLH:	250 mg/m^3

The Protective Action Criteria values are:

PAC-1 = 1.5 mg/m^3 PAC-3 = 250 mg/m^3

PAC-2 = 2.5 mg/m^3

PROTECTIVE EQUIPMENT

Gloves:	Nitrile or Natural Rubber
Coveralls:	Tyvek®
Respirator:	>0.5 mg/m^3 - full facepiece APR with High efficiency filters >1.5 mg/m^3 - SCBA

HEALTH EFFECTS

Eyes:	Irritation, burns and possible eye damage
Skin:	Irritation, burns, itching, rash and skin ulcers
Inhalation:	Nose and throat irritation with coughing and wheezing Headache, fever and chills

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

Flush eyes with large amounts of water for at least 30 minutes. Remove contact lenses if worn. Seek medical attention.

Quickly remove contaminated clothing and wash contaminated skin with large amounts of soap and water.

Begin artificial respiration if breathing has stopped and CPR if necessary.

Transfer promptly to a medical facility.

Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects
The following acute (short-term) health effects may occur immediately or shortly after exposure to **Chromium**:

- Contact can irritate and burn the skin and eyes with possible eye damage.
- Inhaling **Chromium** can irritate the nose and throat causing coughing and wheezing.
- Exposure to **Chromium** *fumes* can cause *"metal fume fever."* This is a flu-like illness with symptoms of metallic taste in the mouth, headache, fever and chills, aches, chest tightness and cough. The symptoms may be delayed for several hours after exposure and usually last for a day or two.

Chronic Health Effects
The following chronic (long-term) health effects can occur at some time after exposure to **Chromium** and can last for months or years:

Cancer Hazard
- While **Chromium** has been tested, it is not classifiable as to its potential to cause cancer.

Reproductive Hazard
- There is no evidence that **Chromium** affects reproduction. This is based on test results presently available to the NJDHSS from published studies.

Other Effects
- Inhaling **Chromium** can cause a sore and/or a hole in the "bone" (septum) dividing the inner nose, sometimes with bleeding, discharge, and/or formation of a crust.
- **Chromium** may cause a skin allergy. If allergy develops, very low future exposure can cause itching and a skin rash.
- **Chromium** may cause an asthma-like allergy. Future exposure can cause asthma attacks with shortness of breath, wheezing, coughing, and/or chest tightness.
- Prolonged skin contact can cause burns, blisters and deep ulcers
- **Chromium** may affect the liver and kidneys.

Medical

Medical Testing
For frequent or potentially high exposure (half the TLV or greater), the following are recommended before beginning work and at regular times after that:

- Lung function tests. The results may be normal if the person is not having an attack at the time of the test.

If symptoms develop or overexposure is suspected, the following are recommended:

- Examine your skin periodically for little bumps or blisters, the first sign of "chrome ulcers." If not treated early, these can last for years after exposure.
- Evaluation by a qualified allergist can help diagnose skin allergy.
- Liver and kidney function tests

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures
- Smoking can cause heart disease, lung cancer, emphysema, and other respiratory problems. It may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.
- More than light alcohol consumption can cause liver damage. Drinking alcohol can increase the liver damage caused by **Chromium**.

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Before entering a confined space where **Chromium** *powder* may be present, check to make sure that an explosive concentration does not exist.
- Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- Avoid skin contact with **Chromium**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend Nitrile and Natural Rubber for gloves, and Tyvek®, or the equivalent, as a protective material for clothing.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear eye protection with side shields or goggles.
- If additional protection is needed for the entire face, use in combination with a face shield. A face shield should not be used without another type of eye protection.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **0.5 mg/m^3**, use a NIOSH approved negative pressure, air-purifying, particulate filter respirator with an N, R or P95 filter. More protection is provided by a full facepiece respirator than by a half-mask respirator, and even greater protection is provided by a powered-air purifying respirator.
- Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Chromium**, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential exists for exposure over **5 mg/m^3**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- Exposure to **250 mg/m^3** is immediately dangerous to life and health. If the possibility of exposure above **250 mg/m^3** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- Extinguish fire using an agent suitable for type of surrounding fire. **Chromium** itself does not burn.
- **Chromium** in *powder* form is FLAMMABLE and a DANGEROUS FIRE HAZARD. It may also spontaneously explode in air.
- Use dry sand or dry chemical extinguishing agents to fight **Chromium** *powder* fires.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- CONTAINERS MAY EXPLODE IN FIRE.
- DO NOT get water inside container.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Chromium** *powder* is spilled, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Moisten spilled material first or use a HEPA-filter vacuum for clean-up and place into sealed containers for disposal.
- Keep **Chromium** *powder* out of confined spaces, such as sewers, because of the possibility of an explosion.
- Ventilate and wash area after clean-up is complete.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Chromium** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Chromium** you should be trained on its proper handling and storage.

- **Chromium** may react violently or explosively with AMMONIUM NITRATE; CARBON DIOXIDE ATMOSPHERES; BROMINE PENTAFLUORIDE; LITHIUM; NITROGEN OXIDES; and SULFUR DIOXIDE.
- **Chromium** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); STRONG ACIDS (such as HYDROCHLORIC and SULFURIC); and ALKALI METALS (such as SODIUM and POTASSIUM).
- Store in tightly closed containers in a cool, well-ventilated area.
- Sources of ignition, such as smoking and open flames, are prohibited where **Chromium** *powder* is used, handled, or stored.

Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Acute Exposure Guideline Levels (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

CFR is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database on human health effects that may result from exposure to various chemicals, maintained by federal EPA.

LEL or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

Protective Action Criteria (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

Right to Know
Hazardous Substance Fact Sheet

Common Name: **COPPER**

Synonyms: Bronze Powder; Gold Bronze

Chemical Name: Copper

Date: September 2008 Revision: September 2016

CAS Number: 7440-50-8

RTK Substance Number: 0528

DOT Number: UN 3077

EMERGENCY RESPONDERS >>>> SEE BACK PAGE

Description and Use

Copper is a reddish-brown, odorless metal. It is used in electrical wiring and plumbing, in alloys and protective coatings for other metals, and in insecticides, fungicides and herbicides.

Hazard Summary

Hazard Rating	NJDHSS	NFPA
HEALTH	2	-
FLAMMABILITY	1	-
REACTIVITY	1	-

FINELY DIVIDED **COPPER** MAY BURN OR EXPLODE IN AIR

POISONOUS GASES ARE PRODUCED IN FIRE

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

Reasons for Citation

- **Copper** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, DEP and EPA.

SEE GLOSSARY ON PAGE 5.

- **Copper** can affect you when inhaled
- Contact can irritate and burn the skin and eyes.
- Inhaling **Copper** can irritate the nose and throat.
- Inhaling **Copper** can cause a sore and/or a hole in the "bone" (septum) dividing the inner nose.
- **Copper** can cause headache, nausea, vomiting, diarrhea and abdominal pain.
- Exposure to **Copper** can cause a flu-like illness called *metal fume fever*.
- **Copper** may cause a skin allergy.
- **Copper** may affect the liver and kidneys.

FIRST AID

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while flushing. Seek medical attention.

Skin Contact

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Inhalation

- Remove the person from exposure
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **1 mg/m³** (as **Copper** *dusts* and *mists*) and **0.1 mg/m³** (as **Copper** *fume*) averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **1 mg/m³** (as **Copper** *dusts* and *mists*) and **0.1 mg/m³** (as **Copper** *fume*) averaged over a 10-hour workshift.

ACGIH: The threshold limit value (TLV) is **1 mg/m³** (as **Copper** *dusts* and *mists*) and **0.2 mg/m³** (as **Copper** *fume*) averaged over an 8-hour workshift.

High-temperature operations such as welding, brazing, soldering, plating, cutting, and metallizing often generate fumes that have different health effects and exposure standards than the metal, metal compound or metal alloy originally used.

Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health and Senior Services Hazardous Substance Fact Sheet, available on the RTK Program website (http://www.state.nj.us/health/workplacehealthandsafety/right-to-know/) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects
The following acute (short-term) health effects may occur immediately or shortly after exposure to **Copper**:

- Contact can irritate and burn the skin and eyes.
- Inhaling **Copper** can irritate the nose and throat, causing coughing and wheezing.
- **Copper** can cause headache, nausea, vomiting, diarrhea and abdominal pain.
- Exposure to **Copper** can cause *"metal fume fever."* This is a flu-like illness with symptoms of metallic taste in the mouth, headache, fever and chills, aches, chest tightness and cough. The symptoms may be delayed for several hours after exposure and usually last for a day or two.

Chronic Health Effects
The following chronic (long-term) health effects can occur at some time after exposure to **Copper** and can last for months or years:

Cancer Hazard
- While **Copper** has been tested, it is not classifiable as to its potential to cause cancer.

Reproductive Hazard
- **Copper** may decrease fertility in males and females.

Other Effects
- Inhaling **Copper** can cause a sore and/or a hole in the "bone" (septum) dividing the inner nose, sometimes with bleeding, discharge, and/or formation of a crust.
- Repeated exposure may cause a greenish discoloration of the skin, hair and teeth.
- **Copper** may cause a skin allergy. If allergy develops, very low future exposure can cause itching and a skin rash.
- **Copper** may affect the liver and kidneys.

Medical

Medical Testing
For frequent or potentially high exposure (half the PEL or greater), the following are recommended before beginning work and at regular times after that:

- Serum and urine **Copper** levels

If symptoms develop or overexposure is suspected, the following are recommended:

- Evaluation by a qualified allergist can help diagnose skin allergy
- Liver and kidney function tests
- Examination of the skin and nose

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures
- More than light alcohol consumption can cause liver damage. Drinking alcohol may increase the liver damage caused by **Copper**.

Conditions Made Worse By Exposure
- "Wilson's Disease" is a rare condition which interferes with the body's ability to get rid of **Copper**. If you have this illness, consult your doctor about **Copper** exposure.

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Before entering a confined space where *finely divided* **Copper** *powder* may be present, check to make sure that an explosive concentration does not exist.
- Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- Avoid skin contact with **Copper**. Wear personal protective equipment made from material which cannot be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend Nitrile and Natural Rubber for gloves and DuPont Tyvek®, or the equivalent, as a protective material for clothing.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear eye protection with side shields or goggles.
- Wear non-vented, impact resistant goggles when working with fumes, gases, or vapors.
- Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **0.1 mg/m³** (as **Copper** *fume*) or over **1 mg/m³** (as **Copper** *dusts* and *mists*), use a NIOSH approved air-purifying, particulate filter respirator with an N95 filter. More protection is provided by a full facepiece respirator than by a half-mask respirator, and even greater protection is provided by a powered-air purifying respirator.
- Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Copper**, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential exists for exposure over **1 mg/m³** (as **Copper** *fume*) or over **10 mg/m³** (as **Copper** *dusts* and *mists*), use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- Exposure to **100 mg/m³** (as **Copper** *dusts* and *mists*) is immediately dangerous to life and health. If the possibility of exposure above **100 mg/m³** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- Extinguish fire using an agent suitable for type of surrounding fire. **Copper** itself does not burn.
- *Finely divided* **Copper** *powder* may burn in air or become an explosion hazard.
- POISONOUS GASES ARE PRODUCED IN FIRE, including *Copper fumes* and *Copper Oxides*.
- Use water spray to keep fire-exposed containers cool.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Copper** is spilled, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Moisten spilled material first or use a HEPA-filter vacuum for clean-up and deposit into sealed containers.
- Ventilate and wash area after clean-up is complete.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Copper** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Copper** you should be trained on its proper handling and storage.

- *Finely divided* **Copper** *powder* reacts violently on contact with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); AZIDES; ETHYLENE OXIDE; IODATES; HYDRAZINES; POTASSIUM COMPOUNDS; SODIUM COMPOUNDS; and ACETYLENES.
- **Copper** is not compatible with STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); 1-BROMO-2-PROPYNE; STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); and ANHYDROUS AMMONIA.
- Store in tightly closed containers in a cool, well-ventilated area away from MOISTURE.
- Sources of ignition, such as smoking and open flames, are prohibited where *finely divided* **Copper** *powder* is used, handled, or stored in a manner that could create a potential fire or explosion hazard.

Occupational Health Information Resources

The New Jersey Department of Health and Senior Services, Occupational Health Service, offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health & Senior Services
Right to Know Program
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.nj.gov
Web address:
http://www.state.nj.us/health/workplacehealthandsafety/right-to-know/

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DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values are intended to provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database maintained by federal EPA. The database contains information on human health effects that may result from exposure to various chemicals in the environment.

LEL or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

PIH is a DOT designation for chemicals which are Poison Inhalation Hazards.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

NJ Health New Jersey Department of Health

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **COPPER**

Synonyms: Bronze Powder; Gold Bronze
CAS No: 7440-50-8
Molecular Formula: Cu
RTK Substance No: 0528
Description: Reddish-brown, odorless metal

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
2 - Health **1 - Fire** **1 - Reactivity** **DOT#: UN 3077** **ERG Guide #: 171** **Hazard Class: 9** (Environmentally Hazardous Material)	Extinguish fire using an agent suitable for type of surrounding fire. **Copper** itself does not burn. *Finely divided* **Copper** *powder* may burn in air or become an explosion hazard. POISONOUS GASES ARE PRODUCED IN FIRE, including *Copper fumes* and *Copper Oxides*. Use water spray to keep fire-exposed containers cool.	*Finely divided* **Copper** *powder* reacts violently on contact with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); AZIDES; ETHYLENE OXIDE; IODATES; HYDRAZINES; POTASSIUM COMPOUNDS; SODIUM COMPOUNDS; and ACETYLENES. **Copper** is not compatible with STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); 1-BROMO-2-PROPYNE; STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); and ANHYDROUS AMMONIA.

SPILL/LEAKS

Isolation Distance:

Spill: 25 meters (75 feet)

Fire: 800 meters (1/2 mile)

Moisten spilled material first or use a HEPA-filter vacuum for clean-up and deposit into sealed containers.

DO NOT wash into sewer.

Copper is a toxic water pollutant.

PHYSICAL PROPERTIES

Odor Threshold:	Odorless
Flash Point:	Noncombustible *solid* Combustible/Explosive *finely divided powder*
Vapor Pressure:	1 mm Hg at 2,962°F (1,628°C)
Specific Gravity:	8.9 (water = 1)
Water Solubility:	Insoluble
Boiling Point:	4,653°F (2,567°C)
Melting Point:	1,981°F (1,083°C)
Molecular Weight:	63.6

EXPOSURE LIMITS

OSHA: 1 mg/m^3(Dust), 0.1 mg/m^3(Fume), 8-hr TWA
NIOSH: 1 mg/m^3(Dust), 0.1 mg/m^3(Fume), 10-hr TWA
ACGIH: 1 mg/m^3(Dust), 0.2 mg/m^3(Fume), 8-hr TWA
(All the above are for *Copper dust and fume*)
IDLH: 100 mg/m^3 (as *Copper*)
PAC: PAC-1 = 3 mg/m^3; PAC-2 = 33 mg/m^3
PAC-3 = 200 mg/m^3

PROTECTIVE EQUIPMENT

Gloves:	Nitrile and Natural Rubber
Coveralls:	DuPont Tyvek®
Respirator:	>0.1 mg/m^3 - Full facepiece APR with High efficiency filter >1 mg/m^3 - Supplied air (Fume) >10 mg/m^3 - Supplied air (Dust/Mist)

HEALTH EFFECTS

Eyes:	Irritation and burns
Skin:	Irritation and burns
Inhalation:	Nose and throat irritation with coughing and wheezing Headache, nausea, vomiting and abdominal pain

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn. Seek medical attention.

Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Begin artificial respiration if breathing has stopped and CPR if necessary.

Transfer promptly to a medical facility

Right to Know
Hazardous Substance Fact Sheet

Common Name: **1,1-DICHLOROETHANE**

Synonyms: 1,1-DCE; Ethylidene Chloride

Chemical Name: Ethane, 1,1-Dichloro-

Date: February 2001 Revision: September 2008

CAS Number: 75-34-3

RTK Substance Number: 0651

DOT Number: UN 2362

EMERGENCY RESPONDERS >>>> SEE BACK PAGE

Description and Use

1,1 Dichloroethane is a colorless, oily liquid with an *Ether* or *Chloroform*-like odor. It is used to make other chemicals, as a grain fumigant, and a solvent.

- **ODOR THRESHOLD= 100 to 200 ppm**
- Odor thresholds vary greatly. Do not rely on odor alone to determine potentially hazardous exposures.

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	2	1
FLAMMABILITY	3	3
REACTIVITY	0	0

CARCINOGEN
FLAMMABLE
POISONOUS GASES ARE PRODUCED IN FIRE
CONTAINERS MAY EXPLODE IN FIRE

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

Reasons for Citation

- **1,1 Dichloroethane** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, DEP, IRIS, NFPA and EPA.
- This chemical is on the Special Health Hazard Substance List.

- **1,1 Dichloroethane** can affect you when inhaled and may pass through the skin.
- **1,1 Dichloroethane** should be handled as a CARCINOGEN--WITH EXTREME CAUTION.
- Contact can irritate the skin and eyes.
- Inhaling **1,1 Dichloroethane** can irritate the nose and throat.
- Exposure can cause headache, dizziness, lightheadedness, and passing out.
- Prolonged contact can cause burns, thickening and cracking of the skin.
- **1,1 Dichloroethane** may affect the liver and kidneys.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact
- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while rinsing.

Skin Contact
- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Inhalation
- Remove the person from exposure
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222
CHEMTREC: 1-800-424-9300
NJDEP Hotline: 1-877-927-6337
National Response Center: 1-800-424-8802

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **100 ppm** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **100 ppm** averaged over a 10-hour workshift.

ACGIH: The threshold limit value (TLV) is **100 ppm** averaged over an 8-hour workshift.

- **1,1 Dichloroethane** may be a CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects
The following acute (short-term) health effects may occur immediately or shortly after exposure to **1,1 Dichloroethane**:

- Contact can irritate the skin and eyes.
- Inhaling **1,1 Dichloroethane** can irritate the nose and throat, causing coughing and wheezing.
- Exposure can cause headache, nausea, vomiting, dizziness, lightheadedness, and passing out.

Chronic Health Effects
The following chronic (long-term) health effects can occur at some time after exposure to **1,1 Dichloroethane** and can last for months or years:

Cancer Hazard
- **1,1 Dichloroethane** may be a CARCINOGEN in humans since it has been shown to cause liver, circulatory, and mammary gland cancer in animals.
- Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard
- While **1,1 Dichloroethane** has been tested, further testing is required to assess its potential to cause reproductive harm.

Other Effects
- Prolonged contact can cause burns, thickening and cracking of the skin.
- This chemical has not been adequately evaluated to determine whether repeated exposure can cause brain or other nerve damage. However, many solvents and other petroleum-based chemicals have been shown to cause such damage. Effects may include reduced memory and concentration, personality changes (withdrawal, irritability), fatigue, sleep disturbances, reduced coordination, and/or effects on nerves supplying internal organs (autonomic nerves) and/or nerves to the arms and legs (weakness, "pins and needles").
- **1,1 Dichloroethane** may affect the liver and kidneys.

Medical

Medical Testing
For frequent or potentially high exposure (half the PEL or greater), the following are recommended before beginning work and at regular times after that:

- Liver and kidney function tests

If symptoms develop or overexposure is suspected, the following is recommended:

- Evaluate for brain effects such as changes in memory, concentration, sleeping patterns and mood (especially irritability and social withdrawal), as well as for headaches and fatigue. Consider evaluations of the cerebellar, autonomic and peripheral nervous systems. Positive and borderline individuals should be referred for neuropsychological testing.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures
- More than light alcohol consumption can cause liver damage. Drinking alcohol may increase the liver damage caused by **1,1 Dichloroethane**.

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Before entering a confined space where **1,1 Dichloroethane** may be present, check to make sure that an explosive concentration does not exist.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- Avoid skin contact with **1,1 Dichloroethane**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend Viton for gloves and DuPont Tychem® BR, LV, Responder® and TK; Kappler® Zytron® 500; and Saint-Gobain ONESuit® TEC, or the equivalent, as protective materials for *Dichloromethane* and *Halogen compounds*.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear indirect-vent, impact and splash resistant goggles when working with liquids.
- Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **100 ppm**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- Exposure to **3,000 ppm** is immediately dangerous to life and health. If the possibility of exposure above **3,000 ppm** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- **1,1 Dichloroethane** is a FLAMMABLE LIQUID.
- Use dry chemical, CO_2, water spray or alcohol-resistant foam as extinguishing agents. Solid streams of water may not be effective.
- POISONOUS GASES ARE PRODUCED IN FIRE, including *Phosgene*.
- CONTAINERS MAY EXPLODE IN FIRE.
- Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **1,1 Dichloroethane** is spilled or leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit into sealed containers.
- Ventilate area of spill or leak.
- Keep **1,1 Dichloroethane** out of confined spaces, such as sewers, because of the possibility of an explosion.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **1,1 Dichloroethane** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **1,1 Dichloroethane** you should be trained on its proper handling and storage.

- **1,1 Dichloroethane** reacts violently with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and POTASSIUM.
- **1,1 Dichloroethane** is not compatible with AMINES; STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); ALKALI METALS (such as LITHIUM, SODIUM and CESIUM); and ALKALINE EARTH METALS (such as BARIUM, MAGNESIUM and CALCIUM).
- Store in tightly closed containers in a cool, well-ventilated area away from COMBUSTIBLES.
- **1,1 Dichloroethane** attacks some PLASTICS; COATINGS and RUBBER.
- Sources of ignition, such as smoking and open flames, are prohibited where **1,1 Dichloroethane** is used, handled, or stored.
- Metal containers involving the transfer of **1,1 Dichloroethane** should be grounded and bonded.
- Use only non-sparking tools and equipment, especially when opening and closing containers of **1,1 Dichloroethane**.

Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Acute Exposure Guideline Levels (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

CFR is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

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The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

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Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database on human health effects that may result from exposure to various chemicals, maintained by federal EPA.

LEL or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

Protective Action Criteria (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **1,1-DICHLOROETHANE**

Synonyms: 1,1-DCE; Ethylidene Chloride
CAS No: 75-34-3
Molecular Formula: $C_2H_4Cl_2$
RTK Substance No: 0651
Description: Colorless, oily liquid with an *Ether* or *Chloroform*-like odor

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
2 - Health **3 - Fire** **0 - Reactivity** **DOT#:** UN 2362 **ERG Guide #:** 130 **Hazard Class:** 3 (Flammable)	FLAMMABLE LIQUID Use dry chemical, CO_2, water spray or alcohol-resistant foam as extinguishing agents. Solid streams of water may not be effective. POISONOUS GASES ARE PRODUCED IN FIRE, including *Phosgene*. CONTAINERS MAY EXPLODE IN FIRE. Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source.	**1,1 Dichloroethane** reacts violently with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and POTASSIUM. **1,1 Dichloroethane** is not compatible with AMINES; STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE); ALKALI METALS (such as LITHIUM, SODIUM and CESIUM); and ALKALINE EARTH METALS (such as BARIUM, MAGNESIUM and CALCIUM).

SPILL/LEAKS

Isolation Distance:
Small Spill: 30 meters (100 feet)
Large Spill: 60 meters (200 feet)
Fire: 800 meters (1/2 mile)

Absorb liquids in vermiculite, dry sand, earth, or a similar material and deposit into sealed containers.
Keep **1,1 Dichloroethane** out of confined spaces, such as sewers, because of the possibility of an explosion.
DO NOT wash into sewer.

1,1 Dichloroethane is a marine pollutant.

PHYSICAL PROPERTIES

Odor Threshold:	100 to 200 ppm
Flash Point:	2°F (-17°C)
LEL:	5.4%
UEL:	16%
Auto Ignition Temp:	856°F (458°C)
Vapor Density:	3.4 (air = 1)
Vapor Pressure:	182 mm Hg at 68°F (20°C)
Specific Gravity:	1.2 (water = 1)
Water Solubility:	Slightly soluble
Boiling Point:	135° to 138°F (57° to 59°C)
Ionization Potential:	11.06 eV
Molecular Weight:	99

EXPOSURE LIMITS

OSHA:	100 ppm, 8-hr TWA
NIOSH:	100 ppm, 10-hr TWA
ACGIH:	100 ppm, 8-hr TWA
IDLH:	3,000 ppm

PROTECTIVE EQUIPMENT

Gloves:	Viton (2.4-hr breakthrough)
Coveralls:	Tychem® BR, LV, Responder® and TK; Zytron® 500; and ONESuit® TEC (>8-hr breakthrough for *Halogen compounds*)
Respirator:	>100 ppm - Supplied air

HEALTH EFFECTS

Eyes:	Irritation
Skin:	Irritation
Inhalation:	Nose and throat irritation with coughing and wheezing
	Headache, nausea, vomiting, dizziness and passing out
Chronic:	Cancer (liver, circulatory, and mammary gland) in animals

FIRST AID AND DECONTAMINATION

Remove the person from exposure.
Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.
Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.
Begin artificial respiration if breathing has stopped and CPR if necessary.
Transfer promptly to a medical facility

Right to Know
Hazardous Substance Fact Sheet

Common Name: **CHROMIUM**

Synonyms: Chrome; Metallic Chromium

Chemical Name: Chromium

Date: January 2000 Revision: March 2009

CAS Number: 7440-47-3

RTK Substance Number: 0432

DOT Number: UN 3089

EMERGENCY RESPONDERS >>>> SEE LAST PAGE

Description and Use

Chromium is a hard, gray, odorless solid with a metallic luster. It is used in stainless and alloy steels, in making alloys, and as an isotope in medicine and research.

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	2	-
FLAMMABILITY	3	-
REACTIVITY	0	-

FLAMMABLE POWDER
POISONOUS GASES ARE PRODUCED IN FIRE
CONTAINERS MAY EXPLODE IN FIRE

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate, 3=serious; 4=severe

Reasons for Citation

- **Chromium** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, DEP, IARC and EPA.
- This chemical is on the Special Health Hazard Substance List.

- **Chromium** can affect you when inhaled.
- Contact can irritate and burn the skin and eyes with possible eye damage.
- Inhaling **Chromium** can irritate the nose and throat.
- Exposure to **Chromium** *fumes* can cause a flu-like illness called *metal fume fever.*
- **Chromium** may cause a skin allergy and an asthma-like allergy
- Inhaling **Chromium** can cause a sore and/or a hole in the "bone" (septum) dividing the inner nose.
- **Chromium** may affect the liver and kidneys.
- **Chromium** in *powder* form is FLAMMABLE and a DANGEROUS FIRE HAZARD. It may also spontaneously explode in air.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact
- Immediately flush with large amounts of water for at least 30 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while flushing. Seek medical attention.

Skin Contact
- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Inhalation
- Remove the person from exposure
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **1 mg/m^3** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **0.5 mg/m^3** averaged over a 8-hour workshift.

ACGIH: The threshold limit value (TLV) is **0.5 mg/m^3** averaged over an 8-hour workshift.

Right to Know
Hazardous Substance Fact Sheet

Common Name: **GASOLINE**

Synonyms: Benzin; Motor Fuel; Petrol

Chemical Name: Gasoline, Natural

Date: April 2003 Revision: December 2008

CAS Number: 8006-61-9

RTK Substance Number: 0957

DOT Number: UN 1203

EMERGENCY RESPONDERS >>>> SEE BACK PAGE

Description and Use

Gasoline is a clear, colorless to amber-colored liquid with a petroleum odor. It is a blend of hydrocarbons used as an automotive fuel and as a solvent.

- **ODOR THRESHOLD= 0.25 ppm**
- Odor thresholds vary greatly. Do not rely on odor alone to determine potentially hazardous exposures.

Reasons for Citation

- **Gasoline** is on the Right to Know Hazardous Substance List because it is cited by ACGIH, DOT, NIOSH, DEP, IARC and NFPA.
- This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while flushing. Seek medical attention.

Skin Contact

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Inhalation

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	2	1
FLAMMABILITY	-	3
REACTIVITY	-	0

CARCINOGEN
FLAMMABLE
POISONOUS GASES ARE PRODUCED IN FIRE
CONTAINERS MAY EXPLODE IN FIRE

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

- **Gasoline** can affect you when inhaled and by passing through the skin.
- **Gasoline** should be handled as a CARCINOGEN–WITH EXTREME CAUTION.
- Contact can irritate and burn the skin and eyes with possible eye damage.
- Inhaling **Gasoline** can irritate the nose, throat and lungs.
- High exposure can cause headache, dizziness, lightheadedness, and passing out.
- Prolonged or repeated exposure can cause drying and cracking of the skin with redness.
- Repeated high exposure may affect the lungs and brain.
- **Gasoline** may damage the liver.
- **Gasoline** may contain *Lead* and *Benzene*. *For more information, consult the Right to Know Hazardous Substance Fact Sheets on BENZENE and TETRAETHYL LEAD.*
- **Gasoline** is a FLAMMABLE LIQUID and a DANGEROUS FIRE HAZARD.

Workplace Exposure Limits

NIOSH: Recommends that exposure to occupational carcinogens be limited to the lowest feasible concentration.

ACGIH: The threshold limit value (TLV) is **300 ppm** averaged over an 8-hour workshift and **500 ppm** as a STEL (short-term exposure limit).

- **Gasoline** may be a CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects
The following acute (short-term) health effects may occur immediately or shortly after exposure to **Gasoline**:

- Contact can irritate and burn the skin and eyes with possible eye damage.
- Inhaling **Gasoline** can irritate the nose, throat and lungs causing coughing, wheezing and/or shortness of breath.
- High exposure can cause headache, nausea, weakness, dizziness, blurred vision, irregular heartbeat, poor coordination, lightheadedness, and passing out.

Chronic Health Effects
The following chronic (long-term) health effects can occur at some time after exposure to **Gasoline** and can last for months or years:

Cancer Hazard
- **Gasoline** may be a CARCINOGEN in humans since it has been shown to cause liver cancer in animals.
- Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard
- There is limited evidence that **Gasoline** may damage the developing fetus and may affect female fertility.

Other Effects
- Prolonged or repeated exposure can cause drying and cracking of the skin with redness.
- Repeated high exposure may affect the lungs and brain.
- **Gasoline** may damage the liver.

Medical

Medical Testing
If symptoms develop or overexposure is suspected, the following are recommended:

- Chest x-ray and lung function tests
- Liver function tests
- Exam of the nervous system
- EEG

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures
- Smoking can cause heart disease, lung cancer, emphysema, and other respiratory problems. It may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.
- More than light alcohol consumption can cause liver damage. Drinking alcohol can increase the liver damage caused by **Gasoline**.

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Before entering a confined space where **Gasoline** may be present, check to make sure that an explosive concentration does not exist.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- Avoid skin contact with **Gasoline**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend Nitrile and Viton for gloves, and Tychem® BR, LV, Responder® and TK, or the equivalent, as protective materials for clothing.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear indirect-vent, impact and splash resistant goggles when working with liquids.
- If additional protection is needed for the entire face, use in combination with a face shield. A face shield should not be used without another type of eye protection.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **300 ppm**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- **Gasoline** is a FLAMMABLE LIQUID.
- Use dry chemical, CO_2, alcohol-resistant foam or other foam extinguishing agents, as water may not be effective in fighting fires.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- CONTAINERS MAY EXPLODE IN FIRE.
- Use water spray to keep fire-exposed containers cool.
- Vapors may travel to a source of ignition and flash back.
- Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Gasoline** is spilled or leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Absorb liquids in vermiculite, dry sand, earth, or a similar material and place into sealed containers for disposal.
- Keep **Gasoline** out of confined spaces, such as sewers, because of the possibility of an explosion.
- Use water spray to keep containers cool.
- Ventilate and wash area after clean-up is complete.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Gasoline** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Gasoline** you should be trained on its proper handling and storage.

- **Gasoline** may react violently with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and NITRIC ACID.
- Store in tightly closed containers in a cool, well-ventilated area.
- Sources of ignition, such as smoking and open flames, are prohibited where **Gasoline** is used, handled, or stored.
- Metal containers involving the transfer of **Gasoline** should be grounded and bonded.
- Use explosion-proof electrical equipment and fittings wherever **Gasoline** is used, handled, manufactured, or stored.
- Use only non-sparking tools and equipment, especially when opening and closing containers of **Gasoline**.
- Flow or agitation may generate electrostatic charges.

Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Acute Exposure Guideline Levels (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

CFR is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database on human health effects that may result from exposure to various chemicals, maintained by federal EPA.

LEL or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

Protective Action Criteria (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **GASOLINE**

Synonyms: Benzin; Motor Fuel; Petrol
CAS No: 8006-61-9
Molecular Formula: C_5H_{12} to C_9H_{20} (Mixture of hydrocarbons which vary by grade)
RTK Substance No: 0957
Description: Clear, colorless to amber-colored liquid with a petroleum odor

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
2 - Health **3 - Fire** **0 - Reactivity** **DOT#:** UN 1203 **ERG Guide #:** 128 **Hazard Class:** 3 (Flammable)	FLAMMABLE LIQUID Use dry chemical, CO_2, alcohol-resistant foam or other foam extinguishing agents, as water may not be effective in fighting fires. POISONOUS GASES ARE PRODUCED IN FIRE. CONTAINERS MAY EXPLODE IN FIRE. Use water spray to keep fire-exposed containers cool. Vapors may travel to a source of ignition and flash back. Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source. Flow or agitation may generate electrostatic charges.	**Gasoline** may react violently with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and NITRIC ACID.

SPILL/LEAKS

Isolation Distance:
Spill: 50 meters (150 feet)
Fire: 800 meters (1/2 mile)

Absorb liquids in vermiculite, dry sand, earth, or a similar material and place into sealed containers for disposal.

Keep **Gasoline** out of confined spaces, such as sewers, because of the possibility of an explosion.

Use only non-sparking tools and equipment, especially when opening and closing containers of **Gasoline**.

DO NOT wash into sewer.

Gasoline is harmful to aquatic organisms and is a marine pollutant.

PHYSICAL PROPERTIES

Odor Threshold:	0.25 ppm
Flash Point:	-36°F (-38°C)
LEL:	1.2%
UEL:	7.6%
Auto Ignition Temp:	536° to 853°F (280° to 456°C)
Vapor Density:	3 to 4 (air = 1)
Vapor Pressure:	38 to 300 mm Hg at 68°F (20°C)
Specific Gravity:	0.73 (water = 1)
Water Solubility:	Insoluble
Boiling Point:	140° to 390°F (60° to 199°C)
Molecular Weight:	72 to 100

EXPOSURE LIMITS

ACGIH: 300 ppm, 8-hr TWA; 500 ppm, STEL

The Protective Action Criteria values are:
PAC-1 = 500 ppm,
PAC-2 = 500 ppm
PAC-3 = 1,500 ppm

PROTECTIVE EQUIPMENT

Gloves:	Nitrile and Viton (>8-hr breakthrough)
Coveralls:	Tychem® BR, LV, Responder® and TK (>8-hr breakthrough)
Respirator:	>300 ppm - Supplied air or SCBA

HEALTH EFFECTS

Eyes:	Irritation and burns
Skin:	Irritation and burns
Inhalation:	Nose, throat and lung irritation with coughing, wheezing and shortness of breath
	Headache, nausea, weakness, dizziness, blurred vision, irregular heartbeat, and passing out
Chronic:	Cancer (liver) in animals

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn. Seek medical attention.

Quickly remove contaminated clothing and wash contaminated skin with large amounts of soap and water.

Begin artificial respiration if breathing has stopped and CPR if necessary.

Transfer promptly to a medical facility

Right to Know
Hazardous Substance Fact Sheet

Common Name: **LEAD**

Synonym: Metallic Lead

Chemical Name: Lead

Date: September 2007 Revision: December 2016

CAS Number: 7439-92-1

RTK Substance Number: 1096

DOT Number: UN 3077

EMERGENCY RESPONDERS >>>> SEE BACK PAGE

Description and Use

Lead is a heavy, soft, silvery-gray metal. It is used in the production of storage batteries, ammunition, cable covering, pigments, glass, ceramic glazes, casting metals, and solders.

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	4	-
FLAMMABILITY	0	-
REACTIVITY	0	-

CARCINOGEN
TERATOGEN
POISONOUS FUMES ARE PRODUCED IN FIRE
DOES NOT BURN

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

Reasons for Citation

- **Lead** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, NTP, DEP, IARC and EPA.
- This chemical is on the Special Health Hazard Substance List.

- **Lead** can affect you when inhaled or swallowed.
- **Lead** is a CARCINOGEN and may be a TERATOGEN. HANDLE WITH EXTREME CAUTION.
- Contact can irritate the eyes.
- Exposure can cause headache, irritability, and muscle and joint pain.
- Repeated exposure can cause *Lead poisoning* with metallic taste, colic and muscle cramps.
- **Lead** may damage the nervous system.
- Exposure may cause kidney and brain damage, and anemia.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

- Immediately flush with large amounts of cool water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while rinsing.

Skin Contact

- Remove contaminated clothing. Wash contaminated skin with soap and water.

Inhalation

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **0.05 mg/m^3** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **0.05 mg/m^3** averaged over a 10-hour workshift. Air concentrations should be maintained so that blood **Lead** is less than **0.06 mg per 100 grams** of whole blood.

ACGIH: The threshold limit value (TLV) is **0.05 mg/m^3** averaged over an 8-hour workshift.

- **Lead** is a PROBABLE CARCINOGEN in humans and may be a TERATOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.

Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK Program website (http://nj.gov/health/workplacehealthandsafety/right-to-know/) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) requires private employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects
The following acute (short-term) health effects may occur immediately or shortly after exposure to **Lead**:

- Contact can irritate the eyes.
- **Lead** can cause headache, irritability, reduced memory, disturbed sleep, and mood and personality changes.
- Exposure can cause upset stomach, poor appetite, weakness and fatigue.

Chronic Health Effects
The following chronic (long-term) health effects can occur at some time after exposure to **Lead** and can last for months or years:

Cancer Hazard
- **Lead** is a PROBABLE CARCINOGEN in humans. There is some evidence that **Lead** and *Lead compounds* cause lung, stomach, brain and kidney cancers in humans and they have been shown to cause kidney cancer in animals.
- Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard
- **Lead** may be a TERATOGEN in humans since it is a teratogen in animals.
- It may decrease fertility in males and females, and damage the developing fetus and the testes (male reproductive glands).

Other Effects
- Repeated exposure to **Lead** can cause *Lead poisoning*. Symptoms include metallic taste, poor appetite, weight loss, colic, nausea, vomiting, and muscle cramps.
- Higher levels can cause muscle and joint pain, and weakness.
- High or repeated exposure may damage the nerves causing weakness, "pins and needles," and poor coordination in the arms and legs.
- **Lead** exposure increases the risk of high blood pressure.
- **Lead** may cause kidney and brain damage, and damage to the blood cells causing anemia.
- Repeated exposure causes **Lead** to accumulate in the body. It can take years for the body to get rid of excess **Lead**.

Medical

Medical Testing
Before first exposure, and every six (6) months thereafter, OSHA requires your employer to provide (for persons exposed to **30 micrograms** or more of *Lead* **per cubic meter** of air for 30 days or more per year):

- Blood *Lead* test
- ZPP (a special test for the effects of *Lead* on blood cells)

For employees with blood *Lead* levels above **40 micrograms per 100 grams** of whole blood (**40 micrograms per deciliter**), OSHA requires blood *Lead* level monitoring every two months until two consecutive blood *Lead* levels are below **40 micrograms per 100 grams** of whole blood. These employees must undergo a medical evaluation, which should include:

- Complete work and medical history
- Thorough physical examination, including examination of the central nervous system
- Blood *Lead* test
- ZPP
- Hemoglobin, hematocrit with complete blood count
- Urinalysis with microscopic examination
- Any other tests determined necessary by the examining physician

This evaluation should be performed at least annually.

OSHA requires your employer to provide you and your doctor with a copy of the OSHA Lead Standards (29 CFR 1910.1025 and 1926.62).

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures

Body exposures to *Lead* from hobbies using *Lead* solder or pigments, target practice, and drinking moonshine made in *Leaded* containers will increase *Lead* levels. Repeated breathing or handling of *Leaded* gasoline may also add to body *Lead* levels.

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Specific engineering controls are required for this chemical by OSHA. Refer to the OSHA **Lead** Standards (29 CFR 1910.1025 and 1926.62).
- Use a vacuum or a wet method to reduce dust during clean-up. DO NOT DRY SWEEP.
- Use a high efficiency particulate air (HEPA) filter when vacuuming. Do not use a standard shop vacuum.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- Avoid skin contact with **Lead**. Wear personal protective equipment made from material which can not be permeated and/or degraded by this substance. Safety equipment suppliers/manufacturers can provide recommendations on the most protective glove/clothing material for your operation.
- Safety equipment manufacturers recommend *Nitrile*, *Latex*, or *Rubber* for gloves and DuPont *Tyvek*® as protective material for clothing.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear non-vented, impact resistant goggles when working with fumes, gases, or vapors.
- For impact hazards (such as flying fragments, chips or particles), wear safety glasses with side shields or safety goggles.
- Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure not higher than **0.5 mg/m^3**, use a half-mask air purifying respirator equipped with high efficiency filters.
- Where the potential exists for exposure not higher than **2.5 mg/m^3**, use a full facepiece, air purifying respirator with high efficiency filters.
- Where the potential exists for exposure not higher than **50 mg/m^3**, use any powered-air purifying respirator with high efficiency filters or a half-mask supplied-air respirator operated in a positive pressure mode.
- Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Lead**, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Be sure to consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential exists for exposure not higher than **100 mg/m^3**, use supplied-air respirators with full facepiece, hood, helmet or suit, operated in a positive pressure mode.
- Exposure to **100 mg/m^3** is immediately dangerous to life and health. If the possibility of exposure above **100 mg/m^3** (as *Lead*) exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- Extinguish fire using an agent suitable for type of surrounding fire. **Lead** itself does not burn.
- POISONOUS FUMES ARE PRODUCED IN FIRE, including *Lead Oxides*.
- Use water spray to keep fire-exposed containers cool.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Lead** is spilled, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Collect spilled material using a HEPA-filter vacuum and deposit into sealed containers.
- Ventilate and wash area after clean-up is complete.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Lead** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Lead** you should be trained on its proper handling and storage.

- A regulated, marked area should be established where **Lead** is handled, used, or stored.
- **Lead** reacts violently with HYDROGEN PEROXIDE; AMMONIUM NITRATE; ZIRCONIUM; SODIUM AZIDE; SODIUM ACETYLIDE; and CHLORINE TRIFLUORIDE.
- **Lead** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC).
- Store in tightly closed containers in a cool, well-ventilated area.

Occupational Health Services Resources

The New Jersey Department of Health, Occupational Health Service, offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health
Right to Know Program
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.nj.gov
Web address:
http://nj.gov/health/workplacehealthandsafety/right-to-know/

GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

CFR is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database by federal EPA. The database contains information on human health effects that may result from exposure to various chemicals in the environment.

LEL or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NAERG is the North American Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

PIH is a DOT designation for chemicals which are Poison Inhalation Hazards.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a measure of how readily a liquid or a solid mixes with air at its surface. A higher vapor pressure indicates a higher concentration of the substance in air and therefore increases the likelihood of breathing it in.

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **LEAD**

Synonym: Metallic Lead
CAS No: 7439-92-1
Molecular Formula: Pb_2
RTK Substance No: 1096
Description: Heavy, soft, silvery-gray metal

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
4 - Health **0 - Fire** **0 - Reactivity** **DOT#:** UN 3077 **ERG Guide #:** 171 **Hazard Class:** 9 (Environmentally Hazardous Substance)	Extinguish fire using an agent suitable for type of surrounding fire. **Lead** itself does not burn. POISONOUS FUMES ARE PRODUCED IN FIRE, including *Lead Oxides*. Use water spray to keep fire-exposed containers cool.	**Lead** reacts violently with HYDROGEN PEROXIDE; AMMONIUM NITRATE; ZIRCONIUM; SODIUM AZIDE; SODIUM ACETYLIDE; and CHLORINE TRIFLUORIDE. **Lead** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC).

SPILL/LEAKS

Isolation Distance: 10 to 25 meters (30 to 80 feet)

Use a HEPA-filter vacuum for clean-up.

Toxic to aquatic organisms.

Hazardous to the environment and persists in the environment.

DO NOT wash into sewer.

PHYSICAL PROPERTIES

Odor Threshold:	No odor
Flash Point:	Not combustible
LEL:	N/A
UEL:	**N/A**
Specific Gravity:	**11.35 at 68°F (20°C)**
Vapor Pressure:	0 mm Hg at 68°F (20°C)
Water Solubility:	Insoluble
Boiling Point:	3,164°F (1,740°C)
Melting Point:	621.5°F (327.5°C)

EXPOSURE LIMITS

OSHA:	0.05 mg/m^3, 8-hr TWA
NIOSH:	0.05 mg/m^3, 10-hr TWA
ACGIH:	0.05 mg/m^3, 8-hr TWA
IDLH LEVEL:	100 mg/m^3
PAC LEVELs:	PAC-1 = 0.15 mg/m^3; PAC-2 = 120 mg/m^3; PAC-3 = 700 mg/m^3

PROTECTIVE EQUIPMENT

Gloves:	Nitrile, Latex, Rubber
Coveralls:	DuPont *Tyvek*®
Boots:	Latex, Butyl, Neoprene
Respirator:	≤0.5 mg/m^3 - N100 ≤2.5 mg/m^3 - full facepiece APR with High Efficiency filters ≤50 mg/m^3 - full facepiece powered APR with High Efficiency filters ≤100 mg/m^3 – Pressure-demand supplied-air >100 mg/m^3 – Pressure-demand SCBA

HEALTH EFFECTS

Eyes:	Irritation
Skin:	No Information
Acute:	Headache, irritability, upset stomach, and weakness
Chronic:	*Lead* may cause lung, brain, stomach, and kidney cancer in humans. Metallic taste, colic, muscle cramps Damage to the nervous system

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.

Remove contaminated clothing and wash contaminated skin with soap and water.

Transfer to a medical facility.

Right to Know Hazardous Substance Fact Sheet

Common Name: **MERCURY, ELEMENTAL AND INORGANIC COMPOUNDS**

Synonyms: Colloidal Mercury; Quicksilver

Chemical Name: Mercury

Date: May 2009 Revision: November 2009

CAS Number: 7439-97-6

RTK Substance Number: 1183

DOT Number: UN 2809

Description and Use

Mercury is a heavy, silvery, liquid metal. It is used for gold recovery and in dental amalgams, thermometers, barometers and other gauges, and in dry cell batteries.

Reasons for Citation

- **Mercury** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, DEP, IARC, IRIS and EPA.
- This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while flushing. Seek medical attention immediately.

Skin Contact

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water. Seek medical attention immediately.

Inhalation

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

EMERGENCY RESPONDERS >>>> SEE LAST PAGE

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	3	-
FLAMMABILITY	0	-
REACTIVITY	0	-
CORROSIVE POISONOUS GASES ARE PRODUCED IN FIRE		

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

- **Mercury** can affect you when inhaled and may be absorbed through the skin.
- Contact can irritate the skin and eyes.
- Inhaling **Mercury** can irritate the nose, throat and lungs.
- Exposure can cause metallic taste in the mouth, nausea and vomiting, and abdominal pain.
- **Mercury** may cause a skin allergy and make the skin turn gray.
- Repeated exposure can cause *Mercury poisoning* with tremors, personality changes, trouble remembering and concentrating, and gum problems.
- **Mercury** may damage the kidneys.
- **Mercury** is a DOT CORROSIVE material.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **0.1 mg/m^3** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **0.05 mg/m^3** (as **Mercury** *vapor*) averaged over a 10-hour workshift and **0.1 mg/m^3** (as **Mercury**), not to be exceeded at any time.

ACGIH: The threshold limit value (TLV) is **0.025 mg/m^3** averaged over an 8-hour workshift.

- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects
The following acute (short-term) health effects may occur immediately or shortly after exposure to **Mercury**:

- Contact can irritate the skin and eyes.
- Inhaling **Mercury** can irritate the nose, throat and lungs causing coughing, wheezing and/or shortness of breath.
- Exposure can cause metallic taste in the mouth, nausea and vomiting, and abdominal pain.

Chronic Health Effects
The following chronic (long-term) health effects can occur at some time after exposure to **Mercury** and can last for months or years:

Cancer Hazard
- While **Mercury** has been tested, it is not classifiable as to its potential to cause cancer.

Reproductive Hazard
- There is limited evidence that **Mercury** may cause an increase in spontaneous abortions and menstrual disorders in exposed women.
- There is limited evidence that **Mercury** may affect male fertility.
- **Mercury** may also damage the developing fetus in animals.

Other Effects
- **Mercury** can irritate the lungs. Repeated exposure may cause bronchitis to develop with coughing, phlegm, and/or shortness of breath.
- **Mercury** may cause a skin allergy. If allergy develops, very low future exposure can cause itching and a skin rash.
- Long-term contact can cause the skin to turn gray, brown staining in the eyes, and may affect peripheral vision (ability to see to the sides).
- Repeated exposure or a very high single exposure can cause *Mercury poisoning*. Symptoms include tremors (shaking), trouble remembering and concentrating, gum problems, increased salivation, loss of appetite and weight, and changes in mood and personality. These can be severe and cause hallucinating and psychosis.
- **Mercury** may damage the kidneys.

Medical

Medical Testing
For frequent or potentially high exposure (half the TLV or greater), the following are recommended before beginning work and at regular times after that:

- Exam of the nervous system (including handwriting test to detect early hand tremor)
- Urine *Mercury* level (usually less than **0.02 mg/liter**)
- Kidney function tests

If symptoms develop or overexposure is suspected, the following is recommended:

- Lung function tests
- Exam of the eyes and vision
- Evaluation by a qualified allergist can help diagnose skin allergy.

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures
- Smoking can cause heart disease, lung cancer, emphysema, and other respiratory problems. It may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.
- Creams to whiten or bleach skin may contain *Mercury*. If you use them, you may be at increased risk of *Mercury* poisoning. A high fish diet, especially of marine predatory fish (fish-eating fish), also may increase your blood *Mercury* levels.

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- For clean-up, use a specialized charcoal-filtered vacuum or suction pump to avoid generating *Mercury vapor*. Do not disturb spilled material.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- Avoid skin contact with **Mercury**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend Butyl, Nitrile, Neoprene, Polyvinyl Chloride, Silver Shield®/4H® and Viton for gloves, and Tychem® fabrics, or the equivalent, as protective materials for clothing.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear non-vented, impact resistant goggles when working with fumes, gases, or vapors.
- If additional protection is needed for the entire face, use in combination with a face shield. A face shield should not be used without another type of eye protection.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **0.05 mg/m^3** (as **Mercury** *vapor*), or over **0.1 mg/m^3** but less than **1 mg/m^3** (as **Mercury**), use a NIOSH approved half-mask respirator with cartridges specific for **Mercury** *vapor*. These cartridges have end of service life indicators (ESLI) which visually indicate when filters must be changed.
- If while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Mercury**, or if while wearing particulate filters abnormal resistance to breathing is experienced, or eye irritation occurs while wearing a full facepiece respirator, leave the area immediately. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Be sure to consider all potential exposures in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential exists for exposure over **0.5 mg/m^3** (as **Mercury** *vapor*) or over **1 mg/m^3** (as **Mercury**), use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- Exposure to **10 mg/m^3** (as **Mercury**) is immediately dangerous to life and health. If the possibility of exposure above **10 mg/m^3** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- Extinguish fire using an agent suitable for type of surrounding fire. **Mercury** itself does not burn.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- Use water spray to keep fire-exposed containers cool.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Mercury** is spilled or leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Cover with a *Sulfur compound* to keep from vaporizing and collect with a charcoal filter vacuum. Kits specific for the clean-up of *Mercury* spills are available. DO NOT USE a regular or shop vacuum.
- Use *Zinc* or *Copper flakes* and a flashlight to check for remaining **Mercury** after clean-up.
- Ventilate and wash area of spill or leak.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Mercury** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Mercury** you should be trained on its proper handling and storage.

- **Mercury** reacts with ACETYLENE to form explosive *Acetylide*.
- **Mercury** can form explosive compounds with AMMONIA and will explode when mixed with CHLORINE DIOXIDE; OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); and METHYL AZIDE.
- **Mercury** is not compatible with COMBUSTIBLE MATERIALS; METALS (such as ALUMINUM and COPPER); CALCIUM; SODIUM CARBIDE; AMINES; LITHIUM; and RUBIDIUM.
- Store in tightly closed containers in a cool, well-ventilated area.

Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Acute Exposure Guideline Levels (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

CFR is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database on human health effects that may result from exposure to various chemicals, maintained by federal EPA.

LEL or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

Protective Action Criteria (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

NJ Health New Jersey Department of Health

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **MERCURY, ELEMENTAL AND INORGANIC COMPOUNDS**

Synonyms: Colloidal Mercury; Quicksilver
CAS No: 7439-97-6
Molecular Formula: Hg
RTK Substance No: 1183
Description: Heavy, silvery, liquid metal

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
3 - Health **0 - Fire** **0 - Reactivity** **DOT#:** UN 2809 **ERG Guide #:** 172 **Hazard Class:** 8 (Corrosive)	Extinguish fire using an agent suitable for type of surrounding fire. **Mercury** itself does not burn. POISONOUS GASES ARE PRODUCED IN FIRE. Use water spray to keep fire-exposed containers cool.	**Mercury** reacts with ACETYLENE to form explosive *Acetylide*. **Mercury** can form explosive compounds with AMMONIA and will explode when mixed with CHLORINE DIOXIDE; OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); and METHYL AZIDE. **Mercury** is not compatible with COMBUSTIBLE MATERIALS; METALS (such as ALUMINUM and COPPER); CALCIUM; SODIUM CARBIDE; AMINES; LITHIUM; and RUBIDIUM.

SPILL/LEAKS

Isolation Distance:

Spill: 50 meters (150 feet)

Fire: 500 meters (1/3 mile)

Cover spill with a *Sulfur compound* to prevent vaporization and collect with a charcoal filter vacuum.

Use *Zinc* or *Copper flakes* and a flashlight to check for remaining **Mercury** after clean-up.

Mercury is very toxic to aquatic life and bioaccumulates.

PHYSICAL PROPERTIES

Odor Threshold:	Odorless
Flash Point:	Nonflammable
Vapor Density:	6.9 (air = 1)
Vapor Pressure:	0.002 mm Hg at 77°F (25°C)
Specific Gravity:	13.6 (water = 1)
Water Solubility:	Insoluble
Boiling Point:	674°F (357°C)
Melting Point:	-38°F (-39°C)
Ionization Potential:	10.4 eV
Molecular Weight:	200.6

EXPOSURE LIMITS

NIOSH: 0.05 mg/m^3, 10-hr TWA (as **Mercury** *vapor*)
0.1 mg/m^3, Ceiling (as **Mercury**)
ACGIH: 0.025 mg/m^3, 8-hr TWA (as **Mercury**)
IDLH: 10 mg/m^3 (as **Mercury**)

The Protective Action Criteria values are:
PAC-1 = 0.3 mg/m^3
PAC-2 = 2.05 mg/m^3
PAC-3 = 4.1 mg/m^3

PROTECTIVE EQUIPMENT

Gloves: Butyl, Nitrile, Neoprene, Polyvinyl Chloride, Silver Shield®/4H® and Viton (>8-hr breakthrough)

Coveralls: Tychem® fabrics (>8-hr breakthrough)

Respirator: >0.025 mg/m^3 - full facepiece APR with cartridges specific for **Mercury**
>0.3 mg/m^3 - SCBA

HEALTH EFFECTS

Eyes: Irritation

Skin: Irritation

Inhalation: Nose, throat and lung irritation with coughing, wheezing and/or shortness of breath
Nausea, vomiting and abdominal pain

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn. Seek medical attention immediately.

Quickly remove contaminated clothing and wash contaminated skin with large amounts of soap and water. Seek medical attention immediately.

Begin artificial respiration if breathing has stopped and CPR if necessary.

Transfer promptly to a medical facility.

Right to Know Hazardous Substance Fact Sheet

Common Name: **POLYCHLORINATED BIPHENYLS**

Synonyms: Aroclor; Chlorodiphenyls; PCBs

Chemical Name: 1,1'-Biphenyl, Chloro Derivs.

Date: April 2002 Revision: November 2008

CAS Number: 1336-36-3

RTK Substance Number: 1554

DOT Number: UN 2315

EMERGENCY RESPONDERS >>>> SEE BACK PAGE

Description and Use

Polychlorinated Biphenyls are light yellow or colorless, thick, oily liquids. They are used in hydraulic and heat transfer liquids. They were formally used in electrical capacitators and transformers.

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	3	2
FLAMMABILITY	-	1
REACTIVITY	-	0

CARCINOGEN
TERATOGEN
POISONOUS GASES ARE PRODUCED IN FIRE

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

Reasons for Citation

- **Polychlorinated Biphenyls** are on the Right to Know Hazardous Substance List because they are cited by OSHA, ACGIH, DOT, NIOSH, NTP, DEP, IARC, IRIS, NFPA and EPA.
- This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while rinsing.

Skin Contact

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Inhalation

- Remove the person from exposure
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222
CHEMTREC: 1-800-424-9300
NJDEP Hotline: 1-877-927-6337
National Response Center: 1-800-424-8802

- **Polychlorinated Biphenyls** can affect you when inhaled and by passing through the skin.
- **Polychlorinated Biphenyls** should be handled as CARCINOGENS and may be TERATOGENS. HANDLE WITH EXTREME CAUTION.
- Contact can irritate the skin and eyes.
- **Polychlorinated Biphenyls** may cause brownish pigmentation of the skin, eyes and fingernails.
- Skin contact may cause an acne-like rash (chloracne).
- Inhaling the vapors can irritate the nose, throat and lungs.
- Exposure to **Polychlorinated Biphenyls** can cause headache, nausea, vomiting, loss of weight and abdominal pain.
- High exposure can damage the nervous system causing headache, numbness, weakness, and tingling ("pins and needles) in the arms and legs.
- **Polychlorinated Biphenyls** may damage the liver.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **1 mg/m^3** (42% *Chlorine*) and **0.5 mg/m^3** (54% *Chlorine*) averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **0.001 mg/m^3** averaged over a 10-hour workshift.

ACGIH: The threshold limit value (TLV) is **1 mg/m^3** (42% *Chlorine*) and **0.5 mg/m^3** (54% *Chlorine*) averaged over an 8-hour workshift.

- **Polychlorinated Biphenyls** are PROBABLE CARCINOGENS and TERATOGENS in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects
The following acute (short-term) health effects may occur immediately or shortly after exposure to **Polychlorinated Biphenyls**:

- Contact can irritate the skin and eyes.
- Inhaling the vapors can irritate the nose, throat and lungs causing coughing, wheezing and/or shortness of breath.
- Exposure to **Polychlorinated Biphenyls** can cause headache, nausea, vomiting, loss of weight and abdominal pain.

Chronic Health Effects
The following chronic (long-term) health effects can occur at some time after exposure to **Polychlorinated Biphenyls** and can last for months or years:

Cancer Hazard
- **Polychlorinated Biphenyls** are PROBABLE CARCINOGENS in humans. There is evidence that they cause cancer of the skin, brain, and pancreas in humans and have been shown to cause liver and pituitary cancer, and leukemia, in animals.
- Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard
- **Polychlorinated Biphenyls** may be TERATOGENS in humans since they are teratogens in animals.
- There is limited evidence that **Polychlorinated Biphenyls** may affect male and female fertility.

Other Effects
- **Polychlorinated Biphenyls** may cause brownish pigmentation of the skin, eyes and fingernails.
- Skin contact may cause an acne-like rash (chloracne).
- High exposure can damage the nervous system causing headache, numbness, weakness, and tingling ("pins and needles) in the arms and legs.
- **Polychlorinated Biphenyls** may damage the liver.

Medical

Medical Testing
Before beginning employment and at regular times after that, for frequent or potentially high exposures, the following are recommended:

- Liver function tests
- Exam of the skin and fingernails

If symptoms develop or overexposure is suspected, the following are recommended:

- Blood PCB levels
- Exam of the nervous system

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures
- More than light alcohol consumption can cause liver damage. Drinking alcohol can increase the liver damage caused by **Polychlorinated Biphenyls**.

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Where possible, transfer **Polychlorinated Biphenyls** from drums or other containers to process containers in an enclosed system.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- Avoid skin contact with **Polychlorinated Biphenyls**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend Butyl, Neoprene, Polyvinyl Chloride, Silver Shield®/4H® and Viton for gloves, and Tychem® CPF 2, SL, CPF 4 and Responder®, or the equivalent, as protective materials for clothing.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear indirect-vent, impact and splash resistant goggles when working with liquids.
- Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **0.001 mg/m^3**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- Exposure to **5 mg/m^3** is immediately dangerous to life and health. If the possibility of exposure above **5 mg/m^3** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- **Polychlorinated Biphenyls** may burn, but do not readily ignite.
- Use dry chemical, CO_2, water spray or alcohol-resistant foam as extinguishing agents.
- POISONOUS GASES ARE PRODUCED IN FIRE, including *Polychlorinated Dibenzofurans* and *Chlorinated Dibenzo-p-dioxins*.
- Use water spray to keep fire-exposed containers cool.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Polychlorinated Biphenyls** are spilled or leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Absorb liquids in vermiculite, dry sand, earth, or a similar material and place into sealed containers for disposal.
- Ventilate and wash area after clean-up is complete.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Polychlorinated Biphenyls** as HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Polychlorinated Biphenyls** you should be trained on its proper handling and storage.

- **Polychlorinated Biphenyls** are not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC).
- Store in tightly closed containers in a cool, well-ventilated area away from STRONG ULTRAVIOLET LIGHT and SUNLIGHT.

Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Acute Exposure Guideline Levels (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

CFR is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database on human health effects that may result from exposure to various chemicals, maintained by federal EPA.

LEL or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

Protective Action Criteria (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

NJ Health
New Jersey Department of Health

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **POLYCHLORINATED BIPHENYLS**

Synonyms: Aroclor; Chlorodiphenyls; PCBs
CAS No: 1336-36-3
Molecular Formula: $C_{12}H_{10-n}Cl_n$
RTK Substance No: 1554
Description: Light yellow or colorless, thick, oily liquids

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
3 - Health **1 - Fire** **0 - Reactivity** **DOT#:** UN 2315 **ERG Guide #:** 171 **Hazard Class:** 9 (Miscellaneous Hazardous Materials)	**Polychlorinated Biphenyls** may burn, but do not readily ignite. Use dry chemical, CO_2, water spray or alcohol-resistant foam as extinguishing agents. POISONOUS GASES ARE PRODUCED IN FIRE, including *Polychlorinated Dibenzofurans* and *Chlorinated Dibenzo-p-dioxins*. Use water spray to keep fire-exposed containers cool.	**Polychlorinated Biphenyls** are not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC).

SPILL/LEAKS

Isolation Distance:

Spills: 50 meters (150 feet)

Fire: 800 meters (1/2 mile)

Absorb liquids in vermiculite, dry sand, earth, or a similar material and place into sealed containers for disposal.

DO NOT wash into sewer.

Polychlorinated Biphenyls bioaccumulate and are hazardous to the environment.

PHYSICAL PROPERTIES

Flash Point:	286° to 385°F (141° to 196°C)
Auto Ignition Temp:	464°F (240°C)
Vapor Pressure:	0.001 mm Hg at 68°F (20°C)
Specific Gravity:	1.3 (water = 1)
Water Solubility:	Insoluble
Boiling Point:	617° to 734°F (325° to 390°C)
Melting Point:	-2° to 50°F (-19° to 10°C)
Molecular Weight:	258 to 326

EXPOSURE LIMITS

OSHA:	1 mg/m^3, 8-hr TWA (42% *Chlorine*) and 0.5 mg/m^3, 8-hr TWA (54% *Chlorine*)
NIOSH:	0.001 mg/m^3, 10-hr TWA
ACGIH:	1 mg/m^3, 8-hr TWA (42% *Chlorine*) and 0.5 mg/m^3, 8-hr TWA (54% *Chlorine*)
IDLH:	5 mg/m^3

PROTECTIVE EQUIPMENT

Gloves:	Butyl, Neoprene, Polyvinyl Chloride, Silver Shield®/4H® and Viton (>4-hr breakthrough)
Coveralls:	Tychem® CPF 2, SL, CPF 4 and Responder® (>8-hr breakthrough)
Respirator:	>0.001 mg/m^3 - Supplied air or SCBA

HEALTH EFFECTS

Eyes:	Irritation
Skin:	Irritation
Inhalation:	Nose, throat and lung irritation with coughing, wheezing and shortness of breath
	Headache, nausea, vomiting, and abdominal pain
Chronic:	Cancer (skin, brain, pancreas) in humans

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.

Quickly remove contaminated clothing and wash contaminated skin with large amounts of soap and water.

Begin artificial respiration if breathing has stopped and CPR if necessary.

Transfer promptly to a medical facility

Right to Know Hazardous Substance Fact Sheet

Common Name: **PETROLEUM DISTILLATES**

Synonyms: Crude Oil; Petroleum Oil

Chemical Name: Petroleum

Date: August 2011

CAS Number: 8002-05-9

RTK Substance Number: 2648

DOT Number: UN 1268

Description and Use

Petroleum Distillates are dark yellow to brown or green-black liquids with a mild *gasoline* or *kerosene*-like odor. They are a complex blend of *Hydrocarbons* used in making petroleum products.

Reasons for Citation

- **Petroleum Distillates** are on the Right to Know Hazardous Substance List because they are cited by OSHA, DOT, NIOSH and IARC.
- This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while rinsing.

Skin Contact

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Inhalation

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

EMERGENCY RESPONDERS >>>> SEE LAST PAGE

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	2	-
FLAMMABILITY	3	-
REACTIVITY	0	-

FLAMMABLE
POISONOUS GASES ARE PRODUCED IN FIRE
CONTAINERS MAY EXPLODE IN FIRE

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

- **Petroleum Distillates** can affect you when inhaled and may be absorbed through the skin.
- Contact can irritate and burn the skin and eyes.
- Inhaling **Petroleum Distillates** can irritate the nose, throat and lungs.
- **Petroleum Distillates** can affect the nervous system causing headache, dizziness, nausea, and loss of balance and coordination.
- **Petroleum Distillates** may affect the liver and kidneys.
- **Petroleum Distillates** are FLAMMABLE LIQUIDS and DANGEROUS FIRE HAZARDS.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **3,500 ppm** averaged over an 8-hour workshift.

NIOSH: The recommended airborne exposure limit (REL) is **88 ppm** averaged over a 10-hour workshift and **450 ppm**, not to be exceeded during any 15-minute work period.

Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act and the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects
The following acute (short-term) health effects may occur immediately or shortly after exposure to **Petroleum Distillates**:

- Contact can irritate and burn the skin and eyes.
- Inhaling **Petroleum Distillates** can irritate the nose, throat and lungs causing coughing, wheezing and/or shortness of breath.
- **Petroleum Distillates** can affect the nervous system causing headache, dizziness, nausea, vomiting, blurred vision, confusion, and loss of balance and coordination. Higher levels may cause coma and death.

Chronic Health Effects
The following chronic (long-term) health effects can occur at some time after exposure to **Petroleum Distillates** and can last for months or years:

Cancer Hazard
- While **Petroleum Distillates** have been tested, they are not classifiable as to their potential to cause cancer.

Reproductive Hazard
- There is limited evidence that **Petroleum Distillates** may affect female fertility.

Other Effects
- Prolonged or repeated exposure can cause drying and cracking of the skin with redness.
- **Petroleum Distillates** can irritate the lungs. Repeated exposure may cause bronchitis to develop with coughing, phlegm, and/or shortness of breath.
- **Petroleum Distillates** may affect the liver and kidneys.

Medical

Medical Testing
For frequent or potentially high exposure (half the REL or greater), the following are recommended before beginning work and at regular times after that:

- Liver and kidney function tests

If symptoms develop or overexposure is suspected, the following are recommended:

- Chest x-ray and lung function tests
- Exam of the nervous system

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures
- Smoking can cause heart disease, lung cancer, emphysema, and other respiratory problems. It may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.
- More than light alcohol consumption can cause liver damage. Drinking alcohol may increase the liver damage caused by **Petroleum Distillates**.

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Before entering a confined space where **Petroleum Distillates** may be present, check to make sure that an explosive concentration does not exist.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- Avoid skin contact with **Petroleum Distillates**. Wear personal protective equipment made from material that can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- The recommended glove materials for *Hydrocarbons* are Silver Shield®/4H®, Viton, Viton/Butyl and Barrier®.
- The recommended protective clothing materials for *Hydrocarbons* are Tychem® BR, CSM and TK; and Trellchem® HPS and VPS, or the equivalent.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear indirect vent goggles when working with liquids that may splash, spray or mist. A face shield is also required if the liquid is severely irritating or corrosive to the skin and eyes.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **88 ppm**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus or an emergency escape air cylinder.
- Exposure to **1,100 ppm** is immediately dangerous to life and health. If the possibility of exposure above **1,100 ppm** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- **Petroleum Distillates** are FLAMMABLE LIQUIDS.
- Use dry chemical, CO_2, alcohol-resistant foam or other foam extinguishing agents, as water may not be effective in fighting fires.
- POISONOUS GASES ARE PRODUCED IN FIRE.
- CONTAINERS MAY EXPLODE IN FIRE.
- Use water spray to keep fire-exposed containers cool.
- Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source and flash back.
- Flow or agitation may generate electrostatic charges.
- **Petroleum Distillates** may form an ignitable vapor/air mixture in closed tanks or containers.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Petroleum Distillates** are spilled or leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Absorb liquids in dry sand, earth, or a noncombustible material and place into sealed containers for disposal.
- Ventilate area of spill or leak.
- Keep **Petroleum Distillates** out of confined spaces, such as sewers, because of the possibility of an explosion.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Petroleum Distillates** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Petroleum Distillates** you should be trained on its proper handling and storage.

- **Petroleum Distillates** may react violently with OXIDIZING AGENTS (such as NITROGEN TETROXIDE, PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and NITRIC ACID.
- Store in tightly closed containers in a cool, well-ventilated area.
- Sources of ignition, such as smoking and open flames, are prohibited where **Petroleum Distillates** are used, handled, or stored.
- Metal containers involving the transfer of **Petroleum Distillates** should be grounded and bonded.
- Use explosion-proof electrical equipment and fittings wherever **Petroleum Distillates** are used, handled, manufactured, or stored.
- Use only non-sparking tools and equipment, especially when opening and closing containers of **Petroleum Distillates**.
- **Petroleum Distillates** may accumulate static electricity when being filled into properly grounded containers.

Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Acute Exposure Guideline Levels (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

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A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

The **critical temperature** is the temperature above which a gas cannot be liquefied, regardless of the pressure applied.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database on human health effects that may result from exposure to various chemicals, maintained by federal EPA.

LEL or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

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PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

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A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Air*), at the same temperature and pressure.

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

NJ Health New Jersey Department of Health

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **PETROLEUM DISTILLATES**

Synonyms: Crude Oil; Petroleum; Petroleum Oil
CAS No: 8002-05-9
Molecular Formula: Varies
RTK Substance No: 2648
Description: Dark yellow to brown or green-black liquids with a mild *gasoline* or *kerosene* odor

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
2 - Health **3 - Fire** **0 - Reactivity** **DOT#:** UN 1268 **ERG Guide #:** 128 **Hazard Class:** 3 (Flammable)	FLAMMABLE LIQUIDS Use dry chemical, CO_2, alcohol-resistant foam or other foam extinguishing agents, as water may not be effective in fighting fires. POISONOUS GASES ARE PRODUCED IN FIRE. CONTAINERS MAY EXPLODE IN FIRE. Use water spray to keep fire-exposed containers cool. Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source and flash back. Flow or agitation may generate electrostatic charges. **Petroleum Distillates** may form an ignitable vapor/air mixture in closed tanks or containers.	**Petroleum Distillates** may react violently with OXIDIZING AGENTS (such as NITROGEN TETROXIDE, PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE) and NITRIC ACID.

SPILL/LEAKS

Isolation Distance:
Spill: 50 meters (150 feet)
Fire: 800 meters (1/2 mile)

Absorb liquids in dry sand, earth, or a noncombustible material and place into sealed containers for disposal.
Bond and ground containers when transferring **Petroleum Distillates.**
Use only non-sparking tools and equipment.
Keep **Petroleum Distillates** out of confined spaces, such as sewers, because of the possibility of an explosion.
DO NOT wash into sewer.

PHYSICAL PROPERTIES

Odor Threshold:	Mild *gasoline* or *kerosene*-like
Flash Point:	-40° to -86°F (-40° to -66°C)
LEL:	1.1%
UEL:	5.9%
Vapor Pressure:	40 mm Hg at 68°F (20°C) (approximately)
Specific Gravity:	0.78 to 0.97 (water = 1)
Water Solubility:	Insoluble
Boiling Point:	86 ° to 460°F (30° to 238°C)
Freezing Point:	-99°F (-73°C)
Molecular Weight:	98 (approximately)

EXPOSURE LIMITS

OSHA: 500 ppm, 8-hr TWA
NIOSH: 88 ppm, 10-hr TWA; 450 ppm, Ceiling (15-minute)
IDLH: 1,100 ppm
The Protective Action Criteria values are:
PAC-1 = 87.5 ppm PAC-2 = 450 ppm
PAC-3 = 1,100 ppm

PROTECTIVE EQUIPMENT

Gloves:	Silver Shield®/4H®, Viton, Viton/Butyl and Barrier® (>8-hr breakthrough for *Hydrocarbons*)
Coveralls:	Tychem® BR, CSM and TK; and Trellchem® HPS and VPS (>8-hr breakthrough for *Hydrocarbons*) **Use turn out gear or flash protection if ignition/fire is the greatest hazard.**
Respirator:	>88 ppm - SCBA

HEALTH EFFECTS

Eyes:	Irritation and burns
Skin:	Irritation and burns
Inhalation:	Nose, throat and lung irritation, with coughing, wheezing and shortness of breath
	Headache, dizziness, confusion and loss of balance

FIRST AID AND DECONTAMINATION

Remove the person from exposure.
Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.
Quickly remove contaminated clothing and wash contaminated skin with large amounts of soap and water.
Begin artificial respiration if breathing has stopped and CPR if necessary.
Transfer promptly to a medical facility.

Right to Know Hazardous Substance Fact Sheet

Common Name: **TETRACHLOROETHYLENE**

Synonyms: Ethylene Tetrachloride; Perchloroethylene

Chemical Name: Ethene, Tetrachloro-

Date: March 2002 Revision: October 2011

CAS Number: 127-18-4

RTK Substance Number: 1810

DOT Number: UN 1897

EMERGENCY RESPONDERS >>>> SEE LAST PAGE

Description and Use

Tetrachloroethylene is a clear, colorless liquid with a sweet *Ether*-like odor. It is used as a dry cleaning solvent, heat transfer medium, degreaser, solvent, and drying agent for metals.

- **ODOR THRESHOLD = 5 to 50 ppm**
- Odor thresholds vary greatly. Do not rely on odor alone to determine potentially hazardous exposures.

Reasons for Citation

- **Tetrachloroethylene** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, NTP, DEP, IARC, IRIS, NFPA and EPA.
- This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while rinsing.

Skin Contact

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water.

Inhalation

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.
- Medical observation is recommended for 24 to 48 hours after overexposure, as pulmonary edema may be delayed.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	3	2
FLAMMABILITY	-	0
REACTIVITY	-	0

CARCINOGEN
POISONOUS GASES ARE PRODUCED IN FIRE
DOES NOT BURN

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

- **Tetrachloroethylene** can affect you when inhaled and by passing through the skin.
- **Tetrachloroethylene** should be handled as a CARCINOGEN--WITH EXTREME CAUTION.
- **Tetrachloroethylene** can cause reproductive damage.
- Contact can irritate and burn the skin and eyes. Prolonged or repeated exposure can cause drying and cracking of the skin with rash, redness and blisters.
- Exposure can irritate the eyes, nose and throat.
- Inhaling **Tetrachloroethylene** can irritate the lungs. Higher exposures may cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency.
- Exposure can cause headache, dizziness, lightheadedness, nausea, vomiting, and passing out.
- **Tetrachloroethylene** may damage the liver and kidneys and affect the nervous system and heart.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **100 ppm** averaged over an 8-hour workshift, **200 ppm**, not to be exceeded during any 15-minute work period, and **300 ppm** as a maximum peak for 5-minutes during any 3-hour period.

NIOSH: Recommends that exposure to occupational carcinogens be limited to the lowest feasible concentration.

ACGIH: The threshold limit value (TLV) is **25 ppm** averaged over an 8-hour workshift and **100 ppm** as a STEL (short-term exposure limit).

- **Tetrachloroethylene** is a PROBABLE CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act and the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects
The following acute (short-term) health effects may occur immediately or shortly after exposure to **Tetrachloroethylene**:

- Contact can irritate and burn the skin and eyes.
- Exposure can irritate the eyes, nose and throat.
- Inhaling **Tetrachloroethylene** can irritate the lungs causing coughing and/or shortness of breath. Higher exposures may cause a build-up of fluid in the lungs (pulmonary edema), a medical emergency, with severe shortness of breath.
- Exposure can cause headache, dizziness, lightheadedness, incoordination, nausea, vomiting, and passing out.

Chronic Health Effects
The following chronic (long-term) health effects can occur at some time after exposure to **Tetrachloroethylene** and can last for months or years:

Cancer Hazard
- **Tetrachloroethylene** is a PROBABLE CARCINOGEN in humans. There is evidence that it causes cancer of the liver, esophagus, bladder, and other types of cancer in humans. It has also been shown to cause cancer of the liver and leukemia in animals.
- Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard
- **Tetrachloroethylene** may damage the developing fetus.
- **Tetrachloroethylene** may decrease fertility in males and females and may damage the male (testes) and female (ovaries) reproductive systems in animals.
- There is limited evidence that **Tetrachloroethylene** causes spontaneous abortions.

Other Effects
- Prolonged or repeated exposure can cause drying and cracking of the skin with rash, redness and blisters.
- **Tetrachloroethylene** may damage the liver and kidneys and affect the nervous system and heart

Medical

Medical Testing
For frequent or potentially high exposure (half the TLV or greater), the following are recommended before beginning work and at regular times after that:

- Liver and kidney function tests

If symptoms develop or overexposure is suspected, the following are recommended:

- Consider chest x-ray after acute overexposure
- Exam of the nervous system
- EKG

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

You have a legal right to request copies of your medical testing under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures
- Smoking can cause heart disease, lung cancer, emphysema, and other respiratory problems. It may worsen respiratory conditions caused by chemical exposure. Even if you have smoked for a long time, stopping now will reduce your risk of developing health problems.
- More than light alcohol consumption can cause liver damage. Drinking alcohol can increase the liver damage caused by **Tetrachloroethylene**.

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Where possible, transfer **Tetrachloroethylene** from drums or other containers to process containers in an enclosed system.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- Avoid skin contact with **Tetrachloroethylene**. Wear personal protective equipment made from material that can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- The recommended glove materials for **Tetrachloroethylene** are Polyvinyl Alcohol, Silver Shield®/4H®, Viton, Viton/Butyl and Barrier®.
- The recommended protective clothing materials for **Tetrachloroethylene** are Tychem® F, CPF3, BR, CSM and TK; and Trellchem® HPS and VPS, or the equivalent.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear indirect vent goggles when working with liquids that may splash, spray or mist. A face shield is also required if the liquid is severely irritating or corrosive to the skin and eyes.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure to **Tetrachloroethylene**, use a NIOSH approved respirator with an organic vapor cartridge. More protection is provided by a full facepiece respirator than by a half-mask respirator, and even greater protection is provided by a powered-air purifying respirator.
- Leave the area immediately if (1) while wearing a filter or cartridge respirator you can smell, taste, or otherwise detect **Tetrachloroethylene**, (2) while wearing particulate filters abnormal resistance to breathing is experienced, or (3) eye irritation occurs while wearing a full facepiece respirator. Check to make sure the respirator-to-face seal is still good. If it is, replace the filter or cartridge. If the seal is no longer good, you may need a new respirator.
- Consider all potential sources of exposure in your workplace. You may need a combination of filters, prefilters or cartridges to protect against different forms of a chemical (such as vapor and mist) or against a mixture of chemicals.
- Where the potential exists for exposure over **25 ppm**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus or an emergency escape air cylinder.
- Exposure to **150 ppm** is immediately dangerous to life and health. If the possibility of exposure above **150 ppm** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- Extinguish fire using an agent suitable for type of surrounding fire. **Tetrachloroethylene** itself does not burn.
- POISONOUS GASES ARE PRODUCED IN FIRE, including *Hydrogen Chloride* and *Phosgene*.
- Use water spray to keep fire-exposed containers cool.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Tetrachloroethylene** is spilled or leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Absorb liquids in dry sand, earth, or a similar material and place into sealed containers for disposal.
- Ventilate area of spill or leak.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Tetrachloroethylene** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Tetrachloroethylene** you should be trained on its proper handling and storage.

- **Tetrachloroethylene** reacts violently with *finely dispersed* or *finely divided* METALS (such as ALUMINUM, BARIUM, LITHIUM, BERYLLIUM and ZINC).
- **Tetrachloroethylene** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); SULFURIC ACID; NITRIC ACID; SODIUM HYDROXIDE; and POTASSIUM HYDROXIDE.
- **Tetrachloroethylene** slowly decomposes in WATER to form acids such as *Hydrogen Chloride*.
- **Tetrachloroethylene** decomposes slowly with heating, and with exposure to ultraviolet light or on contact with hot surfaces, to form toxic *Hydrogen Chloride* and *Phosgene gases*.
- Store in tightly closed containers in a cool, well-ventilated area.

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New Jersey Department of Health
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UEL or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Air*), at the same temperature and pressure.

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

NJ Health New Jersey Department of Health

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **TETRACHLOROETHYLENE**

Synonyms: Ethene, Tetrachloro-; Ethylene Tetrachloride; Perchloroethylene
CAS No: 127-18-4
Molecular Formula: $Cl_2C=CCl_2$
RTK Substance No: 1810
Description: Clear, colorless liquid with a sweet *Ether*-like odor

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
3 - Health **0 - Fire** **0 - Reactivity** **DOT#:** UN 1897 **ERG Guide #:** 160 **Hazard Class:** 6.1 (Toxic)	Extinguish fire using an agent suitable for type of surrounding fire. **Tetrachloroethylene** itself does not burn. POISONOUS GASES ARE PRODUCED IN FIRE, including *Hydrogen Chloride* and *Phosgene*. Use water spray to keep fire-exposed containers cool.	**Tetrachloroethylene** reacts violently with *finely dispersed* or *finely divided* METALS (such as ALUMINUM, BARIUM, LITHIUM, BERYLLIUM and ZINC). **Tetrachloroethylene** is not compatible with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE); SULFURIC ACID; NITRIC ACID; SODIUM HYDROXIDE; and POTASSIUM HYDROXIDE. **Tetrachloroethylene** slowly decomposes in WATER to form acids such as *Hydrogen Chloride*. **Tetrachloroethylene** decomposes slowly with heating, and with exposure to ultraviolet light or on contact with hot surfaces, to form toxic *Hydrogen Chloride* and *Phosgene gases*.

SPILL/LEAKS

Isolation Distance:

Spill: 50 meters (150 feet)

Fire: 800 meters (1/2 mile)

Absorb liquids in dry sand, earth, or a similar material and place into sealed containers for disposal.

DO NOT wash into sewer.

Tetrachloroethylene is toxic to aquatic organisms and may cause long term effects on the aquatic environment.

PHYSICAL PROPERTIES

Odor Threshold:	5 to 50 ppm
Flash Point:	Noncombustible
Vapor Density:	5.8 (air = 1)
Vapor Pressure:	14 mm Hg at 68°F (20°C)
Specific Gravity:	1.62 (water = 1)
Water Solubility:	Very slightly soluble
Boiling Point:	250°F (121°C)
Freezing Point:	-2°F (-19°C)
Ionization Potential:	9.32 eV
Molecular Weight:	165.8

EXPOSURE LIMITS

OSHA:	100 ppm, 8-hr TWA; 200 ppm, Ceiling; 300 ppm, Peak
NIOSH:	Lowest feasible concentration
ACGIH:	25 ppm, 8-hr TWA; 100 ppm, STEL
IDLH:	150 ppm

The Protective Action Criteria values are:
PAC-1 = 35 ppm PAC-2 = 230 ppm
PAC-3 = 1,200 ppm

PROTECTIVE EQUIPMENT

Gloves:	Polyvinyl Alcohol, Silver Shield®/4H®, Viton, Viton/Butyl and Barrier® (>8-hr breakthrough)
Coveralls:	Tychem® F, CPF3, BR and CSM; Trellchem® HPS and VPS (>8-hr breakthrough)
Respirator:	<25 ppm - full facepiece APR with *Organic vapor filters* Spills or Fire - SCBA

HEALTH EFFECTS

Eyes:	Irritation and burns
Skin:	Irritation and burns (skin absorbable)
Inhalation:	Nose, throat and lung irritation with coughing and severe shortness of breath (pulmonary edema) Headache, dizziness, lightheadedness, and passing out
Chronic:	Cancer (liver, esophagus and bladder)

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn.

Quickly remove contaminated clothing and wash contaminated skin with large amounts of soap and water.

Begin artificial respiration if breathing has stopped and CPR if necessary.

Transfer promptly to a medical facility.

Medical observation is recommended as symptoms may be delayed.

Right to Know Hazardous Substance Fact Sheet

Common Name: **TRICHLOROETHYLENE**

Synonyms: Ethylene Trichloride; TCE; Trichloroethene

Chemical Name: Ethene, Trichloro-

Date: January 2000 Revision: December 2008

CAS Number: 79-01-6

RTK Substance Number: 1890

DOT Number: UN 1710

EMERGENCY RESPONDERS >>>> SEE BACK PAGE

Description and Use

Trichloroethylene is a clear, colorless liquid with a sweet odor. It is used as a degreaser for metal parts, as a solvent and fumigant, and to make other chemicals.

- **ODOR THRESHOLD = 1.4 ppm**
- Odor thresholds vary greatly. Do not rely on odor alone to determine potentially hazardous exposures.

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	3	2
FLAMMABILITY	-	1
REACTIVITY	-	0

CARCINOGEN
POISONOUS GASES ARE PRODUCED IN FIRE
CONTAINERS MAY EXPLODE IN FIRE

Hazard Rating Key: 0=minimal; 1=slight; 2=moderate; 3=serious; 4=severe

Reasons for Citation

- **Trichloroethylene** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, NTP, DEP, IARC, IRIS, NFPA and EPA.
- This chemical is on the Special Health Hazard Substance List.

- **Trichloroethylene** can affect you when inhaled and by passing through the skin.
- **Trichloroethylene** should be handled as a CARCINOGEN--WITH EXTREME CAUTION.
- Contact can irritate and burn the skin and eyes with possible eye damage.
- Exposure can cause headache, dizziness, lightheadedness, and passing out. Very high exposure can cause irregular heartbeat, which can be fatal.
- **Trichloroethylene** may cause a skin allergy.
- Repeated exposure may cause personality changes such as depression, anxiety or irritability.
- **Trichloroethylene** may damage the liver and kidneys.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

- Immediately flush with large amounts of water for at least 15 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while flushing. Seek medical attention.

Skin Contact

- Quickly remove contaminated clothing. Immediately wash contaminated skin with large amounts of soap and water. Seek medical attention.

Inhalation

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **100 ppm** averaged over an 8-hour workshift, and **200 ppm**, not to be exceeded during any 15-minute work period, and **300 ppm** as a 5-minute peak in any 2-hour work period.

NIOSH: Recommends that exposure to occupational carcinogens be limited to the lowest feasible concentration.

ACGIH: The threshold limit value (TLV) is **10 ppm** averaged over an 8-hour workshift and **25 ppm** as a STEL (short-term exposure limit).

- **Trichloroethylene** is a PROBABLE CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.
- The above exposure limits are for air levels only. When skin contact also occurs, you may be overexposed, even though air levels are less than the limits listed above.

Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act, the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects
The following acute (short-term) health effects may occur immediately or shortly after exposure to **Trichloroethylene**:

- Contact can irritate and burn the skin and eyes with possible eye damage.
- Exposure can cause headache, dizziness, lightheadedness, visual disturbances, nausea and vomiting, and passing out. Very high exposure can cause irregular heartbeat, which can be fatal.

Chronic Health Effects
The following chronic (long-term) health effects can occur at some time after exposure to **Trichloroethylene** and can last for months or years:

Cancer Hazard
- **Trichloroethylene** is a PROBABLE CARCINOGEN in humans. There is evidence that it causes liver, kidney, and lung cancer in animals.
- Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard
- There is limited evidence that **Trichloroethylene** is a teratogen in animals. Until further testing has been done, it should be treated as a possible teratogen in humans.
- There is limited evidence that **Trichloroethylene** may affect fertility and may damage the male reproductive system (including decreasing the sperm count) in animals.

Other Effects
- **Trichloroethylene** may cause a skin allergy. If allergy develops, very low future exposure can cause itching and a skin rash.
- Repeated exposure may cause personality changes such as depression, anxiety or irritability, and memory loss.
- **Trichloroethylene** may damage the liver and kidneys.

Medical

Medical Testing
For frequent or potentially high exposure (half the TLV or greater, or significant skin contact) the following are recommended before beginning work and at regular times after that:

- Liver and kidney function tests

If symptoms develop or overexposure is suspected, the following are recommended:

- Exam of the nervous system
- Evaluation by a qualified allergist can help diagnose skin allergy.
- Urinary *Trichloroacetic Acid* level (for repeated exposures) or blood **Trichloroethylene** levels (for acute exposure)
- Special 24-48 hour EKG (Holter monitor) to observe and record abnormal heart rhythms

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures
- More than light alcohol consumption can cause liver damage. Drinking alcohol can increase the liver damage caused by **Trichloroethylene**.

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Where possible, transfer **Trichloroethylene** from drums or other containers to process containers in an enclosed system.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- Avoid skin contact with **Trichloroethylene**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- Safety equipment manufacturers recommend Silver Shield®/4H®, Viton and Barrier® for gloves, and Tychem® F, BR, LV, Responder®, and TK; Zytron® 500; ONESuit® TEC; and Trellchem® HPS and VPS, or the equivalent, as protective materials for clothing.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear indirect-vent, impact and splash resistant goggles when working with liquids.
- Wear non-vented, impact resistant goggles when working with fumes, gases, or vapors.
- Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **10 ppm**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus operated in a pressure-demand or other positive-pressure mode.
- Exposure to **1,000 ppm** is immediately dangerous to life and health. If the possibility of exposure above **1,000 ppm** exists, use a NIOSH approved self-contained breathing apparatus with a full facepiece operated in a pressure-demand or other positive-pressure mode equipped with an emergency escape air cylinder.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- **Trichloroethylene** may burn, but does not readily ignite.
- Use dry chemical, CO_2, water spray or alcohol-resistant foam as extinguishing agents.
- POISONOUS GASES ARE PRODUCED IN FIRE, including *Hydrogen Chloride* and *Phosgene*.
- CONTAINERS MAY EXPLODE IN FIRE.
- Use water spray to keep fire-exposed containers cool.
- Use water spray to reduce vapors.
- **Trichloroethylene** accumulates static charge.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Trichloroethylene** is spilled or leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate all ignition sources.
- Absorb liquids in vermiculite, dry sand, earth, fly ash or cement powder and place into sealed containers for disposal.
- Use water spray to keep containers cool.
- Ventilate and wash area after clean-up is complete.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Trichloroethylene** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Trichloroethylene** you should be trained on its proper handling and storage.

- **Trichloroethylene** will react explosively with *finely divided* or *powdered* BARIUM, BERYLLIUM, and MAGNESIUM.
- **Trichloroethylene** reacts with ACTIVE METALS (such as LITHIUM, SODIUM and TITANIUM) to cause flashing and sparks and will react with STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE) and EPOXIDES to form spontanously flammable *Dichloroacetylene*.
- **Trichloroethylene** is not compatible with STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); ISOCYANATES; EPICHLOROHYDRIN; ALCOHOLS; and GLYCOLS.
- Store in tightly closed containers in a cool, well-ventilated area away from COMBUSTIBLES, LIGHT and MOISTURE.
- Use only non-sparking tools and equipment, especially when opening and closing containers of **Trichloroethylene**.
- Metal containers involving the transfer of **Trichloroethylene** should be grounded and bonded as **Trichloroethylene** accumulates static charge.

Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Acute Exposure Guideline Levels (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

CFR is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database on human health effects that may result from exposure to various chemicals, maintained by federal EPA.

LEL or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

Protective Action Criteria (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Hydrogen*), at the same temperature and pressure.

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

NJ Health New Jersey Department of Health

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **TRICHLOROETHYLENE**

Synonyms: Ethylene Trichloride; TCE; Trichloroethene
CAS No: 79-01-6
Molecular Formula: C_2HCl_3
RTK Substance No: 1890
Description: Clear, colorless liquid with a sweet, *Chloroform-like* odor

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
3 - Health **1 - Fire** **0 - Reactivity** **DOT#:** UN 1710 **ERG Guide #:** 160 **Hazard Class:** 6.1 (Poison)	**Trichloroethylene** may burn, but does not readily ignite. Use dry chemical, CO_2, water spray or alcohol-resistant foam as extinguishing agents. POISONOUS GASES ARE PRODUCED IN FIRE, including *Hydrogen Chloride* and *Phosgene*. CONTAINERS MAY EXPLODE IN FIRE. Use water spray to keep fire-exposed containers cool. Use water spray to reduce vapors. **Trichloroethylene** accumulates static charge.	**Trichloroethylene** will react explosively with *finely divided* or *powdered* BARIUM, BERYLLIUM, and MAGNESIUM. **Trichloroethylene** reacts with ACTIVE METALS (such as LITHIUM, SODIUM and TITANIUM) to cause flashing and sparks. **Trichloroethylene** will react with STRONG BASES (such as SODIUM HYDROXIDE and POTASSIUM HYDROXIDE) and EPOXIDES to form spontanously flammable *Dichloroacetylene*. **Trichloroethylene** is not compatible with STRONG ACIDS (such as HYDROCHLORIC, SULFURIC and NITRIC); ISOCYANATES; EPICHLOROHYDRIN; ALCOHOLS; and GLYCOLS.

SPILL/LEAKS

Isolation Distance:

Spill: 50 meters (150 feet)
Fire: 800 meters (1/2 mile)

Absorb liquids in vermiculite, dry sand, earth, fly ash or cement powder and place into sealed containers for disposal.

DO NOT wash into sewer.

Use only non-sparking tools and equipment, especially when opening and closing containers of **Trichloroethylene**.

Metal containers should be grounded and bonded as **Trichloroethylene** accumulates static charge.

Trichloroethylene is slightly toxic to aquatic life.

PHYSICAL PROPERTIES

Odor Threshold:	1.4 ppm
Flash Point:	>200°F (93°C)
LEL:	8%
UEL:	10.5%
Auto Ignition Temp:	788°F (420°C)
Vapor Density:	4.5 (air = 1)
Vapor Pressure:	58 mm Hg at 68°F (20°C)
Specific Gravity:	1.5 (water = 1)
Water Solubility:	Slightly soluble
Boiling Point:	189°F (87°C)
Melting Point:	-99°F (-73°C)
Ionization Potential:	9.5 eV
Molecular Weight:	131.4

EXPOSURE LIMITS

ACGIH: 10 ppm, 8-hr TWA; 25 ppm, 15-min STEL

IDLH: 1,000 ppm

The Protective Action Criteria values are:

PAC-1 = 130 ppm
PAC-2 = 450 ppm
PAC-3 = 3,800 ppm

PROTECTIVE EQUIPMENT

Gloves:	Silver Shield®/4H®, Viton and Barrier® (>8-hr breakthrough)
Coveralls:	Tychem® F, BR, LV, Responder®, and TK; Zytron® 500; ONESuit® TEC; and Trellchem® HPS and VPS (>8-hr breakthrough)
Respirator:	>10 ppm - Supplied air or SCBA

HEALTH EFFECTS

Eyes:	Irritation and burns
Skin:	Irritation and burns
Inhalation:	Headache, dizziness, lightheadedness, visual disturbances, nausea and vomiting, and passing out
Chronic:	Cancer (liver, kidney, and lung) in animals

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

Flush eyes with large amounts of water for at least 15 minutes. Remove contact lenses if worn. Seek medical attention.

Quickly remove contaminated clothing and wash contaminated skin with large amounts of soap and water. Seek medical attention.

Begin artificial respiration if breathing has stopped and CPR if necessary.

Transfer promptly to a medical facility.

Right to Know Hazardous Substance Fact Sheet

Common Name: **VINYL CHLORIDE**

Synonyms: Chloroethylene; Monochloroethylene; VCM

Chemical Name: Ethene, Chloro-

Date: June 2001 Revision: November 2010

CAS Number: 75-01-4

RTK Substance Number: 2001

DOT Number: UN 1086

Description and Use

Vinyl Chloride is a colorless gas, with a sweet odor at high concentrations, that is usually handled as a liquid under pressure. It is used to make *Polyvinyl Chloride* for pipes, wire, and cable coatings, and in furniture, automobiles, and adhesives.

- **ODOR THRESHOLD = >3,000 ppm**
- Odor thresholds vary greatly. Do not rely on odor alone to determine potentially hazardous exposures.

Reasons for Citation

- **Vinyl Chloride** is on the Right to Know Hazardous Substance List because it is cited by OSHA, ACGIH, DOT, NIOSH, NTP, DEP, IARC, IRIS, NFPA and EPA.
- This chemical is on the Special Health Hazard Substance List.

SEE GLOSSARY ON PAGE 5.

FIRST AID

Eye Contact

- Immediately flush with large amounts of water for at least 30 minutes, lifting upper and lower lids. Remove contact lenses, if worn, while flushing. Seek medical attention.

Skin Contact

- Immerse affected part in warm water. Seek medical attention.

Inhalation

- Remove the person from exposure.
- Begin rescue breathing (using universal precautions) if breathing has stopped and CPR if heart action has stopped.
- Transfer promptly to a medical facility.

EMERGENCY NUMBERS

Poison Control: 1-800-222-1222

CHEMTREC: 1-800-424-9300

NJDEP Hotline: 1-877-927-6337

National Response Center: 1-800-424-8802

EMERGENCY RESPONDERS >>>> SEE LAST PAGE

Hazard Summary

Hazard Rating	NJDOH	NFPA
HEALTH	4	2
FLAMMABILITY	4	4
REACTIVITY	2	2

CARCINOGEN
FLAMMABLE AND REACTIVE
POISONOUS GASES ARE PRODUCED IN FIRE
CONTAINERS MAY EXPLODE IN FIRE

Hazard Rating Key: 0=minimal, 1=slight, 2=moderate, 3=serious, 4=severe

- **Vinyl Chloride** can affect you when inhaled.
- **Vinyl Chloride** is a CARCINOGEN and MUTAGEN. HANDLE WITH EXTREME CAUTION.
- **Vinyl Chloride** can cause reproductive damage.
- Exposure to **Vinyl Chloride** can severely irritate and burn the skin and eyes with possible eye damage. Contact with the *liquid or gas* can cause frostbite.
- Inhaling **Vinyl Chloride** can irritate the nose, throat and lungs.
- **Vinyl Chloride** can cause headache, nausea, vomiting, dizziness, fatigue, weakness and confusion. Higher levels can cause lightheadedness and passing out.
- Prolonged or repeated exposure can damage the liver, nervous system and lungs.
- Repeated exposure can damage the skin (scleroderma), bones (acro-osteolysis) and blood vessels in the hands (Raynaud's Syndrome).
- **Vinyl Chloride** is FLAMMABLE and REACTIVE and a DANGEROUS FIRE and EXPLOSION HAZARD.
- EXPLOSIVE POLYMERIZATION may occur at elevated temperatures if **Vinyl Chloride** is not inhibited.

Workplace Exposure Limits

OSHA: The legal airborne permissible exposure limit (PEL) is **1 ppm** averaged over an 8-hour workshift and **5 ppm**, not to be exceeded during any 15-minute work period.

NIOSH: Recommends that exposure to occupational carcinogens be limited to the lowest feasible concentration.

ACGIH: The threshold limit value (TLV) is **1 ppm** averaged over an 8-hour workshift.

- **Vinyl Chloride** is a CARCINOGEN in humans. There may be no safe level of exposure to a carcinogen, so all contact should be reduced to the lowest possible level.

Determining Your Exposure

- Read the product manufacturer's Material Safety Data Sheet (MSDS) and the label to determine product ingredients and important safety and health information about the product mixture.
- For each individual hazardous ingredient, read the New Jersey Department of Health Hazardous Substance Fact Sheet, available on the RTK website (www.nj.gov/health/eoh/rtkweb) or in your facility's RTK Central File or Hazard Communication Standard file.
- You have a right to this information under the New Jersey Worker and Community Right to Know Act and the Public Employees Occupational Safety and Health (PEOSH) Act if you are a public worker in New Jersey, and under the federal Occupational Safety and Health Act (OSHA) if you are a private worker.
- The New Jersey Right to Know Act requires most employers to label chemicals in the workplace and requires public employers to provide their employees with information concerning chemical hazards and controls. The federal OSHA Hazard Communication Standard (29 CFR 1910.1200) and the PEOSH Hazard Communication Standard (N.J.A.C. 12:100-7) require employers to provide similar information and training to their employees.

This Fact Sheet is a summary of available information regarding the health hazards that may result from exposure. Duration of exposure, concentration of the substance and other factors will affect your susceptibility to any of the potential effects described below.

Health Hazard Information

Acute Health Effects
The following acute (short-term) health effects may occur immediately or shortly after exposure to **Vinyl Chloride**:

- Exposure to **Vinyl Chloride** can severely irritate and burn the skin and eyes with possible eye damage. Contact with the *liquid or gas* can cause frostbite.
- Inhaling **Vinyl Chloride** can irritate the nose, throat and lungs causing coughing, wheezing and/or shortness of breath.
- **Vinyl Chloride** can cause headache, nausea, vomiting, dizziness, fatigue, weakness and confusion. Higher levels can cause lightheadedness and passing out.

Chronic Health Effects
The following chronic (long-term) health effects can occur at some time after exposure to **Vinyl Chloride** and can last for months or years:

Cancer Hazard
- **Vinyl Chloride** is a CARCINOGEN in humans. It has been shown to cause liver, brain, lung, and other types of cancer.
- Many scientists believe there is no safe level of exposure to a carcinogen.

Reproductive Hazard
- **Vinyl Chloride** may damage the developing fetus.
- There is limited evidence that **Vinyl Chloride** is a teratogen in animals. Until further testing has been done, it should be treated as a possible teratogen in humans.
- There is limited evidence that **Vinyl Chloride** may damage the male reproductive system (including decreasing the sperm count) and may affect male fertility.
- An excess of spontaneous abortions has been reported among spouses of workers who had been exposed to **Vinyl Chloride**.

Other Effects
- Prolonged or repeated exposure can damage the liver, nervous system and lungs.
- Repeated exposure can cause a disease called "scleroderma." This causes the skin to become very smooth, tight and shiny. It causes the bones of the fingers to erode (acro-osteolysis), and damages the blood vessels in the hands or feet (Raynaud's syndrome). This causes the fingers or toes to turn numb, pale or blue, with even mild cold exposure.

Medical

Medical Testing
Before first exposure and every 12 months thereafter, OSHA requires your employer to provide (for persons exposed to **0.5 ppm** of **Vinyl Chloride**) a work and medical history and exam which shall include:

- Liver function tests
- Chest x-ray and lung function tests

If symptoms develop or overexposure is suspected, the following are recommended:

- Exam of the nervous system
- Exam of the skin

OSHA requires your employer to provide you and your doctor with a copy of the OSHA **Vinyl Chloride** Standard (29 CFR 1910.1017).

Any evaluation should include a careful history of past and present symptoms with an exam. Medical tests that look for damage already done are not a substitute for controlling exposure.

Request copies of your medical testing. You have a legal right to this information under the OSHA Access to Employee Exposure and Medical Records Standard (29 CFR 1910.1020).

Mixed Exposures
- More than light alcohol consumption can cause liver damage. Drinking alcohol may increase the liver damage caused by **Vinyl Chloride**.

Workplace Controls and Practices

Very toxic chemicals, or those that are reproductive hazards or sensitizers, require expert advice on control measures if a less toxic chemical cannot be substituted. Control measures include: (1) enclosing chemical processes for severely irritating and corrosive chemicals, (2) using local exhaust ventilation for chemicals that may be harmful with a single exposure, and (3) using general ventilation to control exposures to skin and eye irritants. For further information on workplace controls, consult the NIOSH document on Control Banding at www.cdc.gov/niosh/topics/ctrlbanding/.

The following work practices are also recommended:

- Label process containers.
- Provide employees with hazard information and training.
- Monitor airborne chemical concentrations.
- Use engineering controls if concentrations exceed recommended exposure levels.
- Provide eye wash fountains and emergency showers.
- Wash or shower if skin comes in contact with a hazardous material.
- Always wash at the end of the workshift.
- Change into clean clothing if clothing becomes contaminated.
- Do not take contaminated clothing home.
- Get special training to wash contaminated clothing.
- Do not eat, smoke, or drink in areas where chemicals are being handled, processed or stored.
- Wash hands carefully before eating, smoking, drinking, applying cosmetics or using the toilet.

In addition, the following may be useful or required:

- Specific actions are required for this chemical by OSHA. Refer to the OSHA **Vinyl Chloride** Standard (29 CFR 1910.1017).
- Before entering a confined space where **Vinyl Chloride** may be present, check to make sure that an explosive concentration does not exist.
- Transfer **Vinyl Chloride** from cylinders or other containers to process containers in an enclosed system.

Personal Protective Equipment

The OSHA Personal Protective Equipment Standard (29 CFR 1910.132) requires employers to determine the appropriate personal protective equipment for each hazard and to train employees on how and when to use protective equipment.

The following recommendations are only guidelines and may not apply to every situation.

Gloves and Clothing

- Avoid skin contact with **Vinyl Chloride**. Wear personal protective equipment made from material which can not be permeated or degraded by this substance. Safety equipment suppliers and manufacturers can provide recommendations on the most protective glove and clothing material for your operation.
- The recommended glove materials for **Vinyl Chloride** are Viton, Viton/Butyl, Silver Shield®/4H® and Barrier®.
- The recommended protective clothing materials for **Vinyl Chloride** are Tychem® BR, CSM and TK; and Trellchem® HPS and VPS or the equivalent.
- Where exposure to cold equipment, vapors, or liquid may occur, employees should be provided with *insulated* gloves and special clothing designed to prevent the freezing of body tissues.
- All protective clothing (suits, gloves, footwear, headgear) should be clean, available each day, and put on before work.

Eye Protection

- Wear non-vented, impact resistant goggles when working with fumes, gases, or vapors.
- Wear a face shield along with goggles when working with corrosive, highly irritating or toxic substances.
- Do not wear contact lenses when working with this substance.

Respiratory Protection

Improper use of respirators is dangerous. Respirators should only be used if the employer has implemented a written program that takes into account workplace conditions, requirements for worker training, respirator fit testing, and medical exams, as described in the OSHA Respiratory Protection Standard (29 CFR 1910.134).

- Where the potential exists for exposure over **1 ppm**, use a NIOSH approved supplied-air respirator with a full facepiece operated in a pressure-demand or other positive-pressure mode. For increased protection use in combination with an auxiliary self-contained breathing apparatus or an emergency escape air cylinder.
- DO NOT USE CHEMICAL CARTRIDGE OR CANISTER RESPIRATORS.

Fire Hazards

If employees are expected to fight fires, they must be trained and equipped as stated in the OSHA Fire Brigades Standard (29 CFR 1910.156).

- **Vinyl Chloride** is a FLAMMABLE AND REACTIVE GAS that can EXPLOSIVELY POLYMERIZE if not inhibited.
- DO NOT attempt to extinguish fire unless flow can be stopped. Shut off supply or let burn.
- Use dry chemical or CO_2 for small fires.
- POISONOUS GASES ARE PRODUCED IN FIRE, including *Hydrogen Chloride* and *Phosgene*.
- CONTAINERS MAY EXPLODE IN FIRE.
- Use water spray to reduce vapors and to keep containers cool.
- Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source or flash back.
- Flow or agitation may generate electrostatic charges.
- **Vinyl Chloride** may form an ignitable vapor/air mixture in closed tanks or containers.

Spills and Emergencies

If employees are required to clean-up spills, they must be properly trained and equipped. The OSHA Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) may apply.

If **Vinyl Chloride** is leaked, take the following steps:

- Evacuate personnel and secure and control entrance to the area.
- Eliminate ignition sources.
- Ventilate area of leak to disperse the gas.
- Stop flow of gas. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair leak or allow cylinder to empty.
- Absorb liquids in dry sand, earth, or a similar material and place into sealed containers for disposal.
- Turn leaking cylinder with leak up to prevent escape of gas in liquid state.
- Ventilate area of spill or leak.
- Keep **Vinyl Chloride** out of confined spaces, such as sewers, because of the possibility of an explosion.
- DO NOT wash into sewer.
- It may be necessary to contain and dispose of **Vinyl Chloride** as a HAZARDOUS WASTE. Contact your state Department of Environmental Protection (DEP) or your regional office of the federal Environmental Protection Agency (EPA) for specific recommendations.

Handling and Storage

Prior to working with **Vinyl Chloride** you should be trained on its proper handling and storage.

- A regulated, marked area should be established where **Vinyl Chloride** is handled, used or stored as required by the OSHA **Vinyl Chloride** Standard (29 CFR 1910.1017).
- **Vinyl Chloride** can polymerize rapidly or explosively when exposed to elevated temperatures (over 125°F (52°C)), or when exposed to AIR or LIGHT in the presence of a CATALYST.
- **Vinyl Chloride** reacts violently with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE).
- **Vinyl Chloride** is not compatible with WATER; METALS (such as COPPER, ALUMINUM, IRON and STEEL); METAL CARBIDES; and METAL ALLOYS as fires and/or explosions may occur.
- *Phenol* should be used as an inhibitor to prevent violent polymerization of **Vinyl Chloride**.
- Store in tightly closed containers in a cool, well-ventilated area away from MOISTURE, HEAT SOURCES and METALS.
- Sources of ignition, such as smoking and open flames, are prohibited where **Vinyl Chloride** is used, handled, or stored.
- Metal containers involving the transfer of **Vinyl Chloride** should be grounded and bonded.
- Use explosion-proof electrical equipment and fittings wherever **Vinyl Chloride** is used, handled, manufactured, or stored.
- Use only non-sparking tools and equipment, especially when opening and closing containers of **Vinyl Chloride**.
- **Vinyl Chloride** may accumulate static electricity.

Occupational Health Information Resources

The New Jersey Department of Health offers multiple services in occupational health. These services include providing informational resources, educational materials, public presentations, and industrial hygiene and medical investigations and evaluations.

For more information, please contact:

New Jersey Department of Health
Right to Know
PO Box 368
Trenton, NJ 08625-0368
Phone: 609-984-2202
Fax: 609-984-7407
E-mail: rtk@doh.state.nj.us
Web address: http://www.nj.gov/health/eoh/rtkweb

GLOSSARY

ACGIH is the American Conference of Governmental Industrial Hygienists. They publish guidelines called Threshold Limit Values (TLVs) for exposure to workplace chemicals.

Acute Exposure Guideline Levels (AEGLs) are established by the EPA. They describe the risk to humans resulting from once-in-a lifetime, or rare, exposure to airborne chemicals.

Boiling point is the temperature at which a substance can change its physical state from a liquid to a gas.

A **carcinogen** is a substance that causes cancer.

The **CAS number** is unique, identifying number, assigned by the Chemical Abstracts Service, to a specific chemical.

CFR is the Code of Federal Regulations, which are the regulations of the United States government.

A **combustible** substance is a solid, liquid or gas that will burn.

A **corrosive** substance is a gas, liquid or solid that causes destruction of human skin or severe corrosion of containers.

The **critical temperature** is the temperature above which a gas cannot be liquefied, regardless of the pressure applied.

DEP is the New Jersey Department of Environmental Protection.

DOT is the Department of Transportation, the federal agency that regulates the transportation of chemicals.

EPA is the Environmental Protection Agency, the federal agency responsible for regulating environmental hazards.

ERG is the Emergency Response Guidebook. It is a guide for emergency responders for transportation emergencies involving hazardous substances.

Emergency Response Planning Guideline (ERPG) values provide estimates of concentration ranges where one reasonably might anticipate observing adverse effects.

A **fetus** is an unborn human or animal.

A **flammable** substance is a solid, liquid, vapor or gas that will ignite easily and burn rapidly.

The **flash point** is the temperature at which a liquid or solid gives off vapor that can form a flammable mixture with air.

IARC is the International Agency for Research on Cancer, a scientific group.

Ionization Potential is the amount of energy needed to remove an electron from an atom or molecule. It is measured in electron volts.

IRIS is the Integrated Risk Information System database on human health effects that may result from exposure to various chemicals, maintained by federal EPA.

LEL or **Lower Explosive Limit**, is the lowest concentration of a combustible substance (gas or vapor) in the air capable of continuing an explosion.

mg/m^3 means milligrams of a chemical in a cubic meter of air. It is a measure of concentration (weight/volume).

A **mutagen** is a substance that causes mutations. A **mutation** is a change in the genetic material in a body cell. Mutations can lead to birth defects, miscarriages, or cancer.

NFPA is the National Fire Protection Association. It classifies substances according to their fire and explosion hazard.

NIOSH is the National Institute for Occupational Safety and Health. It tests equipment, evaluates and approves respirators, conducts studies of workplace hazards, and proposes standards to OSHA.

NTP is the National Toxicology Program which tests chemicals and reviews evidence for cancer.

OSHA is the federal Occupational Safety and Health Administration, which adopts and enforces health and safety standards.

PEOSHA is the New Jersey Public Employees Occupational Safety and Health Act, which adopts and enforces health and safety standards in public workplaces.

Permeated is the movement of chemicals through protective materials.

ppm means parts of a substance per million parts of air. It is a measure of concentration by volume in air.

Protective Action Criteria (PAC) are values established by the Department of Energy and are based on AEGLs and ERPGs. They are used for emergency planning of chemical release events.

A **reactive** substance is a solid, liquid or gas that releases energy under certain conditions.

STEL is a Short Term Exposure Limit which is usually a 15-minute exposure that should not be exceeded at any time during a work day.

A **teratogen** is a substance that causes birth defects by damaging the fetus.

UEL or **Upper Explosive Limit** is the highest concentration in air above which there is too much fuel (gas or vapor) to begin a reaction or explosion.

Vapor Density is the ratio of the weight of a given volume of one gas to the weight of another (usually *Air*), at the same temperature and pressure.

The **vapor pressure** is a force exerted by the vapor in equilibrium with the solid or liquid phase of the same substance. The higher the vapor pressure the higher concentration of the substance in air.

Right to Know Hazardous Substance Fact Sheet

Emergency Responders Quick Reference

Common Name: **VINYL CHLORIDE**

Synonyms: Chloroethylene, Monochloroethylene, VCM
CAS No: 75-01-4
Molecular Formula: CH_2 = CHCl
RTK Substance No: 2001

Description: Colorless gas, with a sweet odor at high concentrations, that is usually handled as a liquid under pressure

HAZARD DATA

Hazard Rating	Firefighting	Reactivity
4 - Health **4 - Fire** **2 - Reactivity** **DOT#:** UN 1086 **ERG Guide #:** 116P **Hazard Class:** 2.1 (Flammable Gas)	FLAMMABLE AND REACTIVE GAS that can EXPLOSIVELY POLYMERIZE if not inhibited. DO NOT attempt to extinguish fire unless flow can be stopped. Shut off supply or let burn. Use dry chemical or CO_2 for small fires. POISONOUS GASES ARE PRODUCED IN FIRE, including *Hydrogen Chloride* and *Phosgene*. CONTAINERS MAY EXPLODE IN FIRE. Use water spray to reduce vapors and to keep containers cool. Vapor is heavier than air and may travel a distance to cause a fire or explosion far from the source or flash back. Flow or agitation may generate electrostatic charges. **Vinyl Chloride** may form an ignitable vapor/air mixture in closed tanks or containers.	**Vinyl Chloride** can polymerize rapidly or explosively when exposed to elevated temperatures (over 125°F (52°C)), or when exposed to AIR or LIGHT in the presence of a CATALYST. **Vinyl Chloride** reacts violently with OXIDIZING AGENTS (such as PERCHLORATES, PEROXIDES, PERMANGANATES, CHLORATES, NITRATES, CHLORINE, BROMINE and FLUORINE). **Vinyl Chloride** is not compatible with WATER; METALS (such as COPPER, ALUMINUM, IRON and STEEL); METAL CARBIDES; and METAL ALLOYS as fires and/or explosions may occur. *Phenol* should be used as an inhibitor to prevent violent polymerization of **Vinyl Chloride**. **Vinyl Chloride** may accumulate static electricity.

SPILL/LEAKS

Isolation Distance:

Spill: 100 meters (330 feet)

Fire: 800 meters (1/2 mile)

Stop flow of gas. If source of leak is a cylinder and the leak cannot be stopped in place, remove the leaking cylinder to a safe place in the open air, and repair leak or allow cylinder to empty.

Absorb liquids in dry sand, earth, or a similar material and place into sealed containers for disposal.

Keep **Vinyl Chloride** out of confined spaces, such as sewers, because of the possibility of an explosion.

Turn leaking cylinder with leak up to prevent escape of gas in liquid state.

Use nonsparkling tools and ground and bond containers when transferring **Vinyl Chloride**.

Vinyl Chloride is hazardous to the environment.

PHYSICAL PROPERTIES

Odor Threshold:	>3,000 ppm
Flash Point:	-108°F (-78°C)
LEL:	3.6%
UEL:	33%
Auto Ignition Temp:	882°F (472°C)
Vapor Density:	2.2 (air = 1)
Vapor Pressure:	2,524 mm Hg at 68°F (20°C)
Specific Gravity:	0.9 (water = 1)
Water Solubility:	Very slightly soluble
Boiling Point:	17°F (-8.3°C)
Freezing Point:	-245° to -256°F (-154° to -160°C)
Ionization Potential:	9.99 eV
Critical Temperature:	306° to 317.3°F (152° to 158.5°C)
Molecular Weight:	62.5

EXPOSURE LIMITS

OSHA: 1 ppm, 8-hr TWA; 5 ppm, Ceiling
NIOSH: Lowest feasible concentration
ACGIH: 1 ppm, 8-hr TWA

The Protective Action Criteria values are:
PAC-1 = 250 ppm PAC-2 = 1,200 ppm
PAC-3 = 4,800 ppm

PROTECTIVE EQUIPMENT

Gloves:	Insulated Viton, Viton/Butyl, Silver Shield®/4H® and Barrier® (>8-hr breakthrough)
Coveralls:	Tychem® BR, CSM and TK; Trellchem HPS and VPS (8-hr breakthrough) >10% of the LEL wear flash protection or turnout gear
Respirator:	SCBA

HEALTH EFFECTS

Eyes:	Irritation and burns, contact with *liquid* or *gas* may cause frostbite
Skin:	Irritation and burns, contact with *liquid* or *gas* may cause frostbite
Inhalation:	Nose, throat and lung irritation with coughing, wheezing and shortness of breath Headache, dizziness, lightheadedness and passing out
Chronic:	Cancer (liver, brain, and lung) in humans

FIRST AID AND DECONTAMINATION

Remove the person from exposure.

Flush eyes with large amounts of water for at least 30 minutes. Remove contact lenses if worn. Seek medical attention.

Immerse affected part in warm water. Seek medical attention.

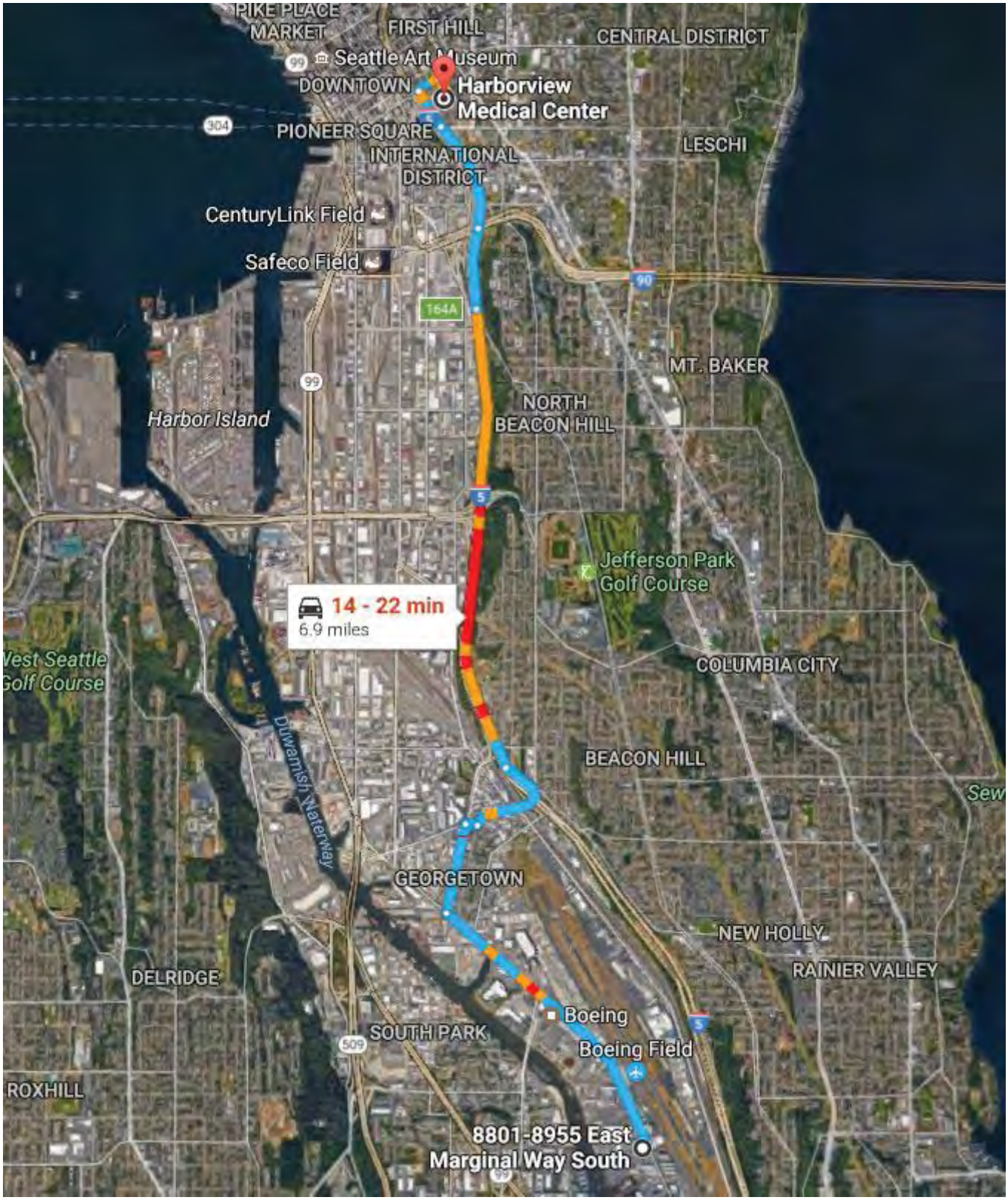
Begin artificial respiration if breathing has stopped and CPR if necessary.

Transfer promptly to a medical facility.

ATTACHMENT D: SITE MAPS TO NEAREST WALK-IN CLINIC AND HOSPITAL

Attachment D

Site Maps to Nearest Walk-In Clinic and Hospital


PIKE PLACE MARKET
FIRST HILL
CENTRAL DISTRICT
Seattle Art Museum
DOWNTOWN
Harborview Medical Center
PIONEER SQUARE
INTERNATIONAL DISTRICT
LESCHI
CenturyLink Field
Safeco Field
MT. BAKER
NORTH BEACON HILL
Harbor Island
Jefferson Park Golf Course
14 - 22 min
6.9 miles
COLUMBIA CITY
BEACON HILL
Duwamish Waterway
GEORGETOWN
NEW HOLLY
RAINIER VALLEY
DELRIDGE
Boeing
Boeing Field
SOUTH PARK
ROXHILL
8801-8955 East Marginal Way South


US HealthWorks Medical Group
10 - 16 min
7.8 miles
10 - 18 min
4.3 miles
12 - 20 min
5.6 miles
Harbor Island
NORTH BEACON HILL
Jefferson Park Golf Course
INDUSTRIAL DISTRICT
Puget Park
COLUMBIA CITY
1st Avenue South
4th Ave S
6th Ave S
15th Ave S
Beacon Ave S
Rainier Ave S
38th Ave S
S Genesee
S Lucile St
S Orcas St
S Graham St
Airport Way S
Martin Luther King Jr Way S
W Marginal Way SW
Duwamish Waterway
16th Ave SW
E Marginal Way
Boeing
Boeing Field
NEW HOLLY
RAINIE
DELRIDGE
SOUTH PARK
9th Ave SW
15th Ave SW
8th Ave S
SW Roxbury St
99
509
5

APPENDIX C: ARCHAEOLOGICAL WORK PLAN

Appendix C

Archaeological Work Plan

CONTENTS

From:	Sarah Steinkraus
To:	Meg Strong
Cc:	Tim Gerrish
Subject:	8801 field monitoring (Project: 2019-03-01609)
Date:	Tuesday, January 5, 2021 10:43:36 AM
Attachments:	image005.png

Hi Meg,
I checked on the IDP and it had not been reviewed. We reached out to DAHP yesterday and they reviewed and approved it. Below is the email confirmation we received for your records.
Thanks,
Sarah

Sarah M.H. Steinkraus, MS, RPA
Principal Investigator/ Senior Archaeologist
Stell
6100 219th St. SW Suite 480 • Mountlake Terrace, WA 98043
Mobile: 360.620.5840 • Office: 206.717.7010
ssteinkraus@stellee.com | www.stellee.com

Galvanizing Sustainable Communities
Certified Veteran-Owned, Woman-Owned Small Business

From: Hanson, Sydney (DAHP) <Sydney.Hanson@dahp.wa.gov>
Sent: Monday, January 4, 2021 4:02 PM
To: Michael Pitts <MPitts@stellee.com>
Subject: RE: Project: 2019-03-01609

Hi Michael,

I have reviewed the monitoring and inadvertent discovery plan. DAHP has no concerns with the project moving forward under this plan, and we look forward to receiving the monitoring report. I have marked the plan "review complete" in WISAARD.

Please have the client reach out to me if they require any additional documentation from us.

All the best,

Sydney Hanson, MA | Transportation Archaeologist
(preferred pronouns: she / her)
360.280.7563 (cell) | sydney.hanson@dahp.wa.gov

Department of Archaeology & Historic Preservation | www.dahp.wa.gov
1110 Capitol Way S, Suite 30 | Olympia WA 98501
PO Box 48343 | Olympia WA 98504-8343

**Please note that all DAHP employees are currently working remotely as a precaution against COVID-19. Our current schedules, email addresses, and cell phone numbers are available on our website. Thank you for your patience and*

understanding.

From: Michael Pitts <MPitts@stellee.com>
Sent: Monday, January 4, 2021 1:58 PM
To: Hanson, Sydney (DAHP) <Sydney.Hanson@dahp.wa.gov>
Subject: RE: Project: 2019-03-01609

Hi Sydney,

Yes, I believe they are referring to the IDP uploaded Oct. 2020.

Many thanks!

Michael Pitts, MA
Archaeologist
Stell
Direct: 509.859.4277 | Corporate: 206.717.7010
www.stellee.com
Galvanizing Sustainable Communities
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From: Hanson, Sydney (DAHP) <Sydney.Hanson@dahp.wa.gov>
Sent: Monday, January 4, 2021 2:53 PM
To: Michael Pitts <MPitts@stellee.com>
Subject: RE: Project: 2019-03-01609

Hi Michael,

I can help! The most recent document uploaded to WISAARD for this project was the monitoring and inadvertent discovery plan (Oct. 2020). Is this what you/the client is talking about?

There is also a monitoring report that has been accepted in WISAARD, which was uploaded in August 2019.

Just let me know what document you need confirmation for and I can write a letter or email.

All the best,

Sydney Hanson, MA | Transportation Archaeologist
(preferred pronouns: she / her)
360.280.7563 (cell) | sydney.hanson@dahp.wa.gov

Department of Archaeology & Historic Preservation | www.dahp.wa.gov
1110 Capitol Way S, Suite 30 | Olympia WA 98501
PO Box 48343 | Olympia WA 98504-8343

**Please note that all DAHP employees are currently working remotely as a precaution against COVID-19. Our current schedules, email addresses, and cell phone numbers are available on our website. Thank you for your patience and understanding.*

From: Michael Pitts <MPitts@stellee.com>
Sent: Monday, January 4, 2021 1:06 PM
To: Hanson, Sydney (DAHP) <Sydney.Hanson@dahp.wa.gov>
Subject: Project: 2019-03-01609

Hi Sydney,

I tried to reach out to Stephanie about this since she is the project contact, but it looks like she's out of the office until next week.

I just got added to this project and I was told that the client would like written confirmation that it has been accepted by DAHP. Would you be able to provide that? Or, if not, what needs to be done so the project can be approved?

Thank you,

Michael Pitts, MA
Archaeologist
Stell
Direct: 509.859.4277 | Corporate: 206.717.7010
www.stellee.com
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CULTURAL RESOURCES REPORT COVER SHEET

Author: Matthew Breidenthal and Sarah M.H. Steinkraus
Title of Report: Cultural Resources Monitoring and Inadvertent Discovery Plan for 8801 East Marginal Way South, Tukwila, Washington

Date of Report: January 12, 2020

County(ies): King Section: 33 Township: 4 Range: 4E
Quad: South Park Acres: 25

PDF of report submitted (REQUIRED) ☒ Yes

Historic Property Inventory Forms to be Approved Online? ☐ Yes ☒ No

Archaeological Site(s)/Isolate(s) Found or Amended? ☐ Yes ☒ No

TCP(s) found? ☐ Yes ☒ No

Replace a draft? ☐ Yes ☒ No

Satisfy a DAHP Archaeological Excavation Permit requirement? ☐ Yes # ☒ No

Were Human Remains Found? ☐ Yes DAHP Case # ☒ No

Archaeological Site #:

_____
_____
_____
_____
_____
_____
_____
_____
_____

8801 East Marginal Way South Remediation Project
Cultural Resources Monitoring
and Inadvertent Discovery Plan
Tukwila, Washington

January 12, 2020

Prepared for:

Shannon & Wilson, Inc.
400 N 34th Street, Suite 100
Seattle, WA 98103

DAHP Project #2019-03-01609.

Prepared by:

Stell
22617 76th Avenue West, Suite 205
Edmonds, WA 98026

By and Matthew Breidenthal, MS and Sarah M.H. Steinkraus, MS, RPA

Stell Project Number: 4005

TABLE OF CONTENTS

FIGURES

1 INTRODUCTION

1.1 PROJECT INFORMATION

Stell was contracted by Shannon & Wilson, Inc. to create a cultural resources monitoring and inadvertent discovery plan for the 8801 East Marginal Way South Remediation Project, Tukwila, Washington project (Project) (Figure 1) (see Appendix A for Inadvertent Discovery Plan). Contaminated soil has been identified in a few locations within the Project area. Shannon & Wilson, Inc. is proposing to undertake a remediation of contaminated soil and water throughout the project area. Seven discrete excavations are proposed to remove contaminated soil (as shown in Figure 3).

Areas with elevated concentrations of contaminants will be excavated and the soil disposed of off-site. Groundwater is also contaminated with halogenated volatile organic compounds across much of the western portion of the Project area. Remedial activities to address the groundwater contamination consist of injection of various chemicals into the subsurface, and the installation of an additional line air sparge (AS)/ soil vapor extraction (SVE) system west of the existing line along the western boundary of much of the width of the project area. In the northwestern corner of the project area, air knifing (a method of using compressed air or water to remove soil) will be used to remove soil adjacent to the pile wall and grout will be injected into the holes. The purpose of the grout is to prevent injected chemical entering the river. The chemical injections will be via borings drilled for the purpose. The AS/SVE will be trenched into place.

The western edge of the project area has a sheet pile wall bulkhead built in approximately 1929 that extends along the approximate northern two-thirds of the western edge of the project area to a depth of approximately 30 feet below ground surface. The sheet pile wall bends into the upland area of the Project area and extends approximately 100 feet to the east along the former southern property line. In the southwest corner of the project area, a riprap embankment or berm was built in approximately 1969 along the southern one-third of the western property boundary and to the east on the southwestern corner of the Project area. After the berm was constructed, approximately 13.5 feet of fill was placed on the east side of the embankment, bringing the ground surface to roughly its present grade.

The project area is within an area designated as very highly likely to yield cultural materials by the Department of Archaeology and Historic Places (DAHP) predictive model. A total of 29 Cultural Resources surveys, 10 archaeology sites (including precontact, historic-era, and multicomponent sites), 1 cemetery, 2 historic properties listed on a historic register, and 2,636 Historic Property Inventory forms have been conducted/recorded and reported to DAHP within 1 mile of the project area. Two ethnographic place names were recorded within or in the immediate vicinity of the project area. The area was originally homesteaded in the 1860s and has been in continuous use since that time.

1.2 PROJECT AREA

The Project area is located on the right (eastern) bank of the Lower Duwamish Waterway (LDW), approximately four miles upstream from the mouth of the Duwamish River, in Section 33 of Township 24 North, Range 4 East, Willamette Meridian. The upland portion of the Project area occupies 24.30 acres at 8801 East Marginal Way South (King County Parcel No. 5422600060), in the City of Tukwila, Washington (see Figure 1 through Figure 3).

The upland portion of the Project area is relatively flat, with a ground surface elevation of approximately 20 feet above mean sea level (msl). The upland portion of the Project area is owned by Centerpoint 8801 Marginal LLC (Centerpoint). The Project area has been leased to Insurance Auto Auctions, Inc. (IAAI) since 2004, although the property is currently vacant. Zoning by the City of Tukwila is manufacturing industrial center/heavy industry.

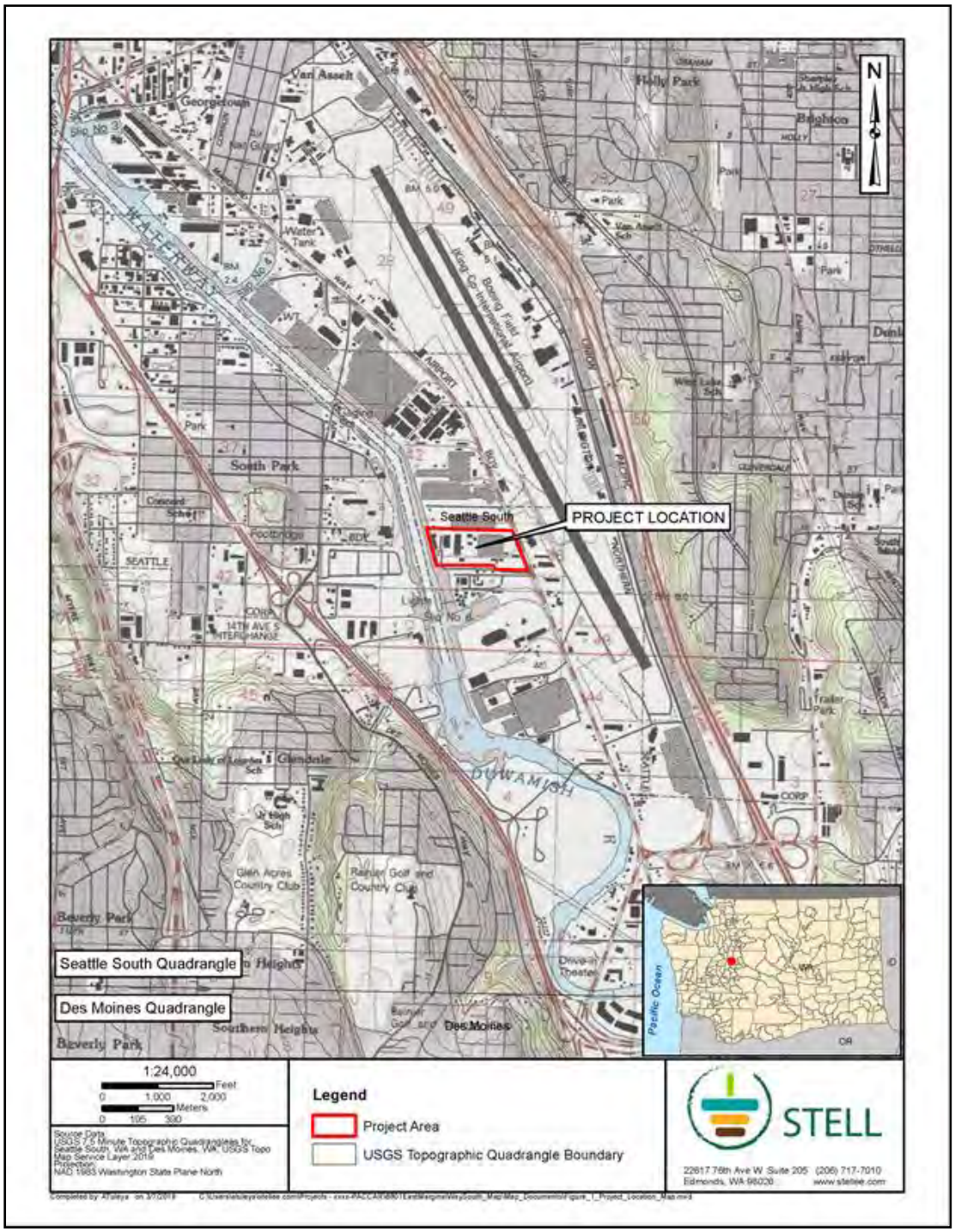


Figure 1. Project area location map projected on the USGS (2019) topographic quadrangle.

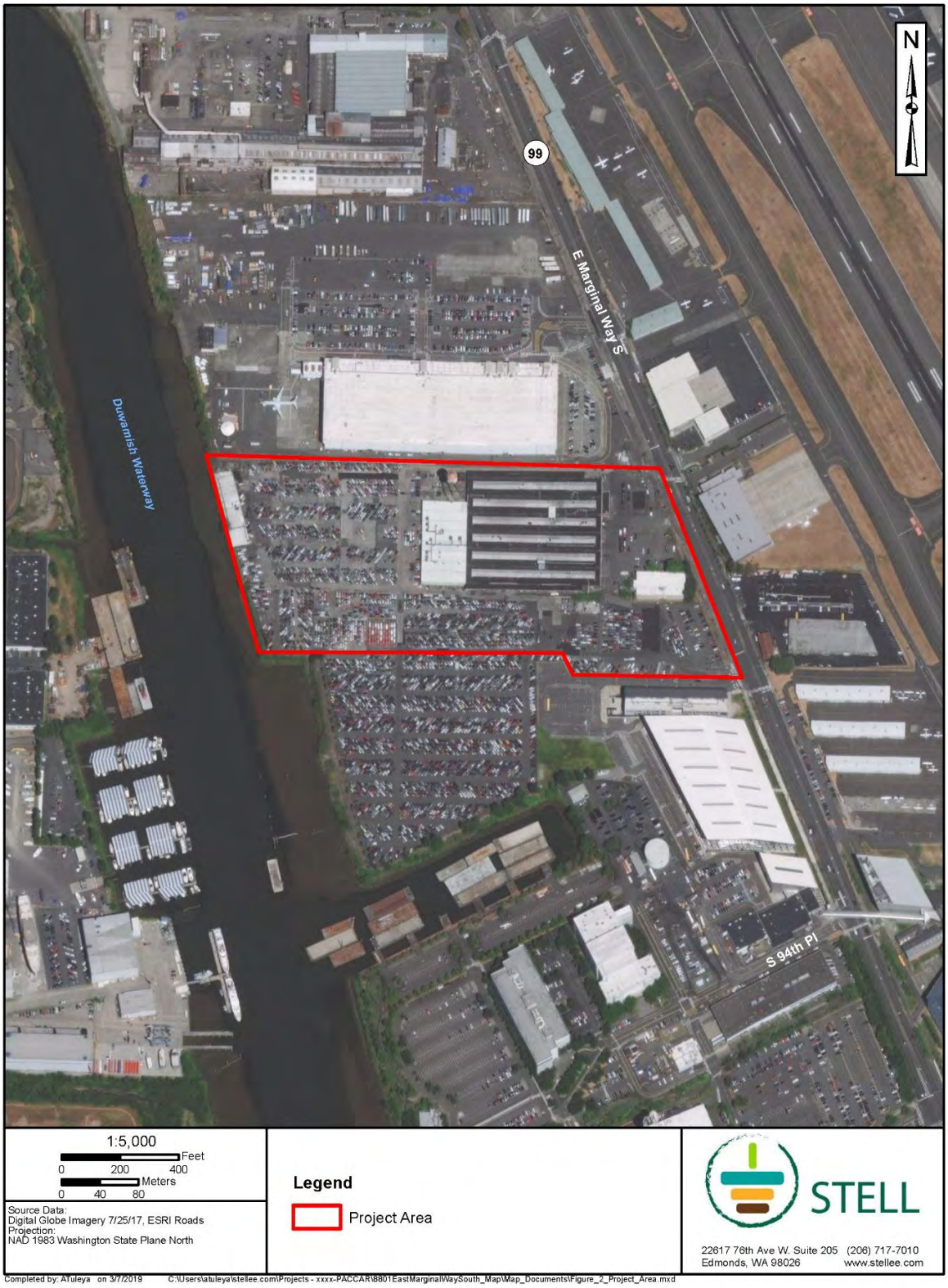


Figure 2. Project area location map projected on an aerial photograph (2017).

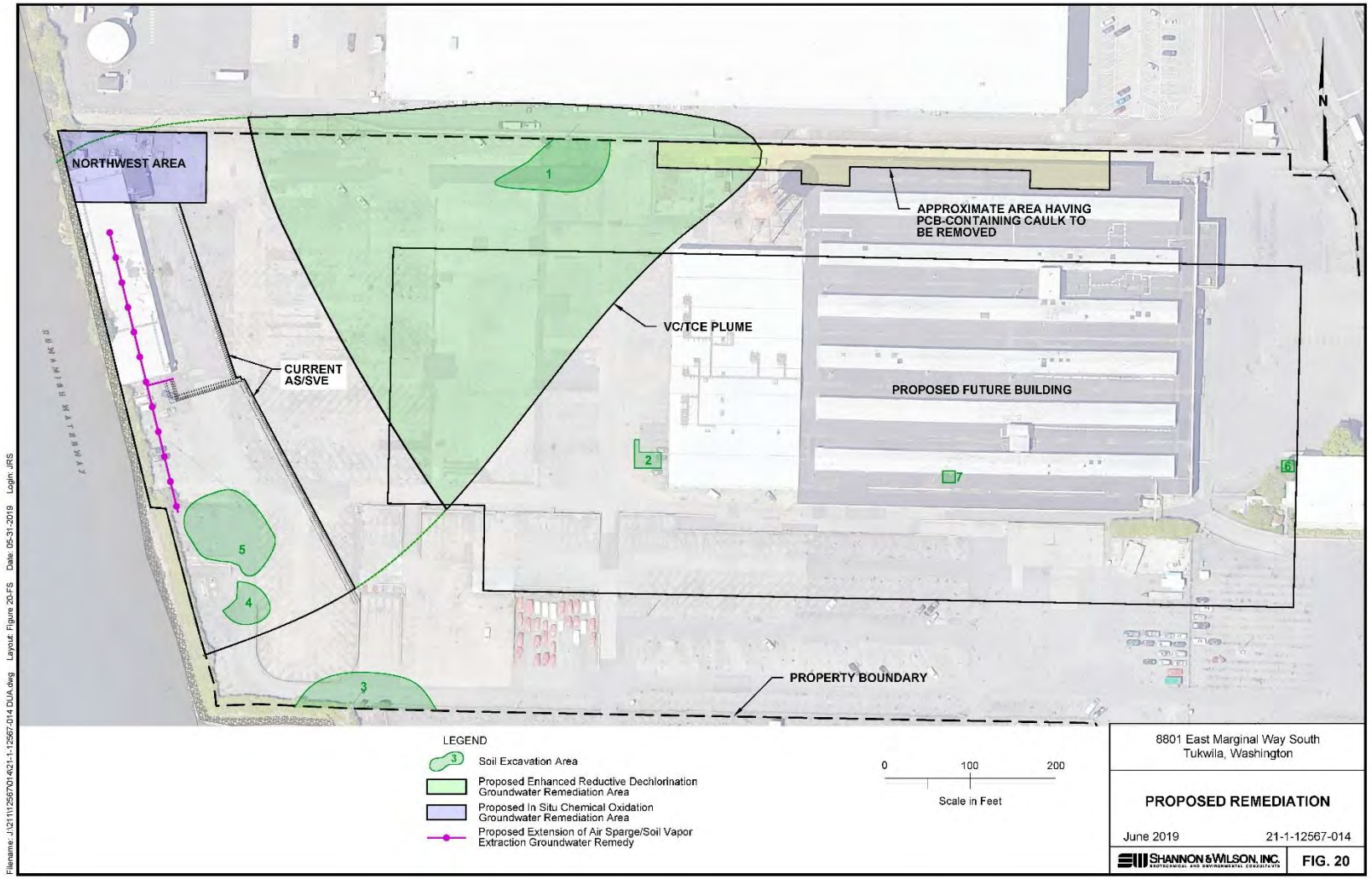


Figure 3. Draft project plan map from Shannon & Wilson.

1.3 PROJECT BACKGROUND

A cultural resources review of the project (which did not include any fieldwork) was conducted in August of 2018 by Stell (Steinkraus and McWilliams 2018). In the report it was recommended that the City of Tukwila consult with local Affected Tribes regarding future project work and that a Monitoring and Inadvertent Discovery Plan (this document) be created. These recommendations were based on DAHP recommendations for the project (see Appendix A in Steinkraus and McWilliams 2018) The DAHP Project Number is 2019-03-01609. This number should be attached to all cultural resources documentation and DAHP communications associated with this project.

Stell's cultural resources review (Steinkraus and McWilliams 2018) found that previously recorded archaeological sites in the area consist of precontact isolates and several shell middens, as well as historic features and refuse concentrations. In terms of archaeological expectations, it is possible that these types of materials may also be located within the project area. This area is along the meander belt of the Lower Duwamish River which was a major travel corridor until the Puget Sound region was logged and roads were constructed in the late 1800s and early 1900s. The placement of the Project area on a notable bend in the river (prior to channelization efforts in the early 1900s) increases the likelihood that humans stopped in this area and therefore increases the odds that cultural materials are present (Figure 4).

This area was also an early farm from 1866 until the land was industrialized in the 1930s, so evidence of agricultural activities such as pieces of farming equipment, horse or other domesticated animal skeletal materials, and domestic materials dating from the late 1800s and early 1900s may also be present subsurface. There may also be evidence of early logging activities as the farmland would have needed to be cleared in order to create agricultural fields (Steinkraus and McWilliams 2018).

Soils in the area are slightly to moderately acid and poorly drained. Soils with low acid levels are generally better for the preservation of any cultural materials that are present, and the anaerobic conditions created in slow-draining soils also increase preservation. Acidic soils can degrade artifacts until they are no longer recognizable, or in extreme cases, until they degrade completely. This means that the subsurface preservation of cultural materials would be quite high in this location (Steinkraus and McWilliams 2018).

A study of the built environment was also conducted for the property in 2019 (Stropes et al. 2019) for a separate project (DAHP Project #2019-10-08110). This review documented four historic properties that include Property #720344, 720349, 720352, and 720356 (see Appendix B for HPI forms). The review recommended that none of these properties were eligible for the National Register of Historic Places or the Washington Heritage Register. All four properties will be demolished for Project #2019-10-08110.

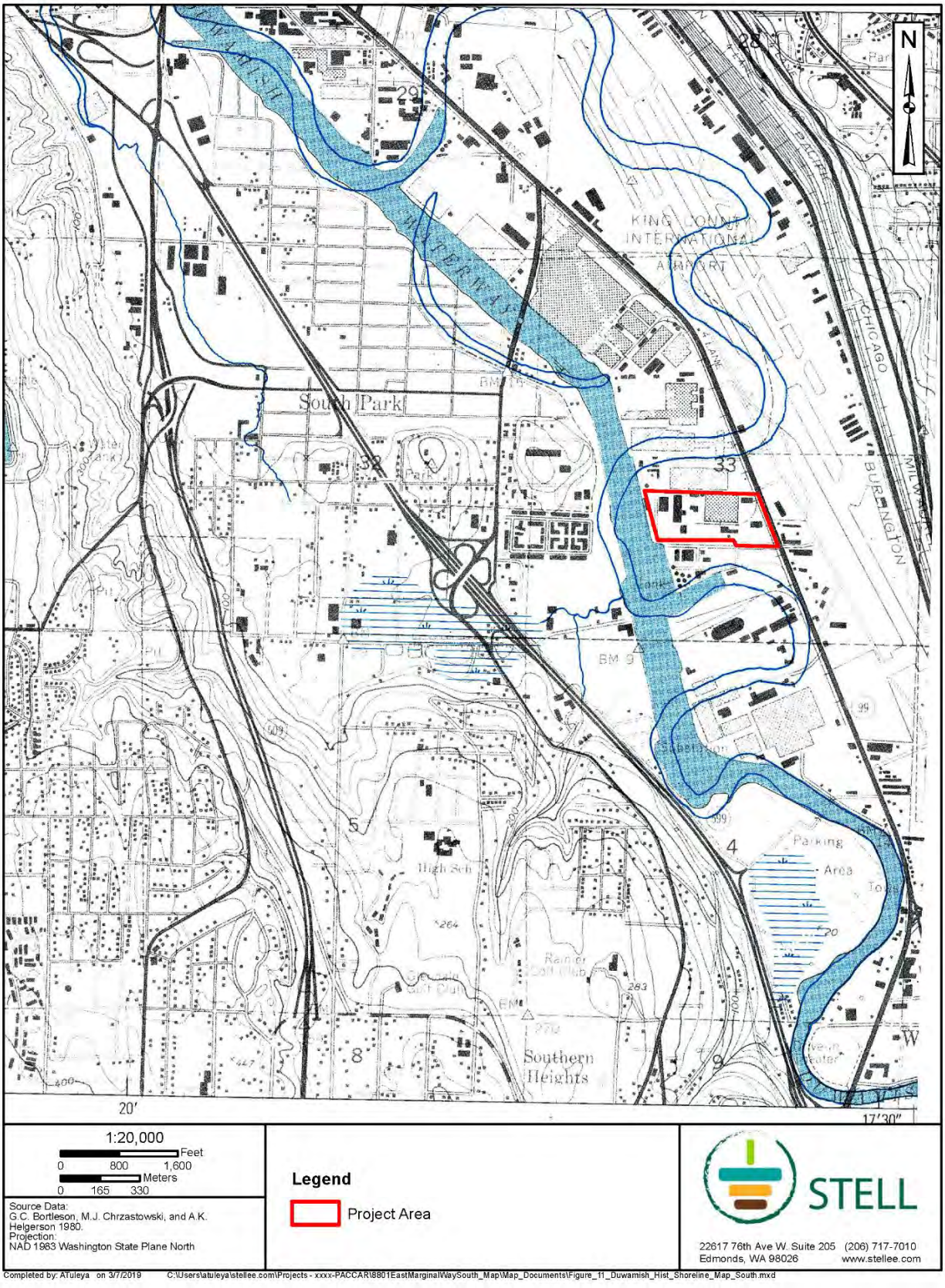


Figure 4. Duwamish River historical channel map.

1.4 REGULATORY ENVIRONMENT

This project is subject to the State Environmental Policy Act (SEPA), which mirrors the National Environmental Policy Act. SEPA requires that all major actions sponsored, funded, permitted, or approved by Washington State and/or local agencies consider the impacts of the planned action on the environment and properties of historical, archaeological, scientific, or cultural importance (Washington Administrative Code 197-11-960). Especially those that are or could be listed on the National Register of Historic Places (NRHP) or other historic registers including the Washington Heritage Register or King County Landmarks. The Department of Archaeology and Historic Preservation (DAHP) is the lead agency for considering the effects of a proposed action on cultural resources and provides formal recommendations to local governments and other Washington State agencies for appropriate treatments or actions.

Historic properties that could be eligible for the NRHP include any artifacts, records, and remains that are related to such a district, site, building, structure, or object (16 United States Code [USC] 470[5]). The quality of significance in American history, architecture, archaeology, and culture is present in districts, sites, buildings, structures, and objects of state and local importance that possess integrity of location, design, setting, materials, workmanship, feeling, and association. They also:

a) Are associated with events that have made a contribution to the broad pattern of our history;
b) Are associated with the lives of people significant in our past;
c) Embody the distinct characteristics of a type, period, or method of construction, represent the work of a master, possess high artistic values, or represent a significant and distinguishable entity whose components may lack individual distinction; or
d) Have yielded, or are likely to yield, information important for understanding prehistory or history (36 Code of Federal Regulations [CFR] 60.4).

2 ARCHAEOLOGICAL MONITORING PLAN

To satisfy the requirements of Washington State DAHP, Stell will provide on-site monitoring, daily logs during monitoring activities, and a technical report at the close of monitoring for the 8801 East Marginal Way South Project. Sarah M.H. Steinkraus, MS, RPA will be the lead archaeologist on this project. Ms. Steinkraus meets the Secretary of the Interior's, and thus Washington State's, criteria for a Professional Archaeologist. Ms. Steinkraus has extensive experience in conducting archaeological surveys, assessments, and monitoring in the Puget Sound region.

2.1 ON-SITE MONITORING

The archaeological monitor will watch any ground disturbing activities within the Project area. The monitor will closely look for any organic or shell midden deposits, signs of soil oxidation, lithic or bone artifacts, or animal or human bones. No previously recorded cultural resources are located within the project area. If artifacts or other potential archaeological deposits are observed, the archaeological monitor will direct the contractor to temporarily cease work in the immediate vicinity while the monitor conducts a close inspection.

The archaeological monitor may from time to time request a temporary halt to work activities in order to document archaeological materials or for a closer inspection of the trench sidewall. Such documentation usually takes a few minutes (entailing photographs and written descriptions) but may take longer. The archaeologist will give an estimate of the amount of time needed to document materials to the equipment operator and/or foreman and will update them of any changes to the estimate.

If potentially significant archaeological deposits are discovered during construction while the archaeological monitor is on site, the monitor will direct the contractor to cordon off the area within 30 feet of the discovery and initiate the find reporting and evaluation processes described in the Inadvertent Discovery Plan (Attachment A). If evidence of cultural resources is found in exposed surfaces within the Project Area, it will be further investigated to establish whether it is eligible for listing in the National Register of Historic Places (NRHP).

If human remains are encountered, the King County Sherriff and Medical Examiner will be immediately notified (Attachment A). If the remains are determined not to be associated with a criminal investigation, the DAHP will be immediately contacted, as well as any affected tribes, if applicable (Attachment A).

2.1.1 MONITORING LOG

The archaeological monitor will complete a monitoring log for each monitoring session to document time in the field, the day's progress and findings, and any difficulties encountered, and actions proposed or taken to alleviate them.

2.1.2 MONITORING REPORT

Following the conclusion of archaeological monitoring activities, Stell will prepare a report describing the conduct and findings of this work effort. The report will include a discussion of the project, the methods used in monitoring, and observations about site geology, environmental history, and any cultural resources that were observed. Photographs, sketches, or maps may be included, as needed. The report will be submitted to Shannon & Wilson, Inc. in complete draft form prior to it being sent to the Washington State DAHP and affected tribes for review.

2.1.3 HEALTH AND SAFETY

The archaeological monitor will be working under an approved health and safety plan provided by the Client's Contractor. That individual will at all times be in compliance with the health and safety plan of the contractor. Staff will be briefed on that plan and will at all times comply with it. Field staff will have all necessary training and certification prior to commencing monitoring activities.

3 REFERENCES

Steinkraus, S.M.H., and T.A. McWilliams

2018 *Cultural Resources Review for 8801 East Marginal Way South, Tukwila, Washington*. Prepared for Shannon & Wilson, Inc. Prepared by Stell, Edmonds, Washington.

Stropes, Tracy A., J.R.K Stropes, Brian F. Smith

2019 Cultural Resources Assessment for the 8801 East Marginal Way Project, City of Tukwila, King County, Washington. Prepared for CenterPoint Properties Trust. Prepared by Brian F. Smith & Associates, Poway, California.

APPENDIX A:
INADVERTENT DISCOVERY PLAN

Inadvertent Discovery Plan for the 8801 East Marginal Way South Remediation Project
City of Tukwila, King County, Washington

INTRODUCTION

Shannon & Wilson, Inc. plans to undertake a remediation of contaminated soil and water throughout the project area in Tukwila, Washington. Seven discrete excavations are proposed to remove contaminated soil. Areas with elevated concentrations of contaminants will be excavated and the soil disposed of off-site. The following Inadvertent Discovery Plan (IDP) outlines procedures to follow, in accordance with federal laws, if archaeological materials or human remains are discovered.

State laws are in place which protect archaeological resources. The Archaeological Sites and Resources law (RCW Chapter 27.53) outlines the protection of archaeological resources. Shannon & Wilson, Inc. will act in accordance with State laws in dealing with the treatment of cultural resources and the consultation of concerned parties. Potentially concerned parties include: the Duwamish Tribe, Suquamish Tribe, Snoqualmie Tribe, Tulalip Tribes, Muckleshoot Tribe, Stillaguamish Tribe, and the Department of Archaeology & Historic Preservation (DAHP), and the City of Tukwila.

A cultural resources review from Stell (Steinkraus and McWilliams 2018), discusses the cultural resources nearest to the Project Area and an assessment of the likelihood that cultural materials may be located within the Project Area. It recommends the creation of a Monitoring and Inadvertent Discovery Plan (this document) and that an archaeological monitor observe all soils removed from the Project area.

A study of the built environment was also conducted for the property in 2019 (Stropes et al. 2019) for a separate project (DAHP Project #2019-10-08110). This review documented four historic properties that include Property #720344, 720349, 720352, and 720356 (see Appendix B for HPI forms). The review recommended that none of these properties were eligible for the National Register of Historic Places or the Washington Heritage Register. All four properties will be demolished for Project #2019-10-08110.

The DAHP Project Number for this Project is 2019-03-01609. This number should be attached to all cultural resources documentation and DAHP communications associated with this project.

The monitoring archaeologist will have the ability to halt construction if they observe or identify any cultural materials and will have adequate time to assess, record, and potentially analyze any resources that might be uncovered. DAHP will be notified of all discoveries that occur during the course of the Project. The results of this monitoring effort will be documented at the completion of the project.

This document serves as the plan for dealing with any discoveries of human skeletal remains, artifacts, sites, or any other cultural resources that are potentially eligible for listing in the National

Register of Historic Places (NRHP). This plan is intended to provide guidance to Shannon & Wilson, Inc. so they can:

1. Comply with applicable local and State laws and regulations, particularly Title 27 Revised Codes of Washington Chapter 27.44 Indian Graves and Records, Chapter 27.53 Archaeological Sites and Resources, and Title 68 Chapter 60.050 Protection of historic graves,
2. Describe to regulatory and review agencies the procedures that Shannon & Wilson, Inc. will follow to prepare for and deal with inadvertent discoveries, and
3. Provide direction and guidance to project personnel on the proper procedures to be followed should an inadvertent discovery occur.

RECOGNIZING CULTURAL MATERIALS

A cultural resource discovery could be from the precontact or historic eras. Examples include:

- An accumulation of shell, burned rocks, or other food related materials;
- Bones or small pieces of bone;
- An area of charcoal or very dark stained soil with artifacts;
- Stone tools or waste flakes (i.e. an arrowhead, or stone chips);
- Clusters of tin cans or bottles, logging or agricultural equipment that appears to be older than 50 years;
- Buried railroad tracks, decking, or other industrial materials; and
- Historic structures, portions of historic structures, or associated utilities aged 40 years or older. These do not include structures that have already been documented and determined not eligible for the National Register of Historic Places by DAHP.

When in doubt, assume the material is a cultural resource.

ON-SITE RESPONSIBILITIES

STEP 1: STOP WORK. If any Shannon & Wilson, Inc. employee, contractor, or subcontractor believes that they have uncovered a cultural resource at any point during the project, all work adjacent to the discovery must stop. The discovery location should be secured at all times.

STEP 2: NOTIFY MONITOR. If there is an archaeological monitor for the project, notify that person. If there is a monitoring plan in place, the monitor will follow its provisions. If there is no archaeological monitor in place the Project Manager should be notified at which time they should contact a professional archaeologist to examine the find and determine if it is a cultural resource or not and provide significance recommendations.

STEP 3: NOTIFY AND CONSULT WITH DAHP. Immediately contact DAHP to assist in the significance evaluation of all inadvertent discoveries of cultural resources. Any discovery deemed eligible for listing in the National Register of Historic Places (NRHP) will be assessed and treated per the provisions set forth in this document (Attachment A). If the state agency representatives determine that the discovery is an eligible cultural resource, they and the affected tribe(s), will

consult to determine appropriate treatment to be presented and agreed upon in a Memorandum of Agreement (MOA) or other appropriate documentation.

Mitigation measures will be developed in consultation with City of Tukwila, DAHP, and the affected tribes (where appropriate), which could include avoidance through redesign, conducting data recovery and/or relocating materials or remains. Agreed upon treatment measures performed by Shannon & Wilson, Inc. may include protecting in place or data recovery such as mapping, photography, limited probing, and sample collection, or other measures. This information is covered by the Public Records Act (RCW 42.17.250) and specific components of the records are exempt from disclosure (RCW 42.17.310(1)(k)) to avoid the looting or depredation of such sites.

PROTOCOL FOR TREATMENT OF HUMAN REMAINS

As per RCW 68.50.645, in the event that human remains, or material evidence of burial sites are encountered within the Project Area, whether during planned maintenance and construction activities, authorized archaeological excavations, or as a result of natural processes, the following protocol will be strictly followed:

1. If human skeletal remains are located within the Project Area, then all activity that may cause further disturbance to the remains will cease within at least 30 feet.
2. The area of the find will be secured and protected from further disturbance.
3. The finding of human skeletal remains will be reported to the King County Medical Examiner and local law enforcement in the most expeditious manner possible. The remains will not be touched, moved, or further disturbed.
4. The county medical examiner will assume jurisdiction over the human skeletal remains and make a determination of whether those remains are forensic or non-forensic. If the county medical examiner determines the remains are non-forensic, then they will report that finding to the Department of Archaeology and Historic Preservation (DAHP) who will then take jurisdiction over the remains.
5. The DAHP will notify any appropriate cemeteries and all affected tribes of the find.
6. The State Physical Anthropologist will make a determination of whether the remains are Indian or Non-Indian and report that finding to any appropriate cemeteries and the affected tribes.
7. The DAHP will then handle all consultation with the affected parties as to the future preservation, excavation, and disposition of the remains.

Failure to follow this human remains protocol is a misdemeanor in Washington State.

PROTOCOL FOR RESPONSE TO VANDALISM

Vandalism consists of disturbance to historic properties, including unauthorized digging into archaeological sites or collection of artifacts. The probability for vandalism within the project is low; however, if at any time, employees or contractors encounter unauthorized visitors who appear to be digging or collecting materials from the ground surface, or are in possession of excavation equipment, or if a Shannon & Wilson, Inc. representative encounters evidence of recent unauthorized excavations or abandoned digging equipment (such as screens or shovels), the following protocol will be implemented.

1. If a possible vandal or looter is present, the Shannon & Wilson, Inc. representative will note information about the person, their equipment, and their vehicle and immediately relay the information to the work supervisor, who will confirm the information and notify the King County Sheriff's Office.
2. If the Shannon & Wilson, Inc. representative notes abandoned excavations or digging equipment, they will notify within 24 hours the cultural resources coordinator, who will notify the King County Sheriff's Office and the DAHP. The cultural resources coordinator will visit the site as soon as possible to assess any damage.
3. If a Native American site has been vandalized, the cultural resources coordinator will notify representatives of the affected tribes and the DAHP about this assessment and will invite them to attend the site inspection.
4. The assessment of impact will be described in a formal letter report from Shannon & Wilson, Inc. to the City of Tukwila, affected tribes, and DAHP, if applicable.
5. In consultation with the City of Tukwila, affected tribes, and DAHP, Shannon & Wilson, Inc. will identify what actions, if any, should be taken to mitigate damage to an affected site and/or prevent further damage.
6. Any act of vandalism or looting that involves human remains will also trigger the protocol for the treatment of human remains outlined above.
7. All acts of vandalism or looting will be referred to the King County Sheriff for investigation and possible prosecution.

PROTOCOL FOR EMERGENCY RESPONSE

A number of events can occur within the Project that require a rapid response in order to safeguard facilities, provide for protection of wildlife habitat, protect public and private property, and prevent serious injury or loss of human life. These include, but are not limited to; wild fire, wind and electrical storms, mass wasting events (erosion), flood, earthquake, and dam or other Project facility failure. The emergency response protocol is designed to be implemented after such events have occurred.

1. The supervisor of response will notify the cultural resources coordinator of the location and nature of the emergency activities.
2. The cultural resources coordinator will check relevant databases for historic properties in the vicinity of the emergency.
3. If historic properties are in the area of the emergency or the response (for example, both the area of the wild fire and the location of the construction of a fire line), then the cultural resources coordinator will be responsible for conducting a professional review by a qualified person of the condition of those properties.
4. The cultural resources coordinator will use existing documentation as a comparison to a field visit to determine if historic properties and/or cultural resources have been destroyed, damaged, or endangered by the emergency event or the response. If any of these conditions exist, then the cultural resources coordinator will document them in the field with mapping, photographs, and, in the case of imminent loss, collection of artifacts. The cultural resources coordinator will prepare a report documenting the nature and location of the emergency event, the nature of the response, the impact on the historic properties and/or cultural resources, and any proposals to prevent further damage to the properties and to mitigate for the loss. This report will be submitted to the City of Tukwila, affected tribes, and DAHP within 4 months of the event for review and comment. After a 30-day comment period, the comments of all of the consulting parties will be incorporated into a final report and copies will be sent to all of the participating parties.
5. If no alteration to the condition of the properties has occurred, a letter to that effect noting the date(s) of the field visit(s) will be placed on file in lieu of the formal report.

AGENCY CONTACTS

Shannon & Wilson, Inc.
Primary Contact: Meg Strong
Mobile: 206-695-6787

Cultural Resources Specialist, Stell
Primary Contact: Sarah Steinkraus, Principal Investigator/ Senior Archaeologist
Mobile: 360-620-5840

Washington Dept. of Ecology
Primary Contact: Erin Hobbs
Mobile: 425-649-7231

King County Medical Examiner
Contact Number: 206-731-3232

King County Sheriff
Contact Number: 206-296-3311 or 911

City of Tukwila Police Department
Business Contact Number: 206-433-1808

City of Tukwila
Office: 6200 Southcenter Blvd. Tukwila, WA
Contact Number: 206-433-1800

Department of Archaeology & Historic Preservation Office
Primary Contact: Stephanie Jolivette, Local Government Archaeologist
Office: 360-586-3088

Secondary Contact: Dr. Guy Tasa, State Physical Anthropologist
Office: 360-586-3534

Tribal Contacts:

Duwamish Tribe
Primary Contact: Cecile Hansen, Chairwoman
Office: 206-431-1582

Suquamish Tribe
Primary Contact: Dennis Lewarch, Tribal Historic Preservation Officer
Office: 360-394-8529

Snoqualmie Nation
Primary Contact: Steve Mullen-Moses, Director of Archaeology and Historic Preservation
Office: 425-495-6097

Tulalip Tribes
Primary Contact: Richard Young, Cultural Resources Director
Office: 360-716-2652

Muckleshoot Indian Tribe
Primary Contact: Laura Murphy, Archaeologist
Office: 253-876-327

Stillaguamish Tribe
Primary Contact: Kerry Lyste, Tribal Historic Preservation Officer
Office: 360-652-7362 ext. 226

APPENDIX B- HPI FORMS

Historic Property Report

Resource Name: Fisher Body Corporation Woodworking Plant

Property ID: 720344

Location

Address: 8801 E Marginal Way S, Seattle, WA, 98108, USA

Geographic Areas: King Certified Local Government, King County, T24R04E33, SEATTLE SOUTH Quadrangle

Information

Number of stories: 1.00

Construction Dates:

Construction Type	Year	Circa
Built Date	1928	☑
Addition	1969	☑
Remodel	1939	☐
Remodel	1945	☐

Historic Use:

Category	Subcategory
Industry/Processing/Extraction	Industry/Processing/Extraction - Manufacturing Facility
Industry/Processing/Extraction	Industry/Processing/Extraction - Manufacturing Facility

Historic Context:

Category
Industry/Manufacturing

Historic Property Report

Resource Name: Fisher Body Corporation Woodworking Plant

Property ID: 720344

Architect/Engineer:

Category	Name or Company

Thematics:

Local Registers and Districts

Name	Date Listed	Notes

Project History

Project Number, Organization, Project Name	Resource Inventory	SHPO Determination	SHPO Determined By, Determined Date
2019-10-08110, , Warehouse construction at 8801 East Marginal Way	10/24/2019		

Historic Property Report

Resource Name: Fisher Body Corporation Woodworking Plant

Property ID: 720344

Photos

Fisher Body Corporation Woodworking Plant.jpg

90thAnniversary_billboard_1956.jpg

134-Factory-1951c.jpg

134-Factory-1951a.jpg

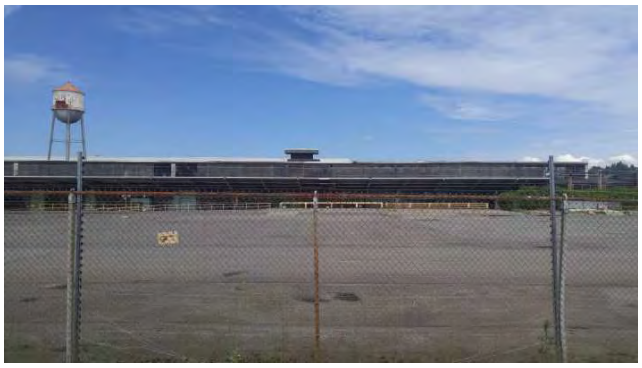
Structure 1 North Facade.jpg

Structure 1 West Facade.jpg

Historic Property Report

Resource Name: Fisher Body Corporation Woodworking Plant

Property ID: 720344



Structure 1 South Facade.jpg

1941 Advertisement courtesy of Graff 2008.png

Historic Property Report

Resource Name: Fisher Body Corporation Woodworking Plant

Property ID: 720344

Inventory Details - 10/24/2019

Common name:

Date recorded: 10/24/2019

Field Recorder: Tracy Stropes

Field Site number:

SHPO Determination

Detail Information

Characteristics:

Category	Item
Plan	Irregular
Cladding	Brick
Cladding	Brick
Roof Material	Wood - Plank
Roof Type	Monitor
Roof Type	Gable - Front
Roof Material	Asphalt/Composition
Form Type	Utilitarian
Foundation	Concrete - Poured

Surveyor Opinion

Property appears to meet criteria for the National Register of Historic Places: No

Property is located in a potential historic district (National and/or local): No

Property potentially contributes to a historic district (National and/or local): No

Significance narrative: The Fisher Body Corporation Woodworking Plant, which was framed on the north and south by railroad spur lines, was recorded in Kroll's 1930s-1940s atlas as the "Fisher Body Corp Plant." In contradiction to Assessor's records which state that Structure 1 was completed in 1930, a report by GMC, which lists properties and companies operated in 1933, documents the Fisher Body Company (FBC) of Seattle, a 193,505-square-foot woodworking plant, as having been acquired in 1928 (Pound 1934). The square footage of the building, as described by GMC (Pound 1934), matches the current square footage of the original portion of the woodworking plant.

The 1928 date of construction for the plant is substantiated by a 1928 newspaper article that indicates that Ed Fisher, the president of FBC, visited Seattle in May 1928 investigating a prospective site for a factory branch (Spokane Chronicle 1928). Two additional newspaper articles from 1929 (Spokane Chronicle 1929; Semi-Weekly Spokesman Review 1929) reference a Seattle-based FBC facility, which indicates that Structure 1 was completed between May 1928 and October 1929.

The woodworking plant was constructed by Fisher Body Company as a woodworking facility for use in the manufacture of wooden body parts for automobiles. The building functioned as such until 1939, when the property was leased to the Boeing Aircraft

Company as a sub-assembly manufacturing facility until 1946.

In 1939, the property was leased by the Boeing Aircraft Company to serve as an "addition to its assembly facilities" (Spokane Chronicle 1939). A 1941 Boeing advertisement depicts the building as "Boeing Plant No. 3." In order to convert the plant into an aircraft manufacturing facility, woodworking machinery was removed and "sub-assembly fixtures for airplane parts" were installed (National Aeronautic Association of U.S.A., Inc. 1940). A March 1940 article indicates that the Seattle-based Boeing facilities, which also included Boeing Plant Nos. 1 and 2 located to the north along the Duwamish River, were used to manufacture four-engine, Boeing B-17B, Flying Fortresses for the United States Army Air Corps:

"The manufacture of parts takes place at Boeing Plant No. 1, and small sub-assemblies are made at the new Boeing Plant No. 3. Both of these other plants feed the assembly lines at Plant No. 2." (New York National Guardsman 1940). The Boeing Aircraft Company used the structure only until the end of World War II, after which the Pacific Car & Foundry Company (PACCAR), the parent company of Kenworth Motor Truck Corporation (Kenworth), purchased the property in October 1945 (Siefkes 1998). Between 1946 and 2001, the building functioned as a manufacturing plant for Kenworth, focusing upon the production of trucks and buses.

Although all three companies were influential in different periods of the city of Tukwila's history, the modifications made to the original woodworking plant and the property itself have negatively impacted the buildings' ability to convey any potential association with each period of use. This is especially true since the entire primary (east) façade was modified after 1965, when gabled parapets and original windows and doors were removed. Additional modifications include removal of the western wall for the construction of a warehouse addition between 1969 and 1980 and the construction of a brick, projecting entryway addition on the east façade between 1969 and 1980, which was subsequently moved further north on the east façade between 1980 and 1990. Although the woodworking plant was used as a manufacturing facility for FBC, Boeing, and Kenworth, no specific historic events are known to have occurred at the property. Therefore, due to the modifications made to Structure 1 and the surrounding property, which have negatively impacted integrity of design, materials, setting, and feeling, the building no longer possesses the physical features that would convey the property's historic character. The woodworking facility was originally built during Tuwkila's period of early industrial development along the Duwamish River. However, the building no longer retains enough integrity to convey an association with either period. In addition, although the building was operated by FBC, Boeing, and Kenworth to manufacture wood parts for automobile bodies, airplane parts, and trucks, a majority of the modifications that affected its overall integrity occurred after the historic period, thereby negatively impacting its association with all three companies. The woodworking facility did play a role in the manufacturing of parts for war planes during World War II; however, this contribution is not sufficient to be the basis for satisfaction of local or National Register significance criteria. Although the woodworking plant was constructed as part of FBC's operations, it did not serve as the office or work place for any of the Fisher brothers. The building is also not associated with any significant individuals from Boeing or Kenworth who may have worked at the facility during its various stages of manufacturing. The woodworking facility also does not embody the distinctive characteristics of a type, period, style, or method of design or construction, primarily due to the substantial modifications that the building has undergone since its construction and subsequent uses as a manufacturing facility for FBC, Boeing, and Kenworth. It is unlikely that the

building could contribute additional information which could be considered important to the history of the local area or the state, or would be of any scientific value. As such, the Fisher Body Corporation Woodworking Plant does not appear to meet criteria for the National Register of Historic Places.

Physical description: Although the main roof of the building appears flat from the primary (east) façade due to the application of a non-original metal parapet, the roof actually exhibits six separate, extremely low-pitched gables with a monitor set atop each gable. The roof of the main body of the structure is supported by six separate Fink steel truss systems, while the framing for the monitors above consists of typical monitor truss systems (Punmia et al. 1998).

Large, fixed, steel-framed, multi-pane windows with floating vents are located on both the north and south façades of the monitors. Exterior walls of the building originally consisted of brick masonry and large, fixed, steel-framed, multi-pane windows with floating vents on the north, south, and east façades. Although many of the original windows have been retained on the north and south facades, windows and doors on the east façade, except for at the southeast corner , were replaced after 1965. Since the construction of a warehouse addition resulted in the removal the west façade of the building between 1969 and 1980, its original configuration is unknown.

When the building was initially constructed, the property featured two railroad spurs that ran along the north and south façades of the structure. The original loading doors, which were likely primarily wood and folding-style, featured bands of steel-framed, fixed, multi-pane clerestory windows above. These loading doors were interspersed along the north and south façades in order to load and unload materials from the train cars. Although all doors have been replaced, except those at the western end of the north façade and some on the south façade, most original openings have been retained. Metal-framed awnings with a wood soffit were included in the original design of the building on the north and south façades in order to shelter the railroad tracks during shipping and receiving.

The 1969 to 1980 warehouse addition constructed onto the west façade of the woodworking plant is side-gabled with a low-pitched roof and exhibits metal exterior cladding. The warehouse addition features no windows or doors on the north façade, three pedestrian doors and 11 loading doors of various sizes on the west façade, and a pedestrian door and two horizontal pass-through windows on the south façade.

Historic Property Report

Resource Name: Fisher Body Corporation Woodworking Plant Property ID: 720344

Bibliography:

National Aeronautic Association of U.S.A., Inc.
1940 National Aeronautics Volume 18. National Aeronautic Association of U.S.A., Inc., Washington, D.C.

New York National Guardsman
1940 A Bomber Every Four Days. New York National Guardsman. March.

Pound, Arthur
1934 The Turning Wheel. Originally published by Doubleday, Doran & Company, Inc. Republished in 2013 by Edizioni Savine, Ancarano (TE), Italy.

Punmia, B.C., Ashok Kumar Jain, and Arun Kumar Jain
1998 Comprehensive Design of Steel Structures. Laxmi Publications (P), Ltd. New Delhi, India.

Semi-Weekly Spokesman Review
1929 Sigma Point is Prosperity. 28 December:30. Spokane, Washington.

Siefkes, Doug
1998 Kenworth: The First 75 Years. Barry Provorse, Woodinville, Washington. Distributec in the United States by Sasquatch Books, Seattle, Washington.

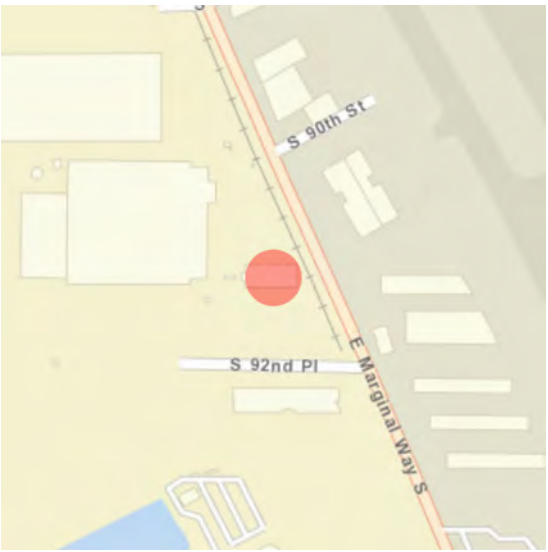
Spokane Chronicle
1928 Fisher Body Firm Seeks Coast Plant. 8 May:10. Spokane, Washington.
1929 Man Electrocuted. 31 Oct:19. Spokane, Washington
1939 Increase Space. 5 December:17. Spokane, Washington.

Historic Property Report

Resource Name: Kenworth Office Building

Property ID: 720349

Location



Address: 8801 E Marginal Way S, Seattle, WA, 98108, USA

Geographic Areas: King Certified Local Government, King County, T24R04E33, SEATTLE SOUTH Quadrangle

Information

Number of stories: 2.00

Construction Dates:

Construction Type	Year	Circa
Built Date	1964	☐

Historic Use:

Category	Subcategory
Commerce/Trade	Commerce/Trade - Business
Commerce/Trade	Commerce/Trade - Business

Historic Context:

Category

Architect/Engineer:

Category	Name or Company

Thematics:

Local Registers and Districts

Name	Date Listed	Notes

Project History

Historic Property Report

Resource Name: Kenworth Office Building Property ID: 720349

Project Number, Organization, Project Name	Resource Inventory	SHPO Determination	SHPO Determined By, Determined Date
2019-10-08110, , Warehouse construction at 8801 East Marginal Way	10/24/2019		

Photos

North Facade of Structure 2.jpg

North facade of the western entryway projection on Structure 2.jpg

View of central main entrance on the primary (north) facade.jpg

West facade of Structure 2.jpg

South facade of the Kenworth Office Building.jpg

Historic Property Report

Resource Name: Kenworth Office Building Property ID: 720349

Inventory Details - 10/24/2019

Common name:

Date recorded: 10/24/2019

Field Recorder: Tracy Stropes

Field Site number:

SHPO Determination

Detail Information

Characteristics:

Category	Item
Foundation	Concrete - Poured
Form Type	Commercial - Solid End Wall
Roof Type	Flat with Parapet
Roof Material	Asphalt/Composition - Built Up
Cladding	Glass - Spandrel Glass
Structural System	Masonry - Concrete Block
Plan	Rectangle

Styles:

Period	Style Details
Modern Movement	Curtain Wall

Surveyor Opinion

Property appears to meet criteria for the National Register of Historic Places: No

Property is located in a potential historic district (National and/or local): No

Property potentially contributes to a historic district (National and/or local): No

Historic Property Report

Resource Name: Kenworth Office Building Property ID: 720349

Significance narrative:

The Kenworth Office Building was constructed as a A Mesian-style office building for the Kenworth manufacturing facility located in the former Fisher Body Corporation Woodworking Plant on the property. The Kenworth Office Building appears to have replaced a brick office addition on the woodworking plant that was constructed between 1941 to 1956 and demolished between 1965 and 1969 after construction of Structure 2 had been completed.

Prior to the construction of the Kenworth Office Building, Kenworth utilized the property primarily for the manufacture of trucks and busses. Throughout the mid- to late twentieth century, Kenworth continued to grow, establishing offices and factories as far as Melbourne, Australia. On June 4, 1993, Kenworth opened a new facility in Renton, Washington, relocating most operations to the new facility. By 2001, Kenworth had ceased production at the 8801 East Marginal Way facility (Kenworth 2013). Since 2005, the property has been used by IAAI. No known historic events or significant persons are associated with the Kenworth Office Building. In addition, although the building was designed in the Mesian style it is not considered a unique or exceptionally representative example of the style.

Physical description:

The primary (north) façade of the building features a curtain wall made up of large panes of floor-to-ceiling glass set in extruded, aluminum mullions. Spandrel panels of pale green (first floor) and charcoal (second floor) divide the glass horizontally, hiding the floors and ceilings between the two floors. Support walls for the building are made of eight-inch concrete block masonry along the south, west, and east façades.

Two entry doors are located on the primary (north) façade: one near the center and one toward the western end. The entrance near the center is raised approximately two feet from ground level and exhibits a set of double doors accessed via a landing, which is sheltered by a simple, rectangular, metal overhang that is supported by rectangular metal posts. A ramp extending west from the central door allows access to the entryway from the ground level. The ramp and landing feature a simple aluminum railing. The railing and overhang appear original to the building. The entrance at the western end of the north façade is set back within the building and features a single, metal-framed, glass door. Access to this door is achieved via a concrete ramp with a non-original steel railing. On the west façade of of the building is a structural projection that features another entryway. This western entryway allows access into the building from the former woodworking facility via a covered ramp. The north façade of the entryway projection possesses the same floor-to-ceiling windows as the primary façade. The west façade also features a solid structural wall and two floor-to-ceiling windows on the second floor. A metal overhang, similar to the one at the main entrance, only smaller, shelters the western entry door. The covered ramp leading to the west façade from the former woodworking facility exhibits domed sky-lights. It is not original to the building and sits approximately six inches below the metal overhang.

The roof of the building is flat with an enclosed structural system and no overhang. The load-bearing, concrete block masonry, exterior walls extend past the roofline creating parapets. Those façades featuring curtain walls have no parapet. The south and east façades feature no windows and only small, fireproof, pedestrian doors.

Bibliography:

Kenworth
2013 News Release: Kenworth and PACCAR Assembly Plants Carry on Kenworth's 90-Year Tradition of Quality and Innovation. Electronic document, https://www.kenworth.com/news/news-releases/2013/october/90th-anniversary-plants.aspx, accessed July 24, 2019.

Historic Property Report

Resource Name: Fisher Body Corporation Woodworking Plant Water Storage Tank

Property ID: 720352

Location

Address: 8801 E Marginal Way S, Seattle, WA, 98108, USA

Geographic Areas: King Certified Local Government, King County, T24R04E33, SEATTLE SOUTH Quadrangle

Information

Number of stories: N/A

Construction Dates:

Construction Type	Year	Circa
Built Date	1928	☑

Historic Use:

Category	Subcategory
Industry/Processing/Extraction	Industry/Processing/Extraction - Manufacturing Facility
Industry/Processing/Extraction	Industry/Processing/Extraction - Manufacturing Facility

Historic Context:

Category
Industry/Manufacturing

Architect/Engineer:

Category	Name or Company

Historic Property Report

Resource Name: Fisher Body Corporation Woodworking Plant Water Storage Tank

Property ID: 720352

Thematics:

Local Registers and Districts

Name	Date Listed	Notes

Project History

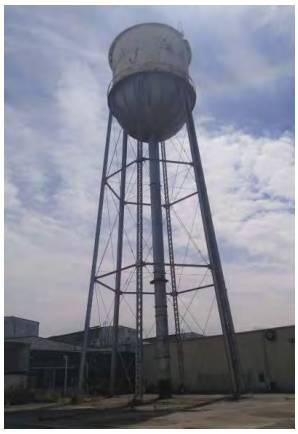
Project Number, Organization, Project Name	Resource Inventory	SHPO Determination	SHPO Determined By, Determined Date
2019-10-08110, , Warehouse construction at 8801 East Marginal Way	10/25/2019		

Historic Property Report

Resource Name: Fisher Body Corporation Woodworking Plant Water Storage Tank

Property ID: 720352

Photos



Structure 3.jpg

20190712_124500.jpg

134-Factory-1951c.jpg

Historic Property Report

Resource Name: Fisher Body Corporation Woodworking Plant Water Storage Tank

Property ID: 720352

Inventory Details - 10/25/2019

Common name:

Date recorded: 10/25/2019

Field Recorder: Tracy Stropes

Field Site number:

SHPO Determination

Detail Information

Characteristics:

Category	Item
Foundation	Concrete - Poured
Form Type	Utilitarian
Roof Type	Conical
Roof Material	Metal
Cladding	Metal
Structural System	Metal - Steel
Plan	Apsidal

Surveyor Opinion

Property appears to meet criteria for the National Register of Historic Places: No

Property is located in a potential historic district (National and/or local): No

Property potentially contributes to a historic district (National and/or local): No

Historic Property Report

Resource Name: Fisher Body Corporation Woodworking Plant Water Storage Tank

Property ID: 720352

Significance narrative: The Fisher Body Corporation Water Storage Tank is a water storage tank built between 1928 and 1929 as part of the woodworking facility for Fisher Body Corporation (Pound 1934). In 1939, the property was leased by the Boeing Aircraft Company to serve as an "addition to its assembly facilities" (Spokane Chronicle 1939). A 1941 Boeing advertisement depicts Structures 1 and 3 as "Boeing Plant No. 3." A March 1940 article indicates that the Seattle-based Boeing facilities, which also included Boeing Plant Nos. 1 and 2 located to the north along the Duwamish River, were used to manufacture four-engine, Boeing B-17B, Flying Fortresses for the United States Army Air Corps:

The manufacture of parts takes place at Boeing Plant No. 1, and small sub-assemblies are made at the new Boeing Plant No. 3. Both of these other plants feed the assembly lines at Plant No. 2. (New York National Guardsman 1940)

The Boeing Aircraft Company used the original Fisher Body Corporation Woodworking Facility and the associated water storage tank only until the end of World War II, after which the Pacific Car & Foundry Company (PACCAR), the parent company of Kenworth Motor Truck Corporation (Kenworth), purchased the property in October 1945 (Siefkes 1998). Kenworth utilized the structures as a truck and bus manufacturing facility until a new facility opened in Renton, Washington in 1993. Afterwards, Kenworth's use of the East Marginal Way property dwindled until finally ceasing by 2001 (Kenworth 2013).
The Fisher Body Corporation Woodworking Plant and associated water storage tank were originally built during Tuwkila's period of early industrial development along the Duwamish River. However, the buildings no longer retain enough integrity to convey an association with either period. In addition, although the structures were utilized by FBC, Boeing, and Kenworth to manufacture wood parts for automobile bodies, airplane parts, and trucks, a majority of the modifications that affected their overall integrity occurred after the historic period, thereby negatively impacting their association with all three companies. The structures did play a role in the manufacturing of parts for war planes during World War II; however, this contribution is not sufficient to be the basis for satisfaction of local or National Register significance criteria. Although the structures were built as part of FBC's operations, they did not serve as the office or work place for any of the Fisher brothers. The structures are also not associated with any significant individuals from Boeing or Kenworth who may have worked at the facility during its various stages of manufacturing. The water storage tank also does not embody the distinctive characteristics of a type, period, style, or method of design or construction. It is unlikely that the water storage tank could contribute additional information which could be considered important to the history of the local area or the state, or would be of any scientific value. As such, water storage tank does not appear to meet criteria for the National Register of Historic Places.

Physical description: The Fisher Body Corporation Woodworking Plant Water Storage Tank was designed as an elevated, spheroid-bottomed, riveted steel plate, water storage tank with a conical roof that is supported by six Z-laced girder steel legs. Built between 1928 and 1929, the water tower served to provide water pressure to the FBC manufacturing facility. No manufacturer's plaque or builder information could be found for the water storage tank.

Historic Property Report

Resource Name: Fisher Body Corporation Woodworking Plant Water Storage Tank

Property ID: 720352

Bibliography:

Kenworth
2013 News Release: Kenworth and PACCAR Assembly Plants Carry on Kenworth's 90-Year Tradition of Quality and Innovation. Electronic document, https://www.kenworth.com/news/news-releases/2013/october/90th-anniversary-plants.aspx, accessed July 24, 2019.

New York National Guardsman
1940 A Bomber Every Four Days. New York National Guardsman. March.

Pound, Arthur
1934 The Turning Wheel. Originally published by Doubleday, Doran & Company, Inc. Republished in 2013 by Edizioni Savine, Ancarano (TE), Italy.

Siefkes, Doug
1998 Kenworth: The First 75 Years. Barry Provorse, Woodinville, Washington. Distributec in the United States by Sasquatch Books, Seattle, Washington.

Spokane Chronicle
1939 Increase Space. 5 December:17. Spokane, Washington.

Historic Property Report

Resource Name: Groundwater Treatment Facility

Property ID: 720356

Location

Address: 8801 E Marginal Way S, Seattle, WA, 98108, USA

Geographic Areas: King Certified Local Government, King County, T24R04E33, SEATTLE SOUTH Quadrangle

Information

Number of stories: 1.00

Construction Dates:

Construction Type	Year	Circa
Built Date	1940	☑
Addition	1967	☑
Addition	1975	☑

Historic Use:

Category	Subcategory
Industry/Processing/Extraction	Industry/Processing/Extraction - Waterworks
Industry/Processing/Extraction	Industry/Processing/Extraction - Waterworks

Historic Context:

Category
Industry/Manufacturing

Architect/Engineer:

Category	Name or Company

Historic Property Report

Resource Name: Groundwater Treatment Facility Property ID: 720356

Thematics:

Local Registers and Districts

Name	Date Listed	Notes

Project History

Project Number, Organization, Project Name	Resource Inventory	SHPO Determination	SHPO Determined By, Determined Date
2019-10-08110, , Warehouse construction at 8801 East Marginal Way	10/25/2019		

Photos

Groundwater Treatment Facility East Facade.jpg

Groundwater Treatment Facility North Facade.jpg

Groundwater Treatment Facility Additions East Facade.jpg

Groundwater Treatment Facility South Facade.jpg

Historic Property Report

Resource Name: Groundwater Treatment Facility Property ID: 720356

Inventory Details - 10/25/2019

Common name:

Date recorded: 10/25/2019

Field Recorder: Tracy Stropes

Field Site number:

SHPO Determination

Detail Information

Characteristics:

Category	Item
Foundation	Concrete - Poured
Form Type	Utilitarian
Roof Type	Gable - Side
Roof Material	Metal
Cladding	Metal
Structural System	Metal - Steel
Plan	Rectangle

Surveyor Opinion

Property appears to meet criteria for the National Register of Historic Places: No

Property is located in a potential historic district (National and/or local): No

Property potentially contributes to a historic district (National and/or local): No

Significance narrative: Aerial photos and maps indicate that the Groundwater Treatment Facility structure was built as a groundwater treatment facility on the western edge of what was either the Boeing or Kenworth campus when it was constructed between 1940 and 1964. The building is not known to be associated with any specific historic events and is not associated with any broad patterns of history or any significant persons. As a utilitarian building, it is not representative of any specific architectural style or method of construction. The building has been determined ineligible for designation as a King County Landmark and does not qualify for listing on the NRHP under any eligibility criteria, due to a lack of overall historic integrity and lack of association with any significant persons or events.

Historic Property Report

Resource Name: Groundwater Treatment Facility Property ID: 720356

Physical description:

The Groundwater Treatment Facility was constructed along the western boundary of the property between 1940 and 1964. Between 1964 and 1969, the building was enlarged to the south, which increased its footprint by more than 100 percent. Also between 1964 and 1969, a small, wood-paneled addition was constructed on the east façade near the northeast corner of the building.

Currently, a large doorway is present on the south façade of the southern1964 to 1969 addition, with a metal, sectional, roll-top door located on the interior of the wall. A metal pedestrian door with modern hardware is located immediately east of the large doorway. Although only one story in height, wood rooms and lofts were constructed on the interior of the southern 1964 to 1969 addition to allow for storage space.

No windows are located on the east façade and only one doorway with a hollow metal door is present near the northern end. Additional openings have been cut into the metal along the east façade of the building, but no window or door framing is present in the openings. Several sections of the east façade have also begun to rust off or have already fallen away.

Between 1969 and 1980, a small, flat-roofed concrete block addition was constructed on the east façade of the building, north of the 1964 to 1969 wood-paneled addition. Three other additions were constructed on the north façade between 1969 and 1980, including: a flat-roofed, metal-clad portion with a sectional, roll-up door; a small, brick, shed-roofed addition constructed onto the metal-clad addition's north façade; and a concrete block addition constructed west of the metal-clad addition.

The original building and the additions were combined into one single, large, utilitarian structure not designed in any specific architectural style. Framing for the original building, the 1964 to 1969 southern addition, and the 1969 to 1980 metal-clad addition consists of metal I-beams that support a side-gabled roof. These portions of the building are clad in riveted metal siding and the roof exhibits sheet metal roofing. The original building and all additions are entirely unadorned with no architectural detailing present.