HARTCROWSER

Earth and Environmental Technologies

Preliminary Groundwater and Soil Quality Assessment Northwest Cooperage Company, Inc. Seattle, Washington

Prepared for
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PRELIMINARY GROUNDWATER AND SOIL QUALITY ASSESSMENT
NORTHWEST COOPERAGE COMPANY, INC.
SEATTLE, WASHINGTON

INTRODUCTION

This report presents the results of our preliminary assessment of the soil and groundwater quality conditions at the Northwest Cooperage site. This work was conducted in general accordance with our proposal dated February 21, 1986. The site is located adjacent to the First Avenue South Bridge and the Duwamish River as shown on Figure 1. Northwest Cooperage has operated as a drum recycling facility on the site for approximately 40 years.

To implement this preliminary assessment, Hart Crowser completed the following work:

- Conducted a site visit, attended meetings with EPA, and developed a work plan,
- Conducted surface soil sampling at 30 locations,
- Drilled three borings to obtain subsurface soil samples,
- Installed three groundwater monitoring wells,
- Obtained groundwater samples from the monitoring wells,
- Coordinated chemical analysis of soil and groundwater samples,

- Compiled and reviewed information gathered in conjunction with our work and prepared this report.

This report has been prepared for the exclusive use of Northwest Cooperage Company for specific application to the referenced site. This work was performed in accordance with generally accepted professional practices relating to the nature of the work accomplished. This warranty is in lieu of all other warranties, express or implied.

The following section summarizes our findings and recommendations. The main body of the report contains additional detail and supporting information. Sampling locations are shown on Figure 1. Boring logs, well construction features and field sampling procedures are described in Appendix A. Appendix B contains the laboratory reports relating to this work and includes method references and quality control information.

FINDINGS AND RECOMMENDATIONS

- The hydraulic gradient and apparent groundwater flow direction was inland from the river based on measurements made on May 14, 1986. However, the observed gradient may have been temporarily induced by tidal action or local construction dewatering.

- The most probable contaminant migration pathways are via groundwater transport or soil erosion (unpaved portions of Zone 6). Since there are no known drinking water wells beneath or in the vicinity of the site, the Duwamish River is the most likely receptor of concern.

- Metals and a variety of organic compounds were detected at low concentration levels in soil and groundwater beneath the site. Given the relatively low groundwater concentrations of detected constituents, soil properties, and possible groundwater flow reversals, it is unlikely that releases from the site would cause fresh water aquatic standards to be exceeded in the Duwamish River.

- Additional site characterization is recommended. The purpose of collecting this additional data is to assess whether the existing data are representative of the site groundwater conditions, and to estimate the magnitude of possible releases to the river. The specific objectives of this work are to assess:

  - the direction of groundwater flow beneath the site and the influence on groundwater flow from tidal action and dewatering,
  - groundwater quality beneath other portions of the facility,
  - groundwater flow quantities.

- If the additional data confirm our observations as to groundwater flow directions and water quality, and the data allow estimation of flow quantities, then the site characterization should be completed.

- To complete the site characterization we recommend that the following work be completed:

  - Groundwater measurements should be made in the existing three wells over at least one tidal cycle. This data would be analyzed to assess the effects of tidal fluctuations on groundwater flow direction. The status of METRO dewatering should also be assessed.

  - Two additional wells should be installed at the locations shown on Figure 1. These wells would be constructed in a similar fashion as the three existing wells.

  - The new wells and a control point on the small creek located on the north side of the property should be surveyed to the same datum as the existing wells and two sets of water level measurements should be made at "low" and "high" groundwater levels. Groundwater flow directions and gradients for each set of measurements would be assessed.

  - Permeability tests (in-situ) should be completed in all wells.

- Groundwater samples should be obtained from the two new wells and analyses for priority pollutants should be completed.

- The data should be compiled and analyzed, and a site characterization report should be prepared.

HYDROGEOLOGY

Regional Conditions

The N.W. Cooperage site is located within the Duwamish River Valley (Figure 1). The valley deposits consist of unconsolidated alluvial sand, gravel, silt and clay (river deposits). The valley deposits are surrounded by glacially formed uplands consisting of till, outwash (sand and gravel), and interglacial deposits (sand, gravel, silt and clay).

In the Puget Sound region, the glacial uplands typically act as recharge areas where regional hydraulic gradients are downward while the valleys act as discharge areas where the regional hydraulic gradients are upward. In the vicinity of the Duwamish River Valley, groundwater typically flows from the uplands into the valley and discharges into the river.

Our review of existing data, including the preliminary assessment report prepared by EPA, indicates that no drinking water wells are present in the immediate vicinity of the site. Based on this data, the presence of the river, and general hydrogeologic conditions, little potential exists for drinking water aquifers to be adversely impacted by site activities.

Local Conditions

Drilling conducted in conjunction with our work penetrated fill and natural sand deposits to the maximum depth of approximately 25 feet below ground surface. The upper 15 to 20 feet were very variable in composition. Samples of this material were composed of fine to coarse sand, sandy gravel, and sandy silt with varying amounts of wood and plant material

(Figures A-2 through A-4). These samples are interpreted to represent either fill or natural river deposits.

Samples of slightly silty, fine sand were recovered at depths of between about 15 to 23 feet. These samples are interpreted to represent natural river deposits and were encountered in all three borings.

The depth to groundwater at the monitoring wells was measured at approximately 8 to 16 feet below ground surface on May 14, 1986. The water table was deepest at well B-3 and was about 8 feet deep at wells B-1 and B-2.

Relative water table elevations in feet for May 14, 1986 are:

B-1	85.53
B-2	85.84
B-3	82.59

These water table elevations indicate that the groundwater flow gradient is away from the river and towards monitoring well B-3 for the period measured. This flow direction is contrary to expectations based on the regional hydrogeologic conditions and could be caused by:

- tidal fluctuation in the Duwamish River inducing local water table fluctuations,

- construction dewatering in the area (to install a METRO sewer pipeline) which could cause the water table to be lower at well B-3 relative to wells B-1 and B-2.

Tidal fluctuations in the river could cause temporary reversals of flow beneath the site. The net groundwater flow would still be towards the waterway. We have encountered this condition on other sites adjacent to tidally influenced waterways in the Puget Sound region.

Dewatering for pipeline installation was observed during our field work. This dewatering is assumed to be temporary and its effects on measured water levels (if any) should dissipate once the activity ceases.

SOIL AND GROUNDWATER QUALITY

Soil and groundwater samples were analyzed to assess the presence of chemical contamination. The sampling and chemical analysis conducted were as follows:

- Surface soil samples (approximately 0 to 2 feet in depth) were obtained at the locations shown on Figure 1. Six composite samples were formed by combining the individual samples collected within the six zones shown on Figure 1.

- Subsurface soil samples were obtained in conjunction with drilling for installation of the monitoring wells. Two composite soil samples were formed from samples obtained from borings B-1 and B-2. Samples taken from below about 2 feet and above the water table (at the time of drilling) were used to prepare the composite.

- Groundwater samples were obtained from the three monitoring wells. These wells were located based on the results of the surface soil chemical analyses and were placed to increase the probability that groundwater contamination would be detected if present.

- Soil and groundwater samples were analyzed for priority pollutants. Subsurface soil samples were scanned in the field using a portable photoionization detector (PID) for volatile hydrocarbons. Groundwater samples were also tested in the field for specific conductance, temperature, and pH.

The results of the these analyses are summarized in Table 1 for those constituents detected above trace quantities. The laboratory reports of the analyses, including method references and quality control information,

are presented in Appendix B. The measurements made with the portable photoionization detector are presented on the boring logs (Figures A-2 through A-4).

Surface Soil Quality

The surface soil composite sample from Zone 6 generally exhibited the highest concentration of priority pollutant metals. Concentrations of chromium, lead, mercury, cadmium, copper, nickel, and zinc in Zone 6 were elevated relative to other surface soil composite samples. Surface soil composite samples from Zones 3 and 5 generally exhibited lower concentrations of priority pollutant trace metals than the other zones. The total cyanide concentration was highest in the surface soil composite sample from Zone 4, and lowest in that of Zone 1.

Methylene chloride was detected above trace concentrations in surface soil composite samples from all but Zone 3. Acetone was detected in Zones 4, 5, and 6. Only Zone 6 exhibited detectable concentrations of other volatile priority pollutant organic compounds above trace levels. A total of approximately 1.8 ppm of volatile organic chemicals were detected in Zone 6. Surface soil composite samples from Zones 1, 2, and 6 generally exhibited the highest concentrations of solvent-extractable priority pollutant organic compounds. Zones 3, 4, and 6 generally exhibited the highest concentrations of priority pollutant pesticides and PCB's.

Subsurface Soil Quality

In general, priority pollutant metal concentrations were higher in the composite sample from boring B-2 as compared with B-1. Chromium, lead and zinc were detected in quantities greater than 100 ppm. Total cyanide and total phenolics exhibited similar concentrations. With the exception of antimony, the metal levels detected in the composite boring samples are similar to the concentrations detected in the composite surface samples.

Photoionization detector (PID) responses of less than 1 to 2 ppm were measured in the subsurface soil samples from boring B-3 (background well). Responses of 10 to 25 ppm were measured in samples obtained from boring B-1 and 10 to 85 ppm in samples from boring B-2. Highest responses were measured in samples taken above the water level at the time of drilling (ATD).

Samples with the highest PID responses were included in the composite samples for analysis. The indications provided by the responses measured in the field are reflected in the higher concentrations of priority pollutant volatile organic compounds detected in the composite sample from boring B-2. In this composite sample, total volatiles were detected at 2.8 ppm. This compares with about 0.68 ppm detected in B-1 and about 1.8 detected in the surface soil sample from Zone 6.

The total concentrations of solvent-extractable priority pollutant organic compounds were similar for composite samples from borings B-1 and B-2 (between about 10 and 11 ppm). This compares with a total extractable organic chemical concentration of about 8.5 ppm detected in Zone 6 surface samples. The total PCB concentrations in the composite samples from borings B-1 and B-2 were less than 3 ppm. No PCB's were detected in the surface samples.

Groundwater Quality

The results of the chemical analysis from two groundwater samples obtained from the on-site wells are summarized in Table 1. Metals and a relatively small number of organic chemicals were detected in the samples. The highest concentration of an individual metal was 0.110 ppm (zinc - in well B-1) and of an individual organic chemical was 0.460 ppm (ethylbenzene in well B-2).

Specific conductance and pH measured in groundwater from the on-site monitoring wells were higher than at the off-site monitoring well. The highest specific conductance was measured in well B-1 (the closest well to

the river), which is likely indicative of the effects of infiltrating river water during higher elevation tidal cycles. The pH and conductance measurements are presented in Table A-2.

Chromium, copper, and silver concentrations detected in the on-site monitoring wells (B-1 and B-2) are approximately equal to or less than the concentrations detected in the background monitoring well (B-3). Mercury and beryllium were not detected in any of the groundwater samples.

Antimony, arsenic, and lead were detectable in the sample from monitoring well B-2 but were below detection limits for samples obtained from monitoring wells B-1 and B-3. Nickel is higher in the samples from B-1 and B-2 as compared with B-3. Zinc is higher in the sample from well B-2 and substantially higher in the sample from well B-1 relative to well B-3.

Samples from B-1 and B-2 have higher total cyanide concentrations relative to B-3. Phenol was not detected in monitoring well B-1 but was elevated in B-2 relative to monitoring well B-3.

The sample from monitoring well B-2 exhibited the highest concentrations of priority pollutant volatile compounds which is consistent with the PID measurements obtained from B-2 soil samples. Volatile compounds detected included vinyl chloride, methylene chloride, acetone, trans-1,2-dichloroethylene, benzene, 4-methyl-2-pentanone, toluene, ethylbenzene, and xylenes. The sum of the detected concentrations is less than 1.4 ppm in the groundwater sample from B-2. Only acetone was detected in the sample from monitoring B-1. Methylene chloride and acetone were detected in the sample from background monitoring well B-3. The concentrations of these two compounds are suspected as laboratory-introduced contamination. Several priority pollutant volatile compounds were detected in the groundwater samples that were not detected in the soil samples.

The groundwater sample from monitoring well B-2 also had the highest concentrations of priority pollutant solvent-extractable organic compounds. However, the total concentration of all compounds detected was

less than 0.6 ppm. No solvent-extractable compounds were detected in the sample from monitoring well B-1. However, several compounds at a total concentration of less than 0.2 ppm, were detected in well B-3. No priority pollutant pesticides or PCB's were detected in the groundwater samples.

Interpretation of Soil and Groundwater Quality

The samples tested in conjunction with our work indicate that the groundwater beneath the site is contaminated, but at a low level, relative to the assumed background conditions. Surface and subsurface soils at the site also appear contaminated. Surface soils appear to be contaminated to substantially varying degrees.

Contaminant Migration

The assumed pathways for contaminant migration are groundwater transport and soil erosion. The expected transport characteristics of the identified contaminants are variable. Our preliminary assessment indicates that the most probable receptor of contaminants from groundwater transport or soil erosion is the Duwamish River.

HART CROWSER, INC.

Matthew G Dalton

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Senior Associate Hydrogeologist

MGD:taa

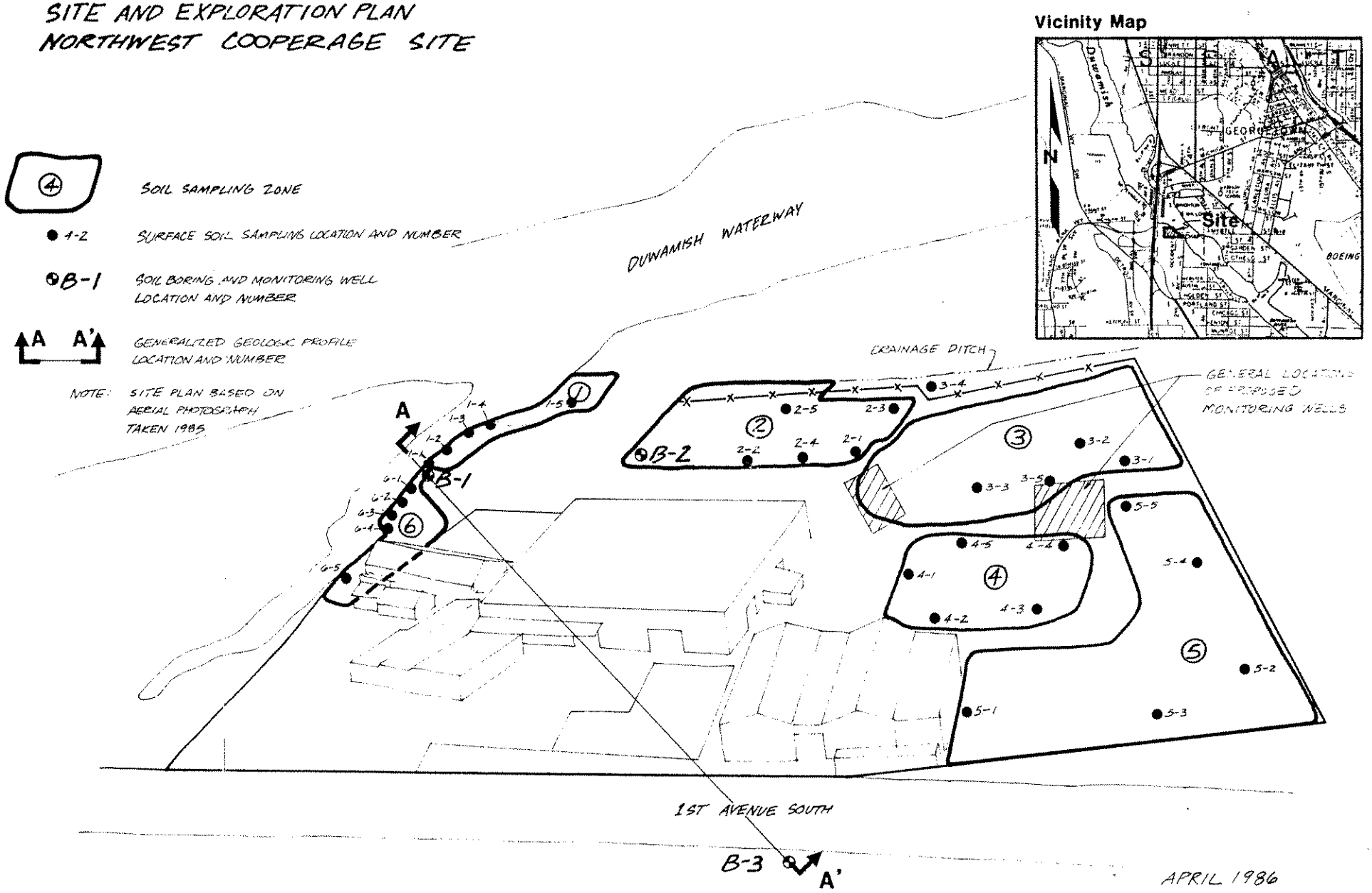
Table 1 - Results of Chemical Analysis

Concentration in ppm

Analyte / Location	Groundwater Samples			Subsurface Soil Composite Samples		Surface Soil Composite Samples					
	B-1	B-2	B-3	B-1	B-2	1	2	3	4	5	6
Antimony	ND	0.015	ND	5.	ND	ND	ND	ND	ND	ND	ND
Arsenic	ND	0.017	ND	5.1	6.2	5.0	5.5	4.5	4.5	4.0	7.8
Beryllium	ND	ND	ND	0.3	0.4	0.4	0.4	0.4	0.4	0.4	0.3
Cadmium	0.006	0.002	0.002	ND	ND	0.5	1.4	0.5	ND	ND	1.5
Chromium	0.003	0.007	0.014	35.	120.	27.	200.	20.	17.	22.	200.
Copper	0.006	0.006	0.004	35.	72.	26.	28.	13.	15.	13.	100.
Lead	ND	0.027	ND	63.	170.	1,400.	640.	48.	160.	60.	1,400.
Mercury	ND	ND	ND	0.2	0.4	0.5	1.0	0.3	0.6	0.2	6.7
Nickel	0.026	0.022	0.009	28.	61.	22.	21.	11.	15.	12.	47.
Silver	0.004	0.003	0.010	0.5	0.9	ND	1.2	0.2	[illegible]	ND	0.2
Zinc	0.110	0.019	0.010	81.	290.	130.	440.	91.	120.	70.	640.
Total Cyanide	0.018	0.070	ND	0.7	8.3	0.6	3.6	1.9	0.8	3.6	4.5
Total Phenol	ND	0.180	0.009	0.7	1.6	ND	0.6	ND	ND	ND	ND
Vinyl Chloride	ND	0.310	ND	ND	ND	ND	ND	ND	ND	ND	ND
Methylene Chloride	TRACE	0.011	0.008	0.130	0.350	0.060	0.040	TRACE	0.051	0.053	0.330
Acetone	0.016	0.056	0.021	0.410	1.700	ND	ND	TRACE	0.060	0.044	0.092
Chloroform	ND	ND	ND	ND	ND	TRACE	TRACE	ND	TRACE	ND	TRACE
1,1-Dichloroethylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
1,1-Dichloroethane	ND	TRACE	ND	ND	ND	ND	ND	ND	ND	ND	ND
trans-1,2-Dichloroethylene	ND	0.190	ND	ND	TRACE	ND	ND	ND	ND	ND	ND
1,1,1-Trichloroethane	ND	ND	ND	TRACE	TRACE	ND	ND	ND	ND	ND	TRACE
Trichloroethylene	ND	TRACE	ND	ND	TRACE	ND	TRACE	ND	ND	ND	0.039
Tetrachloroethylene	ND	ND	ND	TRACE	0.130	TRACE	TRACE	ND	ND	ND	0.870
Benzene	ND	0.017	ND	ND	ND	ND	ND	ND	ND	ND	ND
4,-Methyl-2-pentanone	ND	0.011	ND	ND	ND	ND	ND	ND	ND	ND	ND
Toluene	ND	0.270	ND	ND	0.035	ND	ND	ND	ND	ND	TRACE
Ethylbenzene	ND	0.460	ND	TRACE	0.190	ND	ND	ND	ND	ND	0.110
Xylene, all Isomers	TRACE	0.150	ND	0.028	0.360	ND	ND	ND	ND	ND	0.320
Phenol	ND	0.018	ND	ND	0.320	ND	ND	ND	ND	ND	ND
1,2-Dichlorobenzene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.660
2,4-Dimethylphenol	ND	0.320	0.028	ND	0.930	ND	ND	ND	ND	ND	ND
Naphthalene	TRACE	0.018	0.120	1.900	1.900	ND	ND	ND	ND	ND	ND
4-Chloro-m-cresol	ND	0.130	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthylene	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Acenaphthene	ND	ND	0.010	0.680	0.330	ND	ND	ND	ND	ND	ND
Fluorene	ND	ND	ND	0.430	0.340	ND	ND	ND	ND	ND	ND
Pentachlorophenol	ND	ND	ND	ND	ND	0.070	0.480	ND	ND	ND	0.810
Phenanthrene	ND	ND	ND	0.930	0.980	0.086	0.640	ND	ND	ND	0.660
Anthracene	ND	ND	ND	0.250	1.300	ND	ND	ND	ND	ND	ND
Dibutylphthalate	ND	ND	ND	ND	0.530	0.057	0.680	ND	ND	ND	0.600
Fluoranthene	ND	ND	ND	0.750	0.390	0.072	0.840	ND	ND	ND	ND
Pyrene	ND	ND	ND	0.470	0.370	ND	0.510	ND	ND	ND	0.500
Butyl benzyl phthalate	ND	ND	ND	ND	ND	ND	ND	ND	ND	0.150	ND
Bis(2-ethylhexyl)phthalate	TRACE	TRACE	TRACE	2.630	1.800	5.800	6.900	0.320	ND	0.360	4.800
Di-n-octyl phthalate	ND	ND	ND	0.380	0.130	ND	ND	ND	ND	ND	ND
Dibenzofuran	ND	ND	ND	0.420	0.160	ND	ND	ND	ND	ND	ND
2-Methylnaphthalene	ND	ND	0.010	0.770	1.500	ND	ND	ND	ND	ND	1.260
2-Methylphenol	ND	0.026	ND	ND	ND	ND	ND	ND	ND	ND	ND
4-Methylphenol	ND	0.070	ND	0.510	0.530	ND	ND	ND	ND	ND	ND
Dieldrin	ND	ND	ND	ND	ND	ND	ND	ND	0.029	0.016	ND
4,4'-DDE	ND	ND	ND	ND	ND	ND	0.046	ND	ND	ND	0.427
4,4'-DDD	ND	ND	ND	ND	ND	ND	0.110	ND	0.219	0.019	ND
4,4'-DDT	ND	ND	ND	ND	ND	ND	ND	ND	0.246	0.199	0.684
Endrin	ND	ND	ND	ND	ND	0.104	ND	ND	ND	ND	ND
PCB 1248	ND	ND	ND	1.800	1.700	ND	ND	ND	ND	ND	ND
PCB 1260	ND	ND	ND	0.950	1.200	ND	ND	0.398	0.435	ND	ND

Notes: This table summarizes the results of the analyses performed. Refer to Appendix A for discussion of sampling technique. Refer to Appendix B for method references, limits of detection, quality control information, and information regarding trace quantities.

SITE AND EXPLORATION PLAN
NORTHWEST COOPERAGE SITE



APRIL 1986
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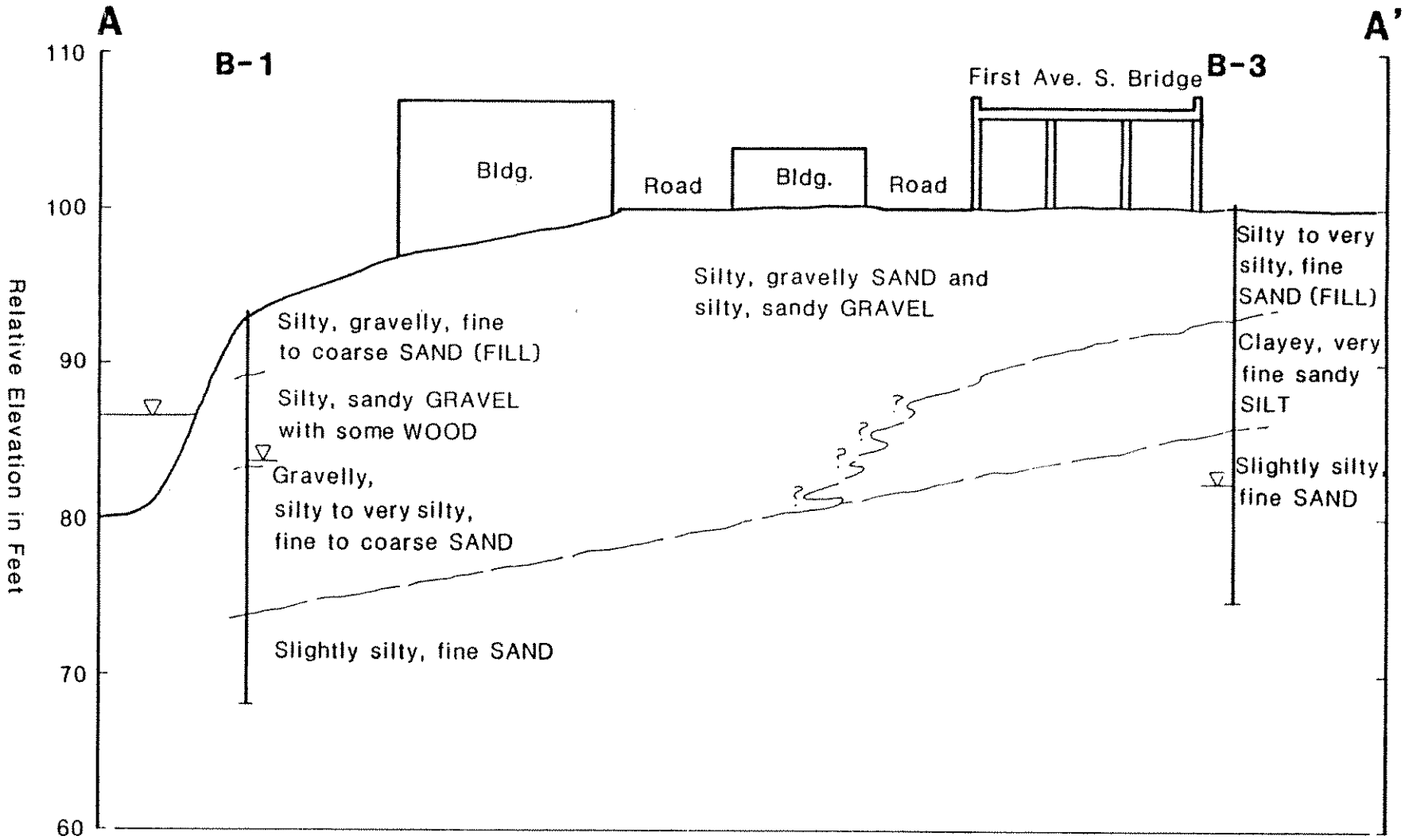
Generalized Geologic Profile A-A'



Note: Stratum lines are based upon interpolation between soil boring and monitoring wells and represent our interpretation of subsurface conditions based on currently available data.

B-1 Soil Boring and Monitoring Well Number

Soil Boring and Monitoring Well Location

Groundwater Level

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HART-CROWSER & associates inc.
Figure 2

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APPENDIX A
FIELD PROCEDURES

The field procedures used by Hart Crowser for this work are presented in this section. The following specific items are covered:

- field work completion,
- surface soil sampling and sample handling,
- borehole soil sampling and sample handling,
- groundwater monitoring well installation,
- groundwater monitoring well development,
- groundwater sampling and sample handling.

In addition to the field procedures, Appendix A includes the following field data:

- system to classify soil samples,
- surface soil sample descriptions,
- boring logs and well construction diagrams,
- water level data,
- chain of custody records.

Field Work Completion

Surface Soil Sampling: Surface soils (0 to 2.0 feet) were collected from 30 locations with the six assigned zones of the site during the period from February 4 to 5, 1986. The soil sampling locations were established by representatives of Hart Crowser, the Environmental Protection Agency (EPA), and their Contractor, Tetra Tech. The surface soil sampling locations are shown on Figure 1. Surface soil sample descriptions are presented in Table A-1.

Borehole Soil Sampling: Soil samples were collected from drilled boreholes at two locations on-site and one location off-site on May 5 and 6, 1986. The boring locations were established by representatives of Hart Crowser and EPA. The boring locations are shown on Figure 1. Interpretive geologic logs of the borings are presented on Figures A-2 through A-4.

Groundwater Monitoring Well Installation and Development: The drilled boreholes were completed as groundwater monitoring wells on May 5 and 6, 1986. Construction diagrams for the monitoring wells are presented on Figures A-2 through A-4.

Groundwater Sampling: Groundwater soil samples were obtained from the monitoring wells on May 14, 1986.

Surface Soil Sampling and Sample Handling

Soil sampling holes were excavated using hand digging equipment to a depth of 2.0 feet where conditions permitted. Soil samples were collected from the side wall of the excavated hole using clean stainless steel trowels. Soil samples were placed in specially cleaned glass jars with polytetrafluoroethylene (PTFE)-lined lids. Split samples were obtained for representatives of EPA. Soil samples were described using the visual/manual classification method of ASTM D2488. This system is presented on Figure A-1. All samples we retained were placed on ice in insulated coolers for transport to the testing laboratory. Samples were accompanied by chain of custody forms and maintained in our custody until receipt by the laboratory. Chain of custody forms are attached.

Excavation and sampling equipment were decontaminated using sequential washes of tap water, detergent solution, tap water and deionized water. Soil sampling holes were backfilled with the excavated material.

Borehole Soil Sampling and Sample Handling

Subcontractors: FLD Drilling of Edmonds, Washington, was subcontracted by Hart Crowser for the drilling work.

Equipment: Drilling was performed using a truck-mounted CME-75 drilling rig equipped with 3-3/4-inch-inside-diameter hollow stem auger. Soils were sampled at approximately 2.5-foot intervals using a 2-inch-outer-diameter split-spoon sampler according to ASTM Method D 1587. Soil samples were described using the visual/manual classification method of ASTM D2488. This systems is presented on Figure A-1. All downhole equipment was steam cleaned before use and between borings. The soil sampler was decontaminated between samples using sequential washes of tap water, detergent solution, tap water, and deionized water. No grease was used on the drilling tools.

Sample Handling: After retrieval, soil samples were placed in specially cleaned glass jars with polytetrafluoroethylene PTFE-lined lids and stored on ice in insulated coolers for transport to the testing laboratory. Samples were accompanied by chain of custody records and maintained in our custody until receipt by the laboratory. At the laboratory, composite samples from the on-site borings were prepared for pickup by representatives of EPA.

Photoionization Detector (PID) Measurements: Approximately 20 to 30 minutes after drilling was terminated, head space measurements were taken using a portable photoionization detector (H-nu PI-101, 10.2 eV Lamp). The readings taken are plotted on Figures A-2 through A-4.

Groundwater Monitoring Well Installation and Development

Installation: The soil borings were completed as monitoring wells by installating 2-inch-inside-diameter, flush threaded, schedule 40, polyvinyl chloride (PVC) pipe and screen through the hollow-stem auger. The screen slot size used was 0.020 inches. A silica sand pack was installed around

the screened section of the well and the borehole sealed with cement-bentonite grout. The well head was secured with a locked enclosure. Construction diagrams of the monitoring wells are shown on Figures A-2 through A-4.

Development: The monitoring wells were developed to remove any fine-grained sediment from the casing and establish hydraulic connection with the geologic formation. Development was performed by removing water with a centrifugal pump or bailer until the removed water was relatively free of turbidity.

Groundwater Sampling and Sample Handling

Groundwater was sampled using a bailer after purging three to five casing volumes from the well. Samples were placed in appropriate containers with preservatives as specified by the analytical methods. Samples for metals analysis were pumped through a 0.45 micron in-line filter prior to preservation. Samples were placed on ice in insulated coolers for transport to the testing laboratory. Samples were accompanied by chain of custody records and maintained in our custody until receipt by the laboratory.

Table A-1 - Surface Soil Sample Descriptions

Sample	Depth in Feet	Description
S-1.1	0.0 to 2.0	Moist, dark brown, slightly silty, fine to medium SAND
S-1.2	0.0 to 2.0	Moist, dark brown, slightly silty, fine to medium SAND
S-1.3	0.0 to 2.0	Moist, dark brown, slightly silty, fine to medium SAND
S-1.4	0.0 to 2.0	Moist, dark brown, silty, medium to coarse SAND
S-1.5	0.0 to 2.0	Moist, dark brown, medium SAND
S-2.1	0.0 to 2.0	Moist, gray, some brick, slightly silty SAND
S-2.2	0.0 to 2.0	Moist, brown to grey, slightly silty, gravelly SAND with brick fragments
S-2.3	0.0 to 2.0	Wet, dense, very silty SAND with occasional gravel and concrete fragments
S-2.4	0.0 to 2.0	Moist, gray to brown, slightly silty SAND with brick fragments
S-2.5	0.0 to 2.0	Moist, brown, silty SAND with gravel layer and roots at 0.5 feet depth

Sample	Depth in Feet	Description
S-3.1	0.0 to 2.0	Moist, fine to medium SAND
S-3.2	0.0 to 1.0	Moist, brown, silty SAND
	1.0 to 2.0	Moist, brown, fine to medium SAND
S-3.3	0.0 to 2.0	Moist, brown to gray, slightly silty SAND
S-3.4	0.0 to 2.0	Moist to saturated, slightly silty, fine to medium sand. Water table at 1.5 feet depth
S-3.5	0.0 to 1.5	Damp, brown, fine to medium SAND
	1.5 to 2.0	Moist, light brown, fine sandy SILT
S-4.1	0.0 to 2.0	Moist, brown, well-sorted fine to medium SAND
S-4.2	0.0 to 2.0	Moist, brown, medium SAND with 2-inch-thick gravel zone at depth of 4 inches
S-4.3	0.0 to 0.5	Moist, dark brown, gravelly SAND with wood chips
	0.5 to 1.3	Moist, gray, very gravelly SAND. Refusal at 1.3 feet

Sample	Depth in Feet	Description
S-4.4	0.0 to 2.0	Moist, brown, silty SAND
S-4.5	0.0 to 2.0	Moist, brown, fine to medium SAND
S-5.1	0.0 to 2.0	Moist, dark brown, slightly silty SAND
S-5.2	0,0 to 2.0	Moist, dark brown, slightly silty SAND
S-5.3	0.0 to 2.0	Moist, dark brown, slightly silty SAND
S-5.4	0.0 to 2.0	Moist, dark brown, silty SAND with interbedded seams of fine gray silt at depth of 0.75 feet
S-5.5	0.0 to 2.0	Moist, dark brown, slightly silty, medium SAND
S-6.1	0.0 to 1.0	Moist, dark brown, silty SAND
	1.0 to 2.0	Moist, gray, sandy SILT
S-6.2	0.0 to 1.0	Moist, dark brown, silty SAND with brick fragments
S-6.3	0.0 to 1.0	Moist, dark brown, silty SAND with brick fragments
	1.0 to 2.0	Moist, gray, sandy SILT with brick fragments

Sample	Depth in Feet	Description
S-6.4	0.0 to 1.0	Moist, dark brown, silty SAND
	1.0 to 2.0	Moist, gray, sandy SILT with occasional brick fragments
S-6.5	0.0 to 1.0	Moist, dark brown, silty SAND
	1.0 to 2.0	Moist, gray, sandy SILT with fragments of yellow chalk-like material at a depth of 2.0 feet

Table A-2 - Temperature, pH, and Specific Conductance Measurements

Monitoring Well	Temperature in ^{o}C	pH	Specific Conductance in micromhos
B-1	13.2	7.0	5000
B-2	13.0	7.3	1400
B-3	14.0	6.2	190

Key to Exploration Logs

Sample Descriptions

Classification of soils in this report is based on visual field and laboratory observations which include density/consistency, moisture condition, grain size, and plasticity estimates and should not be construed to imply field nor laboratory testing unless presented herein. Visual-manual classification methods of ASTM D 2488 were used as an identification guide.

Soil descriptions consist of the following:
Density/consistency, moisture, color, minor constituents, MAJOR CONSTITUENT, additional remarks.

Density/Consistency

Soil density/consistency in borings is related primarily to the Standard Penetration Resistance. Soil density/consistency in test pits is estimated based on visual observation and is presented parenthetically on the test pit logs.

SAND or GRAVEL Density	Standard Penetration Resistance in Blows/Foot
Very loose	0 - 4
Loose	4 - 10
Medium dense	10 - 30
Dense	30 - 50
Very dense	>50

SILT or CLAY Consistency	Standard Penetration Resistance in Blows/Foot	Approximate Shear Strength in TSF
Very soft	0 - 2	<0.125
Soft	2 - 4	0.125 - 0.25
Medium stiff	4 - 8	0.25 - 0.5
Stiff	8 - 15	0.5 - 1.0
Very stiff	15 - 30	1.0 - 2.0
Hard	>30	>2.0

Moisture

Dry	Little perceptible moisture
Damp	Some perceptible moisture, probably below optimum
Moist	Probably near optimum moisture content
Wet	Much perceptible moisture, probably above optimum

Minor Constituents

	Estimated Percentage
Not identified in description	0 - 5
Slightly (clayey, silty, etc.)	5 - 12
Clayey, silty, sandy, gravelly	12 - 30
Very (clayey, silty, etc.)	30 - 50

Legends

Sampling

BORING SAMPLES

- Split Spoon
- Shelby Tube
- Cuttings
- Core Run
- * No Sample Recovery
- P Tube Pushed, Not Driven

TEST PIT SAMPLES

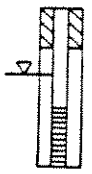
- Grab (Jar)
- Bag
- Shelby Tube

Test Symbols

GS	Grain Size Classification
CN	Consolidation
TUU	Triaxial Unconsolidated Undrained
TCU	Triaxial Consolidated Undrained
TCD	Triaxial Consolidated Drained
QU	Unconfined Compression
DS	Direct Shear
K	Permeability
PP	Pocket Penetrometer Approximate Compressive Strength in TSF
TV	Torvane Approximate Shear Strength in TSF
CBR	California Bearing Ratio
MD	Moisture Density Curve
AL	Atterberg Limits

Water Content in Percent
- Liquid Limit
- Natural
- Plastic Limit

Ground Water Observations



Surface Seal

Ground Water Level on Date (ATD) At Time of Drilling

Observation Well Tip or Slotted Section

Ground Water Seepage (Test Pits)

J-1659 July 1986
HART-CROWSER & associates, inc.
Figure A-1

Boring Log and Construction Data for Well B-1

Geologic Log

Depth in Feet

Ground Surface Elevation in Feet

0 — Loose, moist, gray, silty, gravelly, fine to coarse SAND. (FILL)

5 — Very dense, moist to wet, gray, silty, sandy GRAVEL with abundant WOOD material

10 — Medium dense to very loose, wet, black, gravelly, silty to very silty, loose to coarse SAND with wood fibers and occasional shells. Slight oil sheen.

15

20 — Loose, wet, dark gray, slightly silty, fine SAND with occasional gravel and shells.

25 — Bottom of Boring at 25.0 Feet. Completed 5/5/86.

30

35

40

45

50

Composited for Chemical Analysis

Sample	N
S-1	4
S-2	50/6"
S-3	4
S-4	10
S-5	4
S-6	1
S-7	4
S-8	8
S-9	8

Well Design

Top Casing Relative Elevation in Feet: 95.3 (B-3=100.0)

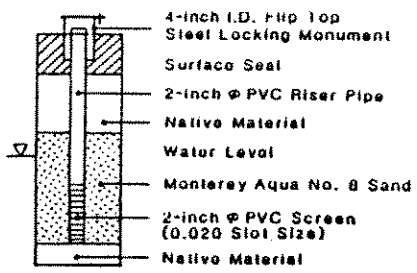
Casing Stickup in Feet: 1.5

■ Headspace Volatile Hydrocarbon Reading in ppm

1 — 10 — 100

5/14/86

ATD



NOTES:

1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level is for date indicated and may vary with time of year.
   ATD: At time of drilling
3. Headspace Volatile Hydrocarbon Concentration as measured in jar samples using an H-Nu PI-101 Photoionization Meter with a 10.2 eV Lamp.

⊠ 2-inch O.D. Split Spoon Sample Driven by 140-lb. Hammer 30-inch Fall

N Standard Penetration Resistance, Blows per Foot

J-1659 May 1986

HART-CROWSER & associates, inc.

Figure A-2

Boring Log and Construction Data for Well B-2

Geologic Log

Depth in Feet

Ground Surface Elevation in Feet

0 – Loose to medium dense, wet to moist, brown to gray, gravelly, silty, fine to coarse SAND. (FILL)

5 – Turning black with slight hydrocarbon-like odor.

– Slight oil sheen present.

10 – Very loose, wet, black, slightly gravelly, silty to very silty, fine to coarse SAND with wood. Slight oil sheen present.

– Decomposed WOOD and charoal-like material.

15 – Loose, wet, dark gray, silty SAND with wood fiber. (FILL?)

20 –

25 – Very loose, wet, tan, very silty, fine SAND.

Bottom of Boring at 25.0 Feet.
Completed 5/5/86.

30 –

35 –

40 –

45 –

50

Sample		N
Composited for Chemical Analysis	S-1	8
	S-2	18
	S-3	15
	S-4	2
	S-5	2
	S-6	2
	S-7	5
	S-8	4
	S-9	3

Well Design

Top Casing Relative Elevation in Feet 95.4 (B-3 =100.0)

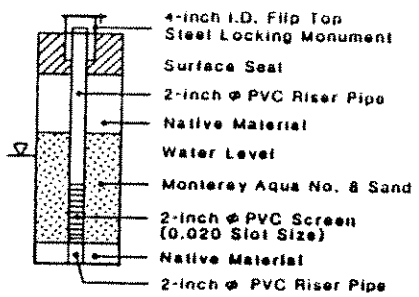
Casing Stickup in Feet 1.0

■ Headspace Volatile Hydrocarbon Reading in ppm

1 10 100

5/14/86 ATD

0 5 10 15 20 25 30 35 40 45 50



NOTES:

1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level is for date indicated and may vary with time of year.
   ATD: At time of drilling
3. Headspace Volatile Hydrocarbon Concentration as measured in jar samples using an H-Nu PI-101 Photoionization Meter with a 10.2 eV Lamp.

⊠ 2-inch O.D. Split Spoon Sample Driven by 140-lb. Hammer 30-inch Fall

N Standard Penetration Resistance, Blows per Foot

J-1659 May 1986

HART-CROWSER & associates, inc.

Figure A-3

Boring Log and Construction Data for Well B-3

Geologic Log

Depth in Feet

Ground Surface Elevation in Feet

0 — Medium dense to loose, moist to wet, brown to gray, very silty to silty, fine SAND with occasional gravel. (FILL)

5

10 — Soft, wet, gray, clayey, very fine sandy SILT with wood and plant material.

— Abundant wood and plant material.

15 — Medium dense to dense, wet, gray, slightly silty, fine SAND.

20

25 — Bottom of Boring at 25.0 Feet.
Completed 5/6/86.

30

35

40

45

50

Sample	N
S-1	10
S-2	8
S-3	2
S-4	2
S-5	3
S-6	23
S-7	25
S-8	21
S-9	48

Well Design

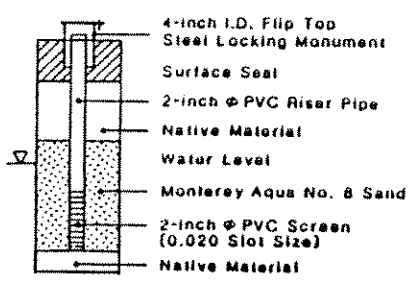
Top Casing Relative Elevation in Feet: 100.0 (Arbitrary)

Casing Stickup in Feet: 1.5

■ Headspace Volatile Hydrocarbon Reading in ppm

1 10 100

5/14/86 ATD



NOTES:

1. Soil descriptions are interpretive and actual changes may be gradual.
2. Water Level is for date indicated and may vary with time of year.
   ATD: At time of drilling
3. Headspace Volatile Hydrocarbon Concentration as measured in jar samples using an H-Nu PI-101 Photoionization Meter with a 10.2 eV Lamp.

⊠ 2-inch O.D. Split Spoon Sample Driven by 140-lb. Hammer 30-inch Fall

N Standard Penetration Resistance, Blows per Foot

J-1659 May 1986

HART-CROWSER & associates, inc.

Figure A-4

Chain of Custody Record

DATE 5MAY86 PAGE 1 OF ___

HART CROWSER & associates inc.
GEOTECHNICAL & HYDROGEOLOGIC CONSULTANTS
1910 Fairview Avenue East • Seattle WA 98102-3699 • (206) 324-9530

CLIENT: HART-CROWSER
ADDRESS: 1910 FAIRVIEW AV EAST, SEATTLE, WA 98103
PROJECT: NW COOPERAGE
SAMPLERS (SIGNATURE): [signature]

SAMPLE NO	DATE	TIME	LOCATION	TESTING PARAMETERS	NUMBER OF CONTAINERS	OBSERVATIONS/ COMMENTS
SPT-1	5MAY86	0835	B-1	To be assigned [illegible]	1	
SPT-2	"	0845	"		1	
SPT-3	"	0900	"		1	
SPT-4	"	0905	"		1	
SPT-5		0915			1	
SPT-6	"	0925	"		1	
SPT-7	"	0930	"		1	
SPT-8		0940			1	
SPT-9	"	0950	↓		1	
SPT-1	5MAY86	1300	B-2			
SPT-2	"	1305				
SPT-3	"	1310			1	
SPT-4	"	1325			1	
SPT-5	"	1335			1	
SPT-6	"	1340			1	
SPT-7	"	1350			1	
SPT-8	"	1400			1	
SPT-9	"	1415	↓		1	

RELINQUISHED BY	DATE	RECEIVED BY	DATE	RELINQUISHED BY	DATE	RECEIVED BY	DATE
Signature: [signature]	5MAY86	Signature		Signature		Signature	
Printed Name: D.H. FUJITA	TIME 1620	Printed Name	TIME	Printed Name	TIME	Printed Name	TIME
Company: HART-CROWSER		Company		Company		Company	

RELINQUISHED BY	DATE	RECEIVED BY	DATE	RELINQUISHED BY	DATE	RECEIVED BY (laboratory)	DATE
Signature		Signature		Signature		Signature: [signature]	5/5
Printed Name	TIME	Printed Name	TIME	Printed Name	TIME	Printed Name: T Gordin	TIME 1620
Company		Company		Company		Company: Laucks	

TOTAL NUMBER OF CONTAINERS: 18
METHOD OF SHIPMENT: HAND CARRY
SPECIAL SHIPMENT/HANDLING OR STORAGE REQUIREMENTS:

FORM NO. 103 (2-85)

DISTRIBUTION: WHITE, CANARY TO LABORATORY • PINK TO HART-CROWSER

J-1659
Figure A-5

HART CROWSER & associates inc.
GEOTECHNICAL & HYDROGEOLOGIC CONSULTANTS
1910 Fairview Avenue East • Seattle WA 98102-3699 • (206) 324-9530

Chain of Custody Record

DATE 6 May 86 PAGE 1 OF 1

CLIENT Hart-Crowser
ADDRESS 1910 Fairview Av E
Seattle, WA 98102
PROJECT NW Cooperative
SAMPLERS (SIGNATURE) [signature]

TESTING PARAMETERS: XRD Consolidated A-Stroland

SAMPLE NO.	DATE	TIME	LOCATION	NUMBER OF CONTAINERS	OBSERVATIONS/ COMMENTS
SPT-1	6 May 86	11:15	B-3	1	
SPT-2	6 May 86	1135	B-3	1	
SPT-3	6 May 86	1145	B-3	1	
SPT-4	6 May 86	1150	B-3	1	
SPT-5	6 May 86	Noon	B-3	1	
SPT-6	6 May 86	1205	B-3	1	
SPT-7	6 May 86	1210	B-3	1	
SPT-8	6 May 86	1215	B-3	1	
SPT-9	6 May 86	1220	B-3	1	

RELINQUISHED BY	DATE / TIME	RECEIVED BY	DATE / TIME
Signature: [signature] Printed Name: D.H. Fujita Company: Hart-Crowser	6 May 86 11/30	Signature: Printed Name: [illegible] Company:	
Signature: Printed Name: Company:		Signature: Printed Name: Company:	

RELINQUISHED BY	DATE / TIME	RECEIVED BY	DATE / TIME
Signature: Printed Name: Company:		Signature: Printed Name: Company:	
Signature: Printed Name: Company:		RECEIVED BY (laboratory) Signature: Kerry Lee Romans Printed Name: Kerry Lee Romans LACKS Analytical Technologies, Inc.	5/6 2:20

9 TOTAL NUMBER OF CONTAINERS

METHOD OF SHIPMENT: Hand Carry

SPECIAL SHIPMENT/HANDLING OR STORAGE REQUIREMENTS

FORM NO. 103 (2-85)

DISTRIBUTION: WHITE, CANARY TO LABORATORY • PINK TO HART-CROWSER

J-1659
Figure A-6

Chain of Custody Record

DATE _____ PAGE 1 OF 1

HART CROWSER & associates inc.
GEOTECHNICAL & HYDROGEOLOGIC CONSULTANTS
1910 Fairview Avenue East • Seattle WA 98102 3699 • (206) 324 9530

CLIENT HART-CROWSER & ASSOC
ADDRESS
PROJECT 1659
SAMPLERS (SIGNATURE)

SAMPLE NO	DATE	TIME	LOCATION	B/N (GC-MS)	VOA (GC-MS)	PCB / PEST	PP METALS *	TOTAL CYANIDE	TOTAL PHENOLICS	NUMBER OF CONTAINERS	OBSERVATIONS/ COMMENTS
S-1		1215	B-1	/	/	/	/	/	/	7	
S-1		1140	B-2	/	/	/	/	/	/	7	
S-1		1425	B-3	/	/	/	/	/	/	7	

TESTING PARAMETERS

RELINQUISHED BY	DATE	RECEIVED BY	DATE	RELINQUISHED BY	DATE	RECEIVED BY	DATE
RC Prior	5/14						
Signature		Signature		Signature		Signature	
Printed Name: Russ Prior	TIME 200	Printed Name	TIME	Printed Name	TIME	Printed Name	TIME
Company: Hart-Crowser		Company		Company		Company	
RELINQUISHED BY	DATE	RECEIVED BY	DATE	RELINQUISHED BY	DATE	RECEIVED BY (laboratory)	DATE
Signature		Signature		Signature		Signature: J Gordon	5/14
Printed Name	TIME	Printed Name	TIME	Printed Name	TIME	Printed Name: Weeks	TIME 2:00
Company		Company		Company		Analytical Technologies, Inc	

7 TOTAL NUMBER OF CONTAINERS

METHOD OF SHIPMENT: HAND CARRY

SPECIAL SHIPMENT/HANDLING OR STORAGE REQUIREMENTS:
* SAMPLE FOR METALS FILTERED IN FIELD @ 0.45 MICRONS

FORM NO 103 (2-85)

DISTRIBUTION: WHITE, CANARY TO LABORATORY • PINK TO HART-CROWSER

J-1659
Figure A-7

Appendix B
Laboratory Reports

Laucks Testing Laboratories, Inc.

940 South Harney St. Seattle. Washington 98108 (206)767-5060

Chemistry Microbiology and Technical Services

RECEIVED
MAR 27 1986
HART CROWSER & ASSOC., INC.

Certificate

CLIENT Hart Crowser
1910 Fairview Ave. East
Seattle, WA 98102
ATTN: Phillip Spadaro

LABORATORY NO. 95178

DATE March 26, 1986

Job #1659

REPORT ON SOIL

SAMPLE IDENTIFICATION Submitted 2/4 and 2/5 86 and identified as shown:

TESTS PERFORMED AND RESULTS:

1)	S 1.1	2/4/86	PAS 1400
2)	S 1.2	2/4/86	PAS 1310
3)	S 1.3	2/4/86	PAS 1415
4)	S 1.4	2/4/86	PAS 1425
5)	S 1.5	2/4/86	PAS 1435
6)	S 2.1	2/5/86	RCP/PAS 0920
7)	S 2.2	2/5/86	RCP/PAS 0940
8)	S 2.3	2/5/86	RCP/PAS 1000
9)	S 2.4	2/5/86	RCP/PAS 0900
10)	S 2.5	2/5/86	RCP/PAS 1015
11)	S 3.1	2/5/86	RCP/PAS 1105
12)	S 3.2	2/5/86	RCP/PAS 1025
13)	S 3.3	2/5/86	RCP/PAS 1020
14)	S 3.4	2/5/86	RCP/PAS 1100
15)	S 3.5	2/5/86	RCP/PAS 1035
16)	S 4.1	2/4/86	PAS 1150
17)	S 4.2	2/4/86	PAS 1140
18)	S 4.3	2/4/86	PAS 1120
19)	S 4.4	2/4/86	PAS 1200
20)	S 4.5	2/4/86	PAS 1215
21)	S 5.1	2/4/86	PAS 1024
22)	S 5.2	2/4/86	PAS 1040
23)	S 5.3	2/4/86	PAS 1040
24)	S 5.4	2/4/86	PAS 1100
25)	S 5.5	2/4/86	PAS 1110
26)	S 6.1	2/4/86	PAS 1300
27)	S 6.2	2/4/86	PAS 1310
28)	S 6.3	2/4/86	PAS 1320
29)	S 6.4	2/4/86	PAS 1327
30)	S 6.5	2/4/86	PAS 1340

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Testing Laboratories, Inc.
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Certificate

Chemistry, Microbiology, and Technical Services

Hart Crowser

LABORATORY NO. 95178

Samples were composited on an equal volume basis according to the following scheme:

Composite A = samples 1, 2, 3, 4, 5
Composite B = samples 6, 7, 8, 9, 10
Composite C = samples 11, 12, 13, 14, 15
Composite D = samples 16, 17, 18, 19, 20
Composite E = samples 21, 22, 23, 24, 25
Composite F = samples 26, 27, 28, 29, 30

Samples were analyzed for priority pollutants in accordance with Test Methods for Evaluating Solid Waste, (SW-846), U.S.E.P.A., 1982, Methods 8240 (volatile organics), 8270 (semi-volatile extractables), 8080 (pesticides and PCB's), 9010 (cyanide), and the 7000 series (metals analysis). Phenol analysis was in accordance with Method 420.2, Methods for Chemical Analysis of Water & Wastes, U.S.E.P.A., March, 1979.

Inorganics

	A	B	C	D
Total Solids, %	86.6	89.6	88.1	87.4
	parts per million (mg/kg), dry basis			
Antimony	L/3.	L/3.	L/3.	L/3.
Arsenic	5.0	5.5	4.5	4.5
Beryllium	0.4	0.4	0.4	0.4
Cadmium	0.5	1.4	0.5	L/0.5
Chromium	27.	200.	20.	37.
Copper	26.	28.	13.	15.
Lead	1400.	640.	48.	160.
Mercury	0.5	1.0	0.3	0.6
Nickel	22.	21.	11.	15.
Selenium	L/0.5	L/0.5	L/0.5	L/0.5
Silver	L/0.1	1.2	0.2	0.1
Thallium	L/5.	L/5.	L/5.	L/5.
Zinc	130.	440.	91.	120.
Total Cyanide	0.6	3.6	1.9	9.8
Total Phenol	L/0.5	0.6	L/0.5	L/0.5

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LABORATORY NO. 95178

	E	F	Blank
Total Solids, %	90.1	85.9	---
	parts per million (mg/kg), dry basis		
Antimony	L/3.	L/3.	L/3.
Arsenic	4.0	7.8	L/0.5
Beryllium	0.4	0.3	L/0.1
Cadmium	L/0.5	3.5	L/0.5
Chromium	22.	200.	L/1.
Copper	13.	100.	L/1.
Lead	60.	1400.	L/10.
Mercury	0.2	6.7	L/0.1
Nickel	12.	47.	L/2.
Selenium	L/0.5	L/0.5	L/0.5
Silver	L/0.1	0.2	L/0.1
Thallium	L/5.	L/5.	L/5.
Zinc	70.	640.	2.
Total Cyanide	3.6	4.5	1.0
Total Phenol	L/0.5	0.9	L/0.5

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Hart Crowser

LABORATORY NO. 95178

Volatile Organics (by GC/MS)

parts per billion (ug/kg), dry basis

	A	B	C	D
Chloromethane	L/5.	L/5.	L/5.	L/5.
Bromomethane	L/5.	L/5.	L/5.	L/5.
Vinyl Chloride	L/5.	L/5.	L/5.	L/5.
Chloroethane	L/5.	L/5.	L/5.	L/5.
Methylene Chloride	60.	40.	trace	51.
Acrolein	L/25.	L/25.	L/25.	L/25.
*Acetone	L/5.	L/5.	trace	40.
Acrylonitrile	L/25.	L/25.	L/25.	L/25.
*Carbon Disulfide	L/5.	L/5.	L/5.	L/5.
1,1-Dichloroethylene	L/5.	L/5.	L/5.	L/5.
1,1-Dichloroethane	L/5.	L/5.	L/5.	L/5.
trans-1,2-Dichloroethylene	L/5.	L/5.	L/5.	L/5.
Chloroform	trace	trace	L/5.	trace
*2-Butanone	L/5.	L/5.	L/5.	L/5.
1,2-Dichloroethane	L/5.	L/5.	L/5.	L/5.
1,1,1-Trichloroethane	L/5.	L/5.	L/5.	L/5.
*Vinyl Acetate	L/5.	L/5.	L/5.	L/5.
Bromodichloromethane	L/5.	L/5.	L/5.	L/5.
Carbon Tetrachloride	L/5.	L/5.	L/5.	L/5.
1,2-Dichloropropane	L/5.	L/5.	L/5.	L/5.
Trichloroethylene	L/5.	trace	L/5.	L/5.
Benzene	L/5.	L/5.	L/5.	L/5.
Chlorodibromomethane	L/5.	L/5.	L/5.	L/5.
1,1,2-Trichloroethane	L/5.	L/5.	L/5.	L/5.
2-Chloroethyl vinyl ether	L/5.	L/5.	L/5.	L/5.
Bromoform	L/5.	L/5.	L/5.	L/5.
*4-Methyl-2-pentanone	L/5.	L/5.	L/5.	L/5.
*2-Hexanone	L/5.	L/5.	L/5.	L/5.

Laucks
Testing Laboratories, Inc.
940 South Harney St. Seattle Washington 98108 (206)767-5060

Certificate

Chemistry Microbiology and Technical Services

Hart Crowser

LABORATORY NO. 95178

parts per billion (ug/kg), dry basis

	A	B	C	D
1,1,2,2-Tetrachloroethane	L/5.	L/5.	L/5.	L/5.
Tetrachloroethylene	trace	trace	L/5.	L/5.
Toluene	L/5.	L/5.	L/5.	L/5.
Chlorobenzene	L/5.	L/5.	L/5.	L/5.
trans-1,3-Dichloropropene	L/5.	L/5.	L/5.	L/5.
Ethylbenzene	L/5.	L/5.	L/5.	L/5.
cis-1,3-Dichloropropene	L/5.	L/5.	L/5.	L/5.
Styrene	L/5.	L/5.	L/5.	L/5.
o-Xylene	L/5.	L/5.	L/5.	L/5.

parts per billion (ug/kg), dry basis

	E	F	Lab Blank
Chloromethane	L/5.	L/5.	L/5.
Bromomethane	L/5.	L/5.	L/5.
Vinyl Chloride	L/5.	L/5.	L/5.
Chloroethane	L/5.	L/5.	L/5.
Methylene Chloride	53.	330.	L/5.
Acrolein	L/25.	L/25.	L/25.
*Acetone	44.	92.	trace
Acrylonitrile	L/25.	L/25.	L/25.
*Carbon Disulfide	L/5.	L/5.	L/5.
1,1-Dichloroethylene	L/5.	L/5.	L/5.
1,1-Dichloroethane	L/5.	L/5.	L/5.
trans-1,2-Dichloroethylene	L/5.	L/5.	L/5.
Chloroform	L/5.	trace	L/5.
*2-Butanone	L/5.	L/5.	L/5.
1,2-Dichloroethane	L/5.	L/5.	L/5.
1,1,1-Trichloroethane	L/5.	trace	L/5.

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parts per billion (ug/kg), dry basis

	E	F	Lab Blank
*Vinyl Acetate	L/5.	L/5.	L/5.
Bromodichloromethane	L/5.	L/5.	L/5.
Carbon Tetrachloride	L/5.	L/5.	L/5.
1,2-Dichloropropane	L/5.	L/5.	L/5.
Trichloroethylene	L/5.	39.	L/5.
Benzene	L/5.	L/5.	L/5.
Chlorodibromomethane	L/5.	L/5.	L/5.
1,1,2-Trichloroethane	L/5.	L/5.	L/5.
2-Chloroethyl vinyl ether	L/5.	L/5.	L/5.
Bromoform	L/5.	L/5.	L/5.
*4-Methyl-2-pentanone	L/5.	L/5.	L/5.
*2-Hexanone	L/5.	L/5.	L/5.
1,1,2,2-Tetrachloroethane	L/5.	L/5.	L/5.
Tetrachloroethylene	L/5.	870.	L/5.
Toluene	L/5.	trace	L/5.
Chlorobenzene	L/5.	L/5.	L/5.
trans-1,3-Dichloropropene	L/5.	L/5.	L/5.
Ethylbenzene	L/5.	110.	L/5.
cis-1,3-Dichloropropene	L/5.	L/5.	L/5.
Styrene	L/5.	L/5.	L/5.
o-Xylene	L/5.	320.	L/5.

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Extractables (by GC/MS)

parts per billion (ug/kg), dry basis

	A	B	C	D
N-nitrosodimethylamine	L/50.	L/500.	L/50.	L/500.
Bis(2-chloroethyl)ether	L/50.	L/500.	L/50.	L/500.
2-Chlorophenol	L/50.	L/500.	L/50.	L/500.
Phenol	L/50.	L/500.	L/50.	L/500.
1,3-Dichlorobenzene	L/50.	L/500.	L/50.	L/500.
1,4-Dichlorobenzene	L/50.	L/500.	L/50.	L/500.
1,2-Dichlorobenzene	L/50.	L/500.	L/50.	L/500.
Bis(2-chloroisopropyl)ether	L/50.	L/500.	L/50.	L/500.
Hexachloroethane	L/50.	L/500.	L/50.	L/500.
N-nitroso-di-n-propylamine	L/50.	L/500.	L/50.	L/500.
Nitrobenzene	L/50.	L/500.	L/50.	L/500.
Isophorone	L/50.	L/500.	L/50.	L/500.
2-Nitrophenol	L/50.	L/500.	L/50.	L/500.
2,4-Dimethylphenol	L/50.	L/500.	L/50.	L/500.
Bis(2-chloroethoxy)methane	L/50.	L/500.	L/50.	L/500.
2,4-Dichlorophenol	L/50.	L/500.	L/50.	L/500.
1,2,4-Trichlorobenzene	L/50.	L/500.	L/50.	L/500.
Naphthalene	L/50.	L/500.	L/50.	L/500.
Hexachlorobutadiene	L/50.	L/500.	L/50.	L/500.
4-Chloro-m-cresol	L/50.	L/500.	L/50.	L/500.
Hexachlorocyclopentadiene	L/50.	L/500.	L/50.	L/500.
2,4,6-Trichlorophenol	L/50.	L/500.	L/50.	L/500.
2-Chloronaphthalene	L/50.	L/500.	L/50.	L/500.
Acenaphthylene	L/50.	L/500.	L/50.	L/500.
Dimethylphthalate	L/50.	L/500.	L/50.	L/500.
2,6-Dinitrotoluene	L/50.	L/500.	L/50.	L/500.
Acenaphthene	L/50.	L/500.	L/50.	L/500.
2,4-Dinitrophenol	L/50.	L/500.	L/50.	L/500.
2,4-Dinitrotoluene	L/50.	L/500.	L/50.	L/500.
4-Nitrophenol	L/50.	L/500.	L/50.	L/500.
Fluorene	L/50.	L/500.	L/50.	L/500.
4-Chlorophenyl phenyl ether	L/50.	L/500.	L/50.	L/500.
Diethylphthalate	L/50.	L/500.	L/50.	L/500.
4,6-Dinitro-o-cresol	L/50.	L/500.	L/50.	L/500.

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parts per billion (ug/kg), dry basis

	A	B	C	D
1,2-Diphenylhydrazine	L/50.	L/500.	L/50.	L/500.
4-Bromophenyl phenyl ether	L/50.	L/500.	L/50.	L/500.
Hexachlorobenzene	L/50.	L/500.	L/50.	L/500.
Pentachlorophenol	70.	480.	L/50.	L/500.
Phenanthrene	86.	640.	L/50.	L/500.
Anthracene	L/50.	L/500.	L/50.	L/500.
Dibutylphthalate	57.	680.	L/50.	L/500.
Fluoranthene	72.	840.	L/50.	L/500.
Pyrene	L/50.	510.	L/50.	L/500.
Benzidine	L/50.	L/500.	L/50.	L/500.
Butyl benzyl phthalate	L/50.	L/500.	L/50.	L/500.
Benzo(a)anthracene	L/50.	L/500.	L/50.	L/500.
Chrysene	L/50.	L/500.	L/50.	L/500.
3,3'-Dichlorobenzidine	L/50.	L/500.	L/50.	L/500.
Bis(2-ethylhexyl)phthalate	5800.	6900.	320.	L/500.
N-nitrosodiphenylamine	L/50.	L/500.	L/50.	L/500.
Di-n-octyl phthalate	L/50.	L/500.	L/50.	L/500.
Benzo(b)fluoranthene	L/50.	L/500.	L/50.	L/500.
Benzo(k)fluoranthene	L/50.	L/500.	L/50.	L/500.
Benzo(a)pyrene	L/50.	L/500.	L/50.	L/500.
Indeno(1,2,3-cd)pyrene	L/50.	L/500.	L/50.	L/500.
Dibenzo(ah)anthracene	L/50.	L/500.	L/50.	L/500.
Benzo(ghi)perylene	L/50.	L/500.	L/50.	L/500.
*Aniline	L/50.	L/500.	L/50.	L/500.
*Benzoic Acid	L/50.	L/500.	L/50.	L/500.
*Benzyl Alcohol	L/50.	L/500.	L/50.	L/500.
*4-Chloroaniline	L/50.	L/500.	L/50.	L/500.
*Dibenzofuran	L/50.	L/500.	L/50.	L/500.
*2-Methylnaphthalene	L/50.	L/500.	L/50.	L/500.
*2-Methylphenol	L/50.	L/500.	L/50.	L/500.
*4-Methylphenol	L/50.	L/500.	L/50.	L/500.
*2-Nitroaniline	L/50.	L/500.	L/50.	L/500.
*3-Nitroaniline	L/50.	L/500.	L/50.	L/500.
*4-Nitroaniline	L/50.	L/500.	L/50.	L/500.
*2,4,5-Trichlorophenol	L/50.	L/500.	L/50.	L/500.

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	E	F	Lab Blank
N-nitrosodimethylamine	L/100.	L/500.	L/50.
Bis(2-chloroethyl)ether	L/100.	L/500.	L/50.
2-Chlorophenol	L/100.	L/500.	L/50.
Phenol	L/100.	L/500.	L/50.
1,3-Dichlorobenzene	L/100.	L/500.	L/50.
1,4-Dichlorobenzene	L/100.	L/500.	L/50.
1,2-Dichlorobenzene	L/100.	660.	L/50.
Bis(2-chloroisopropyl)ether	L/100.	L/500.	L/50.
Hexachloroethane	L/100.	L/500.	L/50.
N-nitroso-di-n-propylamine	L/100.	L/500.	L/50.
Nitrobenzene	L/100.	L/500.	L/50.
Isophorone	L/100.	L/500.	L/50.
2-Nitrophenol	L/100.	L/500.	L/50.
2,4-Dimethylphenol	L/100.	L/500.	L/50.
Bis(2-chloroethoxy)methane	L/100.	L/500.	L/50.
2,4-Dichlorophenol	L/100.	L/500.	L/50.
1,2,4-Trichlorobenzene	L/100.	L/500.	L/50.
Naphthalene	L/100.	L/500.	L/50.
Hexachlorobutadiene	L/100.	L/500.	L/50.
4-Chloro-m-cresol	L/100.	L/500.	L/50.
Hexachlorocyclopentadiene	L/100.	L/500.	L/50.
2,4,6-Trichlorophenol	L/100.	L/500.	L/50.
2-Chloronaphthalene	L/100.	L/500.	L/50.
Acenaphthylene	L/100.	L/500.	L/50.
Dimethylphthalate	L/100.	L/500.	L/50.
2,6-Dinitrotoluene	L/100.	L/500.	L/50.
Acenaphthene	L/100.	L/500.	L/50.
2,4-Dinitrophenol	L/100.	L/500.	L/50.
2,4-Dinitrotoluene	L/100.	L/500.	L/50.
4-Nitrophenol	L/100.	L/500.	L/50.
Fluorene	L/100.	L/500.	L/50.
4-Chlorophenyl phenyl ether	L/100.	L/500.	L/50.
Diethylphthalate	L/100.	L/500.	L/50.
4,6-Dinitro-o-cresol	L/100.	L/500.	L/50.

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parts per billion (ug/kg), dry basis

	E	F	Lab Blank
1,2-Diphenylhydrazine	L/100.	L/500.	L/50.
4-Bromophenyl phenyl ether	L/100.	L/500.	L/50.
Hexachlorobenzene	L/100.	L/500.	L/50.
Pentachlorophenol	L/100.	810.	L/50.
Phenanthrene	L/100.	660.	L/50.
Anthracene	L/100.	L/500.	L/50.
Dibutylphthalate	L/100.	600.	L/50.
Fluoranthene	L/100.	L/500.	L/50.
Pyrene	L/100.	500.	L/50.
Benzidine	L/100.	L/500.	L/50.
Butyl benzyl phthalate	150.	L/500.	L/50.
Benzo(a)anthracene	L/100.	L/500.	L/50.
Chrysene	L/100.	L/500.	L/50.
3,3'-Dichlorobenzidine	L/100.	L/500.	L/50.
Bis(2-ethylhexyl)phthalate	360.	4800.	L/50.
N-nitrosodiphenylamine	L/100.	L/500.	L/50.
Di-n-octyl phthalate	L/100.	L/500.	L/50.
Benzo(b)fluoranthene	L/100.	L/500.	L/50.
Benzo(k)fluoranthene	L/100.	L/500.	L/50.
Benzo(a)pyrene	L/100.	L/500.	L/50.
Indeno(1,2,3-cd)pyrene	L/100.	L/500.	L/50.
Dibenzo(ah)anthracene	L/100.	L/500.	L/50.
Benzo(ghi)perylene	L/100.	L/500.	L/50.
*Aniline	L/100.	L/500.	L/50.
*Benzoic Acid	L/100.	L/500.	L/50.
*Benzyl Alcohol	L/100.	L/500.	L/50.
*4-Chloroaniline	L/100.	L/500.	L/50.
*Dibenzofuran	L/100.	L/500.	L/50.
*2-Methylnaphthalene	L/100.	1260.	L/50.
*2-Methylphenol	L/100.	L/500.	L/50.
*4-Methylphenol	L/100.	L/500.	L/50.
*2-Nitroaniline	L/100.	L/500.	L/50.
*3-Nitroaniline	L/100.	L/500.	L/50.
*4-Nitroaniline	L/100.	L/500.	L/50.
*2,4,5-Trichlorophenol	L/100.	L/500.	L/50.

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Pesticides (by GC/ECD)

parts per billion (ug/kg), dry basis

	A	B	C	D
alpha-BHC	L/1.	L/5.	L/1.	L/5.
beta-BHC	L/1.	L/5.	L/1.	L/5.
delta-BHC	L/1.	L/5.	L/1.	L/5.
gamma-BHC (lindane)	L/1.	L/5.	L/1.	L/5.
heptachlor	L/1.	L/5.	L/1.	L/5.
aldrin	L/1.	L/5.	L/1.	L/5.
heptachlor epoxide	L/1.	L/5.	L/1.	L/5.
dieldrin	L/1.	L/5.	L/1.	29.3
4,4'-DDE	L/1.	46.0	L/1.	L/5.
4,4'-DDD	L/2.	110.	L/2.	219.
endosulfan sulfate	L/2.	L/10.	L/2.	L/10.
4,4'-DDT	L/2.	L/10.	L/2.	246.
chlordane	L/2.	L/10.	L/2.	L/10.
alpha endosulfan	L/2.	L/10.	L/2.	L/10.
beta endosulfan	L/2.	L/10.	L/2.	L/10.
endrin	104.	L/10.	L/2.	L/10.
endrin aldehyde	L/2.	L/10.	L/2.	L/10.
toxaphene	L/50.	L/250.	L/50.	L/250.
PCB 1016	L/20.	L/100.	L/20.	L/100.
PCB 1221	L/20.	L/100.	L/20.	L/100.
PCB 1232	L/20.	L/100.	L/20.	L/100.
PCB 1242	L/20.	L/100.	L/20.	L/100.
PCB 1248	L/20.	L/100.	L/20.	L/100.
PCB 1254	L/20.	L/100.	L/20.	L/100.
PCB 1260	L/20.	L/100.	398.	435.
Methoxychlor	L/2.	L/10.	L/2.	L/10.
Endrin Ketone	L/2.	L/10.	L/2.	L/10.

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parts per billion (ug/kg), dry basis

	E	F	Lab Blank
alpha-BHC	L/1.	L/1.	L/1.
beta-BHC	L/1.	L/1.	L/1.
delta-BHC	L/1.	L/1.	L/1.
gamma-BHC (lindane)	L/1.	L/1.	L/1.
heptachlor	L/1.	L/1.	L/1.
aldrin	L/1.	L/1.	L/1.
heptachlor epoxide	L/1.	L/1.	L/1.
dieldrin	15.8	L/1.	L/1.
4,4'-DDE	L/1.	427.	L/1.
4,4'-DDD	19.2	L/2.	L/2.
endosulfan sulfate	L/2.	L/2.	L/2.
4,4'-DDT	199.	684.	L/2.
chlordane	L/2.	L/2.	L/2.
alpha endosulfan	L/2.	L/2.	L/2.
beta endosulfan	L/2.	L/2.	L/2.
endrin	L/2.	L/2.	L/2.
endrin aldehyde	L/2.	L/2.	L/2.
toxaphene	L/50.	L/50.	L/50.
PCB 1016	L/20.	L/20.	L/20.
PCB 1221	L/20.	L/20.	L/20.
PCB 1232	L/20.	L/20.	L/20.
PCB 1242	L/20.	L/20.	L/20.
PCB 1248	L/20.	L/20.	L/20.
PCB 1254	L/20.	L/20.	L/20.
PCB 1260	L/20.	L/20.	L/20.
Methoxychlor	L/2.	L/2.	L/2.
Endrin Ketone	L/2.	L/2.	L/2.

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Key

L/ indicates "less than"
* indicates additional compounds from the EPA's Hazardous Substances List.
trace indicates an unquantifiable amount between 5-25 parts per billion.

Respectfully submitted,

Laucks Testing Laboratories, Inc.

J. M. Owens

JMO:veg

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APPENDIX A

Spike Quality Control Report

		ug/kg				
Sample #	Analyte	Sample Found	Spike Level	Samp & Spike Found	% Recovery	Control Limit
E (MS)	Gamma DHC	0.	32.	18.87	59.0	43-127
	Heptachlor	0.	32.	21.07	65.8	35-130
	Aldrin	0.	32.	24.07	75.2	34-132
	Dieldrin	40.95	80.	104.59	79.6	31-134
	Endrin	0.	80.	74.98	93.7	42-139
	DDT	282.5	80.	256.9	0.*	23-134
E (MSD)	Gamma DHC	0.	32.	27.1	84.7	43-127
	Heptachlor	0.	32.	26.668	83.3	35-130
	Aldrin	0.	32.	28.98	90.6	34-132
	Dieldrin	15.82	80.	96.1	100.	31-134
	Endrin	0.	80.	78.08	97.6	42-139
	DDT	199.	80.	160.	0.*	23-134

* Matrix interference: quantitation hampered by the significantly higher level of DDT found in the sample than the level of the spike.

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APPENDIX B

Matrix Spike/Matrix Spike Duplicate Report

Inorganics/Metals Analyses

		parts per million (mg/kg), dry				mg/kg		
Sample	Analyte	Spike Added	Sample Result	MS Result	% Rec	MSD Result	% Rec	RPD
A	Cyanide	4.1	0.6	3.6	73.	3.6	73.	0.
F	Phenol	2.2	0.9	2.6	77.	2.6	77.	0.
E	Beryllium	2.5	0.4	2.5	84.	2.5	84.	0.
E	Cadmium	2.5	L/0.5	2.6	104.	2.8	112.	-7.4
E	Chromium	25.	22.	42.	80.	42.	80.	0.
E	Copper	50.	13.	59.	92.	60.	94.	-2.2
E	Lead	50.	60.	102.	84.	113.	106.	-23.
E	Nickel	25.	12.	32.	80.	33.	84.	-4.9
E	Zinc	100.	70.	166.	96.	175.	105.	-9.0
E	Mercury	0.5	0.2	0.7	100.	0.7	100.	0.
D	Selenium	2.5	L/0.5	3.2	120.	3.5	132.	-10.
D	Arsenic	25.	4.5	27.6	92.	29.7	101.	-9.
E	Antimony	10.	L/3.	2.9	29.	2.9	29.	0.

MS = Matrix Spike
MSD = Matrix Spike Duplicate
Rec = Recovery
RPD = Relative Percent Difference

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APPENDIX C

Surrogate Recovery Quality Control Report

Listed below are surrogate (chemically similar) compounds utilized in the analysis of volatile and organic compounds. The surrogates are added to every sample prior extraction and analysis to monitor for matrix effects, purging efficiency, and sample processing errors. The control limits represent the 95% confidence interval established in our laboratory through repetitive analysis of these sample types.

Sample No.	Surrogate Compound	Spike Level	Spike Found	% Recovery	Control Limit
		parts per billion (ug/kg)			
Blank	d4-1,2-Dichloroethane	50.	46.2	92.4	50-160
	d8-Toluene	50.	45.8	91.6	50-160
	p-Bromofluorobenzene	50.	46.3	92.6	50-160
A	d4-1,2-Dichloroethane	69.6	62.9	90.4	50-160
	d8-Toluene	69.6	67.1	96.4	50-160
	p-Bromofluorobenzene	69.6	60.8	87.4	50-160
B	d4-1,2-Dichloroethane	68.3	63.9	93.6	50-160
	d8-Toluene	68.3	68.2	99.9	50-160
	p-Bromofluorobenzene	68.3	65.2	95.5	50-160
C	d4-1,2-Dichloroethane	67.8	63.5	93.7	50-160
	d8-Toluene	67.8	67.9	100.	50-160
	p-Bromofluorobenzene	67.8	66.0	97.3	50-160
D	d4-1,2-Dichloroethane	67.6	67.6	100.	50-160
	d8-Toluene	67.6	67.5	99.9	50-160
	p-Bromofluorobenzene	67.6	59.0	87.3	50-160

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Sample No.	Surrogate Compound	Spike Level	Spike Found	% Recovery	Control Limit
		parts per billion (ug/kg)			
E	d4-1,2-Dichloroethane	66.8	67.4	101.	50-160
	d8-Toluene	66.8	68.4	102.	50-160
	p-Bromofluorobenzene	66.8	58.0	86.8	50-160
F	d4-1,2-Dichloroethane	179.	165.	92.3	50-160
	d8-Toluene	179.	174.	97.2	50-160
	p-Bromofluorobenzene	179.	168.	93.9	50-160
C MS	d4-1,2-Dichloroethane	74.2	72.0	97.0	50-160
	d8-Toluene	74.2	71.0	95.7	50-160
	p-Bromofluorobenzene	74.2	65.5	88.3	50-160
C MSD	d4-1,2-Dichloroethane	72.9	69.5	95.3	50-160
	d8-Toluene	72.9	69.6	95.5	50-160
	p-Bromofluorobenzene	72.9	67.1	92.0	50-160
A	2-Fluorophenol	100.	70.1	70.1	25-121
	d5-Phenol	100.	77.2	77.2	24-113
	2-Bromophenol	100.	84.9	84.9	59-97
	d5-Nitrobenzene	50.	34.2	68.4	23-120
	2-Fluorobiphenyl	50.	40.9	81.8	30-115
	d10-Azobenzene	50.	36.2	72.4	---
	2,4,6-Tribromophenol	100.	92.2	92.2	19-122
	d14-Terphenyl	50.	39.8	79.6	18-137
B	2-Fluorophenol	100.	84.4	84.4	25-121
	d5-Phenol	100.	87.8	87.8	24-113
	2-Bromophenol	100.	93.9	93.9	59-97
	d5-Nitrobenzene	50.	36.0	72.0	23-120
	2-Fluorobiphenyl	50.	42.8	85.6	30-115
	d10-Azobenzene	50.	34.7	69.4	---
	2,4,6-Tribromophenol	100.	85.3	85.3	19-122
	d14-Terphenyl	50.	23.7	47.4	18-137

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Sample No.	Surrogate Compound	Spike Level	Spike Found	% Recovery	Control Limit
		parts per billion (ug/kg)			
C	2-Fluorophenol	100.	82.3	82.3	25-121
	d5-Phenol	100.	81.9	81.9	24-113
	2-Bromophenol	100.	89.7	89.7	59-97
	d5-Nitrobenzene	50.	36.4	72.8	23-120
	2-Fluorobiphenyl	50.	37.4	74.8	30-115
	d10-Azobenzene	50.	30.9	61.8	---
	2,4,6-Tribromophenol	100.	86.3	86.3	19-122
	d14-Terphenyl	50.	22.6	45.2	18-137
D	2-Fluorophenol	100.	88.2	88.2	25-121
	d5-Phenol	100.	88.9	88.9	24-113
	2-Bromophenol	100.	94.0	94.0	59-97
	d5-Nitrobenzene	50.	36.9	73.8	23-120
	2-Fluorobiphenyl	50.	45.4	90.8	30-115
	d10-Azobenzene	50.	33.4	66.8	---
	2,4,6-Tribromophenol	100.	98.5	98.5	19-122
	d14-Terphenyl	50.	25.7	51.4	18-137
E	2-Fluorophenol	100.	68.0	68.0	25-121
	d5-Phenol	100.	73.0	73.0	24-113
	2-Bromophenol	100.	81.6	81.6	59-97
	d5-Nitrobenzene	50.	34.4	68.8	23-120
	2-Fluorobiphenyl	50.	38.9	77.8	30-115
	d10-Azobenzene	50.	32.3	64.5	---
	2,4,6-Tribromophenol	100.	95.1	95.1	19-122
	d14-Terphenyl	50.	25.3	50.6	18-137
E MS	2-Fluorophenol	100.	66.8	66.8	25-121
	d5-Phenol	100.	73.3	73.3	24-113
	2-Bromophenol	100.	78.6	78.6	59-97
	d5-Nitrobenzene	50.	35.0	70.0	23-120
	2-Fluorobiphenyl	50.	40.6	81.2	30-115
	d10-Azobenzene	50.	30.1	60.2	---
	2,4,6-Tribromophenol	100.	86.7	86.7	19-122
	d14-Terphenyl	50.	24.4	48.8	18-137

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Sample No.	Surrogate Compound	Spike Level	Spike Found	% Recovery	Control Limit
		parts per billion (ug/kg)			
E MSD	2-Fluorophenol	100.	63.5	63.5	25-121
	d5-Phenol	100.	71.0	71.0	24-113
	2-Bromophenol	100.	74.4	74.4	59-97
	d5-Nitrobenzene	50.	31.8	63.6	23-120
	2-Fluorobiphenyl	50.	36.8	73.6	30-115
	d10-Azobenzene	50.	29.0	58.0	---
	2,4,6-Tribromophenol	100.	92.1	92.1	19-122
	d14-Terphenyl	50.	23.8	47.6	18-137
F	2-Fluorophenol	100.	53.4	53.4	25-121
	d5-Phenol	100.	54.1	54.1	24-113
	2-Bromophenol	100.	63.3	63.3	59-97
	d5-Nitrobenzene	50.	26.2	52.4	23-120
	2-Fluorobiphenyl	50.	36.1	72.2	30-115
	d10-Azobenzene	50.	24.4	48.8	---
	2,4,6-Tribromophenol	100.	79.4	79.4	19-122
	d14-Terphenyl	50.	27.6	55.2	18-137
Blank	2-Fluorophenol	100.	67.2	67.2	25-121
	d5-Phenol	100.	62.5	62.5	24-113
	2-Bromophenol	100.	63.8	63.8	59-97
	d5-Nitrobenzene	50.	33.3	66.6	23-120
	2-Fluorobiphenyl	50.	37.4	74.8	30-115
	d10-Azobenzene	50.	30.4	60.8	---
	2,4,6-Tribromophenol	100.	52.2	52.2	19-122
	d14-Terphenyl	50.	23.3	46.6	18-137

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Sample No.	Surrogate Compound	Spike Level	Spike Found	% Recovery	Control Limit
		parts per billion (ug/kg)			
A	dibutylchlorendate	40.	47.98	119.	20-150
B	dibutylchlorendate	40.	41.87	105.	20-150
C	dibutylchlorendate	40.	61.19	153.	20-150*
D	dibutylchlorendate	40.	33.88	84.7	20-150
E	dibutylchlorendate	40.	70.62	177.	20-150
F	dibutylchlorendate	40.	0.	0.	20-150**
Blank	dibutylchlorendate	40.	92.95	232.	20-150
E MS	dibutylchlorendate	40.	30.26	75.7	20-150
E MSD	dibutylchlorendate	40.	40.17	100.	20-150
A	Isodrin	20.	41.05	205.	43-118#
B	Isodrin	20.	17.72	88.6	43-118#
C	Isodrin	20.	28.75	144.	43-118#
D	Isodrin	20.	16.61	83.1	43-118#
E	Isodrin	20.	30.71	154.	43-118#
F	Isodrin	20.	22.5	113.	43-118#
Blank	Isodrin	20.	36.41	182.	43-118#
E MS	Isodrin	20.	13.07	65.4	43-118#
E MSD	Isodrin	20.	13.33	66.8	43-118#

* Matrix interference
** Sample was not reanalyzed - Isodrin recovery is adequate.
# water control limits - none established for sediment matrix.

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APPENDIX D

Matrix Spike/Duplicate Spike Quality Control

Organics

Reported below are the results of additional QC compounds utilized in the analysis of organic compounds. Compounds of interest are spiked into two additional sample aliquots prior to extraction and/or analysis to monitor for matrix effects, sample processing errors, and to calculate percent recoveries of compunds of interest and relative error in the analysis. The control limits represent the 95% confidence interval established in the laboratory through repetitive analysis of these sample types.

Sample C

	ug/kg				ug/kg				
Compound	Conc Spike	Conc Samp	Conc MS	% REC	Conc MSD	% REC	RPD	RPD Limit	REC Limit
1,1-Dichloroethene	0.250	0.	0.268	107.	0.261	104.	2.8	22	59-172
Trichloroethene	0.250	0.	0.236	94.4	0.241	96.4	-2.1	24	62-137
Chlorobenzene	0.250	0.	0.215	86.0	0.225	90.0	-4.5	21	60-133
Toluene	0.250	0.003	0.206	81.4	0.211	83.4	-2.4	21	59-139
Benzene	0.250	0.	0.233	93.2	0.235	94.0	-0.9	21	66-142

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Sample E

Compound	ug/kg Conc Spike	ug/kg Conc Samp	ug/kg Conc MS	% REC	ug/kg Conc MSD	% REC	RPD	RPD Limit	REC Limit
1,2,4-Trichlorobenzene	100.	0.	70.7	70.7	64.8	64.8	8.7	23	38-107
Acenaphthene	100.	0.	80.1	80.1	72.5	72.5	9.9	19	31-137
2,4-Dinitrotoluene	100.	0.	87.8	87.8	72.6	72.6	19.		
Pyrene	100.	0.	41.9	41.9	44.4	44.4	-5.8	36	35-142
N-Nitrosodipropylamine	100.	0.	70.4	70.4	67.9	67.9	3.6	38	41-126
1,4-Dichlorobenzene	100.	0.	66.6	66.1	65.1	65.1	1.5	27	28-104
Pentachlorophenol	200.	0.	122.	61.	126.	63.	-3.2	47	17-109
Phenol	200.	0.	124.	62.	125.	63.	-1.6	35	26-90
2-Chlorophenol	200.	0.	138.	69.	135.	68.	1.5	50	25-102
P-Chloro-m-cresol	200.	0.	176.	88.	168.	84.	4.7	33	26-103
4-Nitrophenol	200.	0.	192.	96.	152.	76.	23.2	50	11-114

Key

Conc = Concentration
Samp = Sample
MS = Matrix Spike
MSD = Matrix Spike Duplicate
REC = Recovery
RPD = Relative Percent Difference

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CLIENT Hart Crowser
1910 Fairview Ave. E.
Seattle, WA 98102
ATTN: Phillip Spadaro

LABORATORY NO 96635

DATE June 23, 1986

Job #1659

REPORT ON SOIL

SAMPLE IDENTIFICATION Submitted 5/6/86 and identified as shown:

TESTS PERFORMED AND RESULTS:

1) B-1 SPT-1
2) B-1 SPT-2
3) B-1 SPT-3
4) B-1 SPT-4
5) B-1 SPT-5
6) B-1 SPT-6
7) B-1 SPT-7
8) B-1 SPT-8
9) B-1 SPT-9
10) B-2 SPT-1
11) B-2 SPT-2
12) B-2 SPT-3
13) B-2 SPT-4
14) B-2 SPT-5
15) B-2 SPT-6
16) B-2 SPT-7
17) B-2 SPT-8
18) B-2 SPT-9
19) B-3 SPT-1 5/6 11:15
20) B-3 SPT-2 5/6 11:35
21) B-3 SPT-3 5/6 11:45
22) B-3 SPT-4 5/6 11:50
23) B-3 SPT-5 5/6 noon
24) B-3 SPT-6 5/6 12:05
25) B-3 SPT-7 5/6 12:15
26) B-3 SPT-8 5/6 12:10
27) B-3 SPT-9 5/6 12:20

Samples were composited according to the following scheme:

Composite A: Samples 1-4
Composite B: Samples 10-12

At your request, the remaining samples were held without analysis in the laboratory.

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Samples were analyzed for priority pollutants in accordance with Test Methods for Evaluating Solid Waste, (SW-846), U.S.E.P.A., 1982, Methods 8240 (volatile organics), 8270 (semi-volatile extractables), 8080 (pesticides and PCB's), 9010 (cyanide), 6010 and the 7000 series (metals analysis). Phenol analysis was in accordance with Method 420.2, Methods for Chemical Analysis of Water & Wastes, U.S.E.P.A., March, 1979.

Inorganics

	A	B	Lab Blank
Total Solids, %	81.4	86.8	---
	parts per million (mg/kg), dry basis		
Antimony	5.	L/3.	L/3.
Arsenic	5.1	6.2	L/0.5
Beryllium	0.3	0.4	L/0.1
Cadmium	L/0.5	L/0.5	L/0.5
Chromium	35.	120.	L/1.
Copper	35.	72.	L/1.
Lead	63.	170.	L/10.
Mercury	0.2	0.4	L/0.1
Nickel	28.	61.	L/2.
Selenium	L/0.5	L/0.5	L/0.5
Silver	0.5	0.9	0.3
Thallium	L/0.5	L/0.5	L/0.5
Zinc	81.	290.	2.
Total Cyanide	0.7	8.3	L/0.5
Total Phenol	0.7	1.6	L/0.5

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Volatile Organics (by GC/MS)

parts per billion (ug/kg), dry basis

	A	B	Lab Blank
Chloromethane	L/5.	L/5.	L/5.
Bromomethane	L/5.	L/5.	L/5.
Vinyl Chloride	L/5.	L/5.	L/5.
Chloroethane	L/5.	L/5.	L/5.
Methylene Chloride	130.	350.	L/5.
Acrolein	L/25.	L/25.	L/25.
*Acetone	410.	1700.	trace
Acrylonitrile	L/25.	L/25.	L/25.
*Carbon Disulfide	L/5.	L/5.	L/5.
1,1-Dichloroethylene	L/5.	L/5.	L/5.
1,1-Dichloroethane	L/5.	L/5.	L/5.
trans-1,2-Dichloroethylene	L/5.	trace	L/5.
Chloroform	L/5.	L/5.	L/5.
*2-Butanone	L/5.	L/5.	L/5.
1,2-Dichloroethane	L/5.	L/5.	L/5.
1,1,1-Trichloroethane	trace	trace	L/5.
*Vinyl Acetate	L/5.	L/5.	L/5.
Bromodichloromethane	L/5.	L/5.	L/5.
Carbon Tetrachloride	L/5.	L/5.	L/5.
1,2-Dichloropropane	L/5.	L/5.	L/5.
Trichloroethylene	L/5.	trace	L/5.

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parts per billion (ug/kg), dry basis

	A	B	Lab Blank
Benzene	L/5.	L/5.	L/5.
Chlorodibromomethane	L/5.	L/5.	L/5.
1,1,2-Trichloroethane	L/5.	L/5.	L/5.
2-Chloroethyl vinyl ether	L/5.	L/5.	L/5.
Bromoform	L/5.	L/5.	L/5.
*4-Methyl-2-pentanone	L/5.	L/5.	L/5.
*2-Hexanone	L/5.	L/5.	L/5.
1,1,2,2-Tetrachloroethane	L/5.	L/5.	L/5.
Tetrachloroethylene	trace	130.	L/5.
Toluene	L/5.	35.	L/5.
Chlorobenzene	L/5.	L/5.	L/5.
trans-1,3-Dichloropropene	L/5.	L/5.	L/5.
Ethylbenzene	trace	190.	L/5.
cis-1,3-Dichloropropene	L/5.	L/5.	L/5.
*Styrene	L/5.	L/5.	L/5.
*Total Xylenes	28.	360.	L/5.

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Extractables (by GC/MS)

parts per billion (ug/kg), dry basis

	A	B	Lab Blank
N-nitrosodimethylamine	L/50.	L/50.	L/50.
Bis(2-chloroethyl)ether	L/50.	L/50.	L/50.
2-Chlorophenol	L/50.	L/50.	L/50.
Phenol	L/50.	320.	L/50.
1,3-Dichlorobenzene	L/50.	L/50.	L/50.
1,4-Dichlorobenzene	L/50.	L/50.	L/50.
1,2-Dichlorobenzene	L/50.	L/50.	L/50.
Bis(2-chloroisopropyl)ether	L/50.	L/50.	L/50.
Hexachloroethane	L/50.	L/50.	L/50.
N-nitroso-di-n-propylamine	L/50.	L/50.	L/50.
Nitrobenzene	L/50.	L/50.	L/50.
Isophorone	L/50.	L/50.	L/50.
2-Nitrophenol	L/50.	L/50.	L/50.
2,4-Dimethylphenol	L/50.	930.	L/50.
Bis(2-chloroethoxy)methane	L/50.	L/50.	L/50.
2,4-Dichlorophenol	L/50.	L/50.	L/50.
1,2,4-Trichlorobenzene	L/50.	L/50.	L/50.
Naphthalene	1900.	1900.	L/50.
Hexachlorobutadiene	L/50.	L/50.	L/50.
4-Chloro-m-cresol	L/50.	L/50.	L/50.
Hexachlorocyclopentadiene	L/50.	L/50.	L/50.
2,4,6-Trichlorophenol	L/50.	L/50.	L/50.
2-Chloronaphthalene	L/50.	L/50.	L/50.
Acenaphthylene	L/50.	L/50.	L/50.
Dimethylphthalate	L/50.	L/50.	L/50.
2,6-Dinitrotoluene	L/50.	L/50.	L/50.
Acenaphthene	680.	330.	L/50.
2,4-Dinitrophenol	L/50.	L/50.	L/50.
2,4-Dinitrotoluene	L/50.	L/50.	L/50.
4-Nitrophenol	L/50.	L/50.	L/50.
Fluorene	430.	340.	L/50.
4-Chlorophenyl phenyl ether	L/50.	L/50.	L/50.
Diethylphthalate	L/50.	L/50.	L/50.
4,6-Dinitro-o-cresol	L/50.	L/50.	L/50.

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parts per billion (ug/kg), dry basis

	A	B	Lab Blank
1,2-Diphenylhydrazine	L/50.	L/50.	L/50.
4-Bromophenyl phenyl ether	L/50.	L/50.	L/50.
Hexachlorobenzene	L/50.	L/50.	L/50.
Pentachlorophenol	L/50.	L/50.	L/50.
Phenanthrene	930.	980.	L/50.
Anthracene	250.	1300.	L/50.
Dibutylphthalate	L/50.	530.	L/50.
Fluoranthene	750.	390.	L/50.
Pyrene	470.	370.	L/50.
Benzidine	L/50.	L/50.	L/50.
Butyl benzyl phthalate	L/50.	L/50.	L/50.
Benzo(a)anthracene	L/50.	L/50.	L/50.
Chrysene	L/50.	L/50.	L/50.
3,3'-Dichlorobenzidine	L/50.	L/50.	L/50.
Bis(2-ethylhexyl)phthalate	2630.	1800.	63.
N-nitrosodiphenylamine	L/50.	L/50.	L/50.
Di-n-octyl phthalate	380.	130.	L/50.
Benzo(b)fluoranthene	L/50.	L/50.	L/50.
Benzo(k)fluoranthene	L/50.	L/50.	L/50.
Benzo(a)pyrene	L/50.	L/50.	L/50.
Indeno(1,2,3-cd)pyrene	L/50.	L/50.	L/50.
Dibenzo(ah)anthracene	L/50.	L/50.	L/50.
Benzo(ghi)perylene	L/50.	L/50.	L/50.
*Aniline	L/50.	L/50.	L/50.
*Benzoic Acid	L/50.	L/50.	L/50.
*Benzyl Alcohol	L/50.	L/50.	L/50.
*4-Chloroaniline	L/50.	L/50.	L/50.
*Dibenzofuran	420.	160.	L/50.
*2-Methylnaphthalene	770.	1500.	L/50.
*2-Methylphenol	L/50.	L/50.	L/50.
*4-Methylphenol	510.	530.	L/50.
*2-Nitroaniline	L/50.	L/50.	L/50.
*3-Nitroaniline	L/50.	L/50.	L/50.
*4-Nitroaniline	L/50.	L/50.	L/50.
*2,4,5-Trichlorophenol	L/50.	L/50.	L/50.

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Pesticides (by GC/ECD)

parts per billion (ug/kg), dry basis

	A	B	Lab Blank
alpha-BHC	L/10.	L/10.	L/10.
beta-BHC	L/10.	L/10.	L/10.
delta-BHC	L/10.	L/10.	L/10.
gamma-BHC (lindane)	L/10.	L/10.	L/10.
heptachlor	L/10.	L/10.	L/10.
aldrin	L/10.	L/10.	L/10.
heptachlor epoxide	L/10.	L/10.	L/10.
dieldrin	L/10.	L/10.	L/10.
4,4'-DDE	L/10.	L/10.	L/10.
4,4'-DDD	L/10.	L/10.	L/10.
endosulfan sulfate	L/10.	L/10.	L/10.
4,4'-DDT	L/10.	L/10.	L/10.
chlordane	L/10.	L/10.	L/10.
alpha endosulfan	L/10.	L/10.	L/10.
beta endosulfan	L/10.	L/10.	L/10.
endrin	L/10.	L/10.	L/10.
endrin aldehyde	L/10.	L/10.	L/10.
toxaphene	L/1000.	L/1000.	L/1000.
PCB 1016	L/200.	L/200.	L/200.
PCB 1221	L/200.	L/200.	L/200.
PCB 1232	L/200.	L/200.	L/200.
PCB 1242	L/200.	L/200.	L/200.
PCB 1248	1800.	1700.	L/200.
PCB 1254	L/200.	L/200.	L/200.
PCB 1260	950.	1200.	L/200.
Methoxychlor	L/20.	L/20.	L/20.
Endrin Ketone	L/10.	L/10.	L/10.

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Key

L/ indicates "less than"
* indicates additional compounds from the EPA's Hazardous Substances List.
trace indicates an unquantifiable amount between 5-25 parts per billion.

Respectfully submitted,

Laucks Testing Laboratories, Inc.

J. M. Owens

JMO:veg

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APPENDIX

Surrogate Recovery Quality Control Report

Listed below are surrogate (chemically similar) compounds utilized in the analysis of volatile and organic compounds. The surrogates are added to every sample prior to extraction and analysis to monitor for matrix effects, purging efficiency, and sample processing errors. The control limits represent the 95% confidence interval established in our laboratory through repetitive analysis of these sample types.

Sample No.	Surrogate Compound	Spike Level	Spike Found	% Recovery	Control Limit
		parts per billion (ug/kg)			
Blank	d4-1,2-Dichloroethane	50.0	46.4	92.8	50-160
	d8-Toluene	50.0	48.8	97.6	50-160
	p-Bromofluorobenzene	50.0	51.9	104.	50-160
A	d4-1,2-Dichloroethane	172.	152.	88.4	50-160
	d8-Toluene	172.	175.	102.	50-160
	p-Bromofluorobenzene	172.	177.	103.	50-160
B	d4-1,2-Dichloroethane	271.	248.	91.5	50-160
	d8-Toluene	271.	267.	98.5	50-160
	p-Bromofluorobenzene	271.	305.	113.	50-160
Blank	2-Fluorophenol	3333.	2840.	85.2	25-121
	d5-Phenol	3333.	2930.	87.9	24-113
	2-Bromophenol	3333.	2706.	81.2	59-97
	d5-Nitrobenzene	1667.	1299.	77.9	23-120
	2-Fluorobiphenyl	1667.	1319.	79.1	30-115
	d10-Azobenzene	1667.	1325.	79.5	---
	2,4,6-Tribromophenol	3333.	3540.	106.2	19-122
	d14-Terphenyl	1667.	1434.	86.0	18-137

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Sample No.	Surrogate Compound	Spike Level	Spike Found	% Recovery	Control Limit
		parts per billion (ug/kg)			
A	2-Fluorophenol	3876.	3341.	86.2	25-121
	d5-Phenol	3876.	3752.	96.8	24-113
	2-Bromophenol	3876.	3659.	94.4	59-97
	d5-Nitrobenzene	1938.	1454.	75.0	23-120
	2-Fluorobiphenyl	1938.	1826.	94.2	30-115
	d10-Azobenzene	1938.	1820.	93.9	---
	2,4,6-Tribromophenol	3876.	3326.	85.8	19-122
	d14-Terphenyl	1938.	1558.	80.4	18-137
B	2-Fluorophenol	3876.	3178.	82.0	25-121
	d5-Phenol	3876.	3686.	95.1	24-113
	2-Bromophenol	3876.	3527.	91.0	59-97
	d5-Nitrobenzene	1938.	1461.	75.4	23-120
	2-Fluorobiphenyl	1938.	1731.	89.3	30-115
	d10-Azobenzene	1938.	1791.	92.4	---
	2,4,6-Tribromophenol	3876.	3624.	93.5	19-122
	d14-Terphenyl	1938.	1587.	81.9	18-137
Blank	Isodrin	38.8	29.2	75.2	43-118*
A	Isodrin	38.8	23.0	59.4	43-118*
B	Isodrin	38.8	33.5	86.3	43-118*
Blank	dibutylchlorendate	77.5	58.3	75.2	20-150
A	dibutylchlorendate	77.5	34.9	45.0	20-150
B	dibutylchlorendate	77.5	54.2	69.9	20-150

* water matrix control limits only

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CLIENT Hart Crowser
1910 Fairview Ave. E.
Seattle, WA 98102
ATTN: Phillip Spadaro

LABORATORY NO. 96759

DATE June 19, 1986

Job #1659

REPORT ON WATER

SAMPLE IDENTIFICATION Submitted 5/14/86 and identified as shown:

TESTS PERFORMED AND RESULTS:

1) S-1 B-1 12:15
2) S-1 B-2 11:40
3) S-1 B-3 1:45

Samples were analyzed for priority pollutants in accordance with Test Methods for Evaluating Solid Waste, (SW-846), U.S.E.P.A., 1982, Methods 8240 (volatile organics), 8270 (semi-volatile extractables), 8080 (pesticides and PCB's), 9010 (cyanide), and the 7000 series (metals analysis). Phenol analysis was in accordance with Method 420.2, Methods for Chemical Analysis of Water & Wastes, U.S.E.P.A., March, 1979.

Samples analyzed for dissolved metals were filtered in the field.

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Inorganics

parts per billion (ug/L)

	1	2	3	Lab Blank
Dissolved Antimony	L/5.	15.	L/5.	L/5.
Dissolved Arsenic	L/5.	17.	L/5.	L/5.
Dissolved Beryllium	L/1.	L/1.	L/1.	L/1.
Dissolved Cadmium	6.	2.	2.	L/1.
Dissolved Chromium	3.	7.	14.	1.
Dissolved Copper	6.	6.	5.	L/1.
Dissolved Lead	L/10.	27.	L/10.	L/10.
Dissolved Mercury	L/1.	L/1.	L/1.	L/1.
Dissolved Nickel	26.	22.	9.	L/2.
Dissolved Selenium	L/0.5	L/0.5	L/0.5	L/0.5
Dissolved Silver	4.	3.	10.	L/1.
Dissolved Thallium	L/5.	L/5.	L/5.	L/5.
Dissolved Zinc	110.	19.	10.	8.
Total Cyanide	18.	70.	L/5.	L/5.
Total Phenol	L/5.	180.	9.	L/5.

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Volatile Organics (by GC/MS)

parts per billion (ug/L)

	1	2	3	Lab Blank
Chloromethane	L/1.	L/1.	L/1.	L/1.
Bromomethane	L/1.	L/1.	L/1.	L/1.
Vinyl Chloride	L/1.	310.	L/1.	L/1.
Chloroethane	L/1.	L/1.	L/1.	L/1.
Methylene Chloride	tracel	11.	8.	tracel
Acrolein	L/5.	L/5.	L/5.	L/5.
*Acetone	16.	56.	21.	tracel
Acrylonitrile	L/5.	L/5.	L/5.	L/5.
*Carbon Disulfide	L/1.	L/1.	L/1.	L/1.
1,1-Dichloroethylene	L/1.	L/1.	L/1.	L/1.
1,1-Dichloroethane	L/1.	tracel	L/1.	L/1.
trans-1,2-Dichloroethylene	L/1.	190.	L/1.	L/1.
Chloroform	L/1.	L/1.	L/1.	L/1.
*2-Butanone	L/1.	L/1.	L/1.	L/1.
1,2-Dichloroethane	L/1.	L/1.	L/1.	L/1.
1,1,1-Trichloroethane	L/1.	L/1.	L/1.	L/1.
*Vinyl Acetate	L/1.	L/1.	L/1.	L/1.
Bromodichloromethane	L/1.	L/1.	L/1.	L/1.

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parts per billion (ug/L)

	1	2	3	Lab Blank
Carbon Tetrachloride	L/1.	L/1.	L/1.	L/1.
1,2-Dichloropropane	L/1.	L/1.	L/1.	L/1.
Trichloroethylene	L/1.	tracel	L/1.	L/1.
Benzene	L/1.	17.	L/1.	L/1.
Chlorodibromomethane	L/1.	L/1.	L/1.	L/1.
1,1,2-Trichloroethane	L/1.	L/1.	L/1.	L/1.
2-Chloroethyl vinyl ether	L/1.	L/1.	L/1.	L/1.
Bromoform	L/1.	L/1.	L/1.	L/1.
*4-Methyl-2-pentanone	L/1.	11.	L/1.	L/1.
*2-Hexanone	L/1.	L/1.	L/1.	L/1.
1,1,2,2-Tetrachloroethane	L/1.	L/1.	L/1.	L/1.
Tetrachloroethylene	L/1.	L/1.	L/1.	L/1.
Toluene	L/1.	270.	L/1.	L/1.
Chlorobenzene	L/1.	L/1.	L/1.	L/1.
trans-1,3-Dichloropropene	L/1.	L/1.	L/1.	L/1.
Ethylbenzene	L/1.	460.	L/1.	L/1.
cis-1,3-Dichloropropene	L/1.	L/1.	L/1.	L/1.
*Styrene	L/1.	L/1.	L/1.	L/1.
*Total Xylenes	tracel	150.	L/1.	L/1.

Note on Volatile Organic Analysis

Methylene chloride and acetone are common solvents in everyday use at the laboratory. Presence of these compounds in the samples may be the result of unavoidable laboratory contamination. Other detectable organics would be expected to have been native to the samples.

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Extractables (by GC/MS)

parts per billion (ug/L)

	1	2	3	Lab Blank
N-nitrosodimethylamine	L/1.	L/1.	L/1.	L/1.
Bis(2-chloroethyl)ether	L/1.	L/1.	L/1.	L/1.
2-Chlorophenol	L/1.	L/1.	L/1.	L/1.
Phenol	L/1.	18.	L/1.	L/1.
1,3-Dichlorobenzene	L/1.	L/1.	L/1.	L/1.
1,4-Dichlorobenzene	L/1.	L/1.	L/1.	L/1.
1,2-Dichlorobenzene	L/1.	L/1.	L/1.	L/1.
Bis(2-chloroisopropyl)ether	L/1.	L/1.	L/1.	L/1.
Hexachloroethane	L/1.	L/1.	L/1.	L/1.
N-nitroso-di-n-propylamine	L/1.	L/1.	L/1.	L/1.
Nitrobenzene	L/1.	L/1.	L/1.	L/1.
Isophorone	L/1.	L/1.	L/1.	L/1.
2-Nitrophenol	L/1.	L/1.	L/1.	L/1.
2,4-Dimethylphenol	L/1.	320.	28.	L/1.
Bis(2-chloroethoxy)methane	L/1.	L/1.	L/1.	L/1.
2,4-Dichlorophenol	L/1.	L/1.	L/1.	L/1.
1,2,4-Trichlorobenzene	L/1.	L/1.	L/1.	L/1.
Naphthalene	trace2	18.	120.	L/1.
Hexachlorobutadiene	L/1.	L/1.	L/1.	L/1.
4-Chloro-m-cresol	L/1.	130.	L/1.	L/1.
Hexachlorocyclopentadiene	L/1.	L/1.	L/1.	L/1.
2,4,6-Trichlorophenol	L/1.	L/1.	L/1.	L/1.
2-Chloronaphthalene	L/1.	L/1.	L/1.	L/1.
Acenaphthylene	L/1.	L/1.	L/1.	L/1.
Dimethylphthalate	L/1.	L/1.	L/1.	L/1.
2,6-Dinitrotoluene	L/1.	L/1.	L/1.	L/1.
Acenaphthene	L/1.	L/1.	10.	L/1.
2,4-Dinitrophenol	L/1.	L/1.	L/1.	L/1.
2,4-Dinitrotoluene	L/1.	L/1.	L/1.	L/1.
4-Nitrophenol	L/1.	L/1.	L/1.	L/1.
Fluorene	L/1.	L/1.	L/1.	L/1.
4-Chlorophenyl phenyl ether	L/1.	L/1.	L/1.	L/1.
Diethylphthalate	L/1.	L/1.	L/1.	L/1.
4,6-Dinitro-o-cresol	L/1.	L/1.	L/1.	L/1.

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parts per billion (ug/L)

	1	2	3	Lab Blank
1,2-Diphenylhydrazine	L/1.	L/1.	L/1.	L/1.
4-Bromophenyl phenyl ether	L/1.	L/1.	L/1.	L/1.
Hexachlorobenzene	L/1.	L/1.	L/1.	L/1.
Pentachlorophenol	L/1.	L/1.	L/1.	L/1.
Phenanthrene	L/1.	L/1.	L/1.	L/1.
Anthracene	L/1.	L/1.	L/1.	L/1.
Dibutylphthalate	L/1.	L/1.	L/1.	L/1.
Fluoranthene	L/1.	L/1.	L/1.	L/1.
Pyrene	L/1.	L/1.	L/1.	L/1.
Benzidine	L/1.	L/1.	L/1.	L/1.
Butyl benzyl phthalate	L/1.	L/1.	L/1.	L/1.
Benzo(a)anthracene	L/1.	L/1.	L/1.	L/1.
Chrysene	L/1.	L/1.	L/1.	L/1.
3,3'-Dichlorobenzidine	L/1.	L/1.	L/1.	L/1.
Bis(2-ethylhexyl)phthalate	trace2	trace2	trace2	L/1.
N-nitrosodiphenylamine	L/1.	L/1.	L/1.	L/1.
Di-n-octyl phthalate	L/1.	L/1.	L/1.	L/1.
Benzo(b)fluoranthene	L/1.	L/1.	L/1.	L/1.
Benzo(k)fluoranthene	L/1.	L/1.	L/1.	L/1.
Benzo(a)pyrene	L/1.	L/1.	L/1.	L/1.
Indeno(1,2,3-cd)pyrene	L/1.	L/1.	L/1.	L/1.
Dibenzo(ah)anthracene	L/1.	L/1.	L/1.	L/1.
Benzo(ghi)perylene	L/1.	L/1.	L/1.	L/1.
*Aniline	L/1.	L/1.	L/1.	L/1.
*Benzoic Acid	L/1.	L/1.	L/1.	L/1.
*Benzyl Alcohol	L/1.	L/1.	L/1.	L/1.
*4-Chloroaniline	L/1.	L/1.	L/1.	L/1.
*Dibenzofuran	L/1.	L/1.	L/1.	L/1.
*2-Methylnaphthalene	L/1.	L/1.	10.	L/1.
*2-Methylphenol	L/1.	26.	L/1.	L/1.
*4-Methylphenol	L/1.	70.	L/1.	L/1.
*2-Nitroaniline	L/1.	L/1.	L/1.	L/1.
*3-Nitroaniline	L/1.	L/1.	L/1.	L/1.
*4-Nitroaniline	L/1.	L/1.	L/1.	L/1.
*2,4,5-Trichlorophenol	L/1.	L/1.	L/1.	L/1.

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Pesticides (by GC/ECD)

parts per billion (ug/L)

	1	2	3	Lab Blank
alpha-BHC	L/0.2	L/0.2	L/0.2	L/0.2
beta-BHC	L/0.2	L/0.2	L/0.2	L/0.2
delta-BHC	L/0.2	L/0.2	L/0.2	L/0.2
gamma-BHC (lindane)	L/0.2	L/0.2	L/0.2	L/0.2
heptachlor	L/0.2	L/0.2	L/0.2	L/0.2
aldrin	L/0.2	L/0.2	L/0.2	L/0.2
heptachlor epoxide	L/0.2	L/0.2	L/0.2	L/0.2
dieldrin	L/0.2	L/0.2	L/0.2	L/0.2
4,4'-DDE	L/0.2	L/0.2	L/0.2	L/0.2
4,4'-DDD	L/0.4	L/0.4	L/0.4	L/0.4
endosulfan sulfate	L/0.4	L/0.4	L/0.4	L/0.4
4,4'-DDT	L/0.4	L/0.4	L/0.4	L/0.4
chlordane	L/0.4	L/0.4	L/0.4	L/0.4
alpha endosulfan	L/0.4	L/0.4	L/0.4	L/0.4
beta endosulfan	L/0.4	L/0.4	L/0.4	L/0.4
endrin	L/0.4	L/0.4	L/0.4	L/0.4
endrin aldehyde	L/0.4	L/0.4	L/0.4	L/0.4
toxaphene	L/30.	L/30.	L/30.	L/30.
PCB 1016	L/5.	L/5.	L/5.	L/5.
PCB 1221	L/5.	L/5.	L/5.	L/5.
PCB 1232	L/5.	L/5.	L/5.	L/5.
PCB 1242	L/5.	L/5.	L/5.	L/5.
PCB 1248	L/5.	L/5.	L/5.	L/5.
PCB 1254	L/5.	L/5.	L/5.	L/5.
PCB 1260	L/5.	L/5.	L/5.	L/5.
Methoxychlor	L/1.0	L/1.0	L/1.0	L/1.0
Endrin Ketone	L/0.4	L/0.4	L/0.4	L/0.4

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Key

L/ indicates "less than"
* indicates additional compounds from the EPA's Hazardous Substances List.
trace 1 indicates an unquantifiable amount between 1-5 parts per billion.
trace 2 indicates an unquantifiable amount between 1-10 parts per billion.

Respectfully submitted,

Laucks Testing Laboratories, Inc.

J. M. Owens

JMO:veg

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APPENDIX

Surrogate Recovery Quality Control Report

Listed below are surrogate (chemically similar) compounds utilized in the analysis of volatile and organic compounds. The surrogates are added to every sample prior to extraction and analysis to monitor for matrix effects, purging efficiency, and sample processing errors. The control limits represent the 95% confidence interval established in our laboratory through repetitive analysis of these sample types.

Sample No.	Surrogate Compound	Spike Level	Spike Found	% Recovery	Control Limit
		parts per billion (ug/L)			
1	d4-1,2-Dichloroethane	50.0	50.4	101.	77-120
	d8-Toluene	50.0	48.6	97.2	86-119
	p-Bromofluorobenzene	50.0	53.8	108.	85-121
2	d4-1,2-Dichloroethane	50.0	50.3	101.	77-120
	d8-Toluene	50.0	48.2	96.4	86-119
	p-Bromofluorobenzene	50.0	49.5	99.0	85-121
3	d4-1,2-Dichloroethane	50.0	49.2	98.4	77-120
	d8-Toluene	50.0	49.9	99.8	86-119
	p-Bromofluorobenzene	50.0	51.8	104.	85-121
Blank	d4-1,2-Dichloroethane	50.0	45.4	90.8	77-120
	d8-Toluene	50.0	50.3	101.	86-119
	p-Bromofluorobenzene	50.0	50.5	101.	85-121

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Sample No.	Surrogate Compound	Spike Level	Spike Found	% Recovery	Control Limit
		parts per billion (ug/L)			
Blank	2-Fluorophenol	200.	164.2	82.1	21-100
	d5-Phenol	200.	127.2	63.6	10-94
	2-Bromophenol	200.	222.	111.	62-96
	d5-Nitrobenzene	100.	89.5	89.5	35-114
	2-Fluorobiphenyl	100.	96.1	96.1	43-116
	d10-Azobenzene	100.	86.9	86.9	---
	2,4,6-Tribromophenol	200.	228.	114.	10-123
	d14-Terphenyl	100.	99.1	99.1	33-141
1	2-Fluorophenol	200.	126.0	63.0	21-100
	d5-Phenol	200.	128.6	64.3	10-94
	2-Bromophenol	200.	175.0	87.5	62-96
	d5-Nitrobenzene	100.	74.1	74.1	35-114
	2-Fluorobiphenyl	100.	90.0	90.0	43-116
	d10-Azobenzene	100.	105.	105.	---
	2,4,6-Tribromophenol	200.	246.	123.	10-123
	d14-Terphenyl	100.	67.6	67.6	33-141
2	2-Fluorophenol	200.	143.6	71.8	21-100
	d5-Phenol	200.	142.4	71.2	10-94
	2-Bromophenol	200.	204.	102.	62-96
	d5-Nitrobenzene	100.	84.5	84.5	35-114
	2-Fluorobiphenyl	100.	100.	100.	43-116
	d10-Azobenzene	100.	98.5	98.5	---
	2,4,6-Tribromophenol	200.	181.	90.5	10-123
	d14-Terphenyl	100.	45.1	45.1	33-141

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Hart Crowser

LABORATORY NO. 96759

Sample No.	Surrogate Compound	Spike Level	Spike Found	% Recovery	Control Limit
		parts per billion (ug/L)			
3	2-Fluorophenol	200.	102.4	51.2	21-100
	d5-Phenol	200.	85.0	42.5	10-94
	2-Bromophenol	200.	144.4	72.2	62-96
	d5-Nitrobenzene	100.	75.5	75.5	35-114
	2-Fluorobiphenyl	100.	79.1	79.1	43-116
	d10-Azobenzene	100.	73.9	73.9	---
	2,4,6-Tribromophenol	200.	136.4	68.2	10-123
	d14-Terphenyl	100.	39.6	39.6	33-141
Blank	Isodrin	2.5	2.1	84.4	43-118
1	Isodrin	2.5	*-**	*-**	43-118
2	Isodrin	2.5	1.4	55.4	43-118
2	Isodrin	0.5	0.28	56.8	43-118
Blank	Dibutylchlorendate	5.0	3.5	69.5	24-150
1	Dibutylchlorendate	5.0	1.2	24.6	24-150
2	Dibutylchlorendate	5.0	0.5	10.4**	24-150
3	Dibutylchlorendate	1.0	0.508	50.8	24-150

* Isodrin peak obscured

** Sample was re-analyzed due to low surrogate recovery. The second set of surrogate recoveries are reported here and are similar to the first set. This leads us to conclude the poor recovery is due to a matrix effect problem.