CH2M HILL TRANSMITTAL

TO Garth Williams
Snohomish Co. PUD
3320 California
PO Box 1107
Everett Washington 98203

FROM Lynn Laszewski

ATTN

RE

DATE Oct. 25, 1990

PROJECT NUMBER SEA 28472.A0

WE ARE SENDING YOU

- ☐ ATTACHED
- ☐ UNDER SEPARATE COVER VIA
- ☐ SHOP DRAWINGS
- ☐ DOCUMENTS
- ☐ TRACINGS
- ☐ PRINTS
- ☐ SPECIFICATIONS
- ☐ CATALOGS
- ☐ COPY OF LETTER
- ☒ Report for UST Removals

QUANTITY	DESCRIPTION
	Attached is the Summary of Soil Investigation for Underground Storage Tanks at Everett and Mountlake Terrace.
	It was a pleasure working with you on this project. Thanks again,
	Lynn

IF MATERIAL RECEIVED IS NOT AS LISTED, PLEASE NOTIFY US AT ONCE

REMARKS

COPY TO

REV 1/87 FORM 6

CH2M HILL

M E M O R A N D U M

TO: Garth Williams, Supervisor of Facilities
Snohomish County PUD No. 1

FROM: Lynn Laszewski/CH2M HILL
Libby Goldstein/CH2M HILL

DATE: October 24, 1990

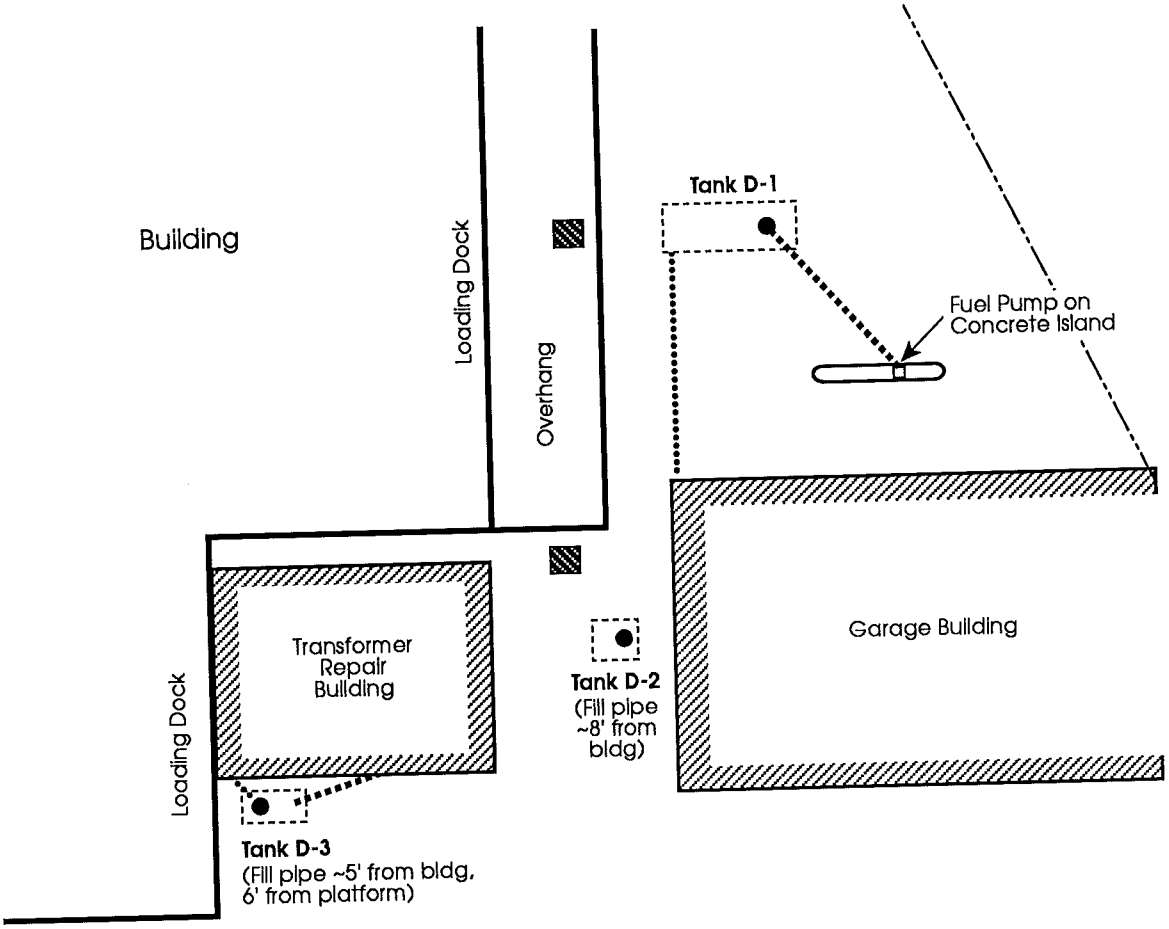
RE: Summary of Soil Investigation for Underground Storage Tanks at Everett and Mountlake Terrace

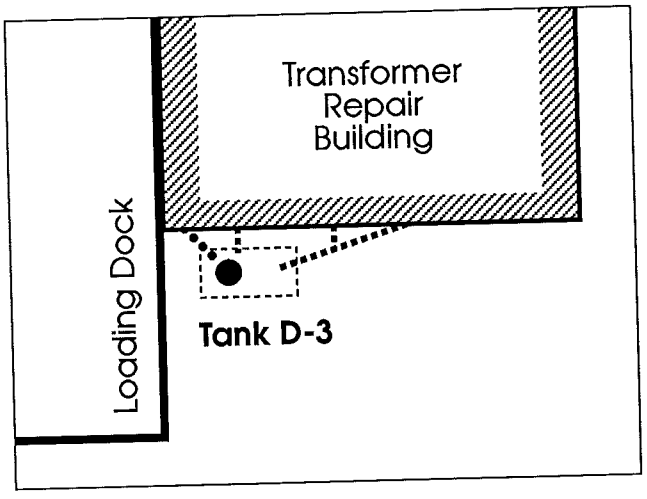
PROJECT: SEA28472.A0

BACKGROUND

Snohomish County Public Utility District No. 1 retained CH2M HILL to observe the removal of four underground storage tanks (UST) and the excavation of contaminated soils associated with the tanks. Three of the UST systems were located at the District's downtown Everett facility and consisted of a 10,000 gallon gasoline tank (D-1), a 300 gallon waste oil tank (D-2), and a 300 gallon used transformer oil tank (D-3). The fourth tank (H-1) was a 2000 gallon gasoline tank located at the Mountlake Terrace facility. Figures 1 and 2 show the location of tanks at each site. All tanks were constructed of single wall steel and were estimated to be approximately 30 years old.

A preliminary investigation was conducted by Hart Crowser Earth and Environmental Technologies in March 1988 to determine if soil may be contaminated in the vicinity of the four UST systems. Soil borings completed near the tanks indicated that soil in the vicinity of D-1 and H-1 contained petroleum hydrocarbons. Borings completed near D-2 did not exhibit detectible contamination. Soil borings were not completed near D-3. In the case of D-1, elevated petroleum hydrocarbons levels appeared to be limited to areas near the tank. The total petroleum hydrocarbons (TPH) detected in this area ranged from less than the detection limit to 2500 ppm. The soil contamination detected near H-1 was at a depth of 2.5 - 4.0 feet from the surface, which may indicate surface spills. TPH levels ranged from less than 20 ppm (detection limit) to 2300 ppm.





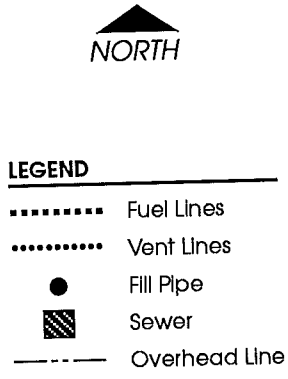


Figure 1
SNOHOMISH PUD
DOWNTOWN EVERETT FACILITY

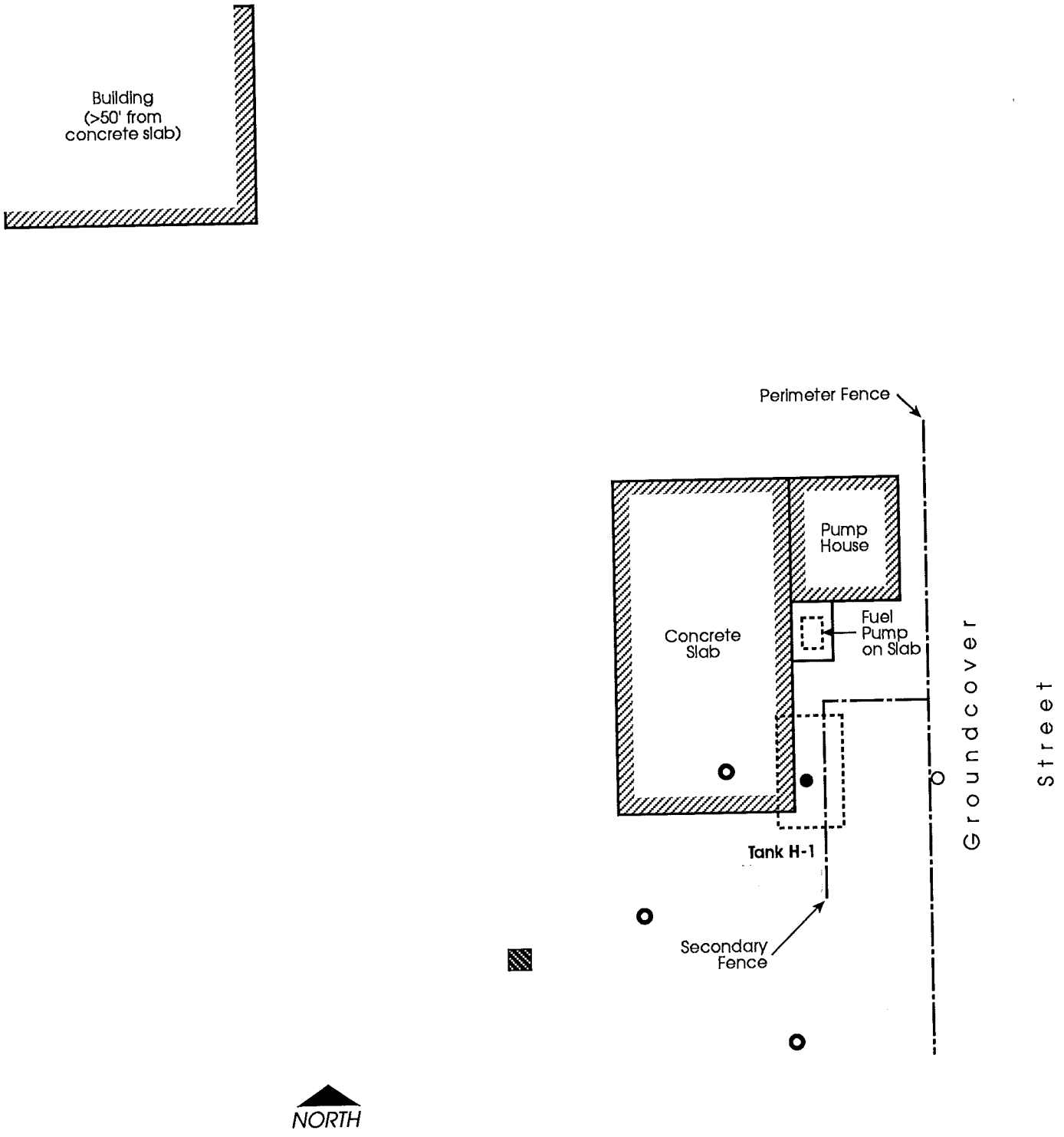


Figure 2
SNOHOMISH PUD
HALLS LAKE FACILITY

The District retained CH2M HILL to oversee the removal of the tanks and contaminated soil and verify (by sampling) the levels of TPH and volatile organic chemicals remaining in the excavation soil. The Verification Sampling Plan was designed to indicate whether or not petroleum contaminated soils were removed to the Department of Ecology (Ecology) guideline levels. This would be accomplished by collecting soil samples from the four walls and floor of each tank excavation pit. The Verification Sampling Plan is included in Attachment A.

This memorandum summarizes the site observations and excavation sampling. Analytical data evaluation and recommendations for additional site remediation are also presented.

SITE INVESTIGATION METHODS

The removal of the UST systems and subsequent soil investigation was conducted from August 16, 1990 through September 5, 1990. The UST systems were removed and the soil in the vicinity of the four USTs were excavated by Lige and William B. Dickson Company. All soil samples collected by CH2M HILL were submitted to Friedman and Bruya, Inc. Environmental Chemists for total petroleum hydrocarbons (TPH) and benzene, toluene, ethyl benzene and xylene (BTEX) analysis. EPA Methods 418.1 and 8020 were used for analysis of TPH and BTEX respectively.

The following criteria were used to determine the extent of excavation:

- soils that were stained, had visible contamination, or were otherwise discolored.
- soils that had a strong petroleum odor
- soils that had readings greater than 3 to 5 ppm above background on the HNu photo-ionization detector.

In general, soil was excavated past the point that contaminated soil was visually observed. Soil samples were then collected from the excavation pit walls and bottom to verify that sufficient contaminated soil was removed. If the analytical results from the pits indicated that the remaining soil exceeded the proposed Ecology clean-up levels, additional soil was excavated. This process was repeated until the analytical results indicated that soils

were below the Ecology clean-up levels proposed June 20, 1990. The proposed Ecology clean up levels are listed in Table 1.

Table 1

WDOE PROPOSED CLEANUP LEVELS FOR UST SITES[a]

Parameters	Benzene	Toulene	Ethylbenzene	Total Xylenes	Total Petroleum Hydrocarbons	
Cleanup Levels	Soil 500 ppb	Soil 40,000 ppb	Soil 20,000 ppb	Soil 20,000 ppb	Gasoline 100,000 ppb	Diesel Fuel/Oil 200,000 ppb

[a] WAC 173-340-450 June 20, 1990 Draft.

Prior to sampling, the backhoe operator was instructed to retrieve soil from the desired location and depth in the excavation pit. Soil samples were collected by scooping soil from the backhoe bucket with a decontaminated stainless steel spoon. To obtain a representative sample, grab samples were collected from several locations within the backhoe bucket.

Soil that was removed from the excavation pits was stockpiled and stored in a predesignated bermed area lined with Visqueen. At the end of each day the stockpiles were covered with an additional Visqueen sheet. These stockpiles remained onsite until analytical results indicated the appropriate method of disposal for the soil. Sampling and

removal of the excavated soil was the responsibility of Lige and William B. Dickson Company.

Tank H-1, Halls Lake Gasoline Tank

Tank H-1 was removed on August 16, 1990. The bottom of the tank was approximately 6 feet below grade. After removal, the tank was visually inspected. No holes or pits were observed on the outer surface of the tank. Tank H-1 excavation was completed on August 17. After excavation, elevated HNu readings were detected from the floor and the west wall of the pit. An additional 3-5 feet of soil was removed from these areas prior to verification sampling. The final dimensions of the excavated pit were 32' x 25' x 9'. Eleven soil samples, 5 floor samples, 5 wall samples and 1 field duplicate sample, were submitted to the laboratory. The floor samples were composited by the laboratory prior to analysis. Soil samples were analyzed for TPH and BTEX.

Tank D-1, Everett Gasoline Tank

Tank D-1 was removed on August 24, 1990 and pit excavation was completed on August 27. The bottom of this tank was approximately 8 feet below grade. Holes or pits were not observed on the outer tank surface. The size of the excavation pit was 21' x 43' x 11'. When Hnu readings indicated that contaminated soil was removed, verification soil samples were collected from the walls and floor of the excavation pit. The five samples collected from the excavation floor were composited by the laboratory prior to analysis. Six soil samples; four wall samples, 1 floor composite sample and 1 field duplicate sample, were analyzed for TPH and BTEX.

The results from the initial verification sample analysis (August 27, 1990) indicated that TPH levels in soil from the west portion of the pit floor exceeded Ecology proposed cleanup levels for gasoline UST systems. As a result, additional soil (2-3 feet) was excavated from the west portion of the pit bottom and additional verification soil samples were collected on August 31, 1990.

Tank D-2, Waste Oil Tank

Tank D-2 was removed on August 24, 1990 and pit excavation was completed on September 5. The bottom of the 300 gallon tank was approximately 7 feet below grade. The tank appeared to be in good condition, no holes or pits were observed on the outer surface. The size of the excavation pit was 22' x 42' x 10'. Initial verification soil samples were collected from the walls and floor of the excavation pit on August 27, 1990. Due to the size of the excavation pit, 2 samples were collected from the floor of the pit. These two samples were composited into one sample by the laboratory prior to analysis. Five soil samples; four wall samples and 1 floor composite sample were analyzed for TPH and BTEX.

Analytical results from August 27, 1990 indicated that TPH levels in the north, west, and south walls of the pit exceeded Ecology proposed cleanup levels for diesel and fuel oils. Additional verification soil samples were collected after re-excavation on August 31, 1990 and September 5, 1990. Approximately 1 to 8 feet of soil was removed during re-excavation of each of the north, west and south walls. A 2 to 3 foot wide band of blue colored soil was observed along the north wall at approximately 5 feet below grade.

HNu readings from the bluish soil ranged from 1 to 5 ppm above background. This material was removed when the additional soil was excavated.

Tank D-3, Transformer Oil Tank

Tank D-3 was removed on August 24, 1990. The bottom of the 300 gallon tank extended to a depth of approximately 5 feet below grade. The size of the excavation pit was 28' x 17' x 9'. During tank removal, some of the liquid remaining in the tank leaked from a small corrosion hole onto the floor of the excavation. Northwest Enviroservices pumped the liquid into a tanker. Verification soil samples were collected from the walls and floor of the excavation pit on August 27. Due to the size of the excavation pit, 2 samples were collected from the floor of the pit. Seven soil samples; four wall samples, 2 floor samples and 1 field duplicate sample, were analyzed for TPH and BTEX.

The analytical results from initial verification samples collected August 27, 1990 indicated that the east floor sample and the wall soil samples exceeded Ecology proposed cleanup levels for TPH. As a result, additional soil was excavated from the walls and east area of the floor on August 31, 1990. Verification soil samples collected on August 31, 1990 indicated that north wall TPH concentrations were still above Ecology cleanup levels. Due to the close proximity of the building to the north wall of tank excavation, removal of additional soil from the north wall was not feasible without jeopardizing the structural integrity of the building. Therefore to determine the horizontal extent of the elevated TPH levels, additional samples were taken by digging with a shovel 1-2 feet into the

excavation north wall beneath the building at the approximate depth of the tank bottom (5 feet).

INVESTIGATION RESULTS

Analytical results the verification soil samples are presented in Tables 2, 3, 4, and 5. Laboratory analytical data is included in Attachment B. Quality Control/Quality Assurance measures employed for this sampling included chain-of-custody, maintenance of sample preservation and holding time requirements and final data validation for conformance to applicable protocols. Data validation revealed that the precision, accuracy, and detection limits were acceptable for EPA analytical methods 8020 and 418.1.

Tank H-1, Halls Lake Gasoline Tank

Eleven soil samples were collected from the Tank H-1 excavation. The initial sample results indicated TPH concentrations were less than 25,000 ppb (detection limit) for all sample locations except the west wall. BTEX concentrations range from less than 1 ppb (detection limit) to 3,800 ppb for xylenes. Verification sample analysis after continued excavation of the west wall indicated that TPH concentrations from the west wall are also less than 25,000 ppm. Table 2 presents the analytical results for samples collected from Tank H-1 excavation.

Table 2

Snohomish County Public Utility District No. 1
Mountlake Terrace, Washington

EXCAVATION SAMPLE RESULTS

TANK H-1 HALLS LAKE GASOLINE TANK

	Parameters	Benzene	Toulene	Ethylbenzene	Total Xylenes	TPH
	WDOE Proposed Cleanup Levels[a]	Soil 500 ppb	Soil 40,000 ppb	Soil 20,000 ppb	Soil 20,000 ppb	Soil 100,000 ppb
Sample Number	Sample Location					
PUD-HL-NWL-8171	North Wall	<1	<1	<1	<1	<25,000
PUD-HL-WWL-8172	West Wall	<200[c]	700	540	3,800	500,000
PUD-HL-SWL-81710[b]	West Wall	<1	<1	<1	<1	<25,000
PUD-HL-XWL-81712[b]	West Wall (dup)	<1	<1	<1	<1	<25,000
PUD-HL-SWL-8173	South Wall	<10[c]	<1	<1	<1	<25,000
PUD-HL-EWL-8174	East Wall	<1	<1	1	13	<25,000
PUD-HL-CFL-81711 PUD-HL-NEFL-8177 PUD-HL-NWFL-8175 PUD-HL-SEFL-8178 PUD-HL-SWFL-8179	Center, Northeast, Northwest, Southeast, and Southwest floor samples composited	<2[c]	<1	1	4	<25,000

[a] WAC 173-340-450 June 20, 1990 Draft.
[b] Resample of west wall of excavation after removal of approximately 3 to 4 feet of soil.
[c] Interferences were present which interfered with the identification and quantification of the analyte indicated.

Tank D-1, Everett Gasoline Tank

Thirteen soil samples from the Tank D-1 excavation were analyzed for TPH and BTEX. Initial verification sample analysis indicated that TPH and BTEX concentrations in excavation wall samples were less than the Ecology proposed cleanup levels for gasoline UST excavations. The composite sample from the excavation pit floor indicated TPH levels at 240,000 ppb and 105 ppb benzene. To determine where additional excavation would be necessary, the individual floor samples were analyzed for TPH. The west portion of the excavation floor had TPH levels of 270,000 ppb. The west area was excavated and resampled on August 31, 1990. Subsequent samples from the northwest and southwest floor areas had TPH concentrations of 50,000 ppb and less than 25,000 ppb, respectively. Table 3 presents the analytical results for samples collected from tank D-1 excavation.

Tank D-2, Waste Oil Tank

Eight wall samples and two excavation floor samples were collected from the Tank D-2 excavation pit. The floor samples were composited by the laboratory prior to analysis. BTEX analysis of the samples did not indicate concentrations greater than 10 ppb for these constituents. Sample analysis indicated that the east wall had TPH levels of 26,000 ppb and the floor composite sample had TPH levels of 47,000 ppb. The initial analyses of samples from north, west, and south walls indicated elevated TPH levels and these walls were re-excavated on August 31, 1990. After removal of approximately 1 to 2 feet of material from the west and south walls, analysis indicated TPH concentrations of 280,000 ppb and less than 25,000 ppb respectively. On September 5, 1990 an additional

Table 3

Snohomish County Public Utility District No. 1
Everett, Washington

EXCAVATION SAMPLE RESULTS

TANK D-1 EVERETT GASOLINE TANK

	Parameters (ppb)	Benzene	Toulene	Ethylbenzene	Total Xylenes	TPH
	WDOE Proposed Cleanup Levels*	Soil 500 ppb	Soil 40,000 ppb	Soil 20,000 ppb	Soil 20,000 ppb	Soil 100,000 ppb
Sample Number	Sample Location					
PUD-E-NWL-82711	North Wall	21	4	1	2	<25,000
PUD-E-WWL-82717	West Wall	1	<1	<1	<1	<25,000
PUD-E-SWL-82718	South Wall	39	7	1	15	<25,000
PUD-E-EWL-82719	East Wall	84	10	2	2	<25,000
PUD-E-XWL-827110	East Wall (dup)	13	2	<1	<1	<25,000
PUD-E-FL-827	Floor composite	105	28	12	65	240,000
PUD-E-SWFL-82712	Southwest floor	<1	<1	<1	<1	270,000
PUD-E-SWFL-83111[b]						<25,000
PUD-E-NWFL-82713	Northwest floor	2	<1	<1	<1	270,000
PUD-E-NWFL-83112[b]						50,000
PUD-E-CFL-82714	Center floor					84,000
PUD-E-SEFL-82715	Southeast floor					49,000
PUD-E-NEFL-82716	Northeast floor					97,000

* WAC 173-340-450 June 20, 1990 Draft.
[b] Resample after further excavation.

2 feet of soil was removed from the west wall of the Tank D-2 excavation and the wall was resampled. The sample analytical results after this excavation indicated TPH levels less than 50,000 ppb. The north wall of the Tank D-2 excavation was re-excavated on August 31, 1990. Approximately 5 to 8 feet of material was removed from the north wall. Analysis of soil collected from the north wall after re-excavation indicated TPH concentrations of 78,000 ppb.

The initial sample from the north wall of the Tank D-2 excavation pit had the highest levels of TPH (1,000,000 ppb). Therefore, the sample was further characterized to determine if other constituents often associated with waste oil were present. The sample collected from the north wall on August 27, 1990 was analyzed for arsenic, lead, cadmium, and chromium total metals and further characterized by Modified EPA Method 8015 analysis. The total metal concentrations in this sample did not appear to vary greatly from anticipated soil concentrations for these constituents. Modified 8015 Analysis indicated that high boiling point petroleum products, such as diesel fuel, hydraulic fluid and motor oil could be present in the north wall sample. Table 4 presents the analytical results for Tank D-2 including total metal analysis.

Tank D-3, Transformer Oil Tank

Sixteen soil samples from the Tank D-3 excavation walls and floor were collected and analyzed for TPH. Samples with elevated TPH levels were also analyzed for BTEX. Analysis of the tank contents during tank cleaning indicated 64 ppm arochlor 1254/60. Therefore soil samples with elevated TPH levels were also analyzed for arochlor 1254.

Table 4

Snohomish County Public Utility District No. 1
Everett, Washington

EXCAVATION SAMPLE RESULTS

TANK D-2 EVERETT WASTE OIL TANK

Parameters (ppb)	Benzene	Toulene	Ethylbenzene	Total Xylenes	TPH
WDOE Proposed Cleanup Levels[a]	Soil 500 ppb	Soil 40,000 ppb	Soil 20,000 ppb	Soil 20,000 ppb	Soil 200,000 ppb
Sample Number	Sample Location				
PUD-E-NWL-827215 PUD-E-NWL-83123[b]	North Wall	<1 <1	<1 <1	<1 <1	<10[d] <1	1,000,000 78,000
PUD-E-WWL-827213 PUD-E-WWL-83124[b] PUD-E-WWL-9521[c]	West Wall	<1 1	<1 <1	<1 <1	<1 <1	360,000 280,000 <50,000
PUD-E-SWL-827214 PUD-E-SWL-83125[b]	South Wall	<1 <1	<1 <1	<1 <1	<1 <1	170,000 <25,000
PUD-E-EWL-827216	East Wall	<1	<1	<1	<1	26,000
PUD-E-WFL-827211 PUD-E-EFL-827212	West and east floor samples composited	1	<1	<1	<1	47,000

WAC 173-340-450 June 20, 1990 Draft
Resample after further excavation 8/31/90
[c] Resample after further excavation 9/5/90
[d] Interferences were present which interfered with the identification and quantitation of the analyte indicated

TOTAL METALS (ppm)

Sample Number	Arsenic	Cadmium	Lead	Chromium
PUD-E-NWL-827215	50	0.9	13	20
Common range for soils[a]	1-50	0.01-0.7	2-200	1-1,000

[a] Lindsay, Willard L. 1979. Chemical Equilibria in soils. John Wiley and Sons, New York.

Analytical results are summarized in Table 5. Arochlor 1254 levels did not exceed the detection limit of 1,000 ppb. Samples analyzed for BTEX did not exceed the detection limit for these constituents except for the initial sample from the excavation south wall. South wall sample BTEX concentrations did not approach the Ecology proposed clean up levels for BTEX.

The initial TPH concentration detected in the west portion of the excavation floor was 54,000 ppb. The walls and east portion of the excavation floor had elevated TPH levels and were re-excavated on August 31, 1990. Analytical results from the north wall following re-excavation indicated TPH levels of 400,000 ppm. Because the north wall of the Tank D-3 pit was previously excavated as close to the adjacent building as practical without jeopardizing the building's integrity, subsequent soil removal was not feasible. To determine the horizontal extent of elevated TPH levels, soil samples were collected from the north wall on September 5, 1990 by digging with a hand shovel approximately 1-2 feet into the north wall. These samples were collected at the approximate depth of the tank bottom (5 feet). One sample was collected from the west, center and east portions of the north wall. Analytical results from these samples indicated TPH concentrations did not exceed 200,000 ppb.

Summary and Conclusions

Tank H-1, Tank D-1, and Tank D-2 final excavation floor and wall samples did not exceed the proposed Ecology cleanup guidelines of 100,000 ppb for gasoline and 200,000 ppb for diesel and fuel oils. Because Tank D-2 contained waste oil, the sample with the

Table 5

Snohomish County Public Utility District No. 1
Everett, Washington

EXCAVATION SAMPLE RESULTS

TANK D-3 EVERETT TRANSFORMER OIL TANK

	Parameters (ppb)	Benzene	Toulene	Ethylbenzene	Total Xylenes	TPH	PCBs
	WDOE Proposed Cleanup Levels[a]	Soil 500 ppb	Soil 40,000 ppb	Soil 20,000 ppb	Soil 20,000 ppb	Soil 200,000 ppb	
Sample Number	Sample Location						
PUD-E-NWL-827319	North Wall	<1	<1	<1	<1	4,000,000	<1,000
PUD-E-NWL-83136[b]						400,000	
PUD-E-NWNWL-9532[d]						<50,000	
PUD-E-CNWL-9533[d]						<50,000	
PUD-E-NENWL-9534[d]						<50,000	
PUD-E-XWL-9535[d,c]						<50,000	
PUD-E-WWL-827320	West Wall	<1	<1	<1	<1	2,900,000	<1,000
PUD-E-WWL-83138[b]						<25,000	
PUD-E-EWL-827323	East Wall	<1	<1	<1	<1	210,000	
PUD-E-EWL-83137[b]		<1	<1	<1	<1	<25,000	
PUD-E-SWL-827321	South Wall	<1	<1	<1	<10[e]	5,000,000	<1,000
PUD-E-XWL-827322[c]		2	4	6	32	5,600,000	
PUD-E-SWL-83139[b]		<1	<1	<1	<1	<25,000	
PUD-E-XWL-831310[b,c]		<1	<1	<1	<1	<25,000	
PUD-E-EFL-827317	East Floor	<1	<1	<1	<1	570,000	<1,000
PUD-E-WFL-827318	West Floor	<1	<1	<1	<1	54,000	<1,000

[a] WAC 173-340-450 June 20, 1990 Draft
[b] Resample after further excavation 8/31/90
[c] Duplicate samples
[d] Resample further in wall 9/5/90
[e] Interferences were present which interfered with the identification and quantitation of the analyte indicated

highest TPH levels was further characterized. Analysis of the Tank D-2 excavation north wall sample did not indicate total arsenic, lead, cadmium or chromium at levels that exceed the ranges that naturally occur in soils. Gas chromatography indicated that the constituents present in the sample are similar to diesel fuel, hydraulic fluid and motor oil. Therefore it appears that these former tank locations do not require further remediation and do meet the Ecology guidelines for UST system closure.

Tank D-3 excavation walls and east portion of the floor exceeded the Ecology proposed TPH cleanup levels for diesel and fuel oil UST closure prior to final excavation. These areas were further excavated on August 31, 1990. Verification sample analysis from the north wall of the excavation still exceeded 200,000 ppb TPH, however continued excavation was not possible without jeopardizing the structural integrity of the adjacent building. To further characterize the horizontal extent of elevated TPH levels, samples were collected from the north wall at the approximate depth of the tank bottom by digging with a shovel 1 to 2 feet into the excavation wall. Sample analysis indicated that TPH levels were less than 50,000 ppb. These analytical results indicate that the horizontal extent of elevated TPH levels (400,000 ppb) do not extend beyond 1 to 2 feet beneath the building foundation. Therefore it appears that removal of soil containing elevated TPH levels under the building would not be essential to protect human health and the environment for the following reasons:

1) TPH levels remaining in the soil are low (400,000 ppb).

2) Analytical results appear to indicate that the area containing elevated TPH levels is limited to approximately four cubic yards of soil.

3) The soil is located below the concrete foundation of a building that will continue to be used by the Snohomish County PUD No. 1 for industrial purposes.

4) Groundwater levels are approximately 72 below the surface and do not approach the estimated depth of contamination (approximately 9 feet below ground surface).

ATTACHMENT A

Engineers
Planners
Economists
Scientists

October 31, 1989

SEA28472.A0

Ms. Nancy Whetter
Administrative Assistant
Public Utility District No. 1
Snohomish County
2320 California Street
Everett, WA 98201

Dear Ms. Whetter:

Attached are the Sampling Plan and Site Safety Plan for underground storage tank removals at Halls Lake and Everett facilities.

I have also included the revised proposed schedule as you requested. The underground storage tank removal specifications will be sent to you tomorrow afternoon.

If you have any questions, please call me.

Sincerely,

CH2M HILL

Lynn Laszewski

Lynn Laszewski

LL/je

Enclosures 3

CH2M HILL Seattle Office 777 108th Avenue, N.E., Bellevue, Washington
P.O. Box 91500, Bellevue, Washington 98009-2050
206.453.5000

SAMPLING PLAN

BACKGROUND

Snohomish County Public Utility District No. 1 has retained CH2M HILL to prepare a soil sampling plan for use during the removal of four underground storage tanks (UST).

Three of the subject tanks are located at the DISTRICT's downtown Everett facility and consist of a gasoline storage tank (D-1), a waste oil tank (D-2) and a used transformer oil tank (D-3). The fourth UST, at the DISTRICT's Halls Lake facility, was a gasoline storage tank (H-1). These tanks are of single-wall steel construction and are estimated to be over 30 years old. The tanks, associated piping and contaminated soils are scheduled to be removed in December 1989.

Analysis of soil borings taken in the vicinity of tanks D-1 and H-1 during an earlier assessment indicate that some of the soil is contaminated with petroleum hydrocarbons. In the case of tank D-1, the contamination appears to be limited to soils near the tanks. With tank H-1, the contamination was found at locations not immediately adjacent to the tank, which may indicate pipe leaks or surface spills.

Borings taken near tank D-2 do not exhibit detectable contamination. Based on the tank history and sampling of the waste contents, soil contamination found during subsequent excavation would be expected to consist of petroleum hydrocarbons, solvents and possibly heavy metals including lead.

No borings have been taken at tank D-3. Potential soil contamination at this tank site would be expected to consist of petroleum hydrocarbons and possibly polychlorinated biphenyls (PCB).

PURPOSE

The purpose of this sampling program is to evaluate concentrations of petroleum constituents (and other contaminants as appropriate) in the soils at the excavation site and compare them with Ecology guidelines and recommendations for residues in soils. Ecology's general guidelines for petroleum product residues are provided in Attachment A.

Laboratory analysis will measure constituent concentrations both in soil samples collected from the excavation pits and in soils excavated during tank removal. Excavated soils with measured concentrations higher than the Ecology guidelines will be treated following Ecology's guidance at an approved location. Soils with constituent concentrations below the Ecology guidelines will be disposed of at an appropriate offsite location. Side and bottom excavation pit samples with measured concentrations higher than the Ecology guidelines will indicate that further soil removal is necessary.

EXCAVATED SOILS

CH2M HILL in consultation with the DISTRICT will select soil stockpile locations near the excavations prior to tank excavation. Separate stockpile areas will be selected for each of the four excavations. In addition, if visibly contaminated soils are noted during excavation, they will be stockpiled in predesignated areas to allow for separate analysis and subsequent disposal.

The stockpile locations will be bermed and lined with Visqueen. At the end of each day, the stockpiles will be covered with Visqueen. Individual stockpiles will remain onsite until sample results are returned, anticipated to be no longer than 48 hours.

The CH2M HILL onsite observer will assist with determining the quantity of soils to be removed. The following criteria will be used to determine the extent of excavation:

- Soils that are stained, have visible contamination, or are otherwise discolored.
- Soils that have a strong petroleum odor.
- Soils that have readings greater than 5-10 ppm above background on the HNu photo-ionization detector. (The manufacturer's specifications for the HNu are included in Attachment B.)

CH2M HILL will collect soil samples from the excavation material and the sides and bottom of each excavation pit after the initial excavation is completed.

SAMPLING PROCEDURES

A minimum of forty samples from the stockpiled excavated material, sixteen excavation pit sidewall samples, twenty excavation pit bottom samples and approximately eight field quality assurance samples will be submitted to the laboratory. The samples from the stockpiles will be composited to give one composite sample from each stockpile, to provide a minimum of four composite stockpile samples for analysis. The samples from the bottoms of the excavation pits will be composited to give one composite sample from each excavation pit bottom, to provide four composite excavation pit bottom samples for analysis. Sidewall samples and field quality assurance samples will not be composited. Table 1 summarizes the sample locations and analyses.

To determine the appropriate disposal method, soils excavated during tank removal will be sampled prior to disposal. For each soil stockpile, soil will be collected from ten to twelve separate locations in the stockpile. Aliquots will be taken from below the surface of the stockpile because volatilization of petroleum constituents from the soil surface may have occurred. This procedure will be repeated for each stockpile. These soils will be submitted to the laboratory for compositing and analysis. A minimum of one composited sample from each stockpile of excavated material will be analyzed.

To establish that the excavation has extended to areas below cleanup guidelines, verification sampling of the pits will be conducted. The verification sampling strategy will be to collect samples from the sidewalls and base of each excavation pit. A minimum of four sidewall sample locations and five bottom sample locations will be sampled in each excavation. A minimum of nine samples per excavation, or thirty-six samples total, will be submitted to the laboratory.

Sidewall samples will be collected by scraping from the bottom to the top of the excavation walls at four locations. These locations will be at approximate right angles to each other. Manual sampling will be performed if the excavation pits are sufficiently shallow and the sidewalls are stable enough to avoid caving or cracking. Sampling personnel will stand at the edge of the excavation and scrape the soil from the excavation sides. If manual sampling is not feasible, the backhoe bucket will be used to scrape soils from the excavation pit walls. Samples will be collected from the center of the backhoe bucket using a stainless steel spoon. The backhoe bucket will be steam cleaned between sample locations.

Samples from the bottom of the excavation pit will be obtained using methods described for sidewall sampling. Sample methods will be determined by the depth of the excavation. A minimum of five locations on the bottom of the excavation will be sampled. These locations will include the four corners and the center of the excavated pit. Sample containers will be filled completely by packing the soil into the containers. This will decrease the amount of volatilization of petroleum constituents.

In the laboratory, the five bottom samples from each excavation will be composited to give one composite bottom sample for each excavation. The sidewall samples and composited bottom samples will be analyzed for constituents listed in Table 1.

Two field quality assurance samples will be obtained each field day. Field quality assurance procedures require the collection of ten percent field blank and and ten percent field duplicate samples. Field blank samples will be obtained by retaining the final rinse water following decontamination of soil sampling equipment. This rinse water will be collected directly into a sample container. The field duplicate samples will be obtained by collecting soils from the same sample source. Since approximately four field days of sampling are anticipated, approximately eight field quality assurance samples will be submitted.

CH2M HILL will select a laboratory and obtain the appropriate number and type of containers for the analyses to be performed. Sample containers and coolers will be obtained from the laboratory prior to excavating the tanks and soils.

SAMPLE HANDLING

The sample containers obtained from the laboratory will be labelled before filling. Each label will contain the following information:

- Site name
- Sample number
- Date and time of sample collection
- Analyses to be conducted
- Name of person collecting the sample

Chain-of-custody records will be maintained from the time of sample procurement until the DISTRICT directs CH2M HILL to transfer those records to them or their designee.

Each time the control of sample bottles or samples is changed, both the sender and the receiver will sign and date the chain-of-custody form. This procedure applies to the courier if the samples are shipped to the laboratory. When a sample is sent to the laboratory, the top signature copy is enclosed in plastic with the sample documentation and secured to the inside of the cooler lid. The second copy of the form will be retained in the project files. A chain-of-custody form will be completed for each shipping container. An example of a chain-of-custody form is included in Attachment C.

If the soil samples are shipped to the laboratory, they will be packaged to minimize the probability of breakage. Each sample container will be placed in a zip-lock plaastic bag and packed in an iced cooler for shipment. The cooler will be secured with fiber tape.

SAMPLE ANALYSIS

The four sidewall samples from each excavation pit will be analyzed individually. The five bottom samples from each pit will be composited by the laboratory into a single analytical sample, to give one analytical sample from each excavation pit bottom. This procedure will result in five sample analyses for each excavation pit.

All analytical samples will be analyzed for total petroleum hydrocarbons (TPH) and benzene, toluene, ethylbenzene and xylenes (BTEX). In addition, soils from the tank D-1 or H-1 excavations that exceed the cleanup guidance for petroleum products will be analyzed for lead. Soils from the tank D-2 excavation which exceed the cleanup guidance for petroleum products will be analyzed for halogenated hydrocarbons and extractable lead, cadmium and chromium. Soils from the tank D-3 excavation which exceed the cleanup guidance for petroleum products will be analyzed for halogenated hydrocarbons.

DECONTAMINATION PROCEDURES

Sampling equipment will be decontaminated before each sample is taken. The equipment will be washed with a detergent (i.e., TSP) and water, and then rinsed with clean water. Decontamination equipment includes buckets, detergent, brushes, garbage bags, hand soap, and paper towels.

After decontamination of heavy equipment (backhoes, etc.) is complete, an HNu photo-ionizer will be used to monitor concentrations of volatile compounds from the equipment. If readings above background are obtained, the equipment will be steam-cleaned prior to leaving the site.

DOCUMENTATION

Activities and observations will be documented in a field notebook. The field notebook will include the following:

- Date and time-of-day for soil removal activities and observations
- General site conditions
- Sample locations in pits and in soil stockpile
- Depth and width of the excavation
- Sample collection, handling, and shipping information
- Weather conditions
- Soil storage/stockpiling locations; source of the excavated soil (e.g., stockpile #1 is soil excavated from the waste oil tank site at the Everett facility)
- Personnel involved with the soil removal and sampling
- HNu readings and exposimeter measurements

Photographs will be taken of site activities and will be logged with the date and time-of-day. These photographs will be included in the files submitted to the DISTRICT.

HEALTH AND SAFETY

CH2M HILL personnel involved in onsite work will have successfully completed the 40-hour Hazardous Waste Site Investigation Training Course. In addition, CH2M HILL onsite personnel will have successfully completed the American Red Cross Multimedia Standard First Aid course and the Basic Life Support course in Cardiopulmonary Resuscitation. Personnel assigned to operate field sampling or analytical equipment will be trained in the operation of that equipment.

A site-specific safety plan will be prepared for the proposed sampling actvities at the site. The safety plan will be based on information provided by the DISTRICT, CH2M HILL, and the sampling plan. The plan will conform to CH2M HILL's Corporate Health and Safety Policy and will be consistent with EPA's "Standard Operating Safety Guides" (1984) and will apply to CH2M HILL personnel while at the site. A copy of this plan will be given to the DISTRICT prior to starting field activities.

DELIVERABLES

Upon completion of the soil sampling project, CH2M HILL will summarize sampling activities in a letter report to the DISTRICT. The report will document the work completed at the Everett and Halls Lake sites and the results of the soil sample analyses. The DISTRICT will review the letter report and may submit it or information from it to Ecology.

Table 1
Summary of Excavation Samples

Tank #	Tank D-1	Tank D-2	Tank D-3	Tank D-4
Historical Contents	gasoline	waste oil	used transformer oil	gasoline
Excavation Pit Samples				
# of samples collected	9	9	9	9
# of samples analyzed	5	5	5	5
# of QA samples	a	a	a	a
Excavated Soil Samples				
# of samples collected	10 to 12 per stockpile	Same as D-1	Same as D-1	Same as D-1
# of samples analyzed	b	b	b	b
# of QA samples	a	a	a	a
Analytical Parameters	TPH/BTEX[c]	TPH/BTEX	TPH/BTEX[d]	TPH/BTEX[e]

a Number of QA samples is dependent on number of field samples. 10% field blank and 10% duplicate samples will be obtained each day. Approximately one field duplicate and one field blank per day of sampling.

b Number of samples will be equal to number of stockpiles.

c Analysis for lead will be performed if TPH/BTEX results are positive.

d Analysis for halogenated hydrocarbons/extractable Pb, Cd, and Cr will be performed if TPH/BTEX results are positive.

e Analysis for halogenated hydrocarbons will be performed if TPH/BTEX results are positive.

CH2M HILL
SITE SAFETY PLAN

GENERAL INFORMATION

CLIENT:	Snohomish County Public Utility District
JOB NO.:	SEA28472.A0
PROJECT MANAGER:	Lynn Laszewski
SITE SAFETY COORDINATOR:	Lynn Laszewski
SITE NAME:	Snohomish County Public Utility District No. 1
SITE LOCATIONS:	Halls Lake and Everett, Washington
ACTIVITIES PLANNED:	Observe the removal of four underground storage tanks. Conduct soil sampling of excavations.
DATES:	August and September 1990
BACKGROUND INFORMATION AVAILABLE FROM:	SEA

PLAN APPROVAL

PLAN PREPARED BY: DATE:	Lynn Laszewski October 25, 1989
APPROVED BY: DATE:	Michael J. Adams January 18, 1990
PLAN REVISED BY: DATE:	Paul Dukich August 14, 1990
REVISED PLAN APPROVED BY: DATE:	Lynn Laszewski August 14, 1990

SITE/WASTE CHARACTERISTICS

FACILITY DESCRIPTIONS

Halls Lake. Facility has one 2,000-gallon gasoline tank. Tank is located along the east fence line. The facility is used for servicing District vehicles.

Everett. Facility has three underground storage tanks: one 10,000-gallon gasoline tank, one 300-gallon waste oil tank, and one 300-gallon transformer oil tank. The waste oil tank has been emptied and previously contained oils, solvents, and inks. Sample analysis indicated that heavy metals may be present in remaining material in tank. The transformer oil tank was used to store oil drained from transformers. Oils may have contained PCBs. Sample analysis indicated PCB levels to 100 ppm.

FEATURES OF THE SITES

Halls Lake. Gasoline tank is located near small shed and storage area. This material will be removed prior to field activities. A belowgrade sewerline and groundwater monitoring wells are in the vicinity of the tank. The locations of buried lines will be determined prior to excavation. District vehicle traffic within the excavation and soil storage areas will be rerouted and excavation work areas will be clearly marked.

Everett. The gasoline tank is located in the center of a District vehicle parking area. District vehicle traffic will be rerouted and kept away from work areas. Buried electrical lines, water, and sewerlines will be located and marked prior to excavation activities.

The waste oil/solvent tank is approximately 8 feet west of the facility garage. A sewerline is located west of the tank and its location will be marked prior to excavation.

The transformer oil tank is located 5 feet east of a cement platform and 5 feet south of the transformer maintenance building. A buried airline is located near this tank. The airline and other buried lines will be located prior to excavation.

WASTE TYPE(S)

Liquid X Solid X Sludge X Gas ___

CHARACTERISTICS

Corrosive___ Ignitable_X_ Radioactive___ Volatile_X_ Toxic_X_
Reactive___ Unknown___ Other___

HAZARD EVALUATION

Chemical Hazards: Gasoline is a variable mixture of paraffins, aromatics, and olefins. Acute toxicity includes anesthetic effects and mucus membrane irritation. Symptoms of acute exposure include headache, blurred vision, dizziness, and nausea. The major toxicity concern is benzene, a known human carcinogen through inhalation. Gasoline typically contains 0.7 to 1.0 percent benzene. The OSHA TWA for benzene is currently 1 ppm.

Gasoline also contains lead, which has adverse health effects if inhaled. The OSHA TWA for lead is 50 $\mu g/m^3$; however, lead is not readily volatilized. The overall TLV for gasoline is 300 ppm, based largely upon assumptions about the hydrocarbon content of gasoline.

Skin contact with gasoline can produce immediate or delayed symptoms of dryness or irritation. If skin comes in contact with gasoline, remove clothing from affected area and wash promptly with soap and water. Dry the skin carefully with a clean towel. If skin is inflamed, painful, or blistered, seek medical attention. If ingestion occurs, DO NOT INDUCE VOMITING! Get medical help! Be prepared to administer artificial respiration.

Polychlorinated Biphenyls (PCBs): PCBs are highly persistent and bioaccumulative as pollutants. Their acute toxicity is low but their chronic toxicities are very similar to the chlorinated pesticides. They are liver toxins with long-term exposure, and at high doses have caused suppression of the immune system, reproductive dysfunction, birth defects, and liver tumors. PCBs are considered a suspect carcinogen. The TWA is 1 mg/m^3 (chlorodiphenyl, 42 percent chlorine, SKIN), 0.5 mg/m^3 (chlorodiphenyl, 54 percent chlorine, SKIN).

Organic Compounds and Solvents: In general, the "organic compounds" are water insoluble, nonpolar molecules. While various functional groups, such as amines, hydroxyls, halogens, carboxyls, etc., can be added to alter these two basic chemical properties, these properties result in two pharmacologic effects that provide the basis of their acute toxicities. Organic chemicals in general act as anesthetics (i.e., they depress the activity of the central nervous system) and are irritants to the eyes, respiratory system, and skin because they are good solvents for lipids (fat). Repeated and prolonged skin contact will dry and defat the skin, resulting in irritation, dermatitis, cell damage, and

necrosis. Eye contact may cause irritation, tearing, and possibly permanent damage. Direct contact of liquid hydrocarbons with lung tissue (aspiration) can result in chemical pneumonitis, pulmonary edema, and hemorrhage. Both the anesthetic and irritant properties or organic alkane compounds are increased by halogenation and unsaturated double bonds. Most functional groups (e.g., amines, carboxylic acids, aldehydes, etc.) increase the ability of organic chemicals to cause tissue damage (corrosivity).

The chronic toxicity of organic chemicals varies widely with structure and the functional noncarbon groups that are attached. These chronic toxicities include kidney, liver, heart, and lung damage; methemoglobin formation in red blood cells and depression of blood cell formation; degenerative changes in the nervous system; sensitization and allergic reactions; and mutagenic, teratogenic, and carcinogenic effects.

Physical Hazards: The major potential physical hazards possible at the site are: flammability of gas (a flashpoint of 50°F); and explosive conditions (LEL for gasoline is 1.3 percent or 13,000 ppm) due to the buildup of concentrations at ground level. Gasoline vapors are heavier than air.

Excavations greater than 4 feet deep will not be entered to obtain the sample. The excavator (backhoe or tracked excavator) will remain at least 20 feet from overhead powerlines at all times when excavating. Personnel will remain outside the turning radius of the excavator/ backhoe when actively excavation.

PROCEDURES

TEAM ORGANIZATION

Team Members	Responsibility
Lynn Laszewski	Team member/SSC
Paul Dukich	Team member
Ken Green[a]	Geotechnical engineer/ Observer
Glen Vedera	Team member

[a]Must remain outside the exclusion zone. Observers will not conduct sampling activities or handle potentially contaminated materials.

FORM 533 will be completed by the SSC and returned to Ann West/WDC at the completion of field activities.

PERSONNEL SAFETY EQUIPMENT

Level of Protection: A___ B___ C X D X

Tyvek coveralls with nitrile outer gloves and latex inner gloves when splash protection is needed. Nitrile outer gloves and latex inner gloves will be worn during sampling and when handling samples. Safety glasses, hard hat, and neoprene steel toe/shank boots will be worn while onsite. TLD badge must be worn if issued to employee.

Level C will include a full-face APR with organic vapor cartridges (GMC-H).

Safety Equipment and Materials

- First-aid kit
- Eyewash kit
- A,B,C 20-lb fire extinguisher (in the excavation area)
- Blanket or stretcher
- Wind direction indicator
- Outdoor thermometer

MONITORING EQUIPMENT AND PROCEDURES

HNu With 10.2 eV Probe. Background readings will be obtained at an upwind location. Record HNu readings in the breathing zone upon initiating site work. Readings should be recorded at least every 1/2 hour during field activities. For an upgrade to be warranted, sustained readings in the breathing zone must be obtained. Spikes on the HNu above the action level do not call for an upgrade.

Action Levels:
(Breathing Zone)

- Zero to 5 ppm above background continued in Level D
- 5 ppm to 25 ppm above background--draw a benzene-specific detector tube (0.5/a-67-28561), according to manufacturer's instructions--continue operations in Level D with benzene results less than 1 ppm (taking benzene readings every 30 minutes) and total organic vapors less than 25 ppm.
- Greater than 25 ppm above background or benzene results greater than 1 ppm--discontinue operations

and allow vapors to dissipate to below appropriate action level.

Explosimeter/O_2 meter: Continuous monitoring if a filter is available. Lead in gasoline will effect the O_2 sensor. If a filter is not available, take readings at least every 15 minutes at the excavation or hole opening, then purge the instrument in clean air.

Action Levels (measured at the excavation):

- Less than 5 percent LEL--Continue excavating.
- Greater than 5 percent to 20 percent LEL--Continue excavating with caution.
- Greater than 20 percent LEL--Shut down excavating operations and allow area to ventilate until LEL falls below 10 percent before resuming work. Mechanical ventilation (i.e., blower) may be required to reduce flammable vapors to below 20 percent. Do not place blower in atmospheres greater than 20 percent of the LEL.

WORK LIMITATIONS

- No eating, drinking, or SMOKING onsite.
- No contact lenses to be worn onsite.
- No facial hair that would interfere with respirator fit.
- No spark sources within 50 feet of the excavation.

SITE ENTRY

Locate emergency telephone numbers and route to hospital prior to starting work. Notify the District of your presence at the site and your field plans. Prior to work onsite, you must conduct a safety briefing with the subcontractors. This shall include informing them of the hazards associated with site work and the chemicals anticipated.

Set up decontamination area upwind of the tank locations. Water and TSP should be placed in buckets prior to beginning work. The decontamination area should be a sufficient distance from the excavation or boring work so that the decon area will not become contaminated by splashing water or flying dirt. It is anticipated work will start in Level D, but be prepared to upgrade or leave the site.

DECONTAMINATION

For Sampling or Subsurface Disturbance Activities For Personnel: Wash boots and outer gloves in TSP and water, rinse, and remove outer gloves. Remove and bag coveralls. If cotton coveralls are used, bag in plastic bags and wash prior to re-wearing. Remove respirator, if worn. Remove surgical gloves and dispose in a plastic trash bag. Wash hands and face. Sanitize respirator nightly, if used. Take a shower and wash hair as soon as possible after leaving the site.

Equipment Needed: Buckets, TSP, MSA cleaner-sanitizer, brushes, garbage bags, hand soap, and paper towels.

For Sampling Equipment: Follow procedures outlined in sampling plan.

For Heavy Equipment: Wash off the bucket of the backhoe or the drilling equipment with TSP and water; rinse in water. Use the HNu to monitor the backhoe or drilling equipment. If HNu readings are detected from the equipment, steam clean it prior to its leaving the site.

It is the responsibility of the Site Safety Coordinator to make sure all pieces of equipment are properly decontaminated according to the procedures outlined above. Documentation of decontamination must be made in the field log notebook that will then become part of the permanent project file. The equipment number must be written in the field log notebook when the equipment comes offsite and is decontaminated, with a denotation that proper procedures have been followed.

DISPOSAL OF MATERIALS GENERATED ONSITE

Contain in a secure area. Follow the client instructions for disposal of water and personnel protection equipment.

EMERGENCY INFORMATION

Form 311, Emergency Information, will be posted onsite.

If an injury occurs onsite, take the following action:

- Stabilize injured person and follow decontamination procedures as much as practical.
- Get medical attention for the injured person immediately.
- Depending on the type and severity of the injury, notify the occupational physician for the injured person.

- Notify Jane Stansfield/DEN.
- Notify Sharon Robinson.
- Fill out Form 306, CH2M HILL Accident Report (attached). Submit to Beth Brown/DEN and Marty Methamel/WDC.

EMERGENCY ROUTES AND TELEPHONE NUMBERS (map to be posted)

	Everett	Halls Lake
Police	911	911
Fire	911	911
Ambulance	252-1234	322-0330
Water	259-8821	776-1161/911
Gas	355-3331	355-3331
Everett General Hospital	258-6300	
Client Contact: Garth Williams	258-8544	258-8544
Stevens Memorial Hospital (Halls Lake)		771-0111

EMERGENCY CONTACTS

Occupational Medical Physician
Name: Dr. Susan Berg, Washington Industrial and Occupational Medical Clinic
Phone: 206/455-1105

Team member under above physician's care: Laszewski, Vedera, Dukich

Site Manager
Name: Lynn Laszewski
Phone: 206/453-5000

Workmen's Compensation
Name: Beth Brown/DEN
Phone: 303/771/0952

If an injury occurs onsite, please notify Sharon as soon as possible after obtaining medical attention for the injured. Notification must be made within 24 hours of the injury.

sea7302/057.51

ATTACHMENT B

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Andrew John Friedman
James E. Bruya, Ph.D.
(206) 285-8282

3008-B 16th Avenue West
Seattle, WA 98119
FAX: (206) 283-5044

August 22, 1990

Lynn Laszewski, Project Manager
CH2M Hill Northwest
P.O. Box 91500
Bellevue, WA 98009-2050

Dear Ms Laszewski:

Enclosed are the results of the analyses of the samples submitted on August 17, 1990 from Project Snohomish Co. PUD.

We appreciate this opportunity to be of service to you on this project. If you have any questions regarding this material, or if you just want to discuss any aspect of your projects, please do not hesitate to contact me.

Sincerely,

AJ Friedman for

Kathy McMullen, Chemist

KMC/fae

Enclosures

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: August 22, 1990
Date Submitted: August 17, 1990
Project: Snohomish Co. PUD

RESULTS OF ANALYSES OF THE SOIL SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS BY IR (EPA METHOD 418.1) Results Reported as µg/g (ppm)

Sample #	Total Petroleum Hydrocarbons (ppm)
PUD-HL-NWL-8171	<25
PUD-HL-SWL-8173	<25
PUD-HL-WWL-8172	500
PUD-HL-EWL-8174	<25
PUD-HL-XWL-81712	<25
Composite PUD-HL-CFL-81711 PUD-HL-NEFL-8177 PUD-HL-NWFL-8175 PUD-HL-SEFL-8178 PUD-HL-SWFL-8179	<25
PUD-HL-SWL-81710	<25

Quality Assurance

Method Blank	
PUD-HL-NWL-8171 (Duplicate)	<25
PUD-HL-NWL-8171 (Matrix Spike) Spiked @ 100 ppm Percent Recovery	78%
PUD-HL-NWL-8171 (Matrix Spike Duplicate) Spiked @ 100 ppm Percent Recovery	91%

FRIEDMAN & BRUYA, INC.
ENVIRONMENTAL CHEMISTS

Date of Report: August 22, 1990
Date Submitted: August 17, 1990
Project: Snohomish Co. PUD

RESULTS OF ANALYSES OF THE SOIL SAMPLES FOR VOLATILE AROMATIC ORGANIC COMPOUNDS USING EPA METHODS 5030 AND 8020
Results Reported as ng/g (ppb)

Sample #	Benzene	Toluene	Et-Benzene	Xylene	
				m,p	*o*
PUD-HL-NWL-8171	<1	<1	<1	<1	<1
PUD-HL-SWL-8173	<10[a]	<1	<1	<1	<1
PUD-HL-WWL-8172	<200[a]	700	540	2,600	1,200
PUD-HL-EWL-8174	<1	<1	1	7	6
PUD-HL-XWL-81712	<1	<1	<1	<1	<1
Composite PUD-HL-CFL-81711 PUD-HL-NEFL-8177 PUD-HL-NWFL-8175 PUD-HL-SEFL-8178 PUD-HL-SWFL-8179	<2[a]	<1	1	2	2
PUD-HL-SWL-81710	<1	<1	<1	<1	<1

[a] - Interferences were present which interfered with the identification and quantitation of the analyte indicated.

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: August 22, 1990
Date Submitted: August 17, 1990
Project: Snohomish Co. PUD

RESULTS OF ANALYSES OF THE SOIL SAMPLES FOR VOLATILE AROMATIC ORGANIC COMPOUNDS USING EPA METHODS 5030 AND 8020
Results Reported as ng/g (ppb)
Quality Assurance

Sample #	Benzene	Toluene	Et-Benzene	Xylene m,p	Xylene o
Method Blank	<1	<1	<1	<1	<1
PUD-HL-EWL-8174 (Duplicate)	<1	<1	1	3	2
PUD-HL-EWL-8174 (Matrix Spike) Spiked @ 1,000 ppb Percent Recovery	130%	130%	120%	120%	130%
PUD-HL-EWL-8174 (Matrix Spike Duplicate) Spiked @ 1,000 ppb Percent Recovery	120%	130%	120%	120%	130%

CHEMTECH QUALITY ANALYTICS

CHAIN OF CUSTODY RECORD

PROJECT NUMBER	PROJECT NAME
SEA28472,A0	Snohomish Co PUD

CLIENT NAME

PROJECT MANAGER: Lynn Laszewski

COPY TO:

REQUESTED COMP. DATE

SAMPLING REQUIREMENTS: SDWA ☐ NPDES ☐ RCRA ☐ OTHER ____

CLIENT ADDRESS AND PHONE NUMBER: 453-5000

STA NO.	DATE	TIME	COMP	GRAB	SOIL	SAMPLE DESCRIPTIONS (12 CHARACTERS)	# OF CONTAINERS	TPH 418.1	BTEX 8020	BTEX 602	LAB ID
NWL	8/17/90	11:11A			X	PUD-HL-NWL-8171	1	X	X		14582
SWL		11:25A			X	PUD-HL-SWL-8173	1	X	X		83
WWL		11:15A			X	PUD-HL-WWL-8172	1	X	X		84
EWL		11:32A			X	PUD-HL-EWL-8174	1	X	X		85
XWL		1:51PM			X	PUD-HL-XWL-8172	1	X	X		86
CFL		1:49PM			X	PUD-HL-CFL-8171	1				87
NEFL		11:43A			X	PUD-HL-NEFL-8177	1				88
NWFL		11:38A			X	PUD-HL-NWFL-8175	1	~~X~~	~~X~~		89
SEFL		11:46A			X	PUD-HL-SEFL-8178	1				90
SWFL		11:50A			X	PUD-HL-SWFL-8179	1				91
~~XBL~~						~~PUD-HL-XBL~~	~~0~~			X	
						~~PUD-HL-XWL-8171~~	~~0~~	X	X		
SWL	↓	1:51PM				PUD-HL-SWL-8171	1	X	X		92

LAB COMPOSITE

1 SAMPLE: LAB TO COMPOSITE THEN ANALYZE FOR ~~418.1~~ and 8020

FOR LAB USE ONLY

LAB#

LAB#

PROJECT NO.

ACK | VERIFIED

QUOTE# | BS

NO. OF SAMP | PG | OF

REMARKS

SAMPLED BY AND TITLE: A Rumburg/sampler	DATE/TIME: 8/17/90 2:00PM	RELINQUISHED BY: L Laszewski	DATE/TIME: 8/17/90 2:51PM
RECEIVED BY: Tamara Hansen	DATE/TIME: 8-17-90 2:51 PM	RELINQUISHED BY:	DATE/TIME
RECEIVED BY:	DATE/TIME	RELINQUISHED BY:	DATE/TIME
RECEIVED BY LAB:	DATE/TIME	SAMPLE SHIPPED VIA: UPS BUS FED-EX HAND OTHER ____	AIR BILL#

HAZWRAP/NEESA Y N

QC LEVEL 1 2 3

COC | ICE

ANA REQ | TEMP

CUST SEAL | Ph

SAMPLE COND.

REMARKS

ENTERED INTO LIMS ____ COC REVIEWED ____

REV 6/89 FORM 340

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Andrew John Friedman
James E. Bruya, Ph.D.
(206) 285-8282

3008-B 16th Avenue West
Seattle, WA 98119
FAX: (206) 283-5044

September 5, 1990

Lynn Laszewski, Project Leader
CH2M Hill Northwest
P.O. Box 91500
Bellevue, WA 98009-2050

Dear Ms. Laszewski:

Enclosed are the results of the analyses of the samples submitted on August 31, 1990 from Project SEA28472.AO.

We appreciate this opportunity to be of service to you on this project. If you have any questions regarding this material, or if you just want to discuss any aspect of your projects, please do not hesitate to contact me.

Sincerely,

Andrew John Friedman

Andrew John Friedman, Chemist

AJF

Enclosures

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: September 5, 1990
Date Submitted: August 31, 1990
Project: SEA28472.AO

RESULTS OF ANALYSES OF THE SOIL SAMPLES FOR VOLATILE AROMATIC ORGANIC COMPOUNDS USING EPA METHOD 8020
Results Reported as ng/g (ppb)

Sample #	Benzene	Toluene	Et-Benzene	Xylene *m,p*	Xylene *o*
PUD-E-SWFL-83111	<1	<1	<1	<1	<1
PUD-E-NWFL-83112	2	<1	<1	<1	<1
PUD-E-NWL-83123	<1	<1	<1	<1	<1
PUD-E-WNL-83124	1	<1	<1	<1	<1
PUD-E-SWL-83125	<1	<1	<1	<1	<1
PUD-E-NWL-83136	<1	<1	<1	<1	<1
PUD-E-EWL-83137	<1	<1	<1	<1	<1
PUD-E-WWL-83138	<1	<1	<1	<1	<1
PUD-E-SWL-83139	<1	<1	<1	<1	<1
PUD-E-XWL-831310	<1	<1	<1	<1	<1
Quality Assurance					
Method Blank	<1	<1	<1	<1	<1
PUD-E-EWL-83137 (Duplicate)	<1	<1	<1	<1	<1
PUD-E-EWL-83137 (Matrix Spike) Spiked @ 1,000 ppb Percent Recovery	110%	100%	92%	92%	97%
PUD-E-EWL-83137 (Matrix Spike Duplicate) Spiked @ 1,000 ppb Percent Recovery	110%	110%	96%	97%	100%

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: September 5, 1990
Date Submitted: August 31, 1990
Project: SEA28472.AO

RESULTS OF ANALYSES OF THE SOIL SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS BY IR (EPA METHOD 418.1) Results Reported as µg/g (ppm)

Sample #	Total Petroleum Hydrocarbons (ppm)
PUD-E-SWFL-83111	<25
PUD-E-NWFL-83112	50
PUD-E-NWL-83123	78
PUD-E-WNL-83124	280
PUD-E-SWL-83125	<25
PUD-E-NWL-83136	400
PUD-E-EWL-83137	<25
PUD-E-WWL-83138	<25
PUD-E-SWL-83139	<25
PUD-E-XWL-831310	<25

Quality Assurance

Method Blank	<25
PUD-E-SWL-83139 (Duplicate)	<25
PUD-E-SWL-83139 (Matrix Spike) Spiked @ 100 ppm Percent Recovery	78%
PUD-E-SWL-83139 (Matrix Spike Duplicate) Spiked @ 100 ppm Percent Recovery	97%

CHMF... QUALITY ANALYTICS

= JEB 0 L

CHAIN OF CUSTODY RECORD

PROJECT NUMBER	PROJECT NAME
SEA28472.A0	Snohomish Co. PUD Everett

CLIENT NAME

PROJECT MANAGER	COPY TO:
Lynn Laszewski	

REQUESTED COMP. DATE

SAMPLING REQUIREMENTS: SDWA ☐ NPDES ☐ RCRA ☐ OTHER ____

CLIENT ADDRESS AND PHONE NUMBER: 453-5000

STA NO.	DATE	TIME	COMP	GRAB	SOIL	SAMPLE DESCRIPTIONS (12 CHARACTERS)	# OF CONTAINERS	ANALYSES REQUESTED: TPH 418.1	ANALYSES REQUESTED: BTEX 8020	LAB ID	REMARKS
SWFL1	8/31/90	9:06A			X	PUD-E-SWFL-83111	1	X	X	14833	
NWFL1	8/31/90	9:14A			X	PUD-E-NWFL-83112	1	X	X	14834	
NWL2	8/31/90	10:40A			X	PUD-E-NWL-83123	1	X	X	14835	
WWL2	8/31/90	10:54A			X	PUD-E-WWL-83124	1	X	X	14836	
SWL2	8/31/90	11:01A			X	PUD-E-SWL-83125	1	X	X	14837	
NWL3	8/31/90	11:26A			X	PUD-E-NWL-83136	1	X	X	14838	
EWL3	8/31/90	11:38A			X	PUD-E-EWL-83137	1	X	X	14839	
WWL3	8/31/90	11:34A			X	PUD-E-WWL-83138	1	X	X	14840	
SWL	8/31/90	11:49A			X	PUD-E-SWL-83139	1	X	X	14841	
XWL	8/31/90	11:49A			X	PUD-E-XWL-831310	1	X	X	14842	

FOR LAB USE ONLY

LAB#

LAB#

PROJECT NO.

ACK | VERIFIED

QUOTE# | BS

NO. OF SAMP | PG | OF

SAMPLED BY AND TITLE	DATE/TIME	RELINQUISHED BY	DATE/TIME
	Aug 31 13:37 PM	Linda G. Laszewski	Aug 31, 1990 1:42 PM
RECEIVED BY:	DATE/TIME	RELINQUISHED BY:	DATE/TIME
	Aug 31 1:42 PM		
RECEIVED BY:	DATE/TIME	RELINQUISHED BY:	DATE/TIME
RECEIVED BY LAB:	DATE/TIME	SAMPLE SHIPPED VIA: UPS BUS FED-EX HAND OTHER ____	AIR BILL#

HAZWRAP/NEESA Y N

QC LEVEL 1 2 3

COC | ICE

ANA REQ | TEMP

CUST SEAL | Ph

SAMPLE COND.

REMARKS

ENTERED INTO LIMS ____ COC REVIEWED ____

REV 6/89 FORM 340

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Andrew John Friedman
James E. Bruya, Ph.D.
(206) 285-8282

3008-B 16th Avenue West
Seattle, WA 98119
FAX: (206) 283-5044

September 7, 1990

Lynn Laszewski, Project Leader
CH2M Hill Northwest
P.O. Box 91500
Bellevue, WA 98009-2050

Dear Ms. Laszewski:

Enclosed are the results of the analyses of the samples submitted on September 6, 1990 from Project SEA28472.AO, Snohomish PUD.

We appreciate this opportunity to be of service to you on this project. If you have any questions regarding this material, or if you just want to discuss any aspect of your projects, please do not hesitate to contact me.

Sincerely,

Andrew John Friedman, Chemist

AJF

Enclosures

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: September 7, 1990
Date Submitted: September 6, 1990
Project: SEA28472.AO, Snohomish PUD

RESULTS OF ANALYSES OF THE SOIL SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS BY IR (EPA METHOD 418.1) Results Reported as µg/g (ppm)

Sample #	Total Petroleum Hydrocarbons (ppm)
PUD-E-WWL-9521	<50
PUD-E-NWNWL-9532	<50
PUD-E-CNWL-9533	<50
PUD-E-NENWL-9534	<50
PUD-E-XWL-9535	<50
Quality Assurance	
Method Blank	<50
PUD-E-CNWL-9533 (Duplicate)	<50
PUD-E-CNWL-9533 (Matrix Spike) Spiked @ 200 ppm Percent Recovery	73%
PUD-E-CNWL-9533 (Matrix Spike Duplicate) Spiked @ 200 ppm Percent Recovery	84%

Bin A E9

CH2M HILL QUALITY ANALYTICS

CHAIN OF CUSTODY RECORD

PROJECT NUMBER: SEA28472.A0
PROJECT NAME: Snohomish Co. PUD
CLIENT NAME:
CLIENT ADDRESS AND PHONE NUMBER: 453-5000
PROJECT MANAGER: Lynn Laszewski
COPY TO:
REQUESTED COMP. DATE:
SAMPLING REQUIREMENTS: SDWA ☐ NPDES ☐ RCRA ☐ OTHER ____

ANALYSES REQUESTED: TPH 418.1; [illegible] (crossed out)

STA NO.	DATE	TIME	COMP	GRAB	SOIL	SAMPLE DESCRIPTIONS (12 CHARACTERS)	# OF CONTAINERS	TPH 418.1	[illegible] (crossed out)	LAB ID
WWL2	9/5/90	3:30P			X	PUD-E-WWL-9521 3	1	X	[crossed out]	14946
NNWL3	9/5/90	3:45P			X	PUD-E-NWNWL-95[illegible]	1	X	[crossed out]	47
CNWL3	9/5/90	3:48P			X	PUD-E-CNWL-9533	1	X	[crossed out]	48
ENWL3	9/5/90	3:55P			X	PUD-E-NENWL-9534	1	X		49
XWL3	9/5/90	3:45P			X	PUD-E-XWL-9535	1	X		50

SAMPLED BY AND TITLE: [signature]	DATE/TIME: 9/5/90 3:55 PM	RELINQUISHED BY: D. Laszewski	DATE/TIME: 9/6/90 10:15A
RECEIVED BY: S. Fenton	DATE/TIME: 9-6-90 1015	RELINQUISHED BY: S. Fenton	DATE/TIME: 9/6/90 1107
RECEIVED BY: [signature]	DATE/TIME: 9-6-90 11:07	RELINQUISHED BY:	DATE/TIME:
RECEIVED BY LAB:	DATE/TIME:	SAMPLE SHIPPED VIA: UPS BUS FED-EX HAND OTHER ____	AIR BILL#

REMARKS

FOR LAB USE ONLY

LAB#
LAB#
PROJECT NO.
ACK | VERIFIED
QUOTE# | BS
NO. OF SAMP | PG | OF
REMARKS

HAZWRAP/NEESA Y N
QC LEVEL 1 2 3
COC | ICE
ANA REQ. | TEMP
CUST SEAL | Ph
SAMPLE COND.

ENTERED INTO LIMS ____ COC REVIE[W] ____

RE[V] FORM

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Andrew John Friedman
James E. Bruya, Ph.D.
(206) 285-8282

3008-B 16th Avenue West
Seattle, WA 98119
FAX: (206) 283-5044

September 12, 1990

Lynn Laszewski, Project Leader
CH2M Hill Northwest
P.O. Box 91500
Bellevue, WA 98009-2050

Dear Ms Laszewski:

Enclosed are the results of the analyses of the samples submitted on August 29, 1990 from Project SEA28472.AO, Snohomish Co. PUD.

We appreciate this opportunity to be of service to you on this project. If you have any questions regarding this material, or if you just want to discuss any aspect of your projects, please do not hesitate to contact me.

Sincerely,

Andrew John Friedman, Chemist

AJF/fae

Enclosures

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: September 12, 1990
Date Submitted: August 29, 1990
Project: SEA28472.AO, Snohomish Co. PUD

RESULTS OF ANALYSES OF THE SOIL SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS BY IR (EPA METHOD 418.1) Results Reported as µg/g (ppm)

Sample #	Total Petroleum Hydrocarbons (ppm)
PUD-E-NWL-82711	<25
Composite of: PUD-E-SWFL-82712, PUD-E-NWFL-82713, PUD-E-CFL-82714, PUD-E-SEFL-82715, PUD-E-NEFL-82716	240
PUD-E-WWL-82717	<25
PUD-E-SWL-82718	<25
PUD-E-EWL-82719	<25
PUD-E-XWL-827110	<25
Composite of: PUD-E-WFL-827211, PUD-E-WWL-827212	47
PUD-E-WWL-827213	360
PUD-E-SWL-827214	170
PUD-E-NWL-827215	1,000
PUD-E-EWL-827216	26
PUD-E-EFL-827317	570
PUD-E-WPL-827318	54
PUD-E-NWL-827319	4,000
PUD-E-WWL-827320	2,900
PUD-E-SWL-827321	5,000
PUD-E-XWL-827322	5,600
PUD-E-EWL-827323	210

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: September 12, 1990
Date Submitted: August 29, 1990
Project: SEA28472.AO, Snohomish Co. PUD

RESULTS OF ANALYSES OF THE SOIL SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS BY IR (EPA METHOD 418.1)
Results Reported as µg/g (ppm)
Quality Assurance

Sample #	Total Petroleum Hydrocarbons (ppm)
Method Blank	<25
PUD-E-SWL-827214 (Duplicate)	510
PUD-E-SWL-827214 (Matrix Spike) Spiked @ 500 ppm Percent Recovery	130%
PUD-E-SWL-827214 (Matrix Spike Duplicate) Spiked @ 500 ppm Percent Recovery	100%
PUD-E-NWL-827319 (Duplicate)	4,900
PUD-E-NWL-827319 (Matrix Spike) Spiked @ 100 ppm Percent Recovery	**a**
PUD-E-NWL-827319 (Matrix Spike Duplicate) Spiked @ 100 ppm Percent Recovery	**a**

a - The amount spiked was insufficient to give meaningful recovery data.

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: September 12, 1990
Date Submitted: August 29, 1990 (Requested August 30)
Project: SEA28472.AO, Snohomish Co. PUD

RESULTS OF ANALYSES OF THE SOIL SAMPLES FOR TOTAL PETROLEUM HYDROCARBONS BY IR (EPA METHOD 418.1) Results Reported as µg/g (ppm)

Sample #	Total Petroleum Hydrocarbons (ppm)
PUD-E-SWFL-82712	270
PUD-E-NWFL-82713	270
PUD-E-CFL-82714	84
PUD-E-SEFL-82715	49
PUD-E-NEFL-82716	97
Quality Assurance	
PUD-E-CFL-82714 (Duplicate)	64
PUD-E-CFL-82714 (Matrix Spike) Spiked @ 50 ppm Percent Recovery	**a**
PUD-E-CFL-82714 (Matrix Spike Duplicate) Spiked @ 50 ppm Percent Recovery	**a**

a - The amount spiked was insufficient to give meaningful recovery data.

FRIEDMAN & BRUYA, INC.
ENVIRONMENTAL CHEMISTS

Date of Report: September 12, 1990
Date Submitted: August 29, 1990 (Requested August 30)
Project: SEA28472.AO, Snohomish Co. PUD

RESULTS OF ANALYSES OF THE SOIL SAMPLES FOR SELECTED METALS BY ICP
Results Reported as µg/g (ppm)

Sample #	Cadmium (ppm)	Chromium (ppm)	Lead (ppm)	Arsenic (ppm)
PUD-E-NWL-827215	0.9	20	13	50
Quality Assurance				
Method Blank	0.2	0.3	0.5	0.8
PUD-E-NWL-827215 (Duplicate)	1	22	15	49
PUD-E-NWL-827215 (Matrix Spike) Spiked @ 50 ppm Percent Recovery	66%	80%	74%	120%
PUD-E-NWL-827215 (Matrix Spike Duplicate) Spiked @ 50 ppm Percent Recovery	68%	72%	74%	82%

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: September 12, 1990
Date Submitted: August 29, 1990 (3 Requested August 30)
Project: SEA28472.AO, Snohomish Co. PUD

RESULTS OF ANALYSES OF THE SOIL SAMPLES FOR PCB AS AROCHLOR 1254 BY GC/ECD
Results Reported as µg/g (ppm)

Sample #	PCB (ppm)
PUD-E-EFL-827317	<1
PUD-E-WPL-827318	<1
PUD-E-NWL-827319	<1
PUD-E-WWL-827320	<1
PUD-E-SWL-827321	<1

Quality Assurance

Method Blank	<1
PUD-E-EFL-827317 (Duplicate)	<1
PUD-E-NWL-827319 (Duplicate)	<1
PUD-E-EFL-827317 (Matrix Spike) Spiked @ 5 ppm Percent Recovery	110%
PUD-E-NWL-827319 (Matrix Spike) Spiked @ 5 ppm Percent Recovery	94%
PUD-E-EFL-827317 (Matrix Spike Duplicate) Spiked @ 5 ppm Percent Recovery	110%
PUD-E-NWL-827319 (Matrix Spike Duplicate) Spiked @ 5 ppm Percent Recovery	90%

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: September 12, 1990
Date Submitted: August 29, 1990
Project: SEA28472.AO, Snohomish Co. PUD

RESULTS OF ANALYSES OF THE SOIL SAMPLES FOR VOLATILE AROMATIC ORGANIC COMPOUNDS USING EPA METHOD 8020
Results Reported as ng/g (ppb)

Sample #	Benzene	Toluene	Et-Benzene	Xylene	
				m,p	*o*
PUD-E-NWL-82711	21	4	1	2	<1
PUD-E-WWL-82717	1	<1	<1	<1	<1
PUD-E-SWL-82718	39	7	1	11	4
PUD-E-EWL-82719	84	10	2	2	<1
PUD-E-XWL-827110	13	2	<1	<1	<1
PUD-E-WWL-827213	<1	<1	<1	<1	<1
PUD-E-SWL-827214	<1	<1	<1	<1	<1
PUD-E-NWL-827215	<1	<1	<1	<10[a]	<10[a]
PUD-E-EWL-827216	<1	<1	<1	<1	<1
PUD-E-EFL-827317	<1	<1	<1	<1	<1
PUD-E-WPL-827318	<1	<1	<1	<1	<1
PUD-E-SWL-827321	<1	<1	<1	<10[a]	<10[a]
PUD-E-XWL-827322	2	4	6	6	26
PUD-E-EWL-827323	<1	<1	<1	<1	<1
Composite of: PUD-E-SWFL-82712, PUD-E-NWFL-82713, PUD-E-CFL-82714, PUD-E-SEFL-82715, PUD-E-NEFL-82716	105	28	12	50	15
Composite of: PUD-E-WFL-827211, PUD-E-WWL-827212	1	<1	<1	<1	<1

[a] - Interferences were present which interfered with the identification and quantitation of the analyte indicated.

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: September 12, 1990
Date Submitted: August 29, 1990
Project: SEA28472.AO, Snohomish Co. PUD

RESULTS OF ANALYSES OF THE SOIL SAMPLES FOR VOLATILE AROMATIC ORGANIC COMPOUNDS USING EPA METHOD 8020
Results Reported as ng/g (ppb)
Quality Assurance

Sample #	Benzene	Toluene	Et-Benzene	Xylene m,p	Xylene o
Method Blank	<1	<1	<1	<1	<1
PUD-E-WWL-827213 (Duplicate)	<1	<1	<1	<1	<1
PUD-E-EWL-827216 (Duplicate)	<1	<1	<1	<1	<1
PUD-E-WWL-827213 (Matrix Spike) Spiked @ 1,000 ppb Percent Recovery	88%	58%[a]	36%[a]	37%[a]	42%[a]
PUD-E-EWL-827216 (Matrix Spike) Spiked @ 1,000 ppb Percent Recovery	85%	82%	73%	78%	85%
PUD-E-WWL-827213 (Matrix Spike Duplicate) Spiked @ 1,000 ppb Percent Recovery	113%	90%	65%[a]	66%[a]	70%
PUD-E-EWL-827216 (Matrix Spike Duplicate) Spiked @ 1,000 ppb Percent Recovery	140%[a]	140%	120%	120%	130%

[a] - Value reported fell outside the control limits established for this analyte.

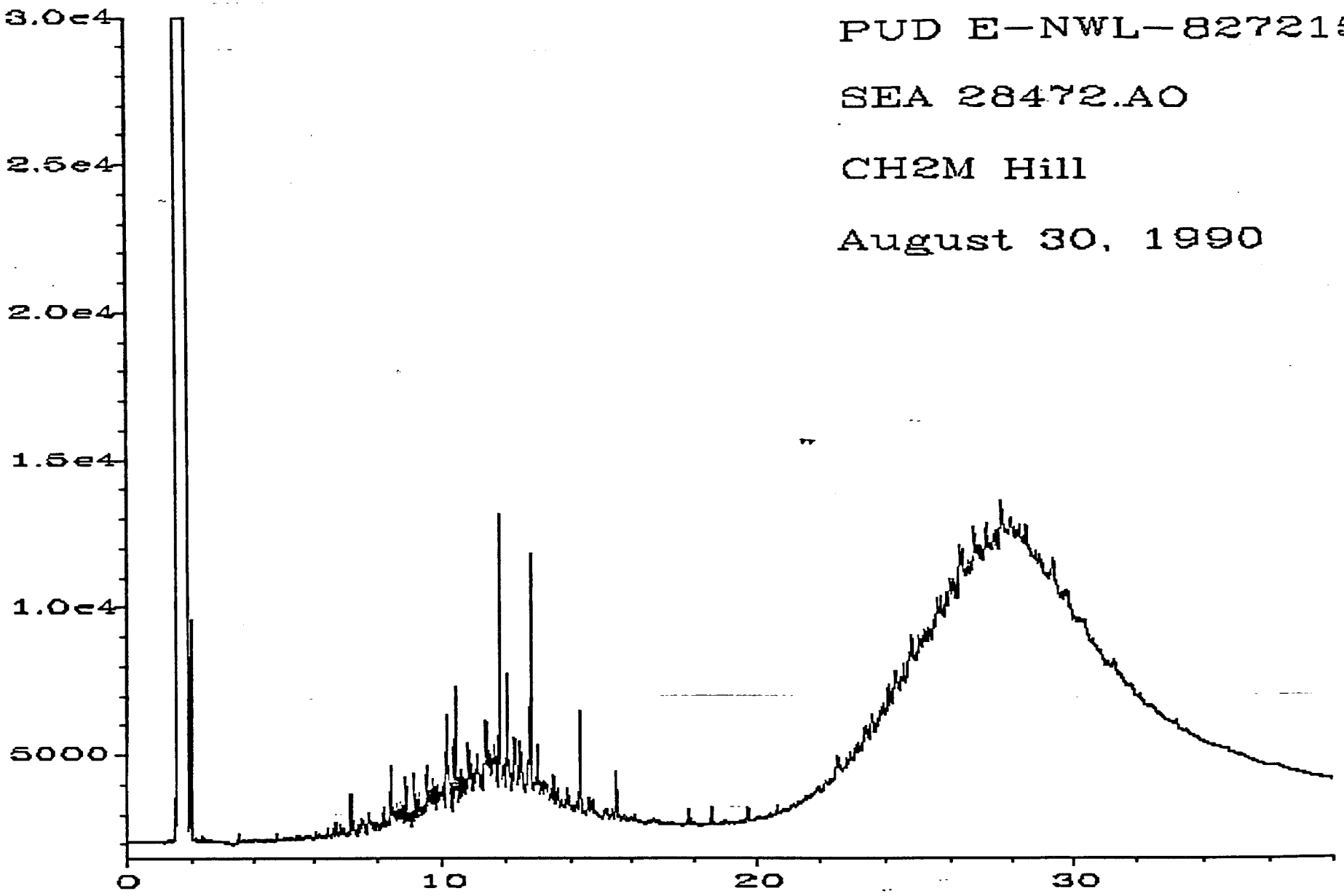
FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Date of Report: September 12, 1990
Date Submitted: August 29, 1990
Project: SEA28472.AO, Snohomish Co. PUD

RESULTS OF ANALYSES OF THE SOIL SAMPLES FOR FINGERPRINT CHARACTERIZATION BY CAPILLARY GAS CHROMATOGRAPHY

Sample #	GC Characterization
PUD-E-NWL-827215	The gas chromatographic trace was indicative of a mixture of a moderate and high boiling petroleum product, such as diesel or hydraulic fluid and motor oil. This characterization is based on the presence of two envelopes of peaks present, the first from ca *n*-C_8 to *n*-C_{15} with a maximum at *n*-C_{12} and the second from *n*-C_{20} to beyond *n*-C_{30}. The latter envelope represents probably ca 5 times the amount of the earlier eluting product. Both of these envelopes of peaks appear to show signs of weathering.



Sig. 1 in C:\HPCHEM\1\DATA\083090-C\002F0801.D

AJF 8E

CH2M HILL QUALITY ANALYTICS

CHAIN OF CUSTODY RECORD

PROJECT NUMBER	PROJECT NAME
SEA 28472.A0	Snohomish Co. PUD

CLIENT NAME

PROJECT MANAGER: Lynn Laszewski

COPY TO:

REQUESTED COMP. DATE

SAMPLING REQUIREMENTS: SDWA ☐ NPDES ☐ RCRA ☐ OTHER ____

CLIENT ADDRESS AND PHONE NUMBER: 453-5000

ANALYSES REQUESTED

FOR LAB USE ONLY: LAB# / LAB# / PROJECT NO. / ACK / VERIFIED / QUOTE# / BS / NO. OF SAMP / PG / OF

STA NO.	DATE	TIME	COMP	GRAB	SOIL	SAMPLE DESCRIPTIONS (12 CHARACTERS)	# OF CONTAINERS	TPH 418.1	BTEX 8020	LAB ID	REMARKS
NWL1	8/27/90	3:03P			X	PUD-E-NWL-82711	1	X	X	14744	
SWFL1	8/27/90	2:27P			X	PUD-E-SWFL-82712	1	X	X	45	1 SAMPLE: LABORATORY TO COMPOSITE THEN ANALYZE COMPOSITE FOR 418.1 & 8020
NWFL1	8/27/90	2:29P			X	PUD-E-NWFL-82713	1	X	X	46	
CFL1	8/27/90	2:35P			X	PUD-E-CFL-82714	1	X	X	47	
SEFL1	8/27/90	2:43P			X	PUD-E-SEFL-82715	1	X	X	48	
NEFL1	8/27/90	2:53P			X	PUD-E-NEFL-82716	1	X	X	49	
WWL1	8/27/90	3:08P			X	PUD-E-WWL-82717	1	X	X	14750	
SWL1	8/27/90	3:12P			X	PUD-E-SWL-82718	1	X	X	51	
EWL1	8/27/90	3:20P			X	PUD-E-EWL-82719	1	X	X	52	
XWL1	8/27/90	3:20P			X	PUD-E-XWL-827110	1	X	X	53	
WFL2	8/27/90	3:50P			X	PUD-E-WFL-827211	1			54	1 SAMPLE: LAB TO COMPOSITE THEN 418.1 & 8020
EFL2	8/27/90	4:11P			X	PUD-E-EFL-827212	1			55	
WWL2	8/27/90	4:03P			X	PUD-E-WWL-827213	1	X	X	56	
SWL2	8/27/90	4:06P			X	PUD-E-SWL-827214	1	X	X	57	
NWL2	8/27/90	4:14P			X	PUD-E-NWL-827215	1	X	X	58	

Run ind. TPH 418.1 per L.D. - AJF 8-30-90

+ DO HFS + Pb, Cr, Cd, As per L. Barrowman AJF 8-30-90

SAMPLED BY AND TITLE	DATE/TIME	RELINQUISHED BY	DATE/TIME
Linda Laszewski	8/27/90 5:07 PM	Linda Laszewski	8/28/90 9:30AM
RECEIVED BY: Lori Keaton	DATE/TIME 8/28/90 9:30	RELINQUISHED BY: Lori Keaton	DATE/TIME 8/28/90 10:20
RECEIVED BY:	DATE/TIME 8.28.90 / 10:30	RELINQUISHED BY:	DATE/TIME
RECEIVED BY LAB: B,1	DATE/TIME	SAMPLE SHIPPED VIA UPS BUS FED-EX HAND OTHER ____	AIR BILL#

HAZWRAP/NEESA Y N

QC LEVEL 1 2 3

COC / ICE

ANA REQ / TEMP

CUST SEAL / Ph

SAMPLE COND.

ENTERED INTO LIMS ____ COC REVIEWED ____

CHEMTECH QUALITY ANALYTICS

CHAIN OF CUSTODY RECORD

1 ASF 8 E

PROJECT NUMBER	PROJECT NAME
SEA28472.A0	Snohomish Co. PUD

CLIENT NAME

PROJECT MANAGER: Lynn Laszewska

COPY TO:

REQUESTED COMP. DATE

SAMPLING REQUIREMENTS: SDWA ☐ NPDES ☐ RCRA ☐ OTHER ____

CLIENT ADDRESS AND PHONE NUMBER: 453-5000

STA NO.	DATE	TIME	COMP	GRAB	SOIL	SAMPLE DESCRIPTIONS (12 CHARACTERS)	# OF CONTAINERS	TPH 418.1	BTEX 8020	PCB's	LAB ID
✓ EWL2	8/27/90	4:31P			X	PUD-E-EWL-827216	1	X	X		14759
✓ EFL3	8/27/90	4:45P			X	PUD-E-EFL-827317	1	X	X	X	60
✓ WFL3	8/27/90	4:52P			X	PUD-E-WFL-827318	1	X	X	X	61
✓ NWL3	8/27/90	4:55P			X	PUD-E-NWL-827319	1	X	X	X	62
X NWL3	8/27/90	4:59P			X	PUD-E-WWL-827320	1	X	X	X	63
✓ SWL3	8/27/90	5:02P			X	PUD-E-SWL-827321	1	X	X	X	64
✓ XWL3	8/27/90	5:02P			X	PUD-E-XWL-827322	1	X	X		65
✓ EWL3	8/27/90	5:07P			X	PUD-E-EWL-827323	1	X	X		66

PCBs per L. Ba 8-30-90 + Cancel BTEX on 3/4 x 320 Bottle -ASF

ANALYSES REQUESTED

FOR LAB USE ONLY

LAB#

LAB#

PROJECT NO.

ACK | VERIFIED

QUOTE# | BS

NO. OF SAMP | PG | OF

REMARKS

SAMPLED BY AND TITLE: Linda Laszewska	DATE/TIME: 8/27/90 5:07 PM	RELINQUISHED BY: Linda Laszewska	DATE/TIME: 8/28/90 9:30AM
RECEIVED BY: Lem Eaton	DATE/TIME: 8/28/90 9:30	RELINQUISHED BY: Lem Eaton	DATE/TIME: 8/28/90 10:20am
RECEIVED BY:	DATE/TIME: 8-28-90/10:30	RELINQUISHED BY:	DATE/TIME:
RECEIVED BY LAB: +BI	DATE/TIME:	SAMPLE SHIPPED VIA: UPS BUS FED-EX HAND OTHER ____	AIR BILL#

HAZWRAP/NEESA Y N

QC LEVEL 1 2 3

COC | ICE

ANA REQ | TEMP

CUST SEAL | Ph

SAMPLE COND.

REMARKS: 2 of 2

ENTERED INTO LIMS ____ COC REVIEWED ____

FRIEDMAN & BRUYA, INC.

ENVIRONMENTAL CHEMISTS

Andrew John Friedman
James E. Bruya, Ph.D.
(206) 285-8282

3008-B 16th Avenue West
Seattle, WA 98119
FAX: (206) 283-5044

October 17, 1990

Lynn Laszewski, Project Manager
CH2M Hill
P. O. Box 91500
Bellevue, WA 98005

Dear Ms Laszewski:

In regards to your inquiry about sample PUD-E-NWL-827215 from your Snohomish PUD project #SEA28472.AO submitted August 28, 1990, the sample appears to contain a product similar in boiling range to a mineral spirit or light kerosene. Although it was only analyzed for benzene, toluene, ethylbenzene, and xylenes, an examination of the gas chromatogram shows little or no contamination eluting prior to the xylenes. No chlorinated compounds were seen in the chromatogram. The expected detection limits for these compounds (1,1-dichloroethylene, methylene chloride, t-dichloroethylene, 1,1-dichloroethane, chloroform, 1,1,1-trichloroethane, carbon tetrachloride, trichloroethylene, tetrachloroethylene) would be between 1 and 10 parts per billion.

Since the sample was already over a month old when the inquiry was made, we feel it would not be productive to re-analyze these samples at this late date for these compounds.

We appreciate this opportunity to be of service to you on this project. If you have any questions regarding this material, or if you just want to discuss any aspect of your projects, please do not hesitate to contact me.

Sincerely,

Andrew John Friedman

Andrew John Friedman, Laboratory Coordinator

AJF/fae