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Sampling and Analysis Plan for the Former Atomic Energy Commission Bus Lot Property

July 1998

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Sampling and Analysis Plan for the Former Atomic Energy Commission Bus Lot Property

R.R. Nielson

July 1998

Prepared for
the U.S. Department of Energy
Richland Operations Office of Science and Technology

Pacific Northwest National Laboratory
Richland, Washington 99352

APPROVAL PAGE

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1.0 INTRODUCTION

This sampling and analysis plan (SAP) presents the rationale and strategy for the sampling and analysis activities proposed in support of an initial investigation of the former Atomic Energy Commission (AEC) bus lot property currently owned by Battelle Memorial Institute. The purpose of the proposed sampling and analysis activity is to investigate the potential for contamination above established action levels. The SAP will provide defensible data of sufficient quality and quantity to support recommendations of whether any further action within the study area is warranted.

To assist in preparing sampling plans and reports, the Washington State Department of Ecology (Ecology) has published *Guidance on Sampling and Data Analysis Methods* (Ecology 1995a). To specifically address sampling plans for petroleum-contaminated sites, Ecology has also published *Guidance for Remediation of Petroleum Contaminated Sites* (Ecology 1995b). Both documents were used as guidance in preparing this plan.

In 1992, a soil sample was taken within the current study area as part of a project to remove two underground storage tanks (USTs) at Battelle's Sixth Street Warehouse Petroleum Dispensing Station (Section 1.3). The results showed that the sample contained elevated levels of total petroleum hydrocarbons (TPH) in the heavy distillate range. This current study was initiated in part as a result of that discovery.

The following topics will now be considered: the historical background of the site, current site conditions, previous investigations performed at the site, an evaluation based on the available data, and the contaminants of potential concern (COPC).

1.1 SITE HISTORY

The study area is located along the southern boundary of the Hanford Site, which is located in southeastern Washington (Figure 1.1). The Hanford Site came into existence as a Federal facility in 1943 when the U.S. Government took possession of the land adjacent to the Columbia River to produce nuclear materials for defense purposes. The Hanford Site's production mission continued until the late 1980s, when the mission changed from producing nuclear materials to cleaning up the radioactive and hazardous wastes generated over the previous years.

Similar to the rest of the Hanford Site, the study-area property was obtained by the US government during the early 1940s. It became the property of the AEC upon its formation on January 1, 1947. In September of that same year, the new construction camp of North Richland was announced (Advanced Advertising 1983). This small village was to primarily house construction workers for the first post-war expansion of the Hanford Site. As such, it consisted of a number of residential, commercial, recreational, and support facilities that were equipped with water, power, sewer, steam, and telephone services (Richland Villager 1947).

Transportation systems were needed to convey residents both to and from North Richland as well as workers to and from the outer areas of the Hanford Site. Accordingly, both a private bus depot and a larger bus system were constructed in the area bounded by 8th (now Battelle Blvd.) and 5th Streets on the north and south, respectively, and "W" and Stevens Avenues on the east and west, respectively (Figure 1.2). This system would operate on an approximately 0.13 km²

Figure 1.1 Vicinity Map

Figure 1.2 Location Map

site and would include bus depots, bus lanes, fuel pumps, bus and private parking areas, an electrical sub-station, and a bus maintenance facility. These were constructed and began operation in 1948 (Richland Villager 1948b). Interviews with retirees indicate that the facility was shut down sometime in late 1954 and sat idle until mid 1955 when it was subsequently demolished. The property would therefore have been used for approximately 7 years.

The property has remained relatively undisturbed since that time (approximately 43 years). The US government sold the property to the City of Richland via a quitclaim deed¹ in 1964. Battelle subsequently purchased it from the City via a statutory warranty deed² in 1965. Other than groundwater well installation (Section 1.2), Battelle has not developed or used the property since its initial purchase.

During this site investigation, virtually no official facility configuration or operating records or information was located for the study area. Historical information was gathered from interviews with retirees, aerial and site photos, general site maps, newspaper articles, and various publications.

1.2 CURRENT SITE CONDITIONS

The following section summarizes currently available information on the structures identified within the approximately 49,000 m² study area and describes what is known about the operations within these facilities. Original facility locations and numbers, along with the services each facility was equipped with, were obtained from maps developed and maintained by the Army Corps of Engineers (Army Corps 1951). A description of these and other features as they exist today is also provided. Figures showing site details are contained in Appendix A (Figures A.1, A.2).

Private Bus Depot Facility (5110)

An aerial photograph³ shows that this facility was the first structure on the property. This photo shows that the facility was most likely constructed in January 1948 and operated for some time as a private bus depot (Richland Villager 1948a). Located on the northwest corner of 5th Street and "W" Avenue, this approximately 110 m² wood frame structure apparently had no permanent foundation. It also operated for a period as a construction office for General Electric. It does not appear that hazardous materials were used or disposed of at this facility. There is no structure present in this location today.

Bus Maintenance Facility (5101)

This facility began operation in August 1948 as a maintenance facility for the fleet of buses used to convey construction workers to and from construction areas at the Hanford Site (Richland Villager 1948b). This approximately 2,300 m² wood frame structure did have a permanent, concrete foundation that remains today. It is located near the northeast corner of Stevens Drive

1 Quitclaim Deed, United States Government to City of Richland, 11/9/64.

2 Statutory Warranty Deed, City of Richland to Battelle, 2/26/65.

3 Aerial photograph of North Richland Construction Camp, Negative #BN-92062221-1CN

and 5th Street. Lube pits were designed in the foundation to give technicians access to the undercarriage of the vehicles they serviced. Staff interviews with retirees indicate that technicians from the Teamsters Union operated this facility. Since Teamsters were tasked only with the operation and light maintenance of vehicles, it is assumed that only light maintenance work was conducted at the facility. This would have included inspections, routine services and maintenance, oil and coolant changes, tire work, etc. Heavier repair work such as engine overhauls, drive-train work, machine work, etc. would have been performed elsewhere by Operating Engineers from a different union.

Records show that the approximately 40 buses maintained at the facility were 1948, 41 passenger "Superior" buses. Each bus was equipped with a 184 horsepower, 6 cylinder gasoline engine manufactured by White (Richland Villager 1948b). This information was corroborated through interviews with retirees and leads to the conclusion that any storage tank(s) supporting the nearby fuel island most likely held leaded gasoline.

Table 1.1 indicates the hazardous materials that were most likely used at the facility and their estimated annual quantities. These are only estimates and are based on data gathered at other similar vehicle maintenance facilities on and off the Hanford Site.

Table 1.1 Estimated Amounts of Hazardous Materials

Material	Description	Annual Usage*	Total Usage*
Gasoline	Leaded	386,800	2,707,600
Motor Oil	30 W	1,500	10,500
Transmission Oil	50 W	200	1,400
Gear Oil	80-90 W	200	1,400
Grease	Standard	225	1,575
Brake Fluid	DOT 3	10	70
Antifreeze	Ethylene Glycol	400	2,800
Batteries	6-12V	20 ea.	140 ea.
Solvent	**	2,700	18,900
Parts Detergent	**	70	490
Paint	**	100	700
Absorbent	Diatomaceous Earth	500 #	3,500 #
Rags	Cloth, Laundered	5,200	46,400 ea.

*All units in Liters unless otherwise noted

**It is unknown which specific solvents/surfactants were used and whether paint products were used at all.

A fuel island is located adjacent to the 5101 Bus Maintenance Facility. It is presumed that gasoline was stored in at least one underground storage tank and was routinely dispensed at this fuel island. Data from a geophysical investigation (Section 1.3) indicate that at least one UST did exist adjacent to the fuel island, but has since been removed. Underground piping leading from the remnants of the fuel island terminate at a visible soil depression where the UST was confirmed to have been removed.

Lubricating oils, antifreeze, solvents, and surfactants were typically purchased in drums and dispensed either by hand or by pneumatic pump. Typical solvents most likely consisted of non-chlorinated petroleum solvents (gasoline, mineral spirits, stoddard solvent, acetone, turpentine, etc.), but may have included chlorinated solvents such as methylene chloride, 1,1,1-trichloroethane (TCA), trichloroethene (TCE), perchloroethylene (PCE), etc.

Waste oil may have been stored in an underground tank and routinely picked up by a waste oil hauler. However, the geophysical investigation failed to locate an existing tank and did not find any evidence that one ever existed. Used oil may also have been spread on the ground for dust control. Waste antifreeze may have accumulated in a tank either above or below ground, but may also have been discharged to the sanitary sewer. Waste solvents may have either been discharged to the ground or sanitary sewer. Surfactants were most likely discharged with rinse water to the ground, and solid waste was most likely disposed of with the sanitary waste (solid refuse).

The geophysical investigation located two seepage pits that are adjacent to and accept plumbing (drains) from the foundation of the bus maintenance facility. The investigation was unable to determine where the plumbing originated within the slab, and it is unknown what materials may have been discharged. The investigation also confirmed that the facility was connected to the Richland sanitary sewer by locating the existing sewer line itself. Two storm drains were placed near the maintenance facility. These discharge directly to the soil with overflow diverted to the sanitary sewer.

Two underground enclosures were located adjacent to the 5101 and 5104 (below) facilities. One of the enclosures accepts main steam lines that are valved and connected to lines coming from the direction of the 5101 and 5104 facilities. This enclosure appears to be a steam pit providing access to steam line controls for at least one of the facilities. Site maps appear to confirm this (Army Corps 1951). The steam lines are insulated with a material that may contain asbestos. The other enclosure may also be a steam pit, but steam lines are no longer present. Based on the configuration of the piping, this may have been a waste disposal pit.

Construction Bus Depot Facility (5104)

This small (approximately 90 m²) building was located just a few meters southeast of the 5101 bus maintenance facility and operated presumably as a dispatch office (Army Corps 1951). This wood-frame structure apparently also had no permanent foundation. No other information is known about this facility. It does not appear that any hazardous materials were used or disposed of at this facility. Except for the steam utility manway described above, there is no structure present in this location today.

Electrical Sub-Station (5103)

This approximately 910 m² "facility" was apparently a wood frame, non-enclosed electrical transfer station that consisted of transformers and other electrical equipment (Army Corps 1951). The structure stood on Stevens Drive between 6th and 7th Streets. Potential soil contamination may exist from leaking transformer oils. There is no structure present in this location today.

Groundwater Wells

Four groundwater wells were installed within the site in October 1979 to measure groundwater levels and gradients. All are approximately 30 m deep. Three of the four wells have been periodically sampled since 1988. These samples have been analyzed for radioactivity and inorganic/organic materials. Additional information for these wells can be obtained through the annual *Hanford Site Groundwater Monitoring Report* (Pacific Northwest National Laboratory [PNNL] 1997a). The remaining well was converted into an irrigation well in 1984 and now supplies water to surrounding acreage⁴. The wells are further described as follows:

- 699-S36-E12B: Installed as part of an environmental surveillance program designed to measure groundwater gradient. The well casing extends to 30.5 m below the surface and is not perforated or screened.
- 699-S36-E13B: Also installed as part of an environmental surveillance program designed to measure groundwater gradient. While the well extends to 30.5 m below the surface, the well casing extends only to 25.0 m. The casing is not perforated or screened.
- 699-S36-E13A: This well is part of the Hanford Groundwater Monitoring Program and is sampled significantly more often than the other wells. Samples are also analyzed for a much larger suite of analytes. This well also extends to 30.5 m below the surface. The bottom 6 m of the 21.3 m casing is screened. This well is located down gradient from the 5101 bus maintenance facility, which is the primary potential source of the COPCs.
- 699-S36-E12A (Irrigation Well A5390): The original well was cleaned out and tested in March 1983, and a submersible pump with connecting piping was installed in October of that same year. The well, which can supply 572,000 m³ maximum per year, became operational in February 1984 and has since operated annually from April 1 to October 31 as an alternative water source to irrigate Battelle acreage.

Environmental Air Sampler

An environmental air sampler was installed in July 1973. As part of the Hanford Environmental Surveillance Program, samples are collected biweekly and analyzed for gross beta. Additional information can be found in the annual Hanford Site Environmental Report (PNNL 1997b).

1.3 PREVIOUS INVESTIGATIONS

In 1992, two USTs were removed at Battelle's Sixth Street Warehouse Petroleum Dispensing Station. This area was located behind (north of) the Sixth Street Warehouse shown in Figure A.1. Battelle contracted with SCM Consultants to investigate, characterize, and clean up the site. As part of this work, an offsite control sample of the surface soil was taken in what is now the northeast corner of the study area. Lauks Testing Lab analyzed this sample using the Ecology Washington Total Petroleum Hydrocarbon-Hydrocarbon Identification (TPH-HCID) protocol. The results showed the sample contained 200 ppm TPH in the heavy distillate range. This value is equal to the Model Toxics Control Act (MTCA) Method A cleanup level for industrial soils (Ecology 1996). The summary report is included as Appendix B.

⁴ Battelle Drawing #R-C-1147, *Groundwater Well*, 5/12/83.

As part of this project, a geophysical investigation of the southwest quadrant of the site was conducted in November 1997. Several subsurface features and structures were identified, as discussed earlier in this section. The summary report is included as Appendix C.

As mentioned above, a significant amount of data also exist for the three groundwater monitoring wells. These have been sampled periodically since 1988 for a number of primary and secondary organic and inorganic pollutants. Data are maintained in the Hanford Environmental Information System (HEIS). Results reported with a qualifier of "U" were less than the detection limit and thus do not represent values above regulatory standards. Data not qualified with a "U" have been compared to federal and state maximum contaminant levels (MCLs). The results of the comparison are included in Appendix D. The following exceedances are noted:

699-S36-E13A:

- Beryllium:** One sample out of eight was slightly above the 5 ug/L MCL for beryllium. Beryllium was not detected in four subsequent samples. Thus, beryllium is not considered a constituent of concern.
- Nitrate:** One nitrogen in nitrate value was slightly above the 10,900 ug/L MCL. Widespread nitrate contamination in this vicinity has been attributed to fertilizer use and possible industrial sources and thus is not related to Bus Lot activities (PNNL 1997a).
- Turbidity:** All reported turbidity values were less than 5 nephelometric turbidity units (NTUs). Although there is a Washington State MCL of 1 NTU for turbidity, the results from monitoring wells are not relevant to this standard. The turbidity of the sample is to a large degree a function of the type of well screen, the sand pack, the well development, and the pumping schedule. These are generally different for monitoring wells so the presence of greater turbidity in these particular wells is not unexpected.

699-S36-E12B:

- pH:** pH was above the upper MCL limit of 8.5 in two of five reported results with a maximum reported value of 9.26. The most recent two samples were within the acceptable pH range. The cause of the high measurements is unexplained but it seems unlikely that the bus lot operations discharged sufficient caustic material to impact the groundwater pH. The MCL range for pH is a secondary MCL and thus is based on the aesthetic qualities of the water rather than health considerations.

Since no regulatory levels for Well #699-S36-E13A have been exceeded in recent (9 years) samples, and since this well is located down gradient from a potential contaminant source area (5101 Bus Maintenance Facility), no further groundwater sampling is warranted.

1.4 EVALUATION

As described in the sections above, a significant amount of data have been gathered for the study area. These data have led to the following conclusions:

- The groundwater down gradient from the 5101 Bus Maintenance Facility does not appear to contain contaminants above established action levels.
- Based on the information gathered during the site investigation, the potential that a historical release occurred that would contribute to present day or future levels of contamination that exceed established action levels is low.
- Any surface (and potentially subsurface) contamination noted in the 1992 control sample was likely due to a controlled process (oiling roadway surfaces) rather than an inadvertent, uncontrolled release of hazardous materials.

However, since much of the facility operational data are unknown, there still exists the question of whether residual soil contamination is present at the site in concentrations that exceed established action levels. Informed conclusions cannot be made without additional data. The data quality objectives (DQO) process (Section 2.0) is used as a guide to determine what questions remain and the best methods for addressing these questions.

1.5 CONTAMINANTS OF POTENTIAL CONCERN

The results from previous investigations and/or process knowledge have led to the identification of several chemicals and materials as being COPCs. These are summarized in Table 1.2.

Table 1.2 Contaminants of Potential Concern

Number	Contaminant Group	Specific Contaminants
1	Metals	Cd, Cr, Pb
2	PCBs* (Aroclors)	1016, 1221, 1232, 1242, 1248, 1254, 1260
3	Pesticides	Dichlorodiphenyltrichloroethane (DDT), Lindane
4	PAHs** (carcinogenic)	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenzo(ah)anthracene, Indeno(1,2,3-cd)pyrene
5	Organics	TPH
6	Volatile Organics	Benzene, Ethylbenzene, Toluene, Xylenes (BTEX), Methylene Chloride, Tetrachloroethylene, Trichloroethylene, 1,1,1-Trichloroethane
7	Other	Asbestos

* Polychlorinated biphenyls

** Polycyclic aromatic hydrocarbons

1.6 ORGANIZATION OF THIS PAPER

This paper discusses the DQOs used in developing this project, the quality assurance project plan, the field sampling plan, and health and safety concerns.

2.0 DATA QUALITY OBJECTIVES

The Environmental Protection Agency's DQO process was used as a guide in developing this SAP (EPA 1994). The DQO process is a strategic planning approach that provides a systematic procedure for defining the criteria that a data collection design should satisfy. Using the DQO process ensures that the type, quantity, and quality of environmental data used in the decision making will be appropriate for the intended application. The seven steps that comprise the DQO process are as follows:

- Step 1: State the problem
- Step 2: Identify the decisions
- Step 3: Identify inputs to the decisions
- Step 4: Define the study boundaries
- Step 5: Develop decision rules
- Step 6: Specify limits on decision error
- Step 7: Optimize the design for obtaining data.

As discussed in Section 1.0, a detailed evaluation was performed on existing historical site records before beginning the DQO process, and a site reconnaissance survey was performed for the purpose of identifying

- areas of potential contamination
- a list of the COPCs
- potentially contaminated media
- potential paths for contaminant migration
- a site conceptual model.

The information gathered from the record search and site reconnaissance survey was used throughout the DQO process to support the statement of the problem and to support the identification of inputs needed to resolve each of the decision statements.

2.1 STEP 1: STATE THE PROBLEM

The objective of this step in the DQO process is to develop a concise description of the problem, identify the primary organizations involved in the study, provide a list of the technical backgrounds of the planning team members, identify the primary decision maker(s), and provide relevant schedule milestones for the study. Information addressing these issues is summarized below,

Problem Description: Determine whether any contamination currently exists within the study area in sufficient concentration to warrant further action.

Planning Team Members/Organizations/Areas of Expertise: The planning team members and the organizations to which they belong are summarized in Table 2.1.

Table 2.1 Planning Team

Organization	Department	Planning Team Member	Title
Battelle, Pacific Northwest Division	Environmental Science and Systems Analysis	KB Olsen	Principal Field Investigator
		DL Stewart	Data Management
	Environmental Management Services	BJ Day	Environmental Compliance
		RR Nielson	Principal Investigator
		HT Tilden	MTCA Subject Matter Expert
	Facility Services	A Gonzalez	Asbestos Sampler
		DP Ryan	Field Engineer
	Facility Transition	JD Bumgardner*	Project Manager
	Legal	SD Cooke	Legal Counsel
	Quality	KJ Kuhl-Klinger	Quality Manager
	RCHN Facility Operations	KA Poston	Project Task Leader
	Safety & Health	RE Johanson	Industrial Hygiene
		DW Wright	Occupational Safety & Health
	Sensors and Measurement Systems	GA Sandness	Principle Geophysical Investigator
Dept. of Energy/Richland Operations	Office of Science and Technology	RF Christensen	DOE Representative
Washington State Dept. of Ecology	Central Regional Office Toxics Cleanup Program	M Peterschidt	Voluntary Cleanup Program Coordinator

*Primary Decision Maker

List of Analytical Laboratories:

Inorganic and Organic Soil Analysis:

Quanterra Environmental Services
13715 Rider Trail North
Earth City, MO 63045

Soil Gas Analysis:

Battelle, Pacific Northwest Division
Sigma V Laboratory
3110 Port of Benton Blvd.
P.O. Box 999
Richland, WA 99352

Asbestos Analysis:

Waste Sampling and Characterization Facility (WSCF)
Waste Management Federal Services of Hanford, Incorporated, PO Box 700
Richland, WA 99352

Schedule Milestones:

Site Investigation	12/1/97
Geophysical Investigation	1/1/98
Conceptual Model	5/1/98
Sampling and Analysis Plan	7/1/98
Field Sampling and Analysis	7/15/98
Final Report	10/1/98

2.2 STEP 2: IDENTIFY THE DECISIONS

The goal of this step is to define the questions that the study will attempt to resolve and to identify the alternative actions that may be taken based on the outcome of the study. The study questions and their corresponding alternative actions will then be joined to form decision statements.

2.2.1 Principal Study Questions

Principal study questions provide the basis for determining how to solve the problem. These questions identify key unknown conditions or unresolved issues that reveal the solution to the problem being investigated. The following is a list of principal study questions that need to be resolved.

Principal Study Question 1: Does the surface and near surface soil within the study area contain contaminants in concentrations that exceed established action levels?

Principal Study Question 2: Does the subsurface soil within the study area contain contaminants in concentrations that exceed established action levels?

Principal Study Question 3: Does the surface or sub-surface soil contain contaminants in sufficient concentrations to negatively impact groundwater?

Principal Study Question 4: Has any potential contamination reached the existing sanitary sewer system piping?

Principal Study Question 5: What are the identities of the unknown buried objects identified during the geophysical investigation?

Principal Study Question 6: Does the underground steam-pipe insulation contain asbestos in concentrations that exceed established action levels?

2.2.2 Alternative Actions

Sampling and analysis activities will be conducted to produce the additional data necessary to resolve the principal study questions. Alternative actions presented below will be based on the data produced.

Principal Study Questions 1-4:

- No action
- Check against background data
- Differentiate between potentially contaminated sampling areas and clean areas
- Perform additional sampling in each potentially contaminated sampling area
- Evaluate the need to provide regulatory notification

Principal Study Question 5:

- No action
- Remove object(s)
- Remove object(s) and soil
- Evaluate the need to provide regulatory notification

Principal Study Question 6:

- No action
- Restrict access
- Remove insulation
- Encapsulate insulation
- Bury insulation

2.3 STEP 3: IDENTIFY INPUTS TO THE DECISIONS

The purpose of this step is to identify the information inputs that will be required to resolve each decision statement and determine which inputs require measurements and/or sampling. The key information requirements include the measurements that may be required, the source of data or information, and the basis for the action levels.

Inputs required for Principle Study Question 1:

To determine whether surface and near surface soil within the study area contains contaminants in concentrations that exceed established action levels, it will be necessary to perform the following activities:

- a) Perform surface and near surface soil sampling at potential sources of contamination. These samples will be analyzed for COPCs #1 through #6 identified in Table 1.2.
- b) Use organic vapor analyzer (OVA) as an indicator of potential contamination during sampling activities.

Inputs required for Principle Study Question 2:

To determine whether the subsurface soil within the study area contains contaminants in concentrations that exceed established action levels, it will be necessary to perform the following activities:

- a) Perform active soil gas probe sampling at potential sources of contamination. These samples will be analyzed for COPC #6 identified in Table 1.2.
- b) Perform soil sampling at the bottom of the original UST excavation. These samples will be analyzed for COPCs #1 through #6 identified in Table 1.2.
- c) Use OVA as an indicator of potential contamination during sampling activities.

Inputs required for Principle Study Question 3:

To determine whether the surface or sub-surface soil contains contaminants in sufficient concentrations to negatively impact groundwater, it will be necessary to perform the following activities:

- a) Perform surface and near surface soil sampling at potential sources of contamination. These samples will be analyzed for COPCs #1 through #6 identified in Table 1.2.
- b) Use OVA as an indicator of potential contamination during sampling activities.

Inputs required for Principle Study Question 4:

To determine whether any potential contamination reached the existing sanitary sewer system piping, it will be necessary to perform the following activities:

- a) Perform sediment sampling at the bottom of existing sanitary sewer structures. These samples will be analyzed for COPCs #1 through #5 identified in Table 1.2.

Inputs required for Principle Study Question 5:

To determine the identities of the unknown buried objects identified during the geophysical investigation, it will be necessary to perform the following activities:

- a) Excavate and visually identify the four remaining unknown object areas.

- b) Depending on the nature of the material found, perform surface and near surface soil sampling at these locations. If soil sampling is warranted, the samples will most likely be analyzed for COPCs #1 through #6 identified in Table 1.2. However, this determination must be made in the field.

Inputs required for Principle Study Question 6:

To determine whether the underground steam pipe insulation contains asbestos in concentrations that exceed established action levels, it will be necessary to perform the following activities:

- a) Sample pipe insulation in the steam pit and underground enclosure. This sample will be analyzed for COPC #7 identified in Table 1.2.

2.4 STEP 4: DEFINE THE STUDY BOUNDARIES

As described in Section 1.1 above, the area of interest is composed of the property bounded by 8th and 5th Streets on the north and south, respectively, and Stevens Drive and "W" Avenue on the west and east, respectively. However, the study area is constrained to the southern block between 5th and 6th Streets as well as the small area between 6th and 7th Streets where the 5103 Sub-Station once stood. The approximately 49,000 m² study area is further delineated into 16 specific sampling areas (SAs) and a background area (Figures A.3, A.4, A.5). If contaminants were released at the site, the potential is greatest that they would have been introduced into the environment at these locations. Accordingly, the following specific sampling areas have been selected as follows:

- SA-1: Underground Enclosure: This approximately 1.5-m × 1.5-m × 3.2-m sub-surface concrete structure is accessible through a 0.6-m-diameter manway. An old, insulated pipe casing enters from the south, and piping leaves the north and west sides towards the foundation. While period maps show that this enclosure was most likely a steam pit, it may have been a liquid waste disposal pit for the 5101 Bus Maintenance Facility. More about the exact purpose of this pit will be learned during field sampling.
- SA-2: Steam Pit: This approximately 1.2-m × 1.2-m × 2.7-m sub-surface concrete structure is also accessible through a 0.6-m-diameter manway. Old, insulated steam lines and casings enter from the south, are valved, and leave the north side of the pit, presumably towards what was once the 5101 Bus Maintenance Facility and the 5104 Bus Depot. Asbestos is thought to be the only potential contaminant located in this sampling area.
- SA-3: Large Seepage Pit: Located near the southeast corner of the maintenance facility foundation, this pit consists of an approximately 0.8-m-diameter vertical concrete pipe filled to within about 1.4 m with soil and cobbles. This covered pit accepts three pipes from the foundation. This seepage pit was presumably designed to receive some form of liquid waste from the bus maintenance facility.

- SA-4: Small Seepage Pit: Located on the east side of the maintenance facility foundation, this pit consists of an approximately 0.4-m-diameter vertical concrete pipe filled to within about 0.5 m with soil and cobbles. This uncovered pit accepts two pipes from the foundation. This pit was presumably also designed to receive some form of liquid waste from the bus maintenance facility.
- SA-5: North Storm Drain: Located north of the concrete slab, this approximately 0.9-m-diameter storm drain is 0.9 m deep and is open to the soil column. The steel top is perforated to accept storm runoff. It is equipped with an overflow pipe that enters from the south and is presumably connected to the sewer system. Waste water containing hazardous materials may have been discharged to this drain during storm runoff periods.
- SA-6: South Storm Drain: Located on the south side of the concrete foundation, this drain is identical to SA-5, except for the orientation of the overflow pipe, which enters from the east.
- SA-7: Foundation Lube Pits: Located near the center of the concrete foundation, these four pits provided the automotive technicians with access to the bus undercarriage during maintenance operations. Each pit is 0.8 m × 16.2 m, and sub-level corridors connect these pits. While access stairways are located at the center and at one end, the pits have been backfilled with construction rubble. Consequently, the exact configuration of the pits is not known. Hazardous materials may have collected or accumulated at the bottom of these lube pits.
- SA-8: West Sanitary Sewer: This 0.6-m-diameter manway is located on the east side of the concrete foundation and provides access to the sewer lines coming into and out of the 5101 Bus Maintenance Facility. This facility may have used the sanitary sewer for disposal of some waste waters containing hazardous materials.
- SA-9: East Sanitary Sewer: Except for location and piping orientation, this sewer access is identical to SA-8. It is located to the east of SA-8 on the same downstream section of piping.
- SA-10: Fuel Island: This area where fuel was once dispensed is located to the east of the 5101 Bus Maintenance Facility. This 15.2-m-long island appears to have been equipped with two pumps. All that exists today is the concrete center strip, subsurface piping, and the surrounding asphalt driveway. Petroleum hydrocarbons may exist in the soils around the island due to spills and/or piping leaks.
- SA-11: Soil Depression: This 6-m × 15-m area is a visible soil depression located adjacent to the fuel island. The geophysical investigation confirmed that a UST was likely present in this location, but was subsequently removed. This survey showed that piping from the fuel island terminates at this depression, and that the original excavation was approximately 2.5 m. Petroleum hydrocarbons may exist in this area due to a leaking tank(s), piping, or from spills.

SA-12: Sub-Station: This area is an approximately 22.6-m × 28.7-m patch of soil exhibiting visible changes in plant-growth patterns. This is most likely due to the undisturbed nature of the soil in this area relative to adjacent areas. It is located just east of Stevens Drive between 6th and 7th Streets. Transformer oils may have spilled on the soil during operation of this facility.

SA-13: Discolored Surface Soil: Aerial photos show a distinct discoloration in the northeast corner of the study area. The size of this area is approximately 10,000 m². If surface soil contamination exists at the site, this location has the highest probability of contamination within the study area. This area contains the original surface soil sample taken during the removal of the Sixth Street Warehouse Petroleum Dispensing Station discussed in Section 1.3. Potential contamination is likely the result of oiling parking and driveway surfaces for dust and weed control.

SA-14: Unknown Buried Objects: The geophysical investigation identified a number of unknown buried metallic objects (Appendix C). These circular or oval shapes indicate the location of reasonably large localized objects or clusters of smaller objects. None of these exhibit a signature that is likely to represent a large tank. While most of these objects have subsequently been positively identified, four unknown buried objects remain. The geophysical investigation determined that these objects are very near to the surface (0 to 0.3 m)

SA-15: North Service Bay Approach: This area is adjacent to the Bus Maintenance Facility foundation at the north edge of the service-bay entrance. Hazardous materials may have been used to clean the floor and may have been allowed to flow out the service bay doors and onto the soil.

SA-16: South Service Bay Approach: This area is identical to SA-15, but is located on the south side of the foundation.

BA-1: Background Area: This area is where the 4103 and 4104 Office Buildings were once located. Due to the function of these facilities, hazardous materials were likely not used in this area.

2.5 STEP 5: DEVELOP DECISION RULE

The following decision rules summarize the attributes the decision maker needs to know about the sample population and how this knowledge will guide the selection of a course of action to solve the problem.

2.5.1 Parameters of Interest

The parameters of interest to the sampling program include the following:

Soil Gas Samples: Results of soil gas data will be in ppm in air. Since this sampling and analytical method will be used only as a screening tool, soil gas sample data will be used to form a baseline. Therefore, action levels listed in Table 2.2 will not apply to these data. Increased levels of any volatile organic contaminant in any of the sampling areas may indicate the need for further study in that area.

Soil Samples: No analytical result can exceed the established action level listed in Table 2.2.

Pipe Insulation Samples: No analytical result can exceed the established action level listed in Table 2.2.

2.5.2 Action levels

Since the study area is zoned as medium industrial (I-M) (City of Richland 1997), action levels have been established using MTCA soil cleanup standards for industrial soils and are summarized in Table 2.2 (Ecology 1996). The asbestos action level is based on the Toxic Substances Control Act (TSCA) limit (40 CFR 763).

Industrial soil levels were selected as action levels for several reasons. No residences exist within the study area, and onsite primary potential exposure would be limited to adult employees. Public access to the property is limited by postings and site security.

A childcare facility is located adjacent to the site (Figure A.1). The most probable exposure scenario for children at this facility would be inhaling contaminated, airborne dust or volatilized organics. Since any release of organics on the site would have occurred over 40 years ago, the probability of exposure due to inhalation of volatile organic contaminants is small. Exposure to inorganic COPCs could occur if contaminated dust particulates were transported with the northwest prevailing wind into the vicinity of the daycare facility. The primary exposure route of concern for inorganic COPCs is ingestion. Since the childcare facility is located adjacent to and not within the study area, the probability of exposure through ingestion is small.

It is recognized that the methods required to analyze soil and soil gas will return results for a much larger set of analytes than those listed in Table 2.2. Only those of potential concern are considered here. However, data for these additional analytes will also be screened against applicable action levels to ensure that all COPCs have been appropriately considered.

Table 2.2 Action Levels for Soil Contaminants

Contaminant Group	COPCs	Action level (mg/kg)
Metals	Cadmium	10.0
	Chromium	500.0
	Lead	1,000.0
PCBs (Aroclors)	1016, 1221, 1232, 1242, 1248, 1254, 1260	10.0
Pesticides	DDT	5.0
	Lindane	20.0
PAHs	Benzo(a)anthracene, Benzo(a)pyrene, Benzo(b)fluoranthene, Benzo(k)fluoranthene, Chrysene, Dibenzo(ah)anthracene, Indeno(1,2,3-cd)pyrene	20.0
Organics	TPH (Gasoline)	100.0
	TPH (Diesel, Other)	200.0
Volatile Organics	Benzene	0.5
	Ethylbenzene	20.0
	Toluene	40.0
	Xylenes	20.0
	Methylene Chloride	0.5
	Tetrachloroethylene	0.5
	Trichloroethylene	0.5
	1,1,1-Trichloroethane	20.0
Other	Asbestos	1 (%)

2.5.3 Alternative Actions

This SAP has been designed so that alternative actions will be taken based on the results from field and/or laboratory analytical data. This approach will ensure that data gaps are filled before the fieldwork is completed and will also ensure the implementation of a cost-effective field sampling program.

2.5.4 Developing Decision Rules

The decision rules for each decision identified in DQO Step 2 (Section 2.2) are summarized below. These if/then statements describe what action will be taken based on the results of the data collection.

Decision Rules 1-4: If the sample data exceed the applicable action levels, a more rigorous verification will be performed on that data set. Similar data from other sample locations within the study area will be compared to separate potentially contaminated sampling areas from non-contaminated areas. A check will also be performed to ensure that quality control requirements were met for these samples. The sample data will also be compared to background levels. If, after this verification step, the data still exceed the action levels, the need to make a regulatory notification will be evaluated.

If the sample data do not exceed the action levels, it will be concluded that a release of hazardous materials sufficient to pose a present day or future threat to human health or the environment has not occurred. A review of the data and concurrence with this conclusion by Ecology will be sought. If Ecology concurs, no further action will be required at the site. If Ecology does not concur, the need for formal regulatory notification will be evaluated.

This decision rule is further illustrated in the logic diagram shown in Figure 2.1.

Decision Rule 5: If the unknown buried objects identified during the geophysical investigation are determined to be potential sources of contamination, then preliminary soil samples will be taken in the vicinity of the objects to determine the potential for contamination from these sources. Any required analyses will be determined only after field identification of the objects. Further action will depend on the identity of the object(s), whether these objects could potentially contribute to contamination at the site, and the results of any samples taken in these areas.

Decision Rule 6: If asbestos is found to be present above the action level, several options will be considered. These will include no action, encapsulation, removal, or burial.

2.6 SPECIFY LIMITS ON DECISION ERROR

The following section identifies the criteria that will be used in the decision rules developed in the previous section. Detection-limit requirements will also be developed. Since the study is constrained to determining only whether hazardous materials are present in sufficient concentrations to warrant further action, and since the study will contain only focused sampling in areas where the potential for finding contamination is the greatest, a statistical approach will not be used. This is consistent with Ecology guidance (Ecology 1995a). No limits on decision errors are specified in this approach.

2.6.1 Regulatory Criteria

Since it has not yet been confirmed that a release of hazardous materials has occurred that would threaten human health or the environment, this activity is not regulated under MTCA. However, as mentioned above, MTCA cleanup levels for industrial soils will be used as action levels (the TSCA level will be used for asbestos). The concentrations of any hazardous substance in each sample will be compared directly with the applicable action level listed in Table 2.2.

980600054.6

Figure 2.1. Logic Diagram

2.6.2 Detection Limit Requirements

Laboratory methods, based upon those published in *Test Methods for Evaluating Solid Waste* (SW-846) will be used for all contaminant groups except asbestos (EPA 1996). Asbestos will follow the analytical procedure prescribed by EPA and found at 40 CFR 763, Subpart E,

Appendix E. Soil gas will be analyzed using the Battelle procedure PNNL-TVP-10. Analytical methods have been selected such that the practical quantitation limits (PQLs) for each analyte are below applicable action levels wherever possible. Method detection limits (MDLs) and PQLs for soils are summarized in Table 2.3. These detection levels are estimated; weight, volume and/or dilution factor variations are sample specific and may result in minor changes to the values listed.

Table 2.3 Method Detection Levels and Practical Quantitation Limits

Contaminant Group	Hazardous Substance	MDLs (mg/kg)	PQLs (mg/kg)
Metals (Method 6010A)	Cadmium	0.29	0.5
	Chromium	0.30	1.0
	Lead	4.76	10.0
PCBs (Aroclors) (Method 8081)	1016	0.00454	0.033
	1221	0.00454	0.033
	1232	0.00454	0.033
	1242	0.00454	0.033
	1248	0.00454	0.033
	1254	0.00281	0.033
	1260	0.00281	0.033
Pesticides	DDT	0.261	1.7
	Lindane	0.456	1.7
PAHs (Method 8310)	Benzo(a)anthracene	0.00181	0.0043
	Benzo(a)pyrene	0.00075	0.0076
	Benzo(b)fluoranthene	0.00310	0.0059
	Benzo(k)fluoranthene	0.00144	0.0056
	Chrysene	0.00087	0.050
	Dibenzo(ah)anthracene	0.00325	0.0099
	Indeno(1,2,3-cd)pyrene	0.00223	0.014
Organics (Methods WTPH-G, D)	TPH (Gasoline)	0.081	5.0
	TPH (Diesel, Other)	79.43	250.0
Volatile Organics (Method 8260)	Benzene	0.042	0.25
	Ethylbenzene	0.065	0.25
	Toluene	0.040	0.25
	Xylenes	0.05	0.25
	Methylene Chloride	0.19	0.25
	Tetrachloroethylene	0.046	0.25
	Trichloroethylene	0.10	0.25
	1,1,1-Trichloroethane	0.045	0.25
Volatile Organics (PNNL-TVP-10)	(Appendix E)	-	-
Other (Method EPA/600/R-93/116)	Asbestos	1 (%)	1 (%)

2.7 STEP 7: OPTIMIZE THE DESIGN FOR OBTAINING DATA

Due to the historical information that was obtained during the site-investigation phase, and because of the visible, distinct features at the site, this sampling activity will be constrained to focused sampling only. Sampling will be performed in each of the 16 SAs and the background area defined in Section 2.4. As mentioned in that section, if contamination exists at the site, the potential is greatest that it would be located in these areas.

Based on the information presented in Sections 1.1 and 1.3, there is a potential for organic and inorganic contamination to exist at the site (Table 1.2). These may have been discharged to the soil column either in specific locations (seepage pits) or may have been spread onto the soil for the purpose of dust suppression and/or weed control.

Specific discharges may have contained waste gasoline, oils, solvents, and/or anti-freeze. In addition, waste oil spread for dust control may have contained PCB and metal contaminants. It is expected that the more mobile organic constituents may have migrated through the soil column and may have reached groundwater several years ago. However, current data from area wells show that the groundwater is free of these contaminants in concentrations that exceed action levels. Less mobile organic and inorganic contaminants may reside at or near the soil surface or in the vadose zone.

The approach will be to focus on organic and inorganic contaminants that may reside at or near the surface of the soil column. These may include metals, PCBs, PAHs and TPHs, and volatile organics. Presence of these contaminants near the surface would indicate a potential for subsurface contamination. Soil gas sampling will also be conducted as an indicator of whether contamination exists in the vadose zone. Thus, conclusions about potential contamination in the vadose zone will be made from indicator data obtained from this near surface study.

The number and type of samples required in each area, along with the estimated sampling and analytical costs, are summarized in Table 2.4. SA-14 has not been entered in the table since the need for sampling in these locations will be determined in the field.

Sample nomenclature will be as follows: "SA," followed by a number, will indicate the sample area in which the sample was taken (Section 2.4). The second set of letters will indicate the type of sample taken:

- I: Insulation sample
- S: Bulk surface soil sample
- SS: Bulk sub-surface soil sample
- SG: Soil gas sample
- V: Volatile organic soil sample

The last number indicates the number taken of that sample type within the sample area (e.g., Sample #SA3-S-2 would indicate the second soil sample taken within Sampling Area 3). Field duplicate samples will end with the letter "D" (e.g., SA3-S-2D), and trip blanks will be

labeled "TB" followed by the batch/trip number (e.g., TB-1). The rinse blank will be labeled RB-1.

Table 2.4 Sample Frequency and Cost

Sampling Area	Surface Soil Samples	Sub-Surface Soil Samples	Volatile Organic Soil Samples	Soil Gas Probe Samples	Insul. Samples	Method								Estimated Cost
						6 0 0 A	8 0 1 1	8 3 1 0	W T P H D	W T P H G	8 2 6 0	PNNL- TVP- 10	EPA/ 600/ R-93/ 116	
SA-1	SA1-S-1					x	x	x	x					\$710
		SA1-SS-1				x	x	x	x					\$710
			SA1-V-1							x	x			\$382
				SA1-SG-1								x		\$234
					SA1-I-1								x	\$154
					SA1-I-2								x	\$154
SA-2	SA2-S-1					x	x	x	x					\$710
				SA2-SG-1								x		\$234
					SA2-I-1								x	\$154
					SA2-I-2								x	\$154
SA-3	SA3-S-1					x	x	x	x					\$710
		SA3-SS-1				x	x	x	x					\$710
			SA3-V-1							x	x			\$382
				SA3-SG-1								x		\$234
SA-4	SA4-S-1					x	x	x	x					\$710
		SA4-SS-1				x	x	x	x					\$710
			SA4-V-1							x	x			\$382
				SA4-SG-1								x		\$234
SA-5	SA5-S-1					x	x	x	x					\$710
		SA5-SS-1				x	x	x	x					\$710
			SA5-V-1							x	x			\$382
				SA5-SG-1								x		\$234
SA-6	SA6-S-1					x	x	x	x					\$710
		SA6-SS-1				x	x	x	x					\$710
			SA6-V-1							x	x			\$382
				SA6-SG-1								x		\$234
SA-7	SA7-S-1					x	x	x	x					\$710
SA-8	SA8-S-1					x	x	x	x					\$710
SA-9	SA9-S-1					x	x	x	x					\$710
SA-10	SA10-S-1					x	x	x	x					\$710
		SA10-SS-1				x	x	x	x					\$710
			SA10-V-1							x	x			\$382
				SA10-SG-1								x		\$234
SA-11	SA11-S-1					x	x	x	x					\$710
		SA11-SS-1				x	x	x	x					\$710
		SA11-SS-2				x	x	x	x					\$710
		SA11-SS-3				x	x	x	x					\$710
		SA11-SS-4				x	x	x	x					\$710
		SA11-SS-5				x	x	x	x					\$710
			SA11-V-1							x	x			\$382
			SA11-V-2							x	x			\$382
			SA11-V-3							x	x			\$382
			SA11-V-4							x	x			\$382
			SA11-V-5							x	x			\$382
				SA11-SG-1								x		\$234
SA-12	SA12-S-1					x	x	x	x					\$710
		SA12-SS-1				x	x	x	x					\$710
			SA12-V-1							x	x			\$382
				SA12-SG-1								x		\$234
SA-13	SA13-S-1					x	x	x	x					\$710
	SA13-S-2					x	x	x	x					\$710
		SA13-SS-1				x	x	x	x					\$710
		SA13-SS-2				x	x	x	x					\$710

Sampling Area	Surface Soil Samples	Sub-Surface Soil Samples	Volatile Organic Soil Samples	Soil Gas Probe Samples	Insul. Samples	Method								Estimated Cost
						600A	801	803	WTPHD	WTPHG	8260	PNNL-TVP-10	EPA/600/R-93/116	
SA-13 (cont.)			SA13-V-1							x	x			\$382
			SA13-V-2							x	x			\$382
				SA13-SG-1								x		\$234
				SA13-SG-2								x		\$234
SA-14				SA14-SG-1								x		\$234
SA-15				SA15-SG-1								x		\$234
SA-16				SA16-SG-1								x		\$234
BA-1	BA1-S-1					x	x	x	x					\$710
	BA1-S-2					x	x	x	x					\$710
		BA1-SS-1				x	x	x	x					\$710
		BA1-SS-2				x	x	x	x					\$710
			BA1-V-1							x	x			\$382
			BA1-V-2							x	x			\$382
				BA1-SG-1								x		\$234
				BA1-SG-2								x		\$234
Labor														\$5,900
TOTAL	16	16	16	16	4	32	32	32	32	16	16	16	4	\$39,000

3.0 QUALITY ASSURANCE PROJECT PLAN

The following section identifies the individuals or organizations participating in the project and discusses specific roles and responsibilities. This section also discusses the quality objectives for measurement data and discusses the special training requirements for the staff performing the work.

3.1 PROJECT MANAGEMENT

This section addresses the basic areas of project management and will ensure that the project has a defined goal, that the participants understand the goal and the approach to be used, and that the planned outputs have been appropriately documented.

3.1.1 Project/Task Organization

The project will be managed through the Legacy Waste and Contamination Project managed by an assigned project manager. The Environmental Science and Systems Analysis Departments will be responsible for collecting, packaging, and shipping samples and for coordinating analytical services and data management. The Environmental Management Services and Safety and Health Departments will provide environmental, occupational safety, and industrial hygiene support as required, while a representative from the Quality Directorate will be responsible for performing an independent quality assurance review. Specific staff and their project assignments are more fully discussed in Section 2.1.

3.1.2 Quality Objectives and Criteria for Measurement Data

The PQLs should be approximately 5% of the action level wherever practical. This will be verified by a review of the laboratory's quoted MDLs and PQLs against the action levels. Table 3.1 summarizes detection limits and action levels.

Data quality expectations for the analytical laboratory are as follows. The laboratory is expected to:

- demonstrate contamination control by a method blank free of contamination that would impact the reported results.
- demonstrate proper application of preparative and analytical methodology by producing a laboratory control sample (LCS) and/or a blank surrogate spike that meets established limits.
- demonstrate effective sub-sampling by achieving a RPD of 20 for sample duplicates and matrix spike duplicates.

- Demonstrate method control with the matrix by achieving a percent recovery that falls within established limits for the matrix spike and matrix spike duplicate.

Table 3.1 Summary of Detection Limits and Action Levels

Media	Analytical Method	Analytical Parameter	MDL (mg/kg)	PQL (mg/kg)	Action level (mg/kg)
Soil	6010A	Cadmium	0.29	0.5	10.0
		Chromium	0.30	1.0	500.0
		Lead	4.76	10.0	1,000.0
	8081	(Aroclor) 1016	0.00454	0.033	10
		1221	0.00454	0.033	10.0
		1232	0.00454	0.033	10.0
		1242	0.00454	0.033	10.0
		1248	0.00454	0.033	10.0
		1254	0.00281	0.033	10.0
		1260	0.00281	0.033	10.0
		DDT	0.261	1.7	5.0
		Lindane	0.456	1.7	20.0
	8310	Benzo(a) anthracene	0.00181	0.0043	20.0
		Benzo(a)pyrene	0.00075	0.0076	20.0
		Benzo(b)fluoranthrene	0.00310	0.0059	20.0
		Benzo(k)fluoranthene	0.00144	0.0056	20.0
		Chrysene	0.00087	0.050	20.0
		Dibenzo(ah)anthracene	0.00325	0.0099	20.0
		Indeno(1,2,3-cd)pyrene	0.00223	0.014	20.0
	WTPH-G	TPH (Gasoline)	0.081	5.0	100.0
	WTPH-D	TPH (Diesel, Other)	79.43	250.0	200.0
	8260	Benzene	0.042	0.25	0.5
		Ethylbenzene	0.065	0.25	20.0
		Toluene	0.040	0.25	40.0
		Xylenes	0.05	0.25	20.0
		Methylene Chloride	0.19	0.25	0.5
		Tetrachloroethylene	0.046	0.25	0.5
		Trichloroethylene	0.10	0.25	0.5
		1,1,1-Trichloroethane	0.045	0.25	20.0
Soil Gas	PNNL-TVP-10	Volatile Organics (Appendix E)	-	-	-
Pipe Insulation	EPA/600/R-93/116	Asbestos	1 (%)	1 (%)	1 (%)

Timely notification to the Analytical Technical Administrator (DL Stewart) is required when any result exceeds the action level when considering the reported value and QC performance. Notification shall be made by E-mail or by an Issue of Resolution Form (Section 3.2.7).

3.1.3 Special Training Requirements/Certification

General training requirements for PNNL field staff are described in the internal PNNL "Training and Qualification for Staff" Standards Based Management System (SBMS) Subject Area. Training course descriptions are listed in the PNNL Course Catalog. Specific staff training requirements as they apply to each SA are as follows:

All SAs, BA: PNNL Hazards Communication Training #671

SA-1, 2: TSCA Title II EPA AHERA/ASHARA Model Accreditation
(40 CFR 763)

SA-1, 2, 3, 7, 8, 9: PNNL Confined Space Entry Training #694

Remote sampling will be used as much as is practicable. Remote sampling may preclude having to enter one or more of these confined spaces.

Specific training requirements for laboratory analytical staff will be listed in the laboratory's Quality Assurance Plan. Laboratory staff are expected to be qualified for the work they perform. Laboratories are considered qualified if they have been evaluated by the Hanford Integrated Contractor Assessment Team (ICAT) for compliance to the Hanford contract.

3.1.4 Documentation and Records

Sampling activities will be documented in a controlled, bound, field logbook. Samples will be documented using field record sheets. The logbook will be filled out daily as appropriate and will include information on sample number, global positioning system (GPS) sample location, collection date and time, field-instrument measurements, site-specific observations, weather conditions, etc. Copies of maps, chain-of-custody forms, and other supplemental materials will be placed into a separate file folder in the project file. Any corrections will be made by a single strike through the information and initialed and dated by the person making the correction. The logbook will be the official record of the sampling activities. The project file will be an attachment of the logbook. A field notebook and/or field record sheets will be used to document sample collection. Transfer of samples between personnel and delivery to the analytical laboratories will be documented on chain-of-custody forms.

Chain-of-custody forms must accompany all samples to the laboratory and must remain with the samples in the laboratory through sample analysis to final reporting. Each laboratory will provide a summary data package that must, at a minimum, include

- Sample numbers referenced to field sample numbers
- Date/time of sample preparation and analysis
- Narrative, to include references to preparative and analytical methods employed as well as a discussion of data quality
- Results, dry weight and including percent solid
- Units (mg/kg)
- Quality control data
- Original chain-of-custody forms.

Results shall be reported to the MDL, with appropriate qualification of data falling between the MDL and PQL.

Upon completion of the study, all documentation will be retained in the project file for a period of at least 5 years.

3.2 MEASUREMENT/DATA ACQUISITION

The following section presents the requirements for sampling methods, sample handling and custody, analytical methods, and field and laboratory quality control. This section also addresses the requirements for instrument calibration and maintenance, supply inspections, and data management.

3.2.1 Sampling Methods Requirements

All soil-sampling activities will focus on surface or near-surface sampling (0 to 3.5 m below ground surface). Most soil samples will be collected at the surface using stainless steel implements (shovels, split spoon core sampler, etc.). Deeper soil samples will be taken using a backhoe where soil samples will be collected directly out of the backhoe bucket and transferred immediately into sample containers.

Active soil gas samples will be taken from 1.8-m probes installed in the ground to a depth of 1.2 m.

Pipe-insulation samples will be taken using an asbestos bulk sampler manufactured by Wonder Marker, Inc.

3.2.2 Sample Handling and Custody Requirements

Sample labels will be affixed to each container indicating the sample number, collection date and time, and person collecting the sample. Each sample will be assigned a unique alphanumeric code (Table 2.4) indicating the site, matrix type, and sample number.

Each laboratory will maintain custody of the samples through report and final disposition. All results will be traceable to the original chain of custody and this SAP.

3.2.3 Sample Preservation, Containers, and Holding Times

Soil gas samples will be collected in triple sorbent traps. Volatile organic soil samples will be collected in 40-mL vials with 10 g methanol. Bulk soil samples will be collected in glass wide-mouth jars. All samples will be stored in ice chests maintained at 4° C +/- 2° until they are transported to the laboratory, where they will be refrigerated at the same temperature.

Transportation of samples from the field to PNNL will occur at the end of each day. All soil samples will then be shipped together at the end of the sampling activity. All holding times required by the applicable SW-846 method will be complied with. Holding times shall be based upon date of collection, consistent with SW-846.

Asbestos samples will be collected in stainless steel collars within plastic vials provided in the Asbestos Bulk Sampler kit manufactured by Wonder Makers, Inc. Samples will be wetted as they are taken. No sample preservation is required for any of the samples.

3.2.4 Analytical Methods Requirements

Analytical methods and data quality requirements are summarized in Section 3.1.2. Performance requirements, required equipment, extraction methods, laboratory documentation procedures, and waste disposal requirements will be contained in laboratory-developed procedures for these methods. Laboratories are considered qualified if they have been evaluated by the Hanford ICAT for compliance to the Hanford contract.

3.2.5 Quality Control Requirements

QC procedures must be followed in the field and laboratory to ensure that reliable data are obtained. When performing this field sampling effort, care shall be taken to prevent the cross-contamination of sampling equipment, sample bottles, and other equipment that could compromise sample integrity. Field duplicate samples will be taken at a frequency of 5%, and a trip blank will be sent with each volatile organic sample shipment. A single rinsate blank will be taken prior to work on the last day of field sampling.

The Quanterra laboratory will be required to prepare a method blank for all techniques and a LCS for all analyses that do not employ surrogates, unless the method dictates otherwise. Further, the laboratory will be required to prepare these while analyzing sample batches resulting from this study. Inorganic analysis shall include a duplicate and matrix spike per batch, and organic analyses shall include a matrix spike and a matrix spike duplicate.

The WSCF laboratory will provide the results of the daily contamination check and instrument calibration. The laboratory will also perform the 10% alternate analyst check on one of the pipe-insulation samples sent.

QC requirements for soil gas analysis are described in the PNNL-TVP-10 analytical procedure.

3.2.6 Instrument/Equipment Inspection, Maintenance and Calibration Requirements

All field screening and analytical instruments will be tested, inspected, and maintained in good condition. Labels or tags will be attached to all field screening and onsite analytical instruments, noting the date when the instrument was last calibrated along with the calibration expiration date. Instrument calibration information will be recorded in the sampling logbook.

All inspection, maintenance, and calibration standards and requirements for laboratory equipment will be outlined in each laboratory Quality Assurance Plan. All results reported to support this project will be traceable to a valid calibration. Laboratories are considered qualified if they have been evaluated by the Hanford ICAT for compliance to the Hanford contract.

3.2.7 Data Management

Sample results reporting will be performed on a turnaround time of no more than 45 days upon receipt of the samples at each laboratory. Analytical results should be sent to the Analytical Technical Administrator at

Battelle, Pacific Northwest Division
c/o DL Stewart
902 Battelle Boulevard
PO Box 999, MSIN K6-96
Richland, WA 99352
Tel: (509) 376-5056
FAX: (509) 372-1704
E-mail: dot.stewart@pnl.gov

Failure to meet the turnaround specified requires timely notification.

Data will be in the form of a summary report using the standard laboratory format, which will include, at a minimum, the information listed in Section 3.1.4. Both an electronic and hard copy will be sent. The laboratory will immediately report any departures from the listed procedures and requirements in this SAP to the Analytical Technical Administrator.

Data resulting from the implementation of this SAP will be managed and maintained by RCHN Facility Operations. All reports and supporting analytical data packages will be subject to final

technical review by qualified reviewers before their submittal to regulatory agencies or inclusion in reports or technical memoranda, at the direction of the Principal Investigator. Electronic data access, when appropriate, shall be through computerized databases [i.e., HEIS]).

3.3 DATA VERIFICATION AND USABILITY

3.3.1 Data Review and Verification Requirements

Data verification is performed on analytical data sets, primarily to confirm that sampling and chain-of-custody documentation is complete, sample numbers can be tied to the specific sampling location, samples were analyzed within the required holding times, analyses met the data quality requirements specified in this plan, and that overall traceability has been maintained.

3.3.2 Verification Methods

The Environmental Science and Systems Analysis Department will perform all data verification in accordance with PNL-MA-567, *Procedures for Groundwater Investigations*.

4.0 FIELD SAMPLING PLAN

4.1 SAMPLING OBJECTIVES

The objective of the field sampling plan (FSP) is to clearly identify the sampling and analysis activities needed to resolve the decision rules identified in Step 5 of the DQO process (Section 2.5). The FSP takes the sampling design proposed in Step 7 of the DQO process (Section 2.7) and presents this design using figures and tables whenever possible to identify sampling locations, total number of samples to be collected, sampling procedures to be implemented, analyses to be performed, and sample-container requirements.

4.2 SAMPLING LOCATIONS AND FREQUENCY

Field screening for radiological constituents and volatile organic compounds will be performed during sampling activities for personnel protection and the possible presence of any undocumented hazardous materials. Hand held alpha (Hanford portable alpha monitor [PAM], Alpha Scintillation Probes and Bicon Surveyor X) and beta/gamma (Eberline E140 or Bicon Surveyor with Pancake Geiger-Meuller [GM] Detector) detectors will be used for detecting potential ionizing radiation. Hand-held organic vapor monitors (Flame Ionization Detector or Photo Ionization Detector) will be used for potential volatile organic constituents

As summarized in Table 2.4, samples will be taken in each of the SAs (Figures A.3, A.4, A.5). Information relating to each specific sampling location is provided as follows:

SA-1: Underground Enclosure: A single 1.8-m soil gas probe will be installed at the surface adjacent to the enclosure to a depth of 1.2 m and allowed to equilibrate for 24 hours. An active soil gas sample will then be taken in a triple sorbent trap. A single surface-soil sample will be taken at the floor of the pit using a small shovel or trowel. If conditions warrant, two additional samples will be taken at the same location at a depth of 0.6 m using a split spoon core sampler if soil conditions warrant. A shovel may be an alternate choice, depending on the amount of cobbles at the sampling location. The soil sampling will attempt to collect only fine-grain soil materials. The soil samples will be surveyed with the OVA, GM, and PAM screening instruments. The surface sample and one sub-surface sample will each be placed in 250-mL wide-mouth glass jars. The other sub-surface sample will be placed in a 40-mL volatile organic analysis (VOA) vial containing methanol. Two samples of pipe insulation will be taken at random locations within the enclosure using the Asbestos Bulk Sampler manufactured by Wonder Makers, Inc. The samples will be wetted as they are taken and will be placed in stainless steel tubes inside plastic tubes provided in the sampling kit.

- SA-2: Steam Pit: A single 1.8-m soil gas probe will be installed at the surface adjacent to the enclosure to a depth of 1.2 m and allowed to equilibrate for 24 hours. An active soil gas sample will then be taken in a triple sorbent trap. A single surface soil sample will be taken at the floor of the pit using a small shovel or trowel. The soil sampling will attempt to collect only fine-grain soil materials. The soil sample will be surveyed with the OVA, GM, and PAM screening instruments. The sample will be placed in 250-mL wide-mouth glass jars. Two samples of pipe insulation will be taken at random locations within the enclosure using the Asbestos Bulk Sampler manufactured by Wonder Makers, Inc. The samples will be wetted as they are taken and will be placed in stainless steel tubes inside plastic tubes provided in the sampling kit.
- SA-3: Large Seepage Pit: A single 1.8-m soil gas probe will be installed adjacent to the pit to a depth of 1.2 m and allowed to equilibrate for 24 hours. An active soil gas sample will then be taken in a triple sorbent trap. Sufficient cobble will be removed from the bottom of the pit to take a surface soil (0 to 0.2 m) sample using a small hand shovel. Two additional samples will be taken at the same location at a depth of 0.6 m from the bottom of the pit using a split-spoon core sampler if soil conditions warrant. A shovel may be an alternate choice depending on the amount of cobbles at the sampling location. The soil sampling will attempt to collect only fine-grain soil materials. The soil samples will be surveyed with the OVA, GM, and PAM screening instruments. The surface sample and one sub-surface sample will each be placed in 250-mL wide-mouth glass jars. The other sub-surface sample will be placed in a 40-mL VOA vial containing methanol.
- SA-4: Small Seepage Pit: Same as SA-3.
- SA-5: North Storm Drain: A single 1.8-m soil gas probe will be installed adjacent to the pit to a depth of 1.2 m and allowed to equilibrate for 24 hours. An active soil gas sample will then be taken in a triple sorbent trap. A single surface-soil sample will be taken at the bottom of the drain using a small hand shovel. Two additional samples will be taken at the same location at a depth of 0.6 m from the bottom of the drain using a split-spoon core sampler if soil conditions warrant. A shovel may be an alternate choice, depending on the amount of cobbles at the sampling location. The soil sampling will attempt to collect only fine-grain soil materials. The soil samples will be surveyed with the OVA, GM, and PAM screening instruments. The surface sample and one sub-surface sample will each be placed in 250-mL wide-mouth glass jars. The other sub-surface sample will be placed in a 40-mL VOA vial containing methanol.
- SA-6: South Storm Drain: Same as SA-5.
- SA-7: Foundation Lube Pits: A section of one of the lube pits will be excavated. A single soil sample will be taken at the floor of the pit using a small shovel. The soil sampling will attempt to collect only fine-grain soil materials. The soil sample will be surveyed with the OVA, GM, and PAM screening instruments. The sample will be placed in a 250-mL wide-mouth glass jar.

SA-8: West Sanitary Sewer: A single surface soil sample will be taken at the floor of the enclosure using a small shovel. The soil sampling will attempt to collect only fine-grain soil materials. The soil sample will be surveyed with the OVA, GM, and PAM screening instruments. The sample will be placed in a 250-mL wide-mouth glass jar.

SA-9: East Sanitary Sewer: Same as SA-8.

SA-10: Fuel Island: A 1.8-m soil gas probe will be installed at the terminus of the north gas pump fuel line adjacent to the asphalt fuel island to a depth of 1.2 m and allowed to equilibrate for 24 hours. An active soil gas sample will then be taken in a triple sorbent trap. A surface soil sample will be taken adjacent to the soil gas sampling location using a small hand shovel. Two additional samples will be taken at the same location at a depth of 0.6 m using a split-spoon core sampler if soil conditions warrant. A shovel may be an alternate choice depending on the amount of cobbles at the sampling location. The soil sampling will attempt to collect only fine-grain soil materials. The soil samples will be surveyed with the OVA, GM, and PAM screening instruments. The surface sample and one sub-surface sample will each be placed in 250-mL wide-mouth glass jars. The other sub-surface sample will be placed in a 40-mL VOA vial containing methanol.

SA-11: Tank Depression: A single 1.8 m soil gas probe will be installed within the area of the depression to a depth of 1.2 m and allowed to equilibrate for 24 hours. An active soil gas sample will then be taken in a triple sorbent trap. A surface-soil sample will be taken adjacent to the soil gas-sampling location using a small hand shovel. Two additional samples will be taken at the same location at a depth of 0.6 m using a split-spoon core sampler if soil conditions warrant. A shovel may be an alternate choice depending on the amount of cobbles at the sampling location. The surface sample and one sub-surface sample will each be placed in 250-mL wide-mouth glass jars. The other sub-surface sample will be placed in a 40-mL VOA vial containing methanol. A backhoe will then be used to excavate to the bottom of the original excavation at the same sampling location. Data from the geophysical investigation indicate this depth to be between 2.4 to 3.0 m. Evidence such as a change in sediment layers, soil composition, and soil color will also be used to determine when this depth has been reached. Once it has become evident that the backhoe has reached the bottom of the original excavation, a bucket of soil will be brought to the surface and six random samples will be taken from soil in the bucket. Three of these will be placed in 250-mL wide-mouth glass jars. The other three will be placed in 40-mL VOA vials containing methanol. The soil sampling will attempt to collect only fine-grain soil materials. All soil samples will be surveyed with the OVA, GM, and PAM screening instruments.

SA-12: Sub-Station: A single 1.8-m soil gas probe will be installed within the boundaries of this sampling area to a depth of 1.2 m and allowed to equilibrate for 24 hours. An active soil gas sample will then be taken in a triple sorbent trap. A surface-soil sample will be taken adjacent to the soil gas sampling location using a small hand shovel. Two additional samples will be taken at the same location at a depth of 0.6 m using a split-spoon core sampler if soil conditions warrant. A shovel may be an alternate choice depending on the amount of cobbles at the sampling location. The soil sampling will attempt to collect

only fine-grain soil materials. The soil samples will be surveyed with the OVA, GM, and PAM screening instruments. The surface sample and one sub-surface sample will each be placed in 250-mL wide-mouth glass jars. The other sub-surface sample will be placed in a 40 mL VOA vial containing methanol.

SA-13: Surface Contamination: Two 1.8-m soil gas probes will be installed within this sampling area to a depth of 1.2 m and allowed to equilibrate for 24 hours. An active soil gas sample will then be taken in a triple sorbent trap. Two surface soil samples will be taken adjacent to the soil gas sampling locations using a small hand shovel. Two additional samples will also be taken at each location at a depth of 0.6 m using a split-spoon core sampler if soil conditions warrant. A shovel may be an alternate choice depending on the amount of cobbles at the sampling location. The soil sampling will attempt to collect only fine-grain soil materials. The soil samples will be surveyed with the OVA, GM, and PAM screening instruments. The surface samples and one each of the sub-surface samples will each be placed in 250-mL wide-mouth glass jars. The other sub-surface samples will be placed in a 40-ml VOA vial containing methanol.

SA-14: Unknown Buried Objects: The backhoe will be used to excavate to the top of the object(s). As these objects are identified, decisions will be made in the field if soil sampling is warranted.

SA-15: North Service Bay Approach: A single 1.8-m soil gas probe will be installed within this sampling area to a depth of 1.2 m and allowed to equilibrate for 24 hours. An active soil gas sample will then be taken in a triple sorbent trap.

SA-16: South Service Bay Approach: Same as SA-15.

BA-1: Background Area: Two soil gas probes will be installed within this sampling area to a depth of 1.2 m and allowed to equilibrate for 24 hours. Active soil gas samples will then be taken in either a 500-mL glass collection flask, a tedlar gas-sampling bag, or a triple sorbent trap. Two surface soil samples will be taken adjacent to the soil gas sampling locations using a small hand shovel. Samples will also be taken at the same locations to a depth of 0.6 m using a split-spoon core sampler if soil conditions warrant. A shovel may be an alternate choice, depending on the amount cobbles at the sampling location. The soil sampling will attempt to collect only fine-grain soil materials. The soil samples will be surveyed with the OVA, GM, and PAM screening instruments. Each sample will be placed in a 250-mL wide-mouth glass jar.

4.3 SAMPLE MANAGEMENT

Sampling activities will be documented in a controlled, bound, field logbook. Samples will be documented using field record sheets. The logbook will be filled out daily as appropriate and will include information on sample number and GPS location, collection date and time, field instrument measurements, site-specific observations, weather conditions, etc. Copies of maps, chain-of-custody forms, and other supplemental materials will be placed into a separate file

folder in the project file. Any corrections will be made by a single strike through the information and initialed and dated by the person making the correction. The logbook will be the official record of the sampling activities. The project file will be an attachment of the logbook.

Sample labels will be affixed to each container indicating the sample number, collection date and time, and person collecting the sample. Each sample will be assigned a unique alphanumeric code (Table 2.4) indicating the site, matrix type, and sample number. All samples will be stored in ice chests maintained at 4° C +/- 2° C until they are delivered to the laboratory, where they will be refrigerated at the same temperature. All soil and soil gas samples will be transported to PNNL at the end of each work day. Chain-of-custody forms must accompany all samples. Transfer of samples between personnel and delivery to the analytical laboratories will be documented on chain-of-custody forms. Soil gas samples will be delivered to the Sigma V Laboratory where they will be refrigerated until they are analyzed. Pipe insulation samples will be immediately transported to the WSCF Laboratory. All other samples will be transported to PNNL where they will be refrigerated until all the samples have been collected. The samples will then together be transported to the Quanterra/Richland Laboratory for subsequent shipment to the Quanterra/St. Louis Laboratory for analysis. Sample management, preservation and holding-time requirements prescribed in the applicable SW-846 methods shall be complied with. Movement of samples containing hazardous materials will be in accordance with the *Packaging and Shipping Hazardous Materials* SBMS Subject Area.

The laboratories were selected from those capable of providing the appropriate analysis and under a present contract to support the Hanford Site. Additional requirements included the certification of analysis rigor and documentation that fulfill the purpose of this investigation.

4.4 CULTURAL AND ECOLOGICAL RESOURCE REVIEWS

The Hanford Cultural Resources Laboratory (HCRL) performed Cultural and Ecological Resource Reviews for the study area. Approval to perform this work was obtained in October 1997. Due to minor changes in scope, the HCRL performed follow-up cultural⁵ and ecological⁶ reviews in June, 1996. Staff are directed to watch for cultural materials (e.g., bones, artifacts) during all work activities. If any are encountered, work in the vicinity of the discovery must stop until an HCRL archaeologist has been notified, has assessed the significance of the find, and, if necessary, arranged for mitigation of the impacts to the find. No cultural or ecological impacts are expected from this study.

5 Memo, NA Cadoret to RR Nielson, *Cultural Resources Review of the Camp Hanford Bus Lot Site Investigation and Characterization – Scope Change*. HCRC #98-NRCH-001A, 6/19/98.

6 Memo, CA Brandt to RR Nielson, *Biological Review of the Abandoned Bus Lot Sampling Project, NRCH Area*, ECR #98-NRCH-001a, 6/26/98.

4.5 MANAGEMENT OF INVESTIGATION-DERIVED WASTE

Field investigation-derived waste (water rinsate, paper towels, etc.) will be managed in accordance with PNL-MA-8, *Waste Management and Environmental Compliance*, and the *Managing Non-Radioactive Chemical Waste* SBMS subject area. No chemical wastes are expected to be generated from field sampling activities. Investigation-derived waste generated from analytical activities at Sigma V will also be managed in accordance with these requirements. Unused samples and associated laboratory waste for analyses performed at offsite laboratories will be dispositioned in accordance with the existing laboratory contract and agreements to manage and dispose of the waste at these laboratories.

4.6 SITE RESTORATION

Soil-sample locations will be backfilled with the excavated soils so as to restore the site to pre-work conditions.

5.0 HEALTH AND SAFETY

All field operations will be performed in accordance with internal PNNL health and safety requirements outlined in controlled manuals and SBMS Subject Areas. These include PNL-MA-43, *Industrial Hygiene, Occupational Safety and Fire Protection Programs*, as well as SBMS Subject Areas *Confined Space Entry, Working at Heights, Personal Protective Clothing and Equipment, Noise, and Safety Rights and Responsibilities*. In addition, a job planning package (JPP) has been prepared in accordance with PNL-MA-761, *Maintenance Services Policies*, which will further control site operations. This package includes an activity hazards analysis as well as a review of hazard-control methods, job-site requirements, and personnel qualifications. The JPP is included with this document as Appendix F.

6.0 REFERENCES

40 CFR 763, *Asbestos*, U.S. Environmental Protection Agency, Washington, D.C.

Advanced Advertising. 1983. *Alive, Richland and the Hanford Project*, Richland, Washington.

Army Corps of Engineers. 1951. *Camp Hanford Basic Information Maps*, 18-02-03 through 18-02-10, Army Corps of Engineers, Walla Walla, Washington.

City of Richland Municipal Code. 1997. *Zoning District Regulations*, Title 23, Chapter 42, Richland, Washington.

Pacific Northwest National Laboratory (PNNL). 1997a. *Hanford Site Groundwater Monitoring for Fiscal Year 1997*, PNNL-11793, Richland, Washington.

Pacific Northwest National Laboratory (PNNL). 1997b. *Hanford Site 1996 Environmental Report*, PNNL-11472, Richland, Washington.

Richland Villager. 1947. *Rush No. Richland Housing. Barracks, Trailer City Get Building Priority, Area to House 16,000*, November 9, 1947, pg. 1.

Richland Villager. 1948a. *First 5,000 in North Richland. Rush Construction of Quarters and Facilities to House 20,000 More*, January 22, 1948, pg. 1.

Richland Villager. 1948b. *New Area Bus Lot is Completed*, August 12, 1948, pg. 1.

U.S. Environmental Protection Agency (EPA). 1994. *Guidance for the Data Quality Objectives Process*, EAP QA/G-4, U.S. Environmental Protection Agency, Washington, D.C.

U.S. Environmental Protection Agency (EPA). 1996. *Test Methods for Evaluating Solid Waste*, SW-846, US Environmental Agency, Washington, D.C.

Washington State Department of Ecology (Ecology). 1995a. *Guidance on Sampling and Data Analysis Methods*, Publication #94-49, Olympia, Washington.

Washington State Department of Ecology (Ecology). 1995b. *Guidance for Remediation of Petroleum Contaminated Soils*, Olympia, Washington.

Washington State Department of Ecology (Ecology). 1996. *Model Toxics Control Act Cleanup Regulation*, Olympia, Washington.

APPENDIX A

Figures A.1 thru A.5

Richland Research Complex Annex

Figure A.

6th Street

Warehouse

Operations Support Building

KinderCare

5th Street

5110 Private Bus Depot

5104 Construction Bus Depot

5101 Bus Maintenance Facility

Study Area Boundaries
Backgroud Area Boundary
Original Facilities

980600054.1

on Well

ental Air Sampler

699-S36-E13A
Ground Water
Well

ary Sewer

Seepage Pit

Discolored
Soil Area

Soil Depression

East
Sanitary
Sewer

uel Island

ary Sewer

out

epage Pit

699-S36-E13B
Ground Water
Well

nd Enclosure

699-S36-E13A
Ground Water
Well

699-S36-E13B
Ground Water
Well

Figure

Discolored
Soil Area

SA-13

SA-9

SA-11

A-10

W. 10th Ave.

W. 10th Ave.

3. Sampling Areas

Figure A.5 Backg

BA-1

5th Street

Background Area Boundary

und Sampling Area

980600054.4
Neg # 92111064-3cn

Figure A.4 Sampling

12

APPENDIX B

SCM Investigation Summary Report

**INDEPENDENT CLEANUP ACTION REPORT
FOR THE
6TH STREET WAREHOUSE COMPLEX**

OWNER: BATTELLE-NORTHWEST
SITE NUMBER 010063
6TH AND "W" STREET INTERSECTION, RICHLAND, WA 99352

BATTELLE, PACIFIC NORTHWEST LABORATORIES
RICHLAND, WASHINGTON 99352

PREPARED BY:

SCM Consultants, Inc.
7601 West Clearwater Avenue, Suite 301
Kennewick, WA 99336

SCM

Consultants, Inc.
Architects & Engineers

INDEPENDENT CLEANUP ACTION REPORT

1.0 SITE INFORMATION

Site ID Number: 010063
Site/Business Name: 6th Street Warehouse, Petroleum Dispensing Station.
Site Address: 790 6th Street, Richland, WA 99352, 200 feet north of the intersection of 6th Street and W Street, Richland, WA 99352
Tank ID Numbers: 5 (WHSE) and 6 (WHSE)
Year Installed: 1980
Tank Capacity: Tank 5 (WHSE) 2000 gallons
Tank 6 (WHSE) 3500 gallons
Last Substance Stored: Tank 5 Regular Leaded Gasoline
Tank 6 Unleaded Gasoline

2.0 INTRODUCTION AND SCOPE:

The Sixth Street Warehouse Petroleum Dispensing Station Tanks were closed as a consolidation effort to reduce the number of underground storage tanks operated by Battelle, Pacific Northwest Laboratories. The tanks were used by maintenance and grounds crews to fuel vehicles and maintenance equipment. The tanks were installed in 1980 and were temporarily closed on 8 August 1991. The tanks were located approximately 200 feet north of the intersection of Sixth Street and W Street, at the Receiving Warehouse, operated by Battelle, Pacific Northwest Laboratories, Richland, WA 99352.

The tanks were removed from service and a Site Check/Site Assessment was performed. A confirmed release for the tank site was reported to Central Region, Washington Department of Ecology, Leaking Underground Storage Tanks (LUST) Section on 31 January 1992 after an evaluation of laboratory analysis reports as a confirmed LUST Site.

3.0 EXTRACT FROM THE SITE ASSESSMENT CHARACTERIZATION REPORT:

Examination of the exterior tank surface revealed a corrosion band approximately 1 foot wide around the tank (Photograph number 4). This circumferential band was located between the fill pipe and pump connections. It appears that precipitation used the fill pipe as a conduit to the ground.

Seventeen site assessment soil samples were collected by the site assessor for site sampling as outlined in the "Guidance for Site Checks and Site Assessments for Underground Storage Tanks". These samples were collected within the limits of the tank removal excavation and from the soil stock piled for fill. Sample locations are identified on Figures 1 and 2. Laboratory analysis indicated fifteen of the seventeen samples were below detection limits of the WTPH-HCID protocol for gasoline, diesel and heavy oils. Samples LT-W and LT-W2 respectively collected from 9 - 12 inches and approximately 24 inches below the west end of tank number 6 revealed gasoline contamination. Additional analysis was performed on these samples using the WTPH-G and total metal protocols.

WTPH-G analysis of LT-W and LT-W2 indicate respective totals of 1500 and 1400 ppm petroleum contamination within the gasoline range. However, the analysis failed to detect the presence of benzene, toluene, xylene or ethyl benzene above the detection limits established by the protocol. Analysis for cadmium, chromium, lead and copper were all below the current detection limits.

WTPH-HCID analysis of samples LT-W and LT-W2 indicated respective totals of 760 and 550 ppm petroleum hydrocarbons in the C_{12} - C_{24} carbon atoms per molecule. Conversations with the laboratory technician indicated that these results were probably the result normal degradation and decomposition of gasoline as the bands were mainly in the C_{12} - C_{15} atom range. Analysis of soil sample Spoil - 9 indicated a reading of 120 ppm petroleum contamination in the Lube Oil and Related Products range. This sample is suspected of being contaminated with either a small chip of asphalt paving or a drop of hydraulic oil from the mechanical equipment used to excavate the tanks.

Laboratory analysis was performed by Laucks Testing Laboratories, Inc, 940 South Harney Street, Seattle, WA 98108. Copies of the site assessment samples are located at Appendix A of this report.

Once removed from the excavation, the inert tanks were triple rinsed by steam cleaning and then rendered unsuitable for use as storage tanks. Large holes were cut in the ends of the inert tanks to facilitate final cleaning and visual inspection to certify them acceptable for scrap metal recycling. OVM Photoionization instruments and MSA chemical specific detector tubes for petroleum hydrocarbons and benzene were used to verify the cleanliness of the tanks prior to certification for disposal.

Visual observations of the tanks were performed by the registered site assessor after cleaning and prior to disposal. These observation revealed corrosion pits approximately 1/32 to 1/16th of an inch deep on the exterior of the tank within the corrosion band. No pitting was observed on the interior surface of the tanks or outside of the corrosion band and no pits appeared to puncture the tank wall.

4.0 SITE CHARACTERIZATION AND INDEPENDENT CLEANUP REPORT:

Description of Release:

A unknown quantity of unleaded gasoline either leaked from or was accidentally spilled at the 6th Street Warehouse Petroleum Dispensing Station. Petroleum contaminated soil was discovered below the bottom of the unleaded gasoline UST, as a result of the tank removal and site closure assessment. Soil analysis using the WTPH-HCID protocol confirmed the soil was contaminated with hydrocarbons in the gasoline range (C_7 to C_{12}). Due to the contamination levels, additional analysis using the WTPH-G, BTX and total lead analytical protocols were performed. The levels for gasoline were determined to be more than the maximum allowable limits of Method A, Cleanup Standards; therefore, no statistical averaging was attempted. No diesel or heavy oil contamination was detected during the site assessment.

Battelle-Northwest employees provided verbal information of an above ground spill during a fuel delivery that overfilled the unleaded tank several years ago. Written records do not exist to document the amount of fuel involved in the overfill.

Description of Response:

The owner, Battelle, Pacific Northwest Laboratories retained SCM Consultants, Inc. to provide site remediation planning, site safety, and independent sampling.

The "Site Remediation Plan", located at Appendix C, was written for the cleanup process. This plan details cleanup activities performed to restore the site to acceptable levels of cleanliness. Responsibilities of the owner, owner's representative, and contractor during the cleanup are contained within this plan.

Cleanup options and methods were reviewed to determine the best method for the site cleanup and restoration. The owner elected to remove the contaminated soil from the site for aeration and bioremediation at the Richland Landfill Regional Treatment Facility (RTF).

Petroleum Contaminated Soil Treatment Permits were obtained from both Benton-Franklin County Health Department and City of Richland for the treatment of the contaminated soil at the Richland Regional Treatment Facility, Richland City Landfill. Approximately 307 cubic yards of petroleum contaminated soil (determined by weight) was removed and transported to the treatment facility for aeration and bioremediation. Copies of the permits are located at Appendix E.

Sampling and Analysis Results

Soil removal continued until consistent readings of less than 5 parts per million (ppm) were obtained on the field photoionization instrument. This level was selected based on operator experience and the cool temperature, which reduced the amount of petroleum hydrocarbon volatilization. Appendix D contains the Photograph Log and photographs of daily activities during the cleanup activities.

After reaching the desired detection limit on field instrumentation eleven soil samples were collected from the limits of the excavation and one off-site control sample were submitted to the laboratory on 17 March 1992. All samples were analyzed by Laucks Testing Lab, 940 South Harney Street, Seattle, WA 98108 using the Department of Ecology WTPH-HCID protocol. Laboratory analysis data sheets are attached at Appendix B of this report.

SAMPLE NUMBER	LOCATION	WTPH-HCID PROTOCOL		
		GASOLINE	DIESEL	HEAVY OILS
BNW-6-1	West wall at the bottom of the excavation	BDL*	BDL	BDL
BNW-6-2	Northwest wall approximately 15 feet deep	BDL	BDL	BDL
BNW-6-3	West wall approximately 18 feet deep	BDL	BDL	BDL
BNW-6-4	Bottom of excavation in southwest corner	BDL	BDL	BDL
BNW-6-5	Bottom of the excavation (20 -22 feet deep)	BDL	BDL	BDL
BNW-6-6	Bottom of the excavation in center	BDL	BDL	BDL
BNW-6-7	East wall at the bottom of the excavation	BDL	BDL	BDL

BNW-6-8	North wall approximately 18 feet deep	BDL	BDL	BDL
BNW-6-9	Southeast wall approximately 18 feet deep	BDL	BDL	BDL
BNW 6-10	Composite soil sample from spoil pile inside fenced area (approximately 10 cubic yards in pile)	BDL	BDL	BDL
BNW 6-11	Duplicate sample for QC purposes	BDL	BDL	BDL
BNW-6-12	Off Site Control approximately 200 yards southwest of the site and 50 yards west of 6th and W Street intersection in the north edge of the sagebrush field.	BDL	BDL	200 ppm**

* BDL means Below Detection Limits of the WTPH-HCID Protocol

** Sample BNW-6-12 was designated as the Off Site Control Sample. This sample was collected from a sagebrush field located to the south and west of the active clean up site. Laboratory analysis indicated this sample contained 200 ppm Lube Oils and related products. Historical investigation into this field indicate that the area was used as temporary living quarters for the civilian work force constructing the Hanford Nuclear Reservation in the early to mid 1940's. Therefore, the area was extensively treated with petroleum based oils as a means of weed and dust control.

After a review of the laboratory data from the eleven samples collected within the cleanup excavation boundary it was determined that all soil remaining at the site is below the maximum allowable contamination levels of the Model Toxic Control Act of 100 ppm for gasoline.

Site Condition Map:

Figure 1 is a detailed site map.

Data on nearby wells, surface water, ground water, land use, and location of potential conduits and sensitive environments.

The Columbia River (Lake Wallula) is located approximately 1/2 mile east and approximately 75 feet below the elevation of the site location.

The City of Richland potable water wells are located approximately 1-1/4 miles southeast of the site.

The excavation was approximately 20 feet deep at the deepest point, and no ground water was observed within the excavation.

Free Product Removal:

No free product was discovered during this cleanup.

Description of planned, current, or completed interim actions and cleanup actions.

Excavation of petroleum contaminated soil is complete. Petroleum contaminated soil was transported to the Richland Landfill Regional Treatment Center for bioremediation. The soil will under go extensive biological treatment and aeration during the next six months. Petroleum contaminated soil is mixed with an equal amount of treated sewage sludge, spread out in a six inch thick layer and harrowed on a weekly basis. In six months composite samples of the mixture will be collected for laboratory analysis. Sampling will be completed as directed by the Benton-Franklin Health Department. Current policy is to collect one sample for each 25-30 cubic yards of soil being treated. Samples will be

analyzed using the WTPH-HCID protocol to determine the extent of remaining contamination. If analysis indicated the soil exceeds Method A Cleanup Limits additional aeration treatment consisting of weekly harrowing will continue. No additional sewage sludge will be added to the soil. The landfill will accept soils determined to meet the minimum Method A Cleanup limits for use within the landfill.

5.0 RESULTS:

The site meets or exceeds the cleanliness levels required by Method A Cleanup Levels for soils as outlined in the Model Toxic Control Act as amended February 1991. Therefore, the site was considered clean and the excavation backfilled. The site was finished to meet the intended requirements of the Warehouse and Maintenance Facility.

Appendices:

Appendix A: Laboratory Analysis of Site Assessment Soil Samples
Appendix B: Laboratory Analysis of Remediation Soil Samples
Appendix C: Site Remediation Plan
Appendix D: Photographs of the Site
Appendix E: Local Permits

Figures:

Figure 1: Site Drawing and Spoil Pile Samples, Drawing #001
Figure 2: Sample Location & Identification, Drawings #002 and #003
Figure 3: Local Area Map

APPENDIX C

Geophysical Investigation Report

Pacific Northwest National Laboratory

Operated by Battelle for the U.S. Department of Energy

December 6, 1997

Robert Nielson
Pacific Northwest National Laboratory
Richland, Washington 99352

Subject: Report on a Geophysical Survey at the Old Hanford Bus Lot – Work Package K60108.

Dear Robert:

This letter report describes a geophysical survey performed in the vicinity of the Maintenance Shop of the Old Hanford Bus Lot. This survey was performed by staff of PNNL's Sensors and Measurement Systems Group during the period October 22 through November 14, 1997. The site is located on Battelle property in the southwest corner of a block bounded by Stevens Drive to the west, 5th Street to the south, W Avenue to the east, and Battelle Boulevard to the north. The facilities at the bus lot included the maintenance shop, associated gas pumps, and a bus depot. These facilities were apparently used into the 1950s, but were demolished sometime in the 1950s or 1960s. At this time, the only remaining portions of the bus lot structures are the large concrete floor slab of the maintenance shop, smaller concrete pads associated with the gas pumps, and several manholes that provided access to underground utilities. There is no obvious surface indication of the location of the bus depot shown on the copies of engineering drawings that you provided to us.

Our objective was to survey the subsurface of the site to detect and map underground pipes and cables, fuel storage tanks, a possible septic-tank/drain-field system, and any other significant underground structure.

Procedures and Sensors

The attached figure is a map that shows the layout of the site, including an outline of the large concrete floor slab of the maintenance shop. This map also shows the results of the geophysical surveys. The surveyed area was nominally 120 m long (in the north-south direction) and 105 m wide (in the east-west direction). A square survey grid with nodes at 15-m intervals was used to facilitate the geophysical survey. It was laid out using a measuring tape and was marked with wooden stakes. The gridded area, slightly smaller than the area of the map, is indicated on the map by the array of small crosses. The actual survey was extended by 5 m along part of the north edge of the grid to ensure the inclusion of three buried features that were detected near the original boundary.

Two sensors were used to perform the survey. The first was a Fisher M-scope pipe and cable locator (metal detector). This is a handheld device that uses a meter to indicate the detection of a metallic object such as a pipe or cable. Strong responses are also indicated by an audible tone. The operator carried the sensor back and forth across the survey area using the wooden stakes and supplemental traffic cones to define roughly parallel lines. The line spacing was approximately 3 m; however, a detailed inspection was performed in areas where the sensor response showed the presence of a buried object. The locations of detected objects were marked on the ground surface using spray paint. These markings were later recorded and transferred to the map.

The M-scope was also employed in a conductive mode whereby its transmitter was connected to an exposed pipe or electrical conduit and its receiver was scanned independently. This is often an effective means of tracing a buried conductor. It was used with some success on the concrete pad; however, the presence of rebar in the concrete seemed to make it difficult to obtain definitive signals.

The second sensor used in the survey was a ground-penetrating radar (GPR) unit. This type of radar unit is specifically designed to transmit signals into the ground and to detect signals reflected from subsurface targets. Virtually any object or material that has electrical properties different from those of the surrounding ground material will reflect the radar signal. Thus, both metallic and nonmetallic targets can be detected, although metallic targets tend to produce much stronger reflections than nonmetallic targets. The specific device used in this survey was a GSSI Model SIR 2, manufactured by Geophysical Survey Systems, Inc., North Salem, NH. A 200-MHz antenna was used to provide effective ground penetration to a depth of at least 4 m. The control unit of the GPR system was mounted on a Suzuki all-terrain vehicle (ATV). The antenna was mounted in a small trailer that was pulled behind the ATV. Data were recorded in digital form along roughly parallel survey lines spaced approximately 2 m apart. Data were collected along two sets of lines oriented N-S and E-W, respectively. This procedure optimized the chances of detecting a given linear target (pipe or cable) by providing orthogonal polarizations of the radar beam.

The along-track density of recorded GPR signals (scans) was approximately 25 scans/m. The spacing of the survey lines was approximately 2 m, although the presence of dense vegetation over much of the site made it difficult to follow straight lines. The vegetation also caused some degradation of the GPR data at locations where the sled and the radar antenna were forced to ride up above the ground surface, thereby weakening the coupling between the antenna and the ground. The overall effect of this problem was relatively minor, however. The recorded data were processed by a lab PC to filter out spurious features caused by internal reflections in the radar antenna, to interpolate the data to equalize the data density, and to display the data in the form of hardcopy radar profiles.

A GPR profile is an amplitude-modulated plot of the radar signals in which the vertical axis corresponds to depth and the horizontal axis corresponds to distance along the ground surface. In this case, the amplitude of the radar signal was displayed as

brightness levels (gray scale). One profile was constructed for each traverse of the site (i.e., for each survey line). A set of these profiles is included as part of this report.

The coordinates of the main features shown on the map, including many of the buried objects detected by the metal detector, were determined by a NovAtel RT-2 differential GPS system. Although the nominal accuracy of this system is ± 2 cm, the accuracy at this site was somewhat degraded (to perhaps ± 10 cm) by the use of a secondary geographical reference point. We used the center of the manhole located a few meters south of the site (on the south side of 5th street). The location of this manhole is shown on the map. This procedure was necessary because the best available primary reference site (survey marker) was located too far to the south to permit reliable telemetry of the GPS correction data.

We had intended to use the GPS to record the coordinates of the GPR antenna as it was pulled along the survey lines. However, we were not able to do so because of the malfunction of a telemetry unit. Instead, we inserted electronic markers into the GPR data as the GPR antenna crossed each row of wooden stakes. This procedure gave a location reference every 15 m along each survey line.

Results

The utilities and other buried objects detected by the metal detector and GPR sensors are shown on the attached map. All of these were detected by the GPR. The metal detector was most effective in detecting the shallower targets, although it easily detected the relatively deep pipes (presumably) at the south end of the grid (at approximately 593749E and 593755E).

A line on the map showing the location of a pipe or cable is usually terminated by one or more dashes. This is intended to indicate that the pipe or cable does not necessarily begin or end at the point suggested by the plotted line. For a variety of reasons (e.g., variations in soil type or moisture content, or a change in the character of the target itself), the signature of a pipe or cable can be stronger in one location than in another. Sometimes it is difficult to detect or recognize a change in the direction of a pipe or cable without using closely spaced survey lines. A change in the depth of a pipe or cable can also make it difficult to trace.

Many pipes and cable conduits are exposed on the concrete slab. Presumably, these form a network under the concrete that culminates in a relatively small number of pipes and cables that actually go to external destinations or come from external sources. Some pipes and cables were found to cross the edge of the slab, but it is likely that the main lines were not detected and mapped. Strong surface reflections at the edge of the slab made it difficult to identify GPR reflections from deeper pipes and cables. Similarly, shallow conductors may have masked deeper conductors in measurements with the metal detector.

Four manholes and a smaller capped hole were available as sources of additional information. These holes are labeled from A to E on the map. Looking into these holes (from the surface only) yielded the following results:

- A. One large pipe enters this large manhole – at the south side near the top. A GPR profile at this location suggests that the depth of the pipe increases sharply to the south. This manhole/pipe configuration suggests that its function may be to collect and drain excess surface water. If so, the pipe is probably connected to the main sewer line. The latter is assumed to be the E-W line that approaches the northeast corner of the slab at coordinate 112580N.
- B. This is a large vertical pipe rather than a manhole. The pipe bends sharply to the north at a depth of 2.1 m. This relatively deep pipe could not be detected by either the GPR or the metal detector, presumably because it is overlain by a smaller pipe or cable and is close to the edge of the slab.
- C. This manhole is a cylindrical hole approximately 1.4 m deep. A layer of cobbles is present at the bottom. A 1-inch pipe enters from the west at a depth of approximately .15 m. A 2.5-inch pipe enters from the northwest at a depth of approximately .6 m. Its direction is toward two vertical pipes in the slab at a distance of 3 or 4 m. A 2-inch rubber hose enters from the north.
- D. This manhole is rectangular concrete box (approximately 1.5 m x 1.5 m) extending to a depth of at least 3.7 m. A 4.5-inch pipe and an adjacent, parallel, 2.5-inch pipe conduit enter at the north side at a depth of approximately .6 m. The direction of these utilities is directly toward the two previously mentioned pipes protruding from the slab. A 12-inch pipe enters from the west at a depth of approximately 1.5 m. A probable steam line enters the manhole at a depth of approximately 3.4 m. This is a 4.5-inch steel pipe inside a 12-inch pipe. Insulation appears to fill the space between the two pipes. The entry angle of the pipes suggests that the steam line approaches the manhole from the south-southeast, perhaps from the vicinity of manhole E.
- E. This manhole is a rectangular concrete structure similar to that of manhole D, although it is smaller and shallower (1.2 m x 1.2 m x 2.7 m depth). A 2- or 2.5-inch pipe enters the cavity from the south at a depth of approximately .6 m; two 1-inch pipes exit to the north at the same depth. The GPR and metal detector data suggest that a deeper main line connects the pipes in and around this manhole to the water main that parallels the street to the south; however, it is not certain that the N-S line is connected to the E-W water main at the street.

It is reasonable to assume that a large fuel storage tank was present near the gas-pump island shown just to the right of center on the map. There is a shallow depression of the ground surface approximately 10-15 m east of the pump island that can be associated with such a tank (or with its removal). Given the absence of visible risers, it seemed likely that the tank had been removed. The GPR and metal detector data strongly

confirm that assessment. The signature from a large steel fuel tank should be easily detected and would be hard to miss if the tank were present.

Eight circular or oval shapes are shown on the map. Each of these indicates the location of a reasonably large localized target or a cluster of smaller targets. None of these exhibits a signature that is likely to represent a large tank. The circular anomaly at 112580N, 593744E could be a manhole, a small tank, a crossing of pipes and/or cable, or debris. The ground surface at that location was covered by a layer of soil and brush and was not cleared for inspection.

If a septic tank and drainfield are present, it was not recognized. An active drainfield is likely to be detected by virtue of the effect of the anomalously high soil moisture on the GPR signals. If tile pipes are present, they might have been missed because they can be difficult to detect in dry soil where the antenna/ground contact is highly variable due to thick vegetation.

The concrete pad is partially underlain by open space to allow access to the grease pits. These spaces have been partially filled with debris and cannot be easily examined from the surface. Although the GPR was able to detect some reflectors under the concrete, the rebar in the concrete degraded the GPR images. The debris also made it impossible to traverse the slab completely in the E-W direction, thereby minimizing the amount of data that could be obtained from the center section of the slab.

This survey was successful in detecting and mapping many of the pipes and cables that provided the utilities used in the former maintenance shop. To obtain significantly improved results, it would be helpful to remove (cut) the vegetation. It might also be effective to use a higher-frequency radar antenna to more precisely survey the slab and to increase spatial resolution near the edges of the slab.

I hope that these results will be helpful to you. If you have questions about the work, please call me.

Sincerely,

A handwritten signature in black ink, appearing to read "Gerald A. Sandness", with a long horizontal flourish extending to the right.

Gerald A. Sandness
375-3808

Attachments: GPR profiles

LEGEND

- Buried pipe or cable
- Edge of concrete pad
- Approximate outline of buried object
- Manhole cover
- Wooden stake used to mark survey grid

Coordinates: Washington State Plane, 1983

AEC BUS LOT - MAINTENANCE SHOP AREA

UNDERGROUND UTILITIES DETECTED BY GEOPHYSICAL SURVEYS

Map 1 of 1	November 13, 1997	Rev. 0
Pacific Northwest National Laboratory, Richland, WA		

APPENDIX D

Groundwater Well Summary Data

GROUNDWATER WELL DATA
699-S36-E13A
(NORTHEAST CORNER)

CONTAMINANT NAME	LAB QUALIFIER	VALUE REPORTED	UNITS	FEDERAL MCLs*	FEDERAL MCL GOALS**	STATE MCLs***	MTCA METHOD A CLEANUP LEVELS#	SAMPLE DATE/TIME
1,1,1,2-Tetrachloroethane	U	10	ug/L					8/4/88
1,1,1-Trichloroethane	U	2	ug/L	200	200	200	200	8/4/88
1,1,1-Trichloroethane	U	5	ug/L	"	"	"	"	1/30/89
1,1,1-Trichloroethane	U	5	ug/L	"	"	"	"	5/24/89
1,1,1-Trichloroethane	U			"	"	"	"	8/30/91
1,1,1-Trichloroethane	J	0.4	ug/L	"	"	"	"	3/12/92
1,1,1-Trichloroethane	U			"	"	"	"	9/15/92
1,1,1-Trichloroethane	U	2	ug/L	"	"	"	"	8/24/93
1,1,1-Trichloroethane	U	2	ug/L	"	"	"	"	12/20/93
1,1,1-Trichloroethane	J	0.2	ug/L	"	"	"	"	6/16/94
1,1,1-Trichloroethane	U	0.5	ug/L	"	"	"	"	1/18/95
1,1,1-Trichloroethane	U	0.061	ug/L	"	"	"	"	1/15/96
1,1,1-Trichloroethane		0.2	ug/L	"	"	"	"	1/29/97
1,1,1-Trichloroethane	U	0.18	ug/L	"	"	"	"	12/10/97
1,1,2,2-Tetrachloroethane	U	10	ug/L					8/4/88
1,1,2-Trichloroethane	U	5	ug/L	5	3	5		8/4/88
1,1,2-Trichloroethane	U	5	ug/L	"	"	"		1/30/89
1,1,2-Trichloroethane	U	5	ug/L	"	"	"		5/24/89
1,1,2-Trichloroethane	U	0.068	ug/L	"	"	"		1/15/96
1,1,2-Trichloroethane	U	0.2	ug/L	"	"	"		1/29/97
1,1,2-Trichloroethane	U	0.1	ug/L	"	"	"		12/10/97
1,1-Dichloroethane	U	10	ug/L					8/4/88
1,1-Dichloroethane	U	5	ug/L					1/30/89
1,1-Dichloroethane	U	5	ug/L					5/24/89
1,1-Dichloroethane	U							8/30/91
1,1-Dichloroethane	U							3/12/92
1,1-Dichloroethane	U							9/15/92
1,1-Dichloroethane	U	2	ug/L					8/24/93
1,1-Dichloroethane	U	2	ug/L					12/20/93
1,1-Dichloroethane	U	2	ug/L					6/16/94
1,1-Dichloroethane	U	0.5	ug/L					1/18/95
1,1-Dichloroethane	U	0.047	ug/L					1/15/96
1,1-Dichloroethane	U	0.2	ug/L					1/29/97
1,1-Dichloroethane	U	0.2	ug/L					12/10/97
1,1-Dichloroethane	U	10	ug/L	7	7	7		8/4/88
1,2,3,4-Tetrachlorobenzene	U	10	ug/L					8/4/88
1,2,3,5-Tetrachlorobenzene	U	10	ug/L					8/4/88
1,2,3-Trichlorobenzene	U	10	ug/L					8/4/88
1,2,3-Trichloropropane	U	10	ug/L					8/4/88
1,2,4,5-Tetrachlorobenzene	U	10	ug/L					8/4/88
1,2,4-Trichlorobenzene	U	10	ug/L	70		70		8/4/88
1,2-Dibromo-3-chloropropane	U	10	ug/L	0.2		0.2		8/4/88
1,2-Dibromoethane	U	10	ug/L	0.05		0.05		8/4/88
1,2-Dichlorobenzene	U	10	ug/L	600	600	600		8/4/88
1,2-Dichloroethane	U	10	ug/L	5		5	5	8/4/88
1,2-Dichloroethane	U	5	ug/L	"		"	"	1/30/89
1,2-Dichloroethane	U	5	ug/L	"		"	"	5/24/89
1,2-Dichloroethane	U			"		"	"	8/30/91
1,2-Dichloroethane	U			"		"	"	3/12/92
1,2-Dichloroethane	U			"		"	"	9/15/92

GROUNDWATER WELL DATA
699-S36-E13A
(NORTHEAST CORNER)

CONTAMINANT NAME	LAB QUALIFIER	VALUE REPORTED	UNITS	FEDERAL MCLs*	FEDERAL MCL GOALS**	STATE MCLs***	MTCA METHOD A CLEANUP LEVELS#	SAMPLE DATE/TIME
1,2-Dichloroethane	U	2	ug/L	"	"	"	"	8/24/93
1,2-Dichloroethane	U	2	ug/L	"	"	"	"	12/20/93
1,2-Dichloroethane	U	2	ug/L	"	"	"	"	6/16/94
1,2-Dichloroethane	U	0.5	ug/L	"	"	"	"	1/18/95
1,2-Dichloroethane	U	0.049	ug/L	"	"	"	"	1/15/96
1,2-Dichloroethane	U	0.2	ug/L	"	"	"	"	1/29/97
1,2-Dichloroethane	U	0.14	ug/L	"	"	"	"	12/10/97
1,2-Dichloropropane	U	10	ug/L	5		5		8/4/88
1,2-Diphenylhydrazine	U	10	ug/L					8/4/88
1,3,5-Trichlorobenzene	U	10	ug/L					8/4/88
1,3-Dichlorobenzene	U	10	ug/L					8/4/88
1,3-Dichloropropene	U	10	ug/L					8/4/88
1,4-Dichlorobenzene	U	10	ug/L	75	75	75		8/4/88
1,4-Dichlorobenzene	U	5	ug/L	"	"	"		1/30/89
1,4-Dichlorobenzene	U	5	ug/L	"	"	"		5/24/89
1,4-Dichlorobenzene	U	0.056	ug/L	"	"	"		1/15/96
1,4-Dichlorobenzene	U	0.2	ug/L	"	"	"		1/29/97
1,4-Dichlorobenzene	U	0.4	ug/L	"	"	"		1/29/97
1,4-Dichlorobenzene	U	0.18	ug/L	"	"	"		12/10/97
1,4-Dioxane	U	500	ug/L					8/4/88
1,4-Naphthoquinone	U	10	ug/L					8/4/88
1-Butanol	U	2.5	ug/L					12/10/97
1-Chloro-2,3-epoxypropane	U	10	ug/L					8/4/88
1-Naphthylamine	U	10	ug/L					8/4/88
2,2'-Oxybis(1-chloropropane)	U	10	ug/L					8/4/88
2,3,4,6-Tetrachlorophenol	U	10	ug/L					8/4/88
2,4,5-T	U	2	ug/L					8/4/88
2,4,5-TP	U	2	ug/L	50	50	50		8/4/88
2,4,5-Trichlorophenol	U	50	ug/L					8/4/88
2,4,6-Trichlorophenol	U	10	ug/L					8/4/88
2,4-Dichlorophenol	U	10	ug/L					8/4/88
2,4-Dichlorophenoxyacetic acid	U	2	ug/L	70	70	70		8/4/88
2,4-Dimethylphenol	U	10	ug/L					8/4/88
2,4-Dinitrophenol	U	50	ug/L					8/4/88
2,4-Dinitrotoluene	U	10	ug/L					8/4/88
2,6-Dichlorophenol	U	10	ug/L					8/4/88
2,6-Dinitrotoluene	U	10	ug/L					8/4/88
2-Acetylaminofluorene	U	10	ug/L					8/4/88
2-Butanone	U	10	ug/L					8/4/88
2-Butanone	U	10	ug/L					1/30/89
2-Butanone	U	10	ug/L					5/24/89
2-Butanone	U	5	ug/L					1/18/95
2-Butanone	U	0.42	ug/L					12/10/97
2-Chloroethyl vinyl ether	U	10	ug/L					8/4/88
2-Chloronaphthalene	U	10	ug/L					8/4/88
2-Chlorophenol	U	10	ug/L					8/4/88
2-Cyclohexyl-4,6-dinitrophenol	U	10	ug/L					8/4/88
2-Methyl-2-(methylthio)propionaldehyde-o-(methylcarbonyl) ox	U	10	ug/L					8/4/88
2-Methylaziridine	U	10	ug/L					8/4/88
2-Methylacetonitrile	U	10	ug/L					8/4/88
2-Naphthylamine	U	10	ug/L					8/4/88

GROUNDWATER WELL DATA
699-S36-E13A
(NORTHEAST CORNER)

CONTAMINANT NAME	LAB QUALIFIER	VALUE REPORTED	UNITS	FEDERAL MCLs*	FEDERAL MCL GOALS**	STATE MCLs***	MTCA METHOD A CLEANUP LEVELS#	SAMPLE DATE/TIME
2-Picoline	U	10	ug/L					8/4/88
2-Propanol	U	500	ug/L					1/18/95
2-secButyl-4,6-dinitrophenol(DNBP)	U	10	ug/L					8/4/88
3,3'-Dichlorobenzidine	U	20	ug/L					8/4/88
3,3'-Dimethoxybenzidine	U	10	ug/L					8/4/88
3,3'-Dimethylbenzidine	U	10	ug/L					8/4/88
3-Methylcholanthrene	U	10	ug/L					8/4/88
4,4'-DDD	U	0.1	ug/L				0.1	8/4/88
4,4'-DDE	U	0.1	ug/L				"	8/4/88
4,4'-DDT	U	0.1	ug/L				"	8/4/88
4,4'-Methylenebis(2-chloroaniline)	U	10	ug/L					8/4/88
4,6-Dinitro-2methyl phenol	U	10	ug/L					8/4/88
4-Aminobiphenyl	U	10	ug/L					8/4/88
4-Bromophenylphenyl ether	U	10	ug/L					8/4/88
4-Chloro-3-methylphenol	U	10	ug/L					8/4/88
4-Chloroaniline	U	10	ug/L					8/4/88
4-Methyl-2-Pentanone	U	10	ug/L					8/4/88
4-Methyl-2-Pentanone	U	10	ug/L					1/30/89
4-Methyl-2-Pentanone	U	10	ug/L					5/24/89
4-Methyl-2-Pentanone	U	5	ug/L					1/18/95
4-Methyl-2-Pentanone	U	0.19	ug/L					12/10/97
4-Nitroaniline	U	50	ug/L					8/4/88
4-Nitrophenol	U	50	ug/L					8/4/88
5-(Aminomethyl)-3-isoxazolol	U	10	ug/L					8/4/88
5-Nitro-o-toluidine	U	10	ug/L					8/4/88
7,12-Dimethylbenz[a]anthracene	U	10	ug/L				0.1	8/4/88
7H-Dibenzo[c,g]carbazole	U	10	ug/L					8/4/88
Acetone	U	7	ug/L					1/30/89
Acetone	U	10	ug/L					5/24/89
Acetone	U	10	ug/L					1/18/95
Acetone	U	1.9	ug/L					12/10/97
Acetonitrile	U	3000	ug/L					8/4/88
Acetophenone	U	10	ug/L					8/4/88
Acrolein	U	10	ug/L					8/4/88
Acrylonitrile	U	10	ug/L					8/4/88
Aldrin	U	0.1	ug/L					8/4/88
Alkalinity		140000	mg/L					8/4/88
Alkalinity		118000	mg/L					1/30/89
Alkalinity		128000	mg/L					5/24/89
alpha,alpha-Dimethylphenethylamine	U	10	ug/L					8/4/88
Alpha-BHC	U	0.1	ug/L					8/4/88
Aluminum	U	150	ug/L	200		200		8/4/88
Aluminum	U	150	ug/L	"		"		8/4/88
Aluminum	U	150	ug/L	"		"		1/30/89
Aluminum	U	150	ug/L	"		"		5/24/89
Aluminum	U		ug/L	"		"		8/24/93
Aluminum	U		ug/L	"		"		12/20/93
Amitrole	U	10	ug/L					8/4/88
Ammonium ion	U	50	ug/L					8/4/88
Aniline	U	10	ug/L					8/4/88
Antimony	U	100	ug/L	6	6	6		8/4/88

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CONTAMINANT NAME	LAB QUALIFIER	VALUE REPORTED	UNITS	FEDERAL MCLs*	FEDERAL MCL GOALS**	STATE MCLs***	MTCA METHOD A CLEANUP LEVELS#	SAMPLE DATE/TIME
Antimony	U	100	ug/L	"	"	"		8/4/88
Antimony	U	100	ug/L	"	"	"		1/30/89
Antimony	U	100	ug/L	"	"	"		5/24/89
Antimony	U			"	"	"		3/12/92
Antimony	U			"	"	"		9/15/92
Antimony	U		ug/L	"	"	"		8/24/93
Antimony	U		ug/L	"	"	"		12/20/93
Aramite	U	10	ug/L					8/4/88
Aroclor-1016	U	1	ug/L	0.5		0.5	0.1	8/4/88
Aroclor-1221	U	1	ug/L	"		"	"	8/4/88
Aroclor-1232	U	1	ug/L	"		"	"	8/4/88
Aroclor-1242	U	1	ug/L	"		"	"	8/4/88
Aroclor-1248	U	1	ug/L	"		"	"	8/4/88
Aroclor-1254	U	1	ug/L	"		"	"	8/4/88
Aroclor-1260	U	1	ug/L	"		"	"	8/4/88
Arsenic		5	ug/L	50		50	5	8/4/88
Arsenic, filtered	U	5	ug/L	"		"	"	8/4/88
Auramine	U	10	ug/L					8/4/88
Barium		33	ug/L	2,000	2,000	2,000		8/4/88
Barium		15	ug/L	"	"	"		8/4/88
Barium		25	ug/L	"	"	"		1/30/89
Barium		12	ug/L	"	"	"		5/24/89
Barium		0.018	mg/L	"	"	"		8/30/91
Barium		24	ug/L	"	"	"		3/12/92
Barium		30	ug/L	"	"	"		9/15/92
Barium	L	19	ug/L	"	"	"		8/24/93
Barium	BL	18	ug/L	"	"	"		12/20/93
Benz[c]acridine	U	10	ug/L				0.1	8/4/88
Benzene	U	5	ug/L	5		5	5	8/4/88
Benzene	U	5	ug/L	"		"	"	1/30/89
Benzene	U	5	ug/L	"		"	"	5/24/89
Benzene	U			"		"	"	8/30/91
Benzene	U			"		"	"	3/12/92
Benzene	U			"		"	"	9/15/92
Benzene	U	0.5	ug/L	"		"	"	8/24/93
Benzene	U	0.5	ug/L	"		"	"	12/20/93
Benzene	U	0.5	ug/L	"		"	"	6/16/94
Benzene	U	0.5	ug/L	"		"	"	1/18/95
Benzene	U	0.059	ug/L	"		"	"	1/15/96
Benzene	U	0.2	ug/L	"		"	"	1/29/97
Benzene	U	0.17	ug/L	"		"	"	12/10/97
Benzenethiol	U	10	ug/L					8/4/88
Benzidine	U	10	ug/L					8/4/88
Benzo(a)anthracene	U	10	ug/L				0.1	8/4/88
Benzo(a)pyrene	U	10	ug/L	0.2		0.2	"	8/4/88
Benzo(b)fluoranthene	U	10	ug/L				"	8/4/88
Benzo(j)fluoranthene	U	10	ug/L				"	8/4/88
Benzyl chloride	U	10	ug/L					8/4/88
Beryllium	U	5	ug/L	4	4	4		8/4/88
Beryllium	U	5	ug/L	"	"	"		8/4/88
Beryllium	U	5	ug/L	"	"	"		1/30/89

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CONTAMINANT NAME	LAB QUALIFIER	VALUE REPORTED	UNITS	FEDERAL MCLs*	FEDERAL MCL GOALS**	STATE MCLs***	MTCA METHOD A CLEANUP LEVELS#	SAMPLE DATE/TIME
Beryllium		6	ug/L	"	"	"		5/24/89
Beryllium	U			"	"	"		3/12/92
Beryllium	U			"	"	"		9/15/92
Beryllium	U		ug/L	"	"	"		8/24/93
Beryllium	U		ug/L	"	"	"		12/20/93
Beta-BHC	U	0.1	ug/L					8/4/88
Bis(2-Chloroethoxy)methane	U	10	ug/L					8/4/88
Bis(2-chloroethyl) ether	U	10	ug/L					8/4/88
Bis(2-ethylhexyl) phthalate	U	10	ug/L	6		6		8/4/88
Bis(chloromethyl) ether	U	10	ug/L					8/4/88
Boron		15	ug/L					1/30/89
Boron		22	ug/L					5/24/89
Boron		0.03	mg/L					8/30/91
Bromide	U	1000	ug/L					1/30/89
Bromide	U	1000	ug/L					5/24/89
Bromide	U							3/12/92
Bromide	U							9/15/92
Bromide	U							8/24/93
Bromide	U		ug/L					6/16/94
Bromide	U	30	ug/L					1/18/95
Bromide	U	72	ug/L					1/15/96
Bromide	U	0.023	mg/L					1/29/97
Bromoacetone	U	10	ug/L					8/4/88
Bromodichloromethane	U	0.5	ug/L	25		25		1/18/95
Bromoform	U	10	ug/L	25		25		8/4/88
Bromoform	U	0.5	ug/L	"		"		1/18/95
Bromomethane	U	10	ug/L					8/4/88
Butylbenzylphthalate	U	10	ug/L					8/4/88
Cadmium	U	2	ug/L	5	5	5	5	8/4/88
Cadmium	U	2	ug/L	"	"	"	"	8/4/88
Cadmium	U	2	ug/L	"	"	"	"	1/30/89
Cadmium	U	2	ug/L	"	"	"	"	5/24/89
Cadmium	U			"	"	"	"	8/30/91
Cadmium	U			"	"	"	"	3/12/92
Cadmium	U			"	"	"	"	9/15/92
Cadmium	U		ug/L	"	"	"	"	8/24/93
Cadmium	U		ug/L	"	"	"	"	12/20/93
Calcium		48400	ug/L					8/4/88
Calcium		49800	ug/L					8/4/88
Calcium		35100	ug/L					1/30/89
Calcium		12100	ug/L					5/24/89
Calcium		26.4	mg/L					8/30/91
Calcium		40000	ug/L					3/12/92
Calcium		43000	ug/L					9/15/92
Calcium		28000	ug/L					8/24/93
Calcium	B	27000	ug/L					12/20/93
Carbon disulfide	U	10	ug/L					8/4/88
Carbon disulfide	U	0.15	ug/L					12/10/97
Carbon tetrachloride	U	5	ug/L	5		5		8/4/88
Carbon tetrachloride	U	5	ug/L	"		"		1/30/89
Carbon tetrachloride	U	5	ug/L	"		"		5/24/89

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CONTAMINANT NAME	LAB QUALIFIER	VALUE REPORTED	UNITS	FEDERAL MCLs*	FEDERAL MCL GOALS**	STATE MCLs***	MTCA METHOD A CLEANUP LEVELS#	SAMPLE DATE/TIME
Carbon tetrachloride	U			"		"		8/30/91
Carbon tetrachloride	U			"		"		3/12/92
Carbon tetrachloride	U			"		"		9/15/92
Carbon tetrachloride	U	2	ug/L	"		"		8/24/93
Carbon tetrachloride	U	2	ug/L	"		"		12/20/93
Carbon tetrachloride	U	2	ug/L	"		"		6/16/94
Carbon tetrachloride	U	0.5	ug/L	"		"		1/18/95
Carbon tetrachloride	U	0.042	ug/L	"		"		1/15/96
Carbon tetrachloride	U	0.5	ug/L	"		"		1/29/97
Carbon tetrachloride	U	0.14	ug/L	"		"		12/10/97
Carbophenothion	U	2	ug/L					8/4/88
Chlordane	U	1	ug/L	2		2		8/4/88
Chloride		6580	ug/L	250,000		250,000		8/4/88
Chloride		5000	ug/L	"		"		1/30/89
Chloride		5600	ug/L	"		"		5/24/89
Chloride		2.04	mg/L	"		"		8/30/91
Chloride		6800	ug/L	"		"		3/12/92
Chloride		7100	ug/L	"		"		9/15/92
Chloride	B	3300	ug/L	"		"		8/24/93
Chloride		5400	ug/L	"		"		6/16/94
Chloride		6800	ug/L	"		"		1/18/95
Chloride		7200	ug/L	"		"		1/15/96
Chloride	D	12	mg/L	"		"		1/29/97
Chloride	D	14.9	mg/L	"		"		12/10/97
Chlornaphazine	U	10	ug/L					8/4/88
Chloroalkyl ethers	U	10	ug/L					8/4/88
Chlorobenzene	U	10	ug/L	100	100	100		8/4/88
Chlorobenzilate	U	30	ug/L					8/4/88
Chloroform	U	5	ug/L	25		25		8/4/88
Chloroform	U	5	ug/L	"		"		1/30/89
Chloroform	U	5	ug/L	"		"		5/24/89
Chloroform	U			"		"		8/30/91
Chloroform	J	0.4	ug/L	"		"		3/12/92
Chloroform	U			"		"		9/15/92
Chloroform	J	0.6	ug/L	"		"		8/24/93
Chloroform	J	0.6	ug/L	"		"		12/20/93
Chloroform	J	1.7	ug/L	"		"		6/16/94
Chloroform		2.4	ug/L	"		"		1/18/95
Chloroform		6.2	ug/L	"		"		1/15/96
Chloroform		1.3	ug/L	"		"		1/29/97
Chloroform	J	0.5	ug/L	"		"		12/10/97
Chloromethane	U	10	ug/L					8/4/88
Chloromethyl methyl ether	U	10	ug/L					8/4/88
Chromium	U	10	ug/L	100	100	100	50	8/4/88
Chromium	U	10	ug/L	"	"	"	"	8/4/88
Chromium	U	10	ug/L	"	"	"	"	1/30/89
Chromium	U	10	ug/L	"	"	"	"	5/24/89
Chromium		0.01	mg/L	"	"	"	"	8/30/91
Chromium	U			"	"	"	"	3/12/92
Chromium	U			"	"	"	"	9/15/92
Chromium	U		ug/L	"	"	"	"	8/24/93

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CONTAMINANT NAME	LAB QUALIFIER	VALUE REPORTED	UNITS	FEDERAL MCLs*	FEDERAL MCL GOALS**	STATE MCLs***	MTCA METHOD A CLEANUP LEVELS#	SAMPLE DATE/TIME
Chromium	U		ug/L	"	"	"	"	12/20/93
Chrysene	U	10	ug/L					8/4/88
cis-1,2-Dichloroethylene	U			70	70	70		8/30/91
cis-1,2-Dichloroethylene	U			"	"	"		3/12/92
cis-1,2-Dichloroethylene	U			"	"	"		9/15/92
cis-1,2-Dichloroethylene	U	0.5	ug/L	"	"	"		8/24/93
cis-1,2-Dichloroethylene	U	2	ug/L	"	"	"		12/20/93
cis-1,2-Dichloroethylene	U	0.5	ug/L	"	"	"		6/16/94
cis-1,2-Dichloroethylene	U	0.5	ug/L	"	"	"		1/18/95
cis-1,2-Dichloroethylene	U	0.049	ug/L	"	"	"		1/15/96
cis-1,2-Dichloroethylene	U	0.2	ug/L	"	"	"		1/29/97
cis-1,2-Dichloroethylene	U	0.1	ug/L	"	"	"		12/10/97
Cobalt	U	20	ug/L					1/30/89
Cobalt	U	20	ug/L					5/24/89
Cobalt	U							8/30/91
Cobalt	U							3/12/92
Cobalt	U							9/15/92
Cobalt	U							8/24/93
Cobalt	U		ug/L					12/20/93
Conductivity		198	umhos/cm			700		8/30/91
Conductivity		291	umhos/cm			"		3/12/92
Conductivity		343	umhos/cm			"		9/15/92
Conductivity		216	umhos/cm			"		8/24/93
Conductivity		213	umhos/cm			"		12/20/93
Conductivity		278	umhos/cm			"		6/16/94
Conductivity		284	umhos/cm			"		1/18/95
Conductivity		269	umhos/cm			"		1/15/96
Conductivity		359	umhos/cm			"		1/29/97
Conductivity		503	umhos/cm			"		12/10/97
Copper	U	10	ug/L	1,000	1,300	1,000		8/4/88
Copper	U	10	ug/L	"	"	"		8/4/88
Copper	U	10	ug/L	"	"	"		1/30/89
Copper	U	10	ug/L	"	"	"		5/24/89
Copper	U	0.005	mg/L	"	"	"		8/30/91
Copper	U			"	"	"		3/12/92
Copper	U			"	"	"		9/15/92
Copper	U		ug/L	"	"	"		8/24/93
Copper	U		ug/L	"	"	"		12/20/93
Crotonaldehyde	U	10	ug/L					8/4/88
Delta-BHC	U	0.1	ug/L					8/4/88
Dibenz[a,h]acridine	U	10	ug/L				0.1	8/4/88
Dibenz[a,h]anthracene	U	10	ug/L				"	8/4/88
Dibenz[a,j]acridine	U	10	ug/L				"	8/4/88
Dibenzo[a,e]pyrene	U	10	ug/L				"	8/4/88
Dibenzo[a,h]pyrene	U	10	ug/L				"	8/4/88
Dibenzo[a,i]pyrene	U	10	ug/L				"	8/4/88
Dibromochloromethane	U	0.5	ug/L	25		25		1/18/95
Dibromomethane	U	10	ug/L					8/4/88
Dichlorodifluoromethane	U	10	ug/L					8/4/88
Dichloromethyl-benzene	U	10	ug/L					8/4/88
Dieldrin	U	0.1	ug/L					8/4/88

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CONTAMINANT NAME	LAB QUALIFIER	VALUE REPORTED	UNITS	FEDERAL MCLs*	FEDERAL MCL GOALS**	STATE MCLs***	MTCA METHOD A CLEANUP LEVELS#	SAMPLE DATE/TIME
Diethyl arsine	U	10	ug/L					8/4/88
Diethylphthalate	U	10	ug/L					8/4/88
Dihydrosafrole	U	10	ug/L					8/4/88
Dimethoate	U	2	ug/L					8/4/88
Dimethyl phthalate	U	10	ug/L					8/4/88
Di-n-butylphthalate	U	10	ug/L					8/4/88
Di-n-octylphthalate	U	10	ug/L					8/4/88
Diphenylamine	U	10	ug/L					8/4/88
Disulfoton	U	2	ug/L					8/4/88
Endosulfan I	U	0.1	ug/L					8/4/88
Endosulfan II	U	0.1	ug/L					8/4/88
Endrin	U	0.1	ug/L	2	2	2		8/4/88
Ethyl cyanide	U	0.96	ug/L					12/10/97
Ethyl methacrylate	U	10	ug/L					8/4/88
Ethyl methanesulfonate	U	10	ug/L					8/4/88
Ethylbenzene	U			700	700	700	30	3/12/92
Ethylbenzene	U			"	"	"	"	9/15/92
Ethylbenzene	U	0.5	ug/L	"	"	"	"	8/24/93
Ethylbenzene	U	0.5	ug/L	"	"	"	"	12/20/93
Ethylbenzene	U	0.5	ug/L	"	"	"	"	6/16/94
Ethylbenzene	U	0.5	ug/L	"	"	"	"	1/18/95
Ethylbenzene	U	0.034	ug/L	"	"	"	"	1/15/96
Ethylbenzene	U	0.2	ug/L	"	"	"	"	1/29/97
Ethylene glycol	U	10000	ug/L					8/4/88
Ethylene oxide	U	3000	ug/L					8/4/88
Ethyleneimine	U	10	ug/L				0.1	8/4/88
Fluoranthene	U	10	ug/L					8/4/88
Fluoride	U	500	ug/L	2,000	4,000	2,000		8/4/88
Fluoride	U	500	ug/L	"	"	"		1/30/89
Fluoride	U	500	ug/L	"	"	"		5/24/89
Fluoride	U	0.309	mg/L	"	"	"		8/30/91
Fluoride	U	200	ug/L	"	"	"		3/12/92
Fluoride	U	200	ug/L	"	"	"		9/15/92
Fluoride	B	200	ug/L	"	"	"		8/24/93
Fluoride	U	500	ug/L	"	"	"		6/16/94
Fluoride	U	300	ug/L	"	"	"		1/18/95
Fluoride	U	340	ug/L	"	"	"		1/15/96
Fluoride	U	0.19	mg/L	"	"	"		1/29/97
Fluoride	U	0.158	mg/L	"	"	"		12/10/97
Formaldehyde	U	500	ug/L					8/4/88
Gamma-BHC (Lindane)	U	0.1	ug/L	0.2	0.2	0.2	0.2	8/4/88
Heptachlor	U	0.1	ug/L	0.4		0.4		8/4/88
Heptachlor epoxide	U	0.1	ug/L	0.2		0.2		8/4/88
Hexachlorobenzene	U	10	ug/L	1		1		8/4/88
Hexachlorobutadiene	U	10	ug/L					8/4/88
Hexachlorocyclopentadiene	U	10	ug/L	50	50	50		8/4/88
Hexachloroethane	U	10	ug/L					8/4/88
Hexachlorophene	U	10	ug/L					8/4/88
Hexachloropropene	U	10	ug/L					8/4/88
Hydrogen sulfide	U	10	ug/L					8/4/88
Indeno(1,2,3-cd)pyrene	U	10	ug/L				0.1	8/4/88

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CONTAMINANT NAME	LAB QUALIFIER	VALUE REPORTED	UNITS	FEDERAL MCLs*	FEDERAL MCL GOALS**	STATE MCLs***	MTCA METHOD A CLEANUP LEVELS#	SAMPLE DATE/TIME
Iodomethane	U	10	ug/L					8/4/88
Iron		38	ug/L	300		300		8/4/88
Iron	U	30	ug/L	"		"		8/4/88
Iron		79	ug/L	"		"		1/30/89
Iron	U	30	ug/L	"		"		5/24/89
Iron		0.06	mg/L	"		"		8/30/91
Iron		50	ug/L	"		"		3/12/92
Iron		40	ug/L	"		"		9/15/92
Iron		24	ug/L	"		"		8/24/93
Iron	U		ug/L	"		"		12/20/93
Isosafrole	U	10	ug/L					8/4/88
Kerosene	U	10000	ug/L					8/4/88
Lead	U	5	ug/L		0		5	8/4/88
Lead	U	5	ug/L		"		"	8/4/88
Lead	U	5	ug/L		"		"	1/30/89
Lead	U	5	ug/L		"		"	5/24/89
Lead	U				"		"	8/30/91
Lithium	U	10	ug/L					1/30/89
Lithium	U	10	ug/L					5/24/89
Magnesium		10300	ug/L					8/4/88
Magnesium		9450	ug/L					8/4/88
Magnesium		7330	ug/L					1/30/89
Magnesium		3000	ug/L					5/24/89
Magnesium		5.33	mg/L					8/30/91
Magnesium		7900	ug/L					3/12/92
Magnesium		8400	ug/L					9/15/92
Magnesium		5600	ug/L					8/24/93
Magnesium		5300	ug/L					12/20/93
Maleic hydrazide	U	500	ug/L					8/4/88
Malononitrile	U	10	ug/L					8/4/88
Manganese	U	5	ug/L	50		50		8/4/88
Manganese	U	5	ug/L	"		"		8/4/88
Manganese		8	ug/L	"		"		1/30/89
Manganese	U	5	ug/L	"		"		5/24/89
Manganese	U			"		"		8/30/91
Manganese	U			"		"		3/12/92
Manganese	U			"		"		9/15/92
Manganese	U		ug/L	"		"		8/24/93
Manganese	U		ug/L	"		"		12/20/93
m-Dinitrobenzene	U	10	ug/L					8/4/88
Melphalan	U	10	ug/L					8/4/88
Mercury	U	0.1	ug/L	2	2	2	2	8/4/88
Mercury	U	0.1	ug/L	"	"	"	"	8/4/88
Methacrylonitrile	U	10	ug/L					8/4/88
Methanethiol	U	10	ug/L					8/4/88
Methapyrilene	U	10	ug/L					8/4/88
Metholonyl	U	10	ug/L					8/4/88
Methoxychlor	U	3	ug/L	40	40	40		8/4/88
Methyl methacrylate	U	10	ug/L					8/4/88
Methyl methanesulfonate	U	10	ug/L					8/4/88
Methyl parathion	U	2	ug/L					8/4/88

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CONTAMINANT NAME	LAB QUALIFIER	VALUE REPORTED	UNITS	FEDERAL MCLs*	FEDERAL MCL GOALS**	STATE MCLs***	MTCA METHOD A CLEANUP LEVELS#	SAMPLE DATE/TIME
Methylenechloride	U	10	ug/L	5		5	5	8/4/88
Methylenechloride	U	5	ug/L	"		"	"	1/30/89
Methylenechloride	U	5	ug/L	"		"	"	5/24/89
Methylenechloride	U			"		"	"	8/30/91
Methylenechloride	U			"		"	"	3/12/92
Methylenechloride	U			"		"	"	9/15/92
Methylenechloride	U	5	ug/L	"		"	"	8/24/93
Methylenechloride	U	5	ug/L	"		"	"	12/20/93
Methylenechloride	U	5	ug/L	"		"	"	6/16/94
Methylenechloride	U	2	ug/L	"		"	"	1/18/95
Methylenechloride	U	0.084	ug/L	"		"	"	1/15/96
Methylenechloride	U	0.2	ug/L	"		"	"	1/29/97
Methylenechloride	U	0.76	ug/L	"		"	"	12/10/97
Methylthiouracil	U	10	ug/L					8/4/88
Molybdenum	U	40	ug/L					1/30/89
Molybdenum	U	40	ug/L					5/24/89
Molybdenum	U							8/30/91
N,N-Diethylhydrazine	U	10	ug/L					8/4/88
Naphthalene	U	10	ug/L				0.1	8/4/88
Nickel	U	10	ug/L			100		8/4/88
Nickel	U	10	ug/L			"		8/4/88
Nickel	U	10	ug/L			"		1/30/89
Nickel	U	10	ug/L			"		5/24/89
Nickel	U					"		8/30/91
Nickel	U					"		3/12/92
Nickel	U					"		9/15/92
Nickel	U		ug/L			"		8/24/93
Nickel	U		ug/L			"		12/20/93
Nicotinic acid	U	100	ug/L					8/4/88
Nitrate		10800	ug/L	10,000	10,000	10,000		8/4/88
Nitrate		5200	ug/L	"	"	"		1/30/89
Nitrate		6100	ug/L	"	"	"		5/24/89
Nitrate		2.41	mg/L	"	"	"		8/30/91
Nitrate		8700	ug/L	"	"	"		3/12/92
Nitrate		7400	ug/L	"	"	"		9/15/92
Nitrate		4400	ug/L	"	"	"		8/24/93
Nitrate		6600	ug/L	"	"	"		6/16/94
Nitrate		7900	ug/L	"	"	"		1/18/95
Nitrate		8300	ug/L	"	"	"		1/15/96
Nitrite	U	1000	ug/L	1,000	1,000	1,000		1/30/89
Nitrite	U	1000	ug/L	"	"	"		5/24/89
Nitrite	U			"	"	"		3/12/92
Nitrite	U			"	"	"		9/15/92
Nitrite	U			"	"	"		8/24/93
Nitrite	U		ug/L	"	"	"		6/16/94
Nitrite	U		ug/L	"	"	"		1/18/95
Nitrite	U		ug/L	"	"	"		1/15/96
Nitrobenzene	U	10	ug/L					8/4/88
Nitrogen in Nitrate	D	4.22	mg/L	10,000	10,000	10,000		1/29/97
Nitrogen in Nitrate	D	10.9	mg/L	"	"	"		12/10/97
Nitrogen in Nitrite	U	0.002	mg/L	1,000	1,000	1,000		1/29/97

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CONTAMINANT NAME	LAB QUALIFIER	VALUE REPORTED	UNITS	FEDERAL MCLs*	FEDERAL MCL GOALS**	STATE MCLs***	MTCA METHOD A CLEANUP LEVELS#	SAMPLE DATE/TIME
Nitrogen in Nitrite	UD	0.002	mg/L	"	"	"	"	12/10/97
Nitrosopyrrolidine	U	10	ug/L	"	"	"	"	8/4/88
N-Nitrosodiethanolamine	U	10	ug/L	"	"	"	"	8/4/88
N-Nitrosodiethylamine	U	10	ug/L	"	"	"	"	8/4/88
N-Nitrosodimethylamine	U	10	ug/L	"	"	"	"	8/4/88
N-Nitrosodi-n-butylamine	U	10	ug/L	"	"	"	"	8/4/88
N-Nitroso-di-n-dipropylamine	U	10	ug/L	"	"	"	"	8/4/88
N-Nitrosomethylethylamine	U	10	ug/L	"	"	"	"	8/4/88
N-Nitrosomethylvinylamine	U	10	ug/L	"	"	"	"	8/4/88
N-Nitrosomorpholine	U	10	ug/L	"	"	"	"	8/4/88
N-Nitroso-N-methylurethane	U	10	ug/L	"	"	"	"	8/4/88
N-Nitrososornicotine	U	10	ug/L	"	"	"	"	8/4/88
N-Nitrosopiperidine	U	10	ug/L	"	"	"	"	8/4/88
O,O,O-Triethyl phosphorothioate	U	10	ug/L	"	"	"	"	8/4/88
o,p-Xylene	U	5	ug/L	5,000	5,000	5,000	20	1/30/89
o,p-Xylene	U	5	ug/L	"	"	"	"	5/24/89
o,p-Xylene	U	5	ug/L	"	"	"	"	8/4/88
o-Toluidine hydrochloride	U	10	ug/L	"	"	"	"	8/4/88
Parathion	U	2	ug/L	"	"	"	"	8/4/88
p-Benzoquinone	U	10	ug/L	"	"	"	"	8/4/88
p-Dimethylaminoazobenzene	U	10	ug/L	"	"	"	"	8/4/88
Pentachlorobenzene	U	10	ug/L	"	"	"	"	8/4/88
Pentachloroethane	U	10	ug/L	"	"	"	"	8/4/88
Pentachloronitrobenzene (PCNB)	U	10	ug/L	"	"	"	"	8/4/88
Pentachlorophenol	U	50	ug/L	1	"	1	"	8/4/88
pH Measurement		7.5	pH	6.5-8.5	"	6.5-8.5	"	8/4/88
pH Measurement		7.9	pH	"	"	"	"	1/30/89
pH Measurement		7.8	pH	"	"	"	"	1/30/89
pH Measurement		7.6	pH	"	"	"	"	5/24/89
pH Measurement		7.9	pH	"	"	"	"	5/24/89
pH Measurement		7.86	pH	"	"	"	"	8/30/91
pH Measurement		6.95	pH	"	"	"	"	3/12/92
pH Measurement		8.23	pH	"	"	"	"	9/15/92
pH Measurement		6.82	pH	"	"	"	"	8/24/93
pH Measurement		7.88	pH	"	"	"	"	12/20/93
pH Measurement		7.93	pH	"	"	"	"	6/16/94
pH Measurement		7.66	pH	"	"	"	"	1/18/95
pH Measurement		7.78	pH	"	"	"	"	1/15/96
pH Measurement		8.44	pH	"	"	"	"	1/29/97
pH Measurement		8.02	pH	"	"	"	"	12/10/97
pH Measurement		7.76	pH	"	"	"	"	8/4/88
Phenacetin	U	10	ug/L	"	"	"	"	8/4/88
Phenol	U	10	ug/L	"	"	"	"	8/4/88
Phenylenediamine	U	10	ug/L	"	"	"	"	8/4/88
Phosphate	U	1000	ug/L	"	"	"	"	1/30/89
Phosphate	U	1000	ug/L	"	"	"	"	5/24/89
Phosphate	U	1000	ug/L	"	"	"	"	8/30/91
Phosphate	U			"	"	"	"	3/12/92
Phosphate	U			"	"	"	"	9/15/92
Phosphate	U			"	"	"	"	8/24/93

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CONTAMINANT NAME	LAB QUALIFIER	VALUE REPORTED	UNITS	FEDERAL MCLs*	FEDERAL MCL GOALS**	STATE MCLs***	MTCA METHOD A CLEANUP LEVELS#	SAMPLE DATE/TIME
Phosphate	U		ug/L					6/16/94
Phosphate	U		ug/L					1/18/95
Phosphate	U	340	ug/L					1/15/96
Phosphate	U	0.036	mg/L					1/29/97
Phthalic acid esters	U	10	ug/L					8/4/88
Potassium		4770	ug/L					8/4/88
Potassium		5090	ug/L					8/4/88
Potassium		4190	ug/L					1/30/89
Potassium		4030	ug/L					5/24/89
Potassium		7	mg/L					8/30/91
Potassium		4100	ug/L					3/12/92
Potassium		4100	ug/L					9/15/92
Potassium		3500	ug/L					8/24/93
Potassium		2900	ug/L					12/20/93
Pronamide	U	10	ug/L					8/4/88
Pyridine	U	500	ug/L					8/4/88
Reserpine	U	10	ug/L					8/4/88
Resorcinol	U	10	ug/L					8/4/88
Safrol	U	10	ug/L					8/4/88
Selenium	U	5	ug/L	50	50	50		8/4/88
Selenium		5	ug/L	"	"	"		8/4/88
Silicon		12900	ug/L					1/30/89
Silicon		9620	ug/L					5/24/89
Silver	U	10	ug/L	100		100		8/4/88
Silver	U	10	ug/L	"		"		8/4/88
Silver	U	10	ug/L	"		"		1/30/89
Silver	U	10	ug/L	"		"		5/24/89
Silver	U			"		"		8/30/91
Silver	U			"		"		3/12/92
Silver	U			"		"		9/15/92
Silver	U			"		"		8/24/93
Silver	U		ug/L	"		"		12/20/93
Sodium		11900	ug/L					8/4/88
Sodium		11900	ug/L					8/4/88
Sodium		9280	ug/L					1/30/89
Sodium		305000	ug/L					5/24/89
Sodium		5.55	mg/L					8/30/91
Sodium		8600	ug/L					3/12/92
Sodium		8700	ug/L					9/15/92
Sodium		7800	ug/L					8/24/93
Sodium	B	7500	ug/L					12/20/93
Specific conductance		329	umhos/cm					8/4/88
Specific conductance		254	umhos/cm					1/30/89
Specific conductance		301	umhos/cm					5/24/89
Strontium (elemental)		214	ug/L					8/4/88
Strontium (elemental)		181	ug/L					8/4/88
Strontium (elemental)		156	ug/L					1/30/89
Strontium (elemental)		77	ug/L					5/24/89
Strychnine	U	50	ug/L					8/4/88
Sulfate		20300	ug/L	250,000		250,000		8/4/88
Sulfate		13800	ug/L	"		"		1/30/89

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CONTAMINANT NAME	LAB QUALIFIER	VALUE REPORTED	UNITS	FEDERAL MCLs*	FEDERAL MCL GOALS**	STATE MCLs***	MTCA METHOD A CLEANUP LEVELS#	SAMPLE DATE/TIME
Sulfate		15200	ug/L	"		"		5/24/89
Sulfate		10.6	mg/L	"		"		8/30/91
Sulfate		18000	ug/L	"		"		3/12/92
Sulfate		18000	ug/L	"		"		9/15/92
Sulfate		14000	ug/L	"		"		8/24/93
Sulfate		15000	ug/L	"		"		6/16/94
Sulfate		16000	ug/L	"		"		1/18/95
Sulfate		16000	ug/L	"		"		1/15/96
Sulfate		24	mg/L	"		"		1/29/97
Sulfate		49.2	mg/L	"		"		12/10/97
sym-Trinitrobenzene		10	ug/L					8/4/88
Temperature		15	Deg C					8/4/88
Temperature		16	Deg C					1/30/89
Temperature		15.8	Deg C					5/24/89
Temperature		16.4	Deg C					8/30/91
Temperature		15.6	Deg C					3/12/92
Temperature		16.9	Deg C					9/15/92
Temperature		16.5	Deg C					8/24/93
Temperature		15.6	Deg C					12/20/93
Temperature		16.2	Deg C					6/16/94
Temperature		16.1	Deg C					1/18/95
Temperature		16.5	Deg C					1/15/96
Temperature		15.9	Deg C					1/29/97
Temperature		16.1	Deg C					12/10/97
Tetrachloroethene		5	ug/L	5		5	5	8/4/88
Tetrachloroethene		5	ug/L	"		"	"	1/30/89
Tetrachloroethene		5	ug/L	"		"	"	5/24/89
Tetrachloroethene		0.2	ug/L	"		"	"	8/30/91
Tetrachloroethene		0.6	ug/L	"		"	"	3/12/92
Tetrachloroethene		0.6	ug/L	"		"	"	9/15/92
Tetrachloroethene		0.2	ug/L	"		"	"	8/24/93
Tetrachloroethene		0.3	ug/L	"		"	"	12/20/93
Tetrachloroethene		0.6	ug/L	"		"	"	6/16/94
Tetrachloroethene		0.5	ug/L	"		"	"	1/18/95
Tetrachloroethene		0.15	ug/L	"		"	"	1/15/96
Tetrachloroethene		0.3	ug/L	"		"	"	1/29/97
Tetrachloroethene		0.4	ug/L	"		"	"	12/10/97
Tetraethylpyrophosphate		2	ug/L					8/4/88
Tetrahydrofuran		10	ug/L					1/30/89
Tetrahydrofuran		10	ug/L					5/24/89
Tetrahydrofuran		5	ug/L					1/18/95
Thallium		5	ug/L	2	0.5	2		8/4/88
Thallium		5	ug/L	"	"	"		8/4/88
Thiofanox		10	ug/L					8/4/88
Thiuram		10	ug/L					8/4/88
Tin		30	ug/L					1/30/89
Tin		30	ug/L					5/24/89
Tin								3/12/92
Tin								9/15/92
Tin			ug/L					8/24/93
Tin			ug/L					12/20/93

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CONTAMINANT NAME	LAB QUALIFIER	VALUE REPORTED	UNITS	FEDERAL MCLs*	FEDERAL MCL GOALS**	STATE MCLs***	MTCA METHOD A CLEANUP LEVELS#	SAMPLE DATE/TIME
Titanium	U	60	ug/L					1/30/89
Titanium	U	60	ug/L					5/24/89
Toluene	U	5	ug/L	1,000	1,000	1,000	40	8/4/88
Toluene	U	5	ug/L	"	"	"	"	1/30/89
Toluene	U	5	ug/L	"	"	"	"	5/24/89
Toluene	J	0.2	ug/L	"	"	"	"	8/30/91
Toluene	J	0.3	ug/L	"	"	"	"	3/12/92
Toluene	U			"	"	"	"	9/15/92
Toluene	U	0.5	ug/L	"	"	"	"	8/24/93
Toluene	U	0.5	ug/L	"	"	"	"	12/20/93
Toluene		0.5	ug/L	"	"	"	"	6/16/94
Toluene	U	1	ug/L	"	"	"	"	1/18/95
Toluene	U	0.048	ug/L	"	"	"	"	1/15/96
Toluene		0.5	ug/L	"	"	"	"	1/29/97
Toluene	J	0.5	ug/L	"	"	"	"	12/10/97
Toluenediamine	U	10	ug/L					8/4/88
Total carbon		33600	ug/L					8/4/88
Total carbon		26200	ug/L					1/30/89
Total carbon		28500	ug/L					5/24/89
Total cresols	U	10	ug/L					8/4/88
Total organic carbon	U	640	ug/L					8/4/88
Total organic carbon	U	600	ug/L					1/30/89
Total organic carbon	U	500	ug/L					5/24/89
Total organic halides	U	44.8	ug/L					8/4/88
Toxaphene	U	1	ug/L	3		3		8/4/88
trans-1,2-Dichloroethylene	U	10	ug/L	100	100	100		8/4/88
trans-1,2-Dichloroethylene	U	5	ug/L	"	"	"		1/30/89
trans-1,2-Dichloroethylene	U	5	ug/L	"	"	"		5/24/89
trans-1,2-Dichloroethylene	U			"	"	"		8/30/91
trans-1,2-Dichloroethylene	U			"	"	"		3/12/92
trans-1,2-Dichloroethylene	U			"	"	"		9/15/92
trans-1,2-Dichloroethylene	U	0.5	ug/L	"	"	"		8/24/93
trans-1,2-Dichloroethylene	U	0.5	ug/L	"	"	"		12/20/93
trans-1,2-Dichloroethylene	U	0.5	ug/L	"	"	"		6/16/94
trans-1,2-Dichloroethylene	U	0.5	ug/L	"	"	"		1/18/95
trans-1,2-Dichloroethylene	U	0.045	ug/L	"	"	"		1/15/96
trans-1,2-Dichloroethylene	U	0.2	ug/L	"	"	"		1/29/97
trans-1,2-Dichloroethylene	U	0.13	ug/L	"	"	"		12/10/97
trans-1,4-dichloro-2-butene	U	10	ug/L					8/4/88
Tributyl phosphate	U	10	ug/L					8/4/88
Trichloroethene	U	5	ug/L	5		5		8/4/88
Trichloroethene	U	5	ug/L	"		"		1/30/89
Trichloroethene	U	5	ug/L	"		"		5/24/89
Trichloroethene	U			"		"		8/30/91
Trichloroethene	U			"		"		3/12/92
Trichloroethene	U			"		"		9/15/92
Trichloroethene	U			"		"		8/24/93
Trichloroethene	U	0.5	ug/L	"		"		12/20/93
Trichloroethene	U	0.5	ug/L	"		"		6/16/94
Trichloroethene	U	0.5	ug/L	"		"		1/18/95
Trichloroethene	U	0.075	ug/L	"		"		1/15/96

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CONTAMINANT NAME	LAB QUALIFIER	VALUE REPORTED	UNITS	FEDERAL MCLs*	FEDERAL MCL GOALS**	STATE MCLs***	MTCA METHOD A CLEANUP LEVELS#	SAMPLE DATE/TIME
Trichloroethene	U	0.2	ug/L	"		"		1/29/97
Trichloroethene	U	0.4	ug/L	"		"		12/10/97
Trichloromethanethiol	U	10	ug/L					8/4/88
Trichloromonofluoromethane	U	10	ug/L					8/4/88
Trichloropropane	U	10	ug/L					8/4/88
Tris(2,3-dibromopropyl) phosphate	U	10	ug/L					8/4/88
Tritium	U	107	pCi/L	20,000				8/4/88
Tritium		89.09999847	pCi/L	"				8/30/91
Tritium		54.70000076	pCi/L	"				3/12/92
Tritium		239	pCi/L	"				9/15/92
Tritium		262	pCi/L	"				8/24/93
Tritium		102	pCi/L	"				12/20/93
Tritium		-296	pCi/L	"				6/16/94
Tritium		74.4	pCi/L	"				1/18/95
Tritium		81.7	pCi/L	"				1/15/96
Tritium		42.9	pCi/L	"				1/29/97
Tritium		42.3	pCi/L	"				12/10/97
Turbidity		2.15	NTU	5		1		1/15/96
Turbidity		2.75	NTU	"		"		1/29/97
Turbidity		4.06	NTU	"		"		12/10/97
Uranium		2.65	ug/L					8/4/88
Vanadium	U	5	ug/L					8/4/88
Vanadium	U	5	ug/L					8/4/88
Vanadium		8	ug/L					1/30/89
Vanadium		8	ug/L					5/24/89
Vanadium	U							3/12/92
Vanadium	U							9/15/92
Vanadium	L	8.1	ug/L					8/24/93
Vanadium	L	10	ug/L					12/20/93
Vinyl chloride	U	10	ug/L	2		2	0.2	8/4/88
Vinyl chloride	U	10	ug/L	"		"	"	1/30/89
Vinyl chloride	U	10	ug/L	"		"	"	5/24/89
Vinyl chloride	U	0.25	ug/L	"		"	"	1/15/96
Vinyl chloride	U	1	ug/L	"		"	"	1/29/97
Vinyl chloride	U	0.68	ug/L	"		"	"	12/10/97
Warfarin	U	10	ug/L					8/4/88
Xylenes (total)	U	5	ug/L	10,000	10,000	10,000	20	8/4/88
Xylenes (total)	U	5	ug/L	"	"	"	"	1/30/89
Xylenes (total)	U	5	ug/L	"	"	"	"	5/24/89
Xylenes (total)	U			"	"	"	"	8/30/91
Xylenes (total)	U			"	"	"	"	3/12/92
Xylenes (total)	U			"	"	"	"	9/15/92
Xylenes (total)	U	0.5	ug/L	"	"	"	"	8/24/93
Xylenes (total)	U	0.5	ug/L	"	"	"	"	12/20/93
Xylenes (total)	U	0.5	ug/L	"	"	"	"	6/16/94
Xylenes (total)	U	1	ug/L	"	"	"	"	1/18/95
Xylenes (total)	U	0.085	ug/L	"	"	"	"	1/15/96
Xylenes (total)	U	0.6	ug/L	"	"	"	"	1/29/97
Xylenes (total)	U	0.14	ug/L	"	"	"	"	12/10/97
Zinc		13	ug/L	5,000		5,000		8/4/88
Zinc	U	5	ug/L	"		"		8/4/88

GROUNDWATER WELL DATA
699-S36-E13A
(NORTHEAST CORNER)

CONTAMINANT NAME	LAB QUALIFIER	VALUE REPORTED	UNITS	FEDERAL MCLs*	FEDERAL MCL GOALS**	STATE MCLs***	MTCA METHOD A CLEANUP LEVELS#	SAMPLE DATE/TIME
Zinc		6	ug/L	"		"		1/30/89
Zinc	U	5	ug/L	"		"		5/24/89
Zinc		0.02	mg/L	"		"		8/30/91
Zinc	U			"		"		3/12/92
Zinc	U			"		"		9/15/92
Zinc	L	3.6	ug/L	"		"		8/24/93
Zinc	L	3.5	ug/L	"		"		12/20/93
Zirconium	U	50	ug/L					1/30/89
Zirconium	U	50	ug/L					5/24/89
U: non detectable R: rejected value Y: suspect value P: potential problem F: value under review L: estimated value J: estimated value D: secondary dilution B: less than quantitation limit but greater than instrument detection limit								
				*40 CFR 141 Subparts A and G, and 40 CFR 143				
				**40 CFR 141 Subpart F (non-carcinogens only)				
				***WAC 246-290-310				
				#WAC 173-340-720				

GROUNDWATER WELL DATA
699-S36-E13B
(SOUTHEAST CORNER)

CONTAMINANT NAME	LAB QUALIFIER	VALUE REPORTED	UNITS	FEDERAL MCLs*	FEDERAL MCL GOALS**	STATE MCLs***	MTCA METHOD A CLEANUP LEVELS#	SAMPLE DATE/TIME
1,1,1-Trichloroethane	U	10	ug/L	200	200	200	200	7/21/86
1,1,1-Trichloroethane	U	2	ug/L	"	"	"	"	6/16/94
1,1,2-Trichloroethane	U	10	ug/L	5	3	5		7/21/86
1,1-Dichloroethane	U	2	ug/L					6/16/94
1,2,3,4-Tetrachlorobenzene	U	10	ug/L					7/21/86
1,2,3,5-Tetrachlorobenzene	U	10	ug/L					7/21/86
1,2,3-Trichlorobenzene	U	10	ug/L					7/21/86
1,2,4,5-Tetrachlorobenzene	U	10	ug/L					7/21/86
1,2,4-Trichlorobenzene	U	10	ug/L	70		70		7/21/86
1,2-Dichlorobenzene	U	10	ug/L	600	600	600		7/21/86
1,2-Dichloroethane	U	2	ug/L	5		5	5	6/16/94
1,3,5-Trichlorobenzene	U	10	ug/L					7/21/86
1,3-Dichlorobenzene	U	10	ug/L					7/21/86
1,4-Dichlorobenzene	U	10	ug/L	75	75	75		7/21/86
1,4-Dioxane	U	500	ug/L					7/21/86
2,4,5-TP	U	1	ug/L	50	50	50		7/21/86
2,4-Dichlorophenoxyacetic acid	U	1	ug/L	70	70	70		7/21/86
2-Butanone	U	10	ug/L					7/21/86
Alpha-BHC	U	1	ug/L					7/21/86
Benzene	U	10	ug/L	5		5	5	7/21/86
Benzene	U	0.5	ug/L	"		"	"	6/16/94
Beta-BHC	U	1	ug/L					7/21/86
Bromide	U							3/11/92
Bromide	U							9/9/92
Bromide	U							8/24/93
Bromide	U		ug/L					6/16/94
Carbon tetrachloride	U	10	ug/L	5		5		7/21/86
Carbon tetrachloride	U	2	ug/L	"		"		6/16/94
Chloride		4130	ug/L	250,000		250,000		8/30/91
Chloride		4400	ug/L	"		"		3/11/92
Chloride		3800	ug/L	"		"		9/9/92
Chloride	B	3200	ug/L	"		"		8/24/93
Chloride		4000	ug/L	"		"		6/16/94
Chloroform	J	1.5	ug/L	25		25		6/16/94
cis-1,2-Dichloroethylene	U	0.5	ug/L	70	70	70		6/16/94
Conductivity		170	umhos/cm			700		8/30/91
Conductivity		162	umhos/cm			"		3/11/92
Conductivity		159	umhos/cm			"		9/9/92
Conductivity		221	umhos/cm			"		8/24/93
Conductivity		201	umhos/cm			"		12/14/93
Conductivity		254	umhos/cm			"		6/16/94

GROUNDWATER WELL DATA

699-S36-E13B

(SOUTHEAST CORNER)

CONTAMINANT NAME	LAB QUALIFIER	VALUE REPORTED	UNITS	FEDERAL MCLs*	FEDERAL MCL GOALS**	STATE MCLs***	MTCA METHOD A CLEANUP LEVELS#	SAMPLE DATE/TIME
Delta-BHC	U	1	ug/L					7/21/86
Endrin	U	1	ug/L	2	2	2		7/21/86
Ethylbenzene	U	0.5	ug/L	700	700	700	30	6/16/94
Fluoride		340	ug/L	2,000	4,000	2,000		8/30/91
Fluoride		300	ug/L	"	"	"		3/11/92
Fluoride		200	ug/L	"	"	"		9/9/92
Fluoride	B	200	ug/L	"	"	"		8/24/93
Fluoride		400	ug/L	"	"	"		6/16/94
Formaldehyde	U	500	ug/L					7/21/86
Gamma-BHC (Lindane)	U	1	ug/L	0.2	0.2	0.2	0.2	7/21/86
Hexachlorobenzene	U	10	ug/L	1		1		7/21/86
Hexachlorophene	U	10	ug/L					7/21/86
Kerosene	U	10000	ug/L					7/21/86
Methoxychlor	U	1	ug/L	40	40	40		7/21/86
Methylenechloride	U	5	ug/L	5		5	5	6/16/94
Naphthalene	U	10	ug/L				0.1	7/21/86
Nitrate	U			10,000	10,000	10,000		8/30/91
Nitrate	U			"	"	"		3/11/92
Nitrate	U			"	"	"		9/9/92
Nitrate		1300	ug/L	"	"	"		8/24/93
Nitrate		4600	ug/L	"	"	"		6/16/94
Nitrite	U			"	"	"		3/11/92
Nitrite	U			1,000	1,000	1,000		9/9/92
Nitrite	U			"	"	"		8/24/93
Nitrite	U		ug/L	"	"	"		6/16/94
o,p-Xylene	U	10	ug/L	5,000	5,000	5,000	20	7/21/86
Pentachlorobenzene	U	10	ug/L					7/21/86
pH Measurement		7.12	pH	6.5-8.5		6.5-8.5		8/30/91
pH Measurement		8.03	pH	"		"		3/11/92
pH Measurement		8.27	pH	"		"		9/9/92
pH Measurement		7.95	pH	"		"		8/24/93
pH Measurement		7.8	pH	"		"		12/14/93
pH Measurement		7.88	pH	"		"		6/16/94
Phenol	U	10	ug/L					7/21/86
Phosphate	U							8/30/91
Phosphate	U							3/11/92
Phosphate	U							9/9/92
Phosphate	U							8/24/93
Phosphate	U		ug/L					6/16/94
Pyridine	U	500	ug/L					7/21/86
Sulfate		396	ug/L	250,000		250,000		8/30/91
Sulfate	U			"		"		3/11/92

GROUNDWATER WELL DATA

699-S36-E13B

(SOUTHEAST CORNER)

CONTAMINANT NAME	LAB QUALIFIER	VALUE REPORTED	UNITS	FEDERAL MCLs*	FEDERAL MCL GOALS**	STATE MCLs***	MTCA METHOD A CLEANUP LEVELS#	SAMPLE DATE/TIME
Sulfate	U			"		"		9/9/92
Sulfate	D	13000	ug/L	"		"		8/24/93
Sulfate	D	14000	ug/L	"		"		6/16/94
Temperature		19.4	Deg C					8/30/91
Temperature		14.3	Deg C					3/11/92
Temperature		17.2	Deg C					9/9/92
Temperature		16.8	Deg C					8/24/93
Temperature		14.9	Deg C					12/14/93
Temperature		16.4	Deg C					6/16/94
Tetrachloroethene	U	10	ug/L	5		5	5	7/21/86
Tetrachloroethene	J	0.2	ug/L	"		"	"	6/16/94
Toluene	U	10	ug/L	1,000	1,000	1,000	40	7/21/86
Toluene	U	1	ug/L	"	"	"	"	6/16/94
Total organic carbon		9740	ug/L					7/21/86
Total organic halides	U	19.6	ug/L					7/21/86
Toxaphene	U	1	ug/L	3		3		7/21/86
trans-1,2-Dichloroethylene	U	0.5	ug/L	100	100	100		6/16/94
Trichloroethene	U	10	ug/L	5		5		7/21/86
Trichloroethene	U	0.5	ug/L	"		"		6/16/94
Tritium		25.89999962	pCi/L	20,000				8/30/91
Tritium		298	pCi/L	"				3/11/92
Tritium		213	pCi/L	"				9/9/92
Tritium		147	pCi/L	"				8/24/93
Tritium		42.2	pCi/L	"				12/14/93
Tritium		-73.2	pCi/L	"				6/16/94
Xylenes (total)	U	10	ug/L	10,000	10,000	10,000	20	7/21/86
Xylenes (total)	U	0.5	ug/L	"	"	"	"	6/16/94
U: non detectable								
R: rejected value								
Y: suspect value								
P: potential problem								
F: value under review								
L: estimated value								
J: estimated value								
D: secondary dilution								
B: less than quantitation limit but greater than instrument detection limit								
*40 CFR 141 Subparts A and G, and 40 CFR 143								
**40 CFR 141 Subpart F (non-carcinogens only)								
***WAC 246-290-310								
#WAC 173-340-720								

GROUNDWATER WELL DATA
699-S36-E12B
(SOUTHWEST CORNER)

CONTAMINANT NAME	LAB QUALIFIER	VALUE REPORTED	UNITS	FEDERAL MCLs*	FEDERAL MCL GOALS**	STATE MCLs***	MTCA METHOD A CLEANUP LEVELS#	SAMPLE DATE/TIME
1,1,1-Trichloroethane	U	2	ug/L	200	200	200	200	6/16/94
1,1-Dichloroethane	U	2	ug/L					6/16/94
1,2-Dichloroethane	U	2	ug/L	5		5	5	6/16/94
Benzene	U	0.5	ug/L	5		5	5	6/16/94
Bromide	U							3/11/92
Bromide	U							9/9/92
Bromide	L	80	ug/L					8/24/93
Bromide	U		ug/L					6/16/94
Carbon tetrachloride	U	2	ug/L	5		5		6/16/94
Chloride		2250	ug/L	250,000		250,000		7/25/91
Chloride		2000	ug/L	"		"		3/11/92
Chloride		2300	ug/L	"		"		9/9/92
Chloride	B	7400	ug/L	"		"		8/24/93
Chloride		5200	ug/L	"		"		6/16/94
Chloroform	J	0.2	ug/L	25		25		6/16/94
cis-1,2-Dichloroethylene	U	0.5	ug/L	70	70	70		6/16/94
Conductivity		133	umhos/cm			700		7/25/91
Conductivity		147	umhos/cm			"		3/11/92
Conductivity		149	umhos/cm			"		9/9/92
Conductivity		191	umhos/cm			"		8/24/93
Conductivity		227	umhos/cm			"		12/14/93
Conductivity		202	umhos/cm			"		6/16/94
Ethylbenzene	U	0.5	ug/L	700	700	700	30	6/16/94
Fluoride	U			2,000	4,000	2,000		7/25/91
Fluoride		100	ug/L	"	"	"		3/11/92
Fluoride		100	ug/L	"	"	"		9/9/92
Fluoride	B	300	ug/L	"	"	"		8/24/93
Fluoride		500	ug/L	"	"	"		6/16/94
Methylenechloride	U	5	ug/L	5		5	5	6/16/94
Nitrate	U			10,000	10,000	10,000		7/25/91
Nitrate	U			"	"	"		3/11/92
Nitrate	U			"	"	"		9/9/92
Nitrate	L	80	ug/L	"	"	"		8/24/93
Nitrate		800	ug/L	"	"	"		6/16/94
Nitrite	U			1,000	1,000	1,000		3/11/92
Nitrite	U			"	"	"		9/9/92
Nitrite	U			"	"	"		8/24/93
Nitrite	U		ug/L	"	"	"		6/16/94
pH Measurement		9.26	pH	6.5-8.5		6.5-8.5		7/25/91
pH Measurement		8.01	pH	"		"		3/11/92
pH Measurement		8.16	pH	"		"		9/9/92

GROUNDWATER WELL DATA

699-S36-E12B

(SOUTHWEST CORNER)

CONTAMINANT NAME	LAB QUALIFIER	VALUE REPORTED	UNITS	FEDERAL MCLs*	FEDERAL MCL GOALS**	STATE MCLS***	MTCA METHOD A CLEANUP LEVELS#	SAMPLE DATE/TIME
pH Measurement		8.74	pH	"		"		8/24/93
pH Measurement		7.87	pH	"		"		12/14/93
pH Measurement		7.87	pH	"		"		6/16/94
Phosphate	U							7/25/91
Phosphate	U							3/11/92
Phosphate	U							9/9/92
Phosphate	U							8/24/93
Phosphate	U		ug/L					6/16/94
Sulfate		437	ug/L	250,000		250,000		7/25/91
Sulfate	U			"		"		3/11/92
Sulfate	U			"		"		9/9/92
Sulfate	D	17000	ug/L	"		"		8/24/93
Sulfate	D	12000	ug/L	"		"		6/16/94
Temperature		16.7	Deg C					7/25/91
Temperature		14.5	Deg C					3/11/92
Temperature		17.7	Deg C					9/9/92
Temperature		18.8	Deg C					8/24/93
Temperature		15	Deg C					12/14/93
Temperature		16.1	Deg C					6/16/94
Tetrachloroethene	J	0.2	ug/L	5		5	5	6/16/94
Toluene	U	1	ug/L	1,000	1,000	1,000	40	6/16/94
trans-1,2-Dichloroethylene	U	0.5	ug/L	100	100	100		6/16/94
Trichloroethene	U	0.5	ug/L	5		5		6/16/94
Tritium		-141	pCi/L	20,000				7/25/91
Tritium		126	pCi/L	"				3/11/92
Tritium		209	pCi/L	"				9/9/92
Tritium		154	pCi/L	"				8/24/93
Tritium		-34.5	pCi/L	"				12/14/93
Tritium		136	pCi/L	"				6/16/94
Xylenes (total)	U	0.5	ug/L	10,000			20	6/16/94
U: non detectable								
R: rejected value								
Y: suspect value								
P: potential problem								
F: value under review								
L: estimated value								
J: estimated value								
D: secondary dilution								
B: less than quantitation limit but greater than instrument detection limit								

*40 CFR 141 Subparts A and G, and 40 CFR 143

**40 CFR 141 Subpart F (non-carcinogens only)

***WAC 246-290-310

#WAC 173-340-720

APPENDIX E

List of Gas Probe Analytes

Pacific Northwest National Laboratory Operating Procedure		Org. Code: D9T24 Procedure No.: PNNL-TVP-10 Rev. No.: 2
Title: Determination of Volatile Organic Compounds In Hanford Waste Tank Headspace Samples Using Triple Sorbent Trap Sampling and Gas Chromatograph/Mass Spectrometer Analysis		
Work Location: 326 Bldg. Lab 23B	Page 1 of 50	
Author: John Evans	Effective Date: February, 1996 Supersedes Date: December, 1995	
Identified Hazards: ☐ Radiological ☒ Hazardous Materials ☒ Physical Hazards ☐ Hazardous Environment ☐ Other:	Was a Procedure Worksheet Completed? ☐ Yes ☒ No Are One-Time Modifications Allowed to this Procedure? ☒ Yes ☐ No	
Signatures:		
Author	<u>J. C. Evans</u> J. C. Evans	<u>2/1/96</u> (Date)
Technical Reviewer	<u>B. D. McVeety</u> B. D. McVeety	<u>2/2/96</u> (Date)
Approval:		
Project Manager	<u>M. W. Ligothke</u> M. W. Ligothke	<u>2/6/96</u> (Date)
Task Manager	<u>J. S. Fruchter</u> J. S. Fruchter	<u>2/6/96</u> (Date)
Concurrences, as appropriate:		
Building Manager	<u>R. D. Sharp</u> R. D. Sharp	<u>2/5/96</u> (Date)
Health & Safety	<u>[Signature]</u> (Signature)	<u>2-6-96</u> (Date)
Process Quality	<u>T. L. Almeida</u> T. L. Almeida	<u>2/1/96</u> (Date)
Quality Operations	<u>K. J. Kuhl-Klinger</u> K. J. Kuhl-Klinger	<u>2/1/96</u> (Date)
Analyst	<u>J. L. Julya</u> J. L. Julya	<u>2-6-96</u> (Date)

PNNL Operating Procedure

Org. Code: D9T24
Procedure No.: PNNL-TVP-10
Rev. No.: 2

Title: Determination of Volatile Organic Compounds In Hanford Waste Tank Headspace Samples Using Triple Sorbent Trap Sampling and Gas Chromatograph/Mass Spectrometer Analysis

Table 1. Compounds Amenable to Analysis by TST Method

Compound	CAS #
dichlorodifluoromethane	75-71-8
chloromethane	74-87-3
1,2-dichloro-1,1,2,2-tetrafluoroethane	76-14-2
vinyl chloride	75-01-4
butane	106-97-8
chloroethane	75-00-3
acetonitrile	75-05-8
acetone	67-64-1
trichlorofluoromethane	75-69-4
pentane	109-66-0
1,1-dichloroethene	75-35-4
methylene chloride	75-09-2
1,1,2-trichloro-1,2,2-trifluoroethane	76-13-1
propanenitrile	107-12-0
1-propanol	71-23-8
1,1-dichloroethane	75-34-3
2-butanone	78-93-3
cis-1,2-dichloroethene	156-59-2
hexane	110-54-3
chloroform	67-66-3
tetrahydrofuran	109-99-9
1,2-dichloroethane	107-06-2
1,1,1-trichloroethane	71-55-6
1-butanenitrile	109-74-0
1-butanol	71-36-3
benzene	71-43-2
carbon tetrachloride	56-23-5
cyclohexane	110-82-7
1,2-dichloropropane	78-87-5
trichloroethene	79-01-6
heptane	142-82-5
cis-1,3-dichloropropene	10061-01-5
4-methyl-2-pentanone	108-10-1
pyridine	110-86-1
trans-1,3-dichloropropene	10061-02-6
pentanenitrile	110-59-8
1,1,2-trichloroethane	79-00-5
toluene	108-88-3
1,2-dibromoethane	106-93-4
octane	111-65-9

PNNL Operating Procedure

Org. Code: D9T24
Procedure No.: PNNL-TVP-10
Rev. No.: 2

Title: Determination of Volatile Organic Compounds In Hanford Waste Tank Headspace Samples Using Triple Sorbent Trap Sampling and Gas Chromatograph/Mass Spectrometer Analysis

Table 1 (contd). Compounds Amenable to Analysis by TST Method

Compound	CAS #
tetrachloroethylene	127-18-4
chlorobenzene	108-90-7
hexanenitrile	628-73-9
ethylbenzene	100-41-4
p/m-xylene	106-42-3
cyclohexanone	108-94-1
styrene	100-42-5
1,1,2,2-tetrachloroethane	79-34-5
o-xylene	95-47-6
nonane	111-84-2
1-ethyl-2-methylbenzene	611-14-3
1,3,5-trimethylbenzene	108-67-8
1,2,4-trimethylbenzene	95-63-6
decane	124-18-5
1,3-dichlorobenzene	541-73-1
1,4-dichlorobenzene	106-46-7
1,2-dichlorobenzene	95-50-1
undecane	1120-21-4
1,2,4-Trichlorobenzene	120-82-1
dodecane	112-40-3
hexachloro-1,3-butadiene	87-68-3
tridecane	629-50-5
tetradecane	629-59-4

APPENDIX F

Job Planning Package

JOB PLANNING PACKAGE

SUMMARY

JPP # _____

General Information:

Date: 7/1/98

Project Title: AEC Bus Lot Field Sampling Prepared By: RR Nielson
 Bldg.: N/A Location: old AEC Bus Lot Safety Class: N/A
 Contractor(s): George Grant MEL Cat.: N/A
 WP#: K60108 Work Req. #: N/A FMP#: N/A
 Work Control Specialist: N/A Safety Rep: DW Wright
 Project Supervisor: KB Olsen Construction Mgr/Liaison: DP Ryan
 Schedule: Start: 7/1/98 Finish: 7/24/98 EMERGENCY Phone #: 375-2400

Scope of Work:

The scope of this activity includes the following:

- Installation, sampling and removal of 6' soil gas probes.
- Surface soil sample collection, and near surface soil sample collection (0-2')
- Sediment sample collection at the bottom of site features (seepage pits, storm drains, sanitary sewers, storm pit, underground enclosure, lube pit, etc.)
- Pipe insulation sampling from underground enclosure and storm pit.
- Excavation to approximately 10' at soil depression and sampling soils in bucket
- Excavate a portion of lube pit to accommodate sediment sampling.
- Excavation of 4 unknown buried metallic targets at approximately 1' depth.

All work will be performed within the study and background area boundaries (see attached Figure A-1).

Additional detail can be found in the Sampling and Analysis Plan prepared for this activity.

Contingency/Emergency Plan/Hold Point:

- If a condition is encountered other than the work described within this Job Planning Package (JPP), discontinue work and notify your supervisor and the Battelle Representative (Chris Olsen).

CONTACTS

- If cultural materials (bones, artifacts) are encountered during work activities, work in the vicinity will cease and the Battelle Rep. contacted.

Robert Nielsen	office: 375-4532 / cell phone: 948-2867 / pager: 85-1270
Chris Olsen	376-4114
Dan Ryan	376-0055 / 948-0070 / 544-4820

Project Requirements: If checked YES, see attachment.

Y N

- ☒ ☐ Additional Approvals Required - Signatures included
- ☐ ☒ Building Configuration
- ☒ ☐ Confined Space Permit - see attached Permit.
- ☐ ☒ Critical Lift Plan
- ☒ ☐ Excavation Review - see attached geophysical survey
- ☐ ☒ Facilities Category Release
- ☐ ☒ Fall Protection Work Plan
- ☐ ☒ Fire Detection System in Service N/A
- ☐ ☒ Formal Test Procedure / ATP
- ☒ ☐ Job Safety Analysis / Potential Hazards - see attached ISA

Y N

- ☐ ☒ Lock & Tag (☐ Personal ☐ Other)
- ☐ ☒ Material Release/Disposition/Excessing
- ☐ ☒ Outage Permit # _____
- ☒ ☐ Pre-Job Meeting - Held when work is initiated.
- ☐ ☒ Quality Control Requirement
- ☐ ☒ RWP # _____
- ☒ ☐ Special Training/Qualification - see Section VIII
- ☐ ☒ Technical Work Document # _____
- ☐ ☒ Welding, Cutting, Grinding Permit
- ☐ ☒ Other

Job Package Approval: Signatures Required / Date

Building Manager [Signature]

Date 7-1-98

Supervisor _____

Date _____

Additional Comments:

- observe all postings prior to entry to any spaces/areas.
- Contractor to brief worker(s) on the contents of this JPP and the employers own Job Safety Analysis (ISA).

CHECKLIST

SECTION I

Date: 7/1/98

Known or Potential Hazards

PREJOB

CHECK POTENTIAL HAZARDS AS APPROPRIATE

Potential Hazards

☒ Animals, insects, etc. - 16	☒ Noise - 10 (Gas probe installation only)
☒ Asbestos - 19 (Steam pit & underground enclosure only)	☒ Off rd. veh. use - 27
☐ Biohazards -	☐ Open excav. > 4' -
☐ Combustible mat'ls -	☒ Overhead hazards - 9 (while below grade only)
☒ Confined space - 3	☐ Oxygen enriched -
☐ Corrosive mat'l -	☐ Oxygen deficient -
☒ Engulfment - 4	☐ Pressure systems -
☐ Entrapment -	☐ Radiological -
☐ Exp/energ. elec > 50v -	☐ Remote locations -
☒ Falls from elevation > 6' - 26 (Fixed ladder provided)	☒ Slip, trip. - 28 (concrete pad & adjacent area)
☐ Flammable mat'ls -	☐ Steam / Condensate -
☐ Inadeq/excess. vent. -	☒ Temp. < 32°F > 90°F - 29
☐ Inadeq. lighting -	☐ Toxic mat'l -
☒ Mechanical - 16	☐ Vehicle traffic -
☐ Microwv, lasers, RF energy -	☐ Welding, cutting, grinding -
☐	☐ Work over water -
☐	☒ Pedestrian Control - 30
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐
☐	☐

Hazard Control Methods

01 - Cleaning/vacuuming	10 - Hearing protection	19 - Respiratory protection	28 - Pre-Job meeting
02 - Communication equipment	11 - Intrinsically safe equipment	20 - Retrieval equipment	29 - Provide drinking water
03 - Confined space permit	12 - Lighting	21 - Sloping/shoring	30 - "What's Happening" Message
04 - Covers, guards, shields, barriers	13 - Lock and tag	22 - Torso protection	31 -
05 - Eye/face protection	14 - Non-spark-producing equipment	23 - Ventilation requirements	32 -
06 - Fall protection work plan	15 - Outage permit	24 - Welding, cutting & grinding permit	33 -
07 - Floatation devices	16 - Protective clothing	25 - Traffic control plan	34 -
08 - Hand protection	17 - Radiological work permit	26 - Bystanders around all openings will be minimized	35 -
09 - Head protection	18 - Reflective clothing	27 - Park in clear areas only	36 -

BUILDING CONFIGURATION REQUIREMENTS, INCLUDING LIMITING CONDITIONS FOR OPERATIONS:

PREJOB ☐
N/A ☒

LOCK AND TAG REQUIREMENTS:

PREJOB ☐
N/A ☒

FOR FACILITIES CATEGORY I, AND WHERE APPLICABLE, CATEGORY II, III, AND/OR OSR EQUIPMENT OR SYSTEMS: N/A ☒

Date _____

(REFERENCE DRIVER: PNL-MA-595)

SECTION V

Component/System Identification

PREJOB ☐
N/A

List manufacturer name, property number, nameplate data as applicable. Attach prints/schematic or Certified Vendor Information (CVI) if applicable:

SECTION VI

Part Procurement:

PREJOB ☐
N/A ☒

SECTION VII

JOB SITE PREPARATION: Identify those items required at the job site:

PREJOB ☒
N/A ☐

Yes No

☒	Barriers:	open excavation / trenches pedestrian control
	Communication Eqpt:	
	Material:	
	Other Eqpt:	
☒	Postings:	Post Confined Space permits at job location.
	Procedures:	
	Tools:	
	Spill Kit:	

SECTION VIII

PERSONNEL QUALIFICATIONS

PREJOB ☒
N/A ☐

Yes No LIST SPECIFIC REQUIREMENTS AND IDENTIFY APPLICABLE PERSONNEL:

Special Training Requirements	☒	Haz. Comm. #671, Confined space #694 For confined space workers, TSCA Title II EPA AHERA/ASHARA Model Acc. for Asbestos Sampler
Special Medical Exams		
Security Clearance Requirements		
Specific Previous Job Experience		
Special Dosimetry Requirements		

SECTION IX

SUPPORT SERVICES.
Check those that apply:

PREJOB ☒
N/A ☐

- ☒ Asbestos Removal
Sampling for potential only
☐ National Plumbing Code Inspection
☐ National Electrical Code Inspection

- ☒ Environmental Monitoring
Cont. Space Air Monitoring
☐ Hazardous Waste Disposal
Reduction Methods Considered:

- ☐ Third Party Inspection
☐ Other (List):

SECTION X

PREJOB ☒

REQUIRED INTERFACE PARTICIPANTS
Check box that applies:

	Date Contacted	Planning Walkdown	Pre-job Mtg.	Post-Job Mtg.	Contractor Interface Mtg.	Comments
☐ Air Balance						
☒ Building Manager <i>7-1-98</i>	6/15/98	6/15/98				
☒ Contractor	6/18/98	6/18/98				
☐ Craftsman						
☐ Customer						
☒ Facilities Engineering	6/15/98	6/18/98				
☐ Maintenance Services Supervisor						
☒ Occupational Safety & Health	6/15/98	6/18/98				
☐ Power Operator						
☐ Quality Control						
☐ Radiological Control Tech.						
☐ Utility Operations Supervisor						
☐ Work Control Specialist						
☐						

SECTION XI

ADDITIONAL JOB PACKAGE APPROVAL
Check signatures that apply:

PREJOB ☒

☒ Facilities Engineering	Date <u>7/8/98</u>
☒ Occupational Safety & Health	Date <u>7/1/98</u>
☐ Quality Control	Date <u>1/1</u>
☐ Radiological Control	Date <u>1/1</u>
☐ Research Operations	Date <u>1/1</u>
☐ Utility Operations	Date <u>1/1</u>
☐ Work Control Specialist	Date <u>1/1</u>
☒ Other <u>Industrial Hygiene</u>	Date <u>7/1/98</u>

PRE-JOB MEETING ATTENDANCE

[illegible]

Conducted by: KB Olsen Print Name

37305
Payroll No.

Signature

Date _____

ADDITIONAL COMMENTS, INSTRUCTIONS, AND/OR ENVIRONMENT, SAFETY & HEALTH (ES&H) INFORMATION

This image shows a single sheet of white paper with horizontal blue or grey ruling lines. The lines are evenly spaced and run across the width of the page. There is no handwriting or printed text on the paper.

JOB SAFETY ANALYSIS

MINIMUM REQUIREMENTS:

Work Activity	Hazards Present	Required Safety Measures/PPE
Gas Probe Installation	Mechanical hazards, noise, heat stress	Safety shoes (shoes with steel toes and puncture resistant soles), leather gloves, ear plugs, drinking water provided.
Confined Space Entry	Atmosphere, fall hazards, bugs & spiders, heat stress.	Confined Space Permit
Excavation	Mechanical hazards, buried objects.	Safety shoes, leather gloves, review geophysical survey results.
Surface Soil Sampling	Uneven surfaces, bugs & spiders, heat stress	Safety shoes, leather gloves, drinking water provided.
Overall Project	Unauthorized personnel, off-road vehicles, confined space hazards.	Distribute "What's Happening" message, park in clear area, define parking area. Remote Sampling will be performed wherever practicable to minimize confined space entry.

FROM : GRANT CONSTRUCTION

PHONE NO. : 509 373 6201

Jul. 06 1998 03:33PM P2

GAG 01

JOB SAFETY ANALYSIS				Page 1 of 2																																																																																																																	
Project No.		Work Order No. N/A		Area 5th and Stevens																																																																																																																	
Prepared By MIKE ELLIS		Date 7/6/98		PNNL.																																																																																																																	
Scope/Description: DIG TEST PITS AND BARRICADE PIT																																																																																																																					
Emergency Contact Person(s): Primary: 736-8035 CELLULAR Secondary: GRANTS OFFICE 946-6188 Emergency Radio/Phone No.: 911 Specific Work Location(s): 5TH AND STEVEN AT THE OLD BUS GARAGE																																																																																																																					
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Confined Space Entry Permit**Author:** RR Nielson

Entry Dates: 7/13-17/98

Entry Times: Business Hours

Permit Expires:

Location of confined space to be entered:

Steam Pit, Underground Enclosure, Sanitary Sewers, Seepage Pit, Lube Pit. All confined spaces are inactive areas within the AEC Bus Lot Study Area (see attached Figure A-1)

Description of work to be performed:

Work will involve soil, sediment and pipe insulation sampling within the confined space.

Approvals ¹	Printed Name	Signature
Entry Supervisor(s):	ML Coffey
	JL Devary
Safety & Health Representative:	RE Johanson
Other:		
Entrants:	A. Gonzalez
	KB Olsen
Attendants:	KB Olsen	
	A. Gonzalez	
Building Manager:	JA Lettau	7-1-98

Signatures on the permit indicate the following:

- ☐ the entry supervisor and Safety and Health Representative indicate that they have reviewed the permit and concluded that appropriate measures have been identified to protect the entrant(s) during the entry.
- ☐ the entrant(s) and attendant(s) indicate that they have been briefed on the hazards and the techniques used to control them and will comply with the hazard control methods.
- ☐ the building manager indicates awareness of the confined space activities taking place in the facility.

Atmospheric Tests Required? ☒ Yes ☐ No			
Tests Performed	Date	Time	Results
Oxygen Content			
Flammable Gases and Vapors			
Potential Toxic Air Contaminants			
Other			
Remarks concerning atmospheric tests:			
Atmospheric test performed by: _____ (Signature) _____ (Date)			

Anticipated Hazards: Check all that apply ()		
☐ biohazards ☐ combustible dusts ☐ corrosive material ☐ electrical ☐ engulfment ☐ entrapment ☐ flammable materials	☒ hazardous atmosphere ☐ inadequate lighting ☒ insects, spiders, etc. ☐ mechanical ☐ noise ☒ other <u>Potential Asbestos</u> ☐ oxygen-deficient	☐ oxygen-enriched ☐ pressure systems ☐ radiological ☒ slip, trip, fall ☐ spark-producing operation ☐ thermal temperature extremes ☐ toxic material

Actions to Control Hazards		
Engineering Controls	☐ intrinsically safe equipment ☐ lighting	☐ subsidence control ☐ ventilation requirements
Describe engineering controls: N/A		
Administrative Controls	☐ communication equipment ☐ lock and tag ☒ monitoring for hazardous environments	☐ outage permit ☐ radiological work permit
Describe administrative controls: Atmospheric testing will be conducted as described above.		
Personal Protective Equipment	☒ eye protection ☒ fall protection equipment ☒ hard hat ☐ hearing protection	☐ non-conductive foot wear ☒ protective clothing ☒ respirators ☐ retrieval equipment

Describe personal protective equipment:

Eye, head, hand, foot and respiratory protection. Fixed ladder provided.

Standard Requirements

1. The entry supervisor verifies that the entrants and attendants have appropriate training and that they understand all hazard control methods specified in this permit.
2. The entrant does only the work identified by this permit. If the work changes, the entrant leaves the space and the work is re-evaluated.
3. The attendant never enters the confined space.
4. If unanticipated hazards occur, the entrant or attendant stops the work and the entrant leaves the space.

Description of Emergency Procedures

In the event of an emergency or off-normal event, call 375-2400. State the problem to the 375-2400 operator. Request any needed emergency assistance and that appropriate staff be notified. If you need further instructions, be sure the 375-2400 operator has the telephone number where you can be reached. This applies 24 hours a day, 365 days of the year. All injured persons must report to First Aid and notify their supervisor of the injury.

For offsite confined space entries, the local emergency services provider should be contacted before the entry is made.

A means for summoning the emergency rescue services is required at the entry site prior to entry (e.g., a cellular phone, telephone, radio). Specify the type of communication device below.

Describe the emergency procedures that will be implemented to provide rescue of staff members working in confined spaces:

After the permit is filled out and signed, it must be posted at the entry portal or by any other equally effective means.

When the confined space entry is completed, the original permit is sent to the Department Secretary, Occupational Safety and Health, P7-79.

LEGEND

- Buried pipe or cable
- Edge of concrete pad
- Approximate outline of buried object
- Manhole cover
- Wooden stake used to mark survey grid

Coordinates: Washington State Plane, 1983

AEC BUS LOT - MAINTENANCE SHOP AREA

UNDERGROUND UTILITIES DETECTED BY GEOPHYSICAL SURVEYS

Map 1 of 1	November 13, 1997	Rev. 0
Pacific Northwest National Laboratory, Richland, WA		

Manhole south
of road (5th street)