SR 3/16/94

DEPARTMENT OF ECOLOGY
NWRO/TCP TANKS UNIT

INTERIM CLEANUP REPORT
SITE CHARACTERIZATON
FINAL CLEANUP REPORT
OTHER _____
AFFECTED MEDIA: SOIL
OTHER _____ GW
INSPECTOR (INITIAL) _____ DATE 1-26-94

SUPPLEMENTAL REPORT

GEOENVIRONMENTAL SERVICES

SUBSURFACE CONTAMINATION STUDY AND

GROUND WATER MONITORING PROGRAM

GENERAL STORES BUILDING

RENTON SERVICE CENTER

RENTON, WASHINGTON

FOR

UGET SOUND POWER & LIGHT CO.

Independent Action Report Update

Site Name: PUGET SOUND

Inc. #: 1556 Date of Report: 12-18-90

County: KING Date Report Rec'd: 1-6-94

Reviewed by: JOHN BOALS

Comments (please include: free prod., tank info., media, contaminant migration, GW conc. trends, PCS treated/fate?):

INTERIM - SUPPLEMENT TO 1-17-90 REPORT. FUTHER ON-SITE INVESTIGATION OF EXTENT OF CONTAMINATION. VERIFICATION OF LIMITS. DRILLED B-32 AND B-33 AND TESTED CORE SAMPLES. (22 ppm + 55 ppm) B-32 + B-33 ARE OUTSIDE CONTAMINATION PLUM. ~~GW TEST OF~~ GW IN THESE HOLES WAS NOT TESTED BUT DID NOT SHOW ANY VISIBLE EVIDENCE OF CONTAMINATION. DRILLED TWO TEST PITS TP-1 + TP-2. EVIDENCE OF HEAVY SHEEN BELOW 5' ON SOIL + GW. TEST FOR BIOTREATABILITY

FREE PRODUCT IN MW-4, 7 + 25.

PUGET POWER

January 6, 1994

Mr. Joseph Hickey
Washington State Department
of Ecology
3190 - 160th Avenue SE
Bellevue, WA 98008-5452

Dear Mr. Hickey:

Enclosed are the following underground tank reports:

- Supplemental Report, Geoenvironmental Services, Off-site Subsurface Contamination Study, General Stores Building, Renton Service Center, Renton, Washington, for Puget Sound Power & Light Company, dated November 29, 1990.
- Supplemental Report, Geoenvironmental Services, Subsurface Contamination Study and Ground Water Monitoring Program, General Stores Building, Renton Service Center, Renton, Washington, dated December 18, 1990.
- Report of Remedial Action and Geotechnical Services, Hydraulic Fluid Remedial Program, Stores Building, Renton Service Center, Renton, Washington, for Puget Sound Power & Light Company, dated October 4, 1991, (Volumes 1 and 2).

These reports were prepared by our consultant GeoEngineers, Inc. and summarize assessment and remediation activities related to a hydraulic fluid leak at Puget Sound Power & Light Company's Renton Service Center located at 620 South Grady Way in Renton, Washington.

If you have any questions regarding these reports, please call Gary Reid at 462-3077, me at 462-3066, or Kathy Killman of GeoEngineers at 861-6000.

Very truly yours,

Ted Van Decar

Ted Van Decar
Staff Environmental Engineer

Enclosure

GeoEngineers

Geotechnical,
Geoenvironmental and
Geologic Services

December 18, 1990

Puget Sound Power & Light Company
P.O. Box 97034
Bellevue, Washington 98009-9734

Attention: Mr. Gary Reid

We are submitting six copies of our supplemental report regarding our subsurface contamination study and ground water monitoring program in the vicinity of the General Stores Building at the Renton Service Center in Renton, Washington. Our services described in this report are part of our ongoing services for this project and were initially authorized verbally by Mr. Gary Reid of Puget Sound Power & Light Company on June 28, 1990. The contract terms for our services are listed in Professional Services Agreement No. BX01074A.

We appreciate the opportunity to be of continued service to Puget Sound Power & Light Company. Please call if you have any questions regarding this report or our services.

Yours very truly,

GeoEngineers, Inc.

Stephen C. Perrigo
Associate

KSK:SCP

File No. 0186-106-B69

GeoEngineers, Inc.
8410 154th Avenue N.E.
Redmond, WA 98052
Telephone (206) 861-6000
Fax (206) 861-6050

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SUPPLEMENTAL REPORT

GEOENVIRONMENTAL SERVICES

SUBSURFACE CONTAMINATION STUDY AND GROUND WATER MONITORING PROGRAM

GENERAL STORES BUILDING, RENTON SERVICE CENTER

RENTON, WASHINGTON

FOR

PUGET SOUND POWER & LIGHT COMPANY

INTRODUCTION

This supplemental report presents the results of our additional subsurface explorations and our ground water monitoring program related to a hydraulic fluid leak in the vicinity of the PSP&L (Puget Sound Power & Light Company) General Stores Building in Renton, Washington. The site is located at 620 South Grady Way and is shown relative to surrounding physical features on the Vicinity Map, Figure 1.

A previous study by GeoEngineers identified and characterized the presence of hydraulic fluid contamination beneath portions of the General Stores Building and the parking area north of the building. The results of that study were presented to PSP&L in a report titled: "Report of Geotechnical Services, Underground Storage Tank Removal and Subsurface Contamination Study, Stores Building, Renton Service Center, Renton, Washington, for Puget Sound Power and Light Company," dated January 17, 1990. The plume of contamination extends from the building to the northwest toward South Grady Way. In the January 17, 1990 report, we discussed the potential for migration of the contaminant through the subsurface soils along the alignment of buried utility lines. The backfill surrounding a sanitary sewer line, which traverses the area of known contamination and extends northwest across South Grady Way, was suspected as being a pathway for the northwesterly migration of hydraulic fluid. The location of this sewer line relative to the General Stores Building is shown in Figure 2.

Data presented in our January, 1990 report suggested that the contaminant plume might extend along the sewer line alignment beneath South Grady Way. GeoEngineers conducted supplementary studies in May, 1990 to better characterize the extent of contamination to the northwest of the General Stores Building. These studies included both on- and off-site subsurface explorations. The results of the additional on-site explorations are detailed in this report. A summary of the results of the off-site explorations was presented to PSP&L in a letter report titled: "Preliminary

Report, Off-Site Geoenvironmental Explorations, Stores Building, Puget Sound Power and Light Company, Renton, Washington," dated July 26, 1990. A more detailed report of the off-site contamination study is presented in our report dated November 29, 1990 and titled: **"Supplemental Report, Geoenvironmental Services, Off-Site Subsurface Contamination Study, General Stores Building, Renton Service Center, Renton, Washington, for Puget Sound Power & Light Company,"** which is a companion to this report.

GeoEngineers is presently assisting PSP&L with remediation of the hydraulic fluid-contaminated soil. The remedial operations in progress include the removal of two underground storage tanks and a service island located north of the General Stores Building. A discussion of subsurface contamination associated with the tanks and service island is presented in our report titled: **"Report of Geotechnical Services, Subsurface Contamination Study, Former Renton Transportation Center,"** dated July 26, 1988. Monitor wells MW-1 through MW-4, which are referenced in this supplemental report, were installed as part of the 1988 study.

SCOPE

The purpose of our additional subsurface explorations is to further delineate the limits of subsurface contamination to assist with planning of the remediation. The purpose of our ongoing monitoring program has been to monitor ground water conditions and free (floating) product thickness prior to remediation. The scope of services completed during this portion of the project has included:

1. Drill two on-site exploratory borings in the parking area north of the General Stores Building.
2. Obtain soil samples from each boring at 2.5 foot intervals and conduct field-screening for potential contamination in each soil sample.
3. Test one soil sample from each new boring for the presence of total petroleum hydrocarbons (TPH) by EPA Method 418.1.
4. Excavate two test pits to evaluate the presence of contamination within backfill surrounding the sanitary sewer line.
5. Complete biotreatability study on hydraulic fluid contaminated soil obtained from the test pits.
6. Measure water table elevations periodically in all monitor wells.

7. Measure product thickness in monitor wells with free product and periodically bail product from the wells.
8. Obtain ground water samples from selected wells for laboratory analysis of TPH by EPA Method 418.1.
9. Test one sample of hydraulic fluid obtained from the hydraulic fluid reservoir for waste characterization.
10. Evaluate the field and laboratory data with regard to existing regulatory concerns.

SUBSURFACE EXPLORATIONS

GENERAL

Two exploratory borings and two test pits were completed to further evaluate the presence of hydraulic fluid contamination in the subsurface soils in the parking area north of the General Stores Building. Details of the subsurface exploration program are presented in Appendix A.

The information gained from these explorations was supplemented by information gathered during our two previous studies and an ongoing monitoring program. A total of 39 borings have been completed for this study and our prior studies. Monitor wells were installed in 30 of the borings. The locations of all exploratory borings, monitor wells, and test pits are shown in Figure 2.

EXPLORATORY BORINGS

Two supplemental on-site borings (B-32 and B-33), were drilled within the paved parking area to the north of the General Stores Building as shown in Figure 2. The borings were completed on May 14, 1990 and were back-filled. Logs of the borings are presented in Appendix A.

Subsurface soil conditions encountered in the two borings were similar to those described in our previous reports on this site. The parking lot pavement consisted of approximately 4 inches of asphaltic concrete underlain by fill material. Approximately 2 feet of gravel was observed to overlie coal mine spoils which extend to a depth of 7 to 8 feet below grade in B-32 and B-33. The coal mine spoils were underlain by fill which consist of silty sand and sand with silt and extends to the base of B-33. Alluvial soil consisting of layered sand, silt and silty sand was encountered below the coal mine spoils in B-32.

One sample each from Borings B-32 and B-33 was submitted to ATI (Analytical Technologies, Inc.) to be tested for the presence of TPH by EPA

Method 418.1. Soil samples were selected on the basis of field screening test results and the depth of the samples relative to the water table, as discussed in Appendix A. No indication of significant contamination of the soil samples obtained from the borings was observed during field screening. The results of TPH analysis are shown on Table 1.

The MTCA (Model Toxics Control Act) will likely be the regulatory mechanism through which Ecology (Washington Department of Ecology) will require the mitigation and monitoring of contaminated sites in the future. The MTCA regulation (Chapter 173-340 WAC) became effective May 4, 1990. The MTCA Method A Compliance Cleanup Levels are presently in final development as part of proposed amendments to the MTCA regulation. The DRAFT MTCA Compliance Cleanup Levels (July 18, 1990) provide a sufficient basis for evaluation of existing subsurface contamination at this site, even though final cleanup levels could change somewhat. The DRAFT MTCA Compliance Cleanup Level for TPH in soils is 200 ppm.

TPH concentrations in the soil samples from B-32 and B-33 were 22 ppm and 59 ppm, respectively. These concentrations are below DRAFT MTCA Compliance Cleanup Levels. Based on these results, and the results of previous soil sample analyses, B-32 and B-33 lie outside the contaminant plume as depicted in Figure 2. Copies of the laboratory test results are presented in Appendix B of this report.

Ground water was encountered at a depth of approximately 7 feet below grade while drilling borings B-32 and B-33. No visible evidence of contamination was observed on the ground water.

TEST PITS

Two test pits (TP-1 and TP-2) were excavated to depths of 7 and 8 feet, respectively, in the paved parking area north of the General Stores building at the locations shown in Figure 2. The test pits were excavated on January 13, 1990 and were backfilled upon completion. Logs of the test pits are presented in Appendix A.

Subsurface conditions encountered in the test pits were similar to the general subsurface conditions across the site. Fill material which consisted of sand with silt and gravel extended approximately 3.0 and 2.5 feet beneath the asphaltic concrete pavement in TP-1 and TP-2, respectively. Coal mine spoils were encountered beneath the overlying fill

layer. The coal mine spoils extended to the base of the explorations. A 6-inch sanitary sewer pipeline was encountered in TP-2 at a depth of about 8.0 feet, as indicated on the test pit log.

Field screening methods, as described in Appendix A, detected no sheen to slight sheen on soil samples obtained in the upper 5 feet of soil in TP-1 and TP-2. Heavy sheen was detected on soil samples obtained from a depth of 5 feet to the base of the explorations.

Ground water seepage was observed at about 6 feet depth in both test pits. Heavy sheens were observed on the ground water seeping into the test pit excavations.

Samples of the contaminated soils were obtained from TP-1 and TP-2 and submitted to ReTec (Remediation Technologies Inc.) for a biotreatability study. The results of the study were presented to PSP&L in a report by ReTec titled: **"Treatability Study for a Hydraulic Oil-Contaminated Soil Sample"** dated April, 1990. A copy of this report is presented in Appendix C. The results of the report indicate that hydraulic fluid-contaminated soil can successfully be remediated in a controlled aboveground situation. ReTec has concluded that hydraulic fluid contamination in soil from this site could be reduced from 600 mg/kg to 200 mg/kg in approximately two months of treatment. However, actual contaminant reduction rates could vary significantly from this estimate as a result of varying contaminate concentrations and environmental factors such as temperature and precipitation.

MONITORING PROGRAM

GROUND WATER ELEVATIONS

Ground water elevations were monitored by periodic measurement of depth to ground water in the existing monitor wells. Thirty monitor wells currently are present in the vicinity of the General Stores Building. Twenty-eight of the monitor wells are located on-site, including MW-1 through MW-4, which were constructed during the 1988 subsurface contamination study. Wells MW-36 and MW-38 are located off site as shown in Figure 2, and were made inaccessible during a repaving project in June 1990. Construction details for the various wells are presented in the appendices of our previously described reports dated July 1988, January 1990 and September 1990.

Water levels have generally been measured on a monthly basis during our ongoing ground water monitoring program. Water levels were measured in MW-6, MW-7 and MW-25 more frequently as part of our free product monitoring program, details of which are described in Appendix A. Water level measurements were generally made using a fiberglass tape and water-finding paste. Measured ground water elevations are presented in Table 2. Water table elevations increased an average of approximately 0.5 feet between December 1989 and the months of January and February 1990, when elevations were highest. Water table elevations decreased steadily between February 1990 and September 1990, falling an average of about 1.0 feet. The depth to ground water ranged from approximately 5 to 9 feet below existing grades in the wells on August 20, 1990. Water table elevations as measured on August 20, 1990 are shown in Figure 3. Water table elevations for selected wells are shown in Figure 4, which demonstrates the seasonal fluctuations of the ground water table.

This most recent data and the water table data from our January 17, 1990 report indicate that water table elevations are lowest during the months of September and October and highest during the months of January and February. The observed rise and fall of the water table correlates with seasonal fluctuations in precipitation.

A ground water contour map is presented in Figure 3. The general direction of ground water flow, based on the August 20, 1990 measurements, is to the west-southwest, as shown in Figure 3.

FREE PRODUCT

Free product has been encountered in MW-6, MW-7 and MW-25 during our ongoing ground water monitoring program. Product thickness measurements during 21 periods between November 28, 1989 and September 24, 1990 are shown on Table 3. Product thickness was determined using a fiberglass tape and water-finding paste and/or a product-water interface probe. Product was bailed from the wells on all but one occasion in an effort to reduce the amount of free product present and to observe product recovery rates. Product recovery was slow in MW-6 but was relatively rapid in MW-7 and MW-25. Product thickness has ranged from none measurable to 0.03 feet in MW-6, 0.02 to 0.59 feet in MW-7, and trace to 0.72 feet in MW-25. A product thickness of 1.50 feet measured in MW-25 on March 29, 1990 is probably a measurement error.

GROUND WATER CHEMISTRY

Ground water samples were obtained from MW-30 and MW-31 on December 27, 1989, and from MW-8, MW-12, MW-19, MW-20 and MW-21 on February 27, 1990. The samples were submitted to ATI for chemical analysis by EPA Method 418.1. TPH was not present above 1 ppm in ground water samples from MW-8, MW-19, MW-20, MW-21 and MW-30. TPH concentrations of 1 ppm and 8.6 ppm were present in ground water samples from MW-12 and MW-31, respectively. The results of the ground water analyses are presented in Table 4. Copies of the laboratory test results are presented in Appendix B of this report.

Ground water samples were also obtained from off-site wells MW-36 and MW-38 in May, 1990 for chemical analysis. The results of the off-site ground water testing are presented in our previously mentioned report. TPH concentrations in MW-36 and MW-38 are below the DRAFT MTCA Method A Compliance Cleanup Levels for ground water.

The MTCA requires mitigation of contaminated ground water where TPH concentrations exceed 1 ppm. TPH concentrations in MW-12 (1.0 ppm) and MW-31 (8.6 ppm) are at or above the DRAFT MTCA Method A Compliance Cleanup Level of 1 ppm. Well MW-31 is located within the hydraulic fluid plume to be remediated. The contaminated ground water in the vicinity of MW-31 will be removed during remedial operations. Well MW-12 is located just outside the hydraulic fluid plume. The TPH concentration in MW-12 should be reduced after the removal of nearby soils contaminated with hydraulic fluid. Site ground water will be re-evaluated relative to Method A Compliance Cleanup Levels after remedial operations are completed.

HYDRAULIC FLUID CHEMISTRY

A product sample obtained from the hydraulic fluid reservoir in the garage of the General Stores Building was submitted to ATI for analysis of semi-volatile organic compounds and total metals concentrations. The purpose of these analyses was to check for the presence of constituents that might be hazardous and to evaluate the designation status of the oil relative to Dangerous Waste regulations. No semi-volatile compounds were detected in the oil sample tested. Barium and cadmium were detected at concentrations of 10.0 and 3.3 ppm, respectively. Based on these test results, the hydraulic fluid would not be designated as a Dangerous Waste.

The results of the hydraulic fluid analyses are presented in Table 5. A copy of the laboratory test results is presented in Appendix B of this report.

MONITOR WELL ABANDONMENT

Twenty of the existing monitor wells were abandoned by representatives of GeoEngineers prior to the beginning of the remedial operations. Wells MW-1 through MW-3, MW-5, MW-6, MW-9, MW-11, MW-13 through MW-18, MW-21 through MW-24, MW-26, MW-30 and MW-31 were abandoned in accordance with current state law in September 26, 1990. Details of the well abandonment procedures will be provided to you in a separate report.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of this study, evaluated in conjunction with data from our previous studies, it is our opinion that the hydraulic fluid contamination at the General Stores Building does not extend off site. The backfill soils surrounding the sanitary sewer pipeline probably have provided a conduit for the northwest migration of the contaminant, but only for a short distance. In our opinion, the existing data is adequate for remedial planning. No additional explorations are necessary prior to remediation. Our interpretation of the limits of contamination incorporating the supplemental data from the May 1990 explorations is shown in Figure 2.

We understand the PSP&L has initiated remediation of the hydraulic fluid contamination in the vicinity of the General Stores Building by soil excavation, as recommended in our January, 1990 report. Remedial operations began on September 27, 1990, at a time when ground water elevations were near the yearly minimum. The results of remedial activities will be discussed in a later report.

GeoEngineers and Sargent Engineers, Inc., the structural consulting engineer for the project, have evaluated the geotechnical and structural effects of the remediation on the integrity of the building prior to the onset of remediation. This issue has been addressed in detailed remediation specifications which were made available to the City of Renton during the permitting process and to the contractors bidding on the project. During soil excavation operations, care will be taken to limit disturbance to the timber piles, pile caps and grade beams which provide foundation support to the building.

During remedial excavation activities, a GeoEngineers field representative will observe the operations and determine the extent of excavation by use of field screening methods. Confirmation that cleanup levels have been achieved will be provided by laboratory analysis of representative soil samples obtained from the limits of the excavation. Subsequent backfilling of the excavation with imported material will require fill control monitoring by a GeoEngineers representative to verify that soil is compacted in accordance with specifications.

Based on our subsurface explorations, we do not anticipate disruption of public access on the South Grady Way right-of-way during the cleanup activities. However, some excavation beyond the actual limits of the contamination will be required to prevent sloughing or caving of the excavation. Cleanup excavations may extend to the edge of the sidewalk.

We recommend that all remaining monitor wells (MW-7 and MW-25) within the area to be excavated during remediation be abandoned prior to excavation. We recommend recovery of free product in wells MW-7 and MW-25 continue until it becomes necessary to abandon these wells. The two monitor wells (MW-36 and MW-38) installed on South Grady Way should also be abandoned during remedial activities. These wells have been paved over and can be located using a metal detector. Proper abandonment of these wells is required by current state laws. Monitor wells remaining outside of the excavation should be preserved, to the extent possible, for the purpose of ground water monitoring subsequent to remediation.

LIMITATIONS

We have prepared this supplemental report for use by the Puget Sound Power & Light Company. The report may be made available to regulatory agencies and to other parties authorized by PSP&L. This report is not intended for use by others and the information contained herein is not applicable to other sites.

Our interpretations of subsurface conditions are based on data from widely spaced boreholes and it is possible that conditions may vary in areas which were not explored by drilling.

Within the limitations of scope our services have been executed in accordance with generally accepted practices in this area at the time this report was prepared. No other conditions, express or implied, should be understood.

We appreciate the opportunity to assist you with this project. Please call if you have any questions.

Yours very truly,

GeoEngineers, Inc.

Galan McInelly
Geologist

Kathy S. Killman
Project Geologist

Stephen C. Perrigo
Associate

GWM:KSK:SCP

TABLE 1
SUMMARY OF ANALYTICAL CHEMISTRY DATA FOR SOIL SAMPLES FROM BORINGS

Boring Number	Sample Depth (feet)	TPH (ppm)	Field Screening Results (1)
B-32	5.5	22	SS
B-33	5.5	59	SS

Notes:
"ppm" indicates "parts per million"
TPH (total petroleum hydrocarbons) analyzed by EPA Method 418.1.
(1) Field screening methods described in Appendix A. "SS" indicates "slight sheen"

TABLE 2 (PAGE 1 OF 2)
WATER LEVEL ELEVATIONS (NOV. 28, 1989 TO SEPT. 24, 1990)

Well Number	Water Table Elevations (feet)							
	11/28/89	12/27/89	01/12/90	01/31/90	02/27/90	03/29/90	04/24/90	04/27/90
MW-1	--	92.43	--	92.95	92.82	92.61	--	92.45
MW-2	--	92.85	--	93.44	93.31	93.09	--	92.86
MW-3	--	93.36	--	94.36	93.99	93.68	--	93.34
MW-4	--	92.91	--	93.53	93.36	93.11	--	92.95
MW-5	--	92.09	--	92.47	92.42	92.22	--	92.09
MW-6	--	92.07	--	92.47	92.39	92.62	*92.06	92.06
MW-7	--	*92.11	*92.63	*92.52	*92.46	*92.18	*92.11	*92.12
MW-8	--	91.94	92.65	--	92.36	91.45	--	91.99
MW-9	--	91.94	--	90.45	92.35	91.32	--	91.98
MW-10	--	91.86	--	--	92.33	92.89	--	91.96
MW-11	--	92.12	92.69	92.51	92.48	92.36	--	92.10
MW-12	--	91.92	92.72	92.49	92.37	92.25	--	91.99
MW-13	--	92.14	92.70	92.40	92.49	92.29	--	92.14
MW-14	--	92.10	--	92.51	92.44	92.26	--	92.11
MW-15	--	92.08	--	92.47	92.42	--	--	92.06
MW-16	--	92.11	--	92.50	92.41	92.27	--	92.08
MW-17	--	91.99	--	92.18	92.22	92.10	--	91.98
MW-18	--	92.02	--	92.41	92.38	92.19	--	92.05
MW-19	--	91.87	--	92.39	92.31	92.09	--	91.94
MW-20	--	91.86	--	92.44	92.32	92.09	--	91.94
MW-21	--	92.11	--	92.54	92.48	92.26	--	92.11
MW-22	--	92.12	--	92.52	92.45	92.27	--	92.11
MW-23	92.17	92.11	--	92.03	92.43	--	--	92.09
MW-24	--	92.10	--	92.50	92.42	92.25	--	92.09
MW-25	--	*92.01	--	92.36	*92.37	*92.05	*92.03	*92.05
MW-26	--	92.02	--	92.27	92.28	92.13	--	92.01
MW-30	91.96	91.92	--	92.38	92.33	92.11	--	91.97
MW-31	92.11	92.08	--	92.40	92.40	92.22	--	92.07
MW-36	--	--	--	--	--	--	--	--
MW-38	--	--	--	--	--	--	--	--

Notes:
"--" indicates "not measured"
Water level elevations based on assumed datum of 100.00 feet at the location shown in Figure 2
*Water level elevation has been corrected for floating product

TABLE 2 (PAGE 2 OF 2)

Well Number	Water Table Elevations (feet)								
	05/04/90	05/16/90	05/30/90	06/11/90	06/29/90	07/13/90	07/27/90	08/20/90	09/24/90
MW-1	--	--	92.29	--	92.39	--	92.43	92.40	91.95
MW-2	--	--	92.65	--	92.79	--	92.78	92.83	92.15
MW-3	--	--	93.03	--	93.25	--	93.05	93.04	92.38
MW-4	--	--	92.75	--	92.83	--	93.11	93.21	92.25
MW-5	--	--	91.93	--	92.02	--	91.85	91.81	91.53
MW-6	92.03	*92.01	*91.92	92.12	91.97	91.88	*91.88	*91.78	*91.48
MW-7	*92.07	*92.04	*91.95	*92.17	*92.02	*91.93	*91.87	*91.81	*91.85
MW-8	--	--	91.81	--	91.87	--	91.68	91.65	91.38
MW-9	--	--	91.82	--	91.89	--	91.74	91.70	91.42
MW-10	--	--	91.73	--	91.71	--	91.59	91.54	91.30
MW-11	--	--	91.97	--	92.04	--	91.88	91.81	*91.46(1)
MW-12	--	--	91.79	--	91.86	--	91.67	91.63	91.36
MW-13	--	--	91.99	--	92.06	--	91.91	91.88	91.20
MW-14	--	--	91.95	--	92.02	--	91.87	91.82	91.52
MW-15	--	--	91.94	--	92.01	--	91.85	91.79	91.53
MW-16	--	--	91.97	--	92.04	--	91.93	91.84	91.55
MW-17	--	--	91.87	--	91.91	--	91.82	91.78	91.53
MW-18	--	--	91.89	--	91.97	--	91.82	91.76	91.46
MW-19	--	--	91.77	--	91.84	--	91.64	91.61	91.34
MW-20	--	--	91.73	--	91.79	--	91.59	91.54	91.26
MW-21	--	--	91.96	--	92.02	--	91.88	91.82	91.64
MW-22	--	--	91.96	--	92.02	--	91.89	91.82	91.55
MW-23	--	--	91.96	--	92.02	--	91.88	91.83	91.69
MW-24	--	--	91.96	--	92.03	--	91.88	91.82	91.45
MW-25	*91.00	*91.97	*91.82	*92.13	*91.92	*91.78	*91.76	*91.73	*91.40
MW-26	--	--	91.90	--	91.93	--	91.85	91.81	91.59
MW-30	--	--	91.79	--	91.85	--	91.67	91.65	91.34
MW-31	--	--	91.73	--	92.00	--	91.36	91.83	91.52
MW-36	--	91.91	91.89	--	--	--	--	--	--
MW-38	--	91.78	91.68	--	--	--	--	--	--

Notes:

"--" indicates "not measured"

Water level elevations based on assumed datum of 100.00 feet at the location shown in Figure 2

*Water level elevation has been corrected for floating product

(1) Measured on 9/26/90

(2) Possible measurement error

TABLE 3
PRODUCT THICKNESS IN MONITOR WELLS

Date	Well Number		
	MW-6	MW-7	MW-25
11/28/89	0.01*	0.06*	0.23*
12/27/89	0	0.24*	0.35*
01/12/90	0	0.59	--
01/31/90	trace*	0.09*	trace*
02/27/90	0	0.09*	0.15*
03/29/90	0	0.17*	1.50* (1)
04/24/90	0.03*	0.20*	0.21*
04/27/90	0	0.12*	0.08*
05/04/90	0	0.11*	0.11*
05/16/90	0.01*	0.10*	0.03*
05/30/90	0.01*	0.10*	0.06*
06/11/90	trace*	0.02*	0.13*
06/29/90	0	0.02*	0.10*
07/13/90	0	0.11*	0.21*
07/27/90	0.02*	0.16*	0.22*
08/20/90	trace*	0.26*	0.58*
08/27/90	0.02*	0.25*	0.43*
09/04/90	trace	0.38*	0.52*
09/10/90	trace	0.37*	0.61*
09/19/90 (2)	--	--	--
09/24/90	0.01*	0.36*	0.72*

Notes:
Product thickness measured in feet using tape and paste and/or product-water interface probe.
"--" indicates "not measured"
*Product removed from the well after measurement
(1) Measurement error possible
(2) Product removed from wells, not measured

TABLE 4
SUMMARY OF ANALYTICAL CHEMISTRY DATA FOR GROUND WATER SAMPLES

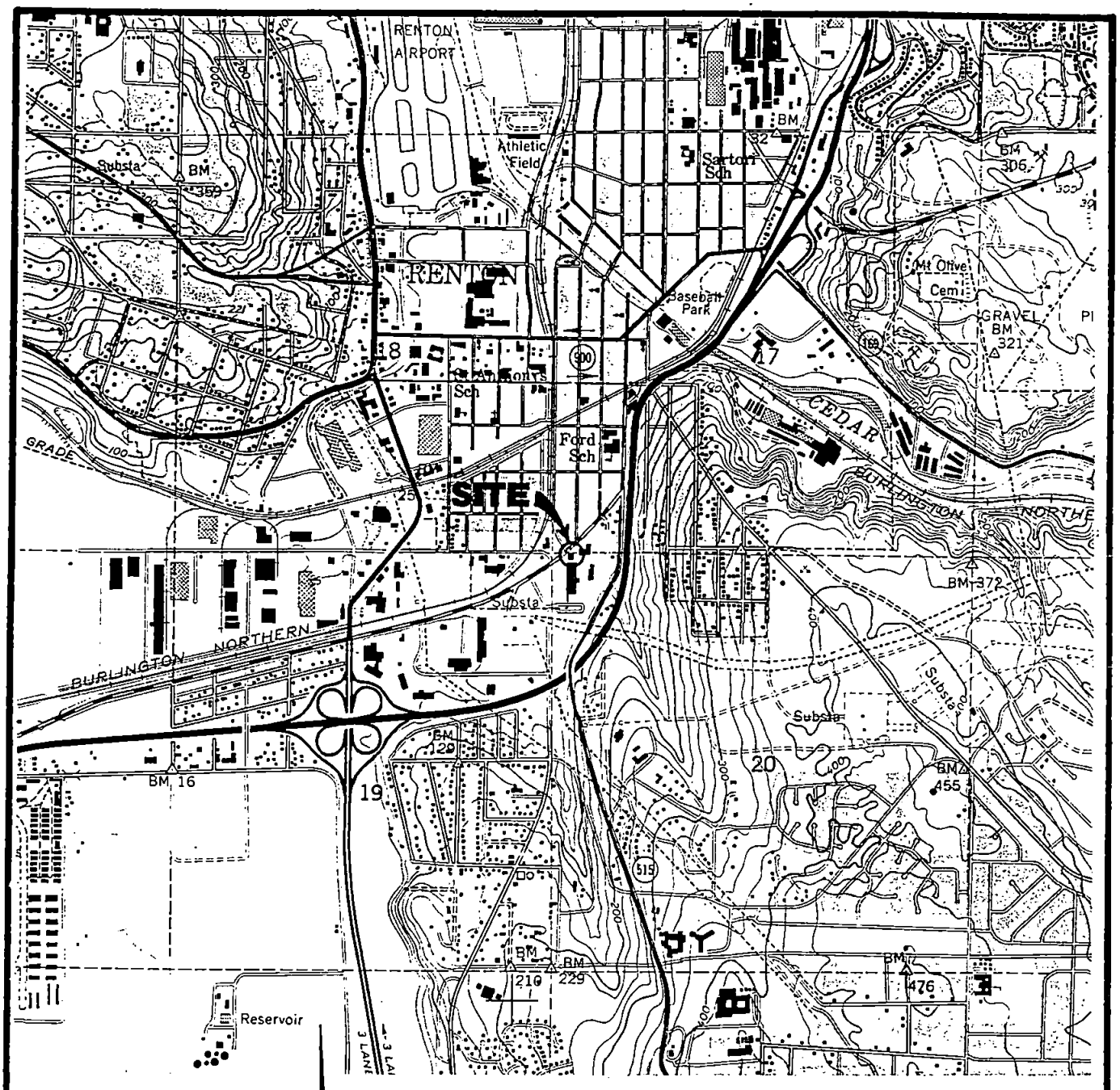
Well Number	Sample Date	TPH (ppm)
MW-30	12/27/89	<0.05
MW-31	12/27/89	8.6
MW-8	02/27/90	<1
MW-12	02/27/90	1.0
MW-19	02/27/90	<1
MW-20	02/27/90	<1
MW-21	02/27/90	<1

Notes:
"ppm" indicates "parts per million"
"<" indicates "less than"
TPH (total petroleum hydrocarbons) analyzed by EPA Method 418.1

TABLE 5
SUMMARY OF ANALYTICAL CHEMISTRY DATA FOR HYDRAULIC FLUID FROM RESERVOIR TANKS

Parameter	Units	Hydraulic Fluid	EPA Method
Semi-volatile Organic Compounds	ppm	None Detected	8270
Total Metals			
arsenic	ppm	<1	7060
barium	ppm	10	7080
cadmium	ppm	3.3	7130
chromium	ppm	<3	7190
lead	ppm	<15	7420
mercury	ppm	<0.15	7470
selenium	ppm	<1	7740
silver	ppm	<3	7760

Notes:
Laboratory results presented in Appendix B.
"ppm" indicates "parts per million"
"<" indicates "less than"



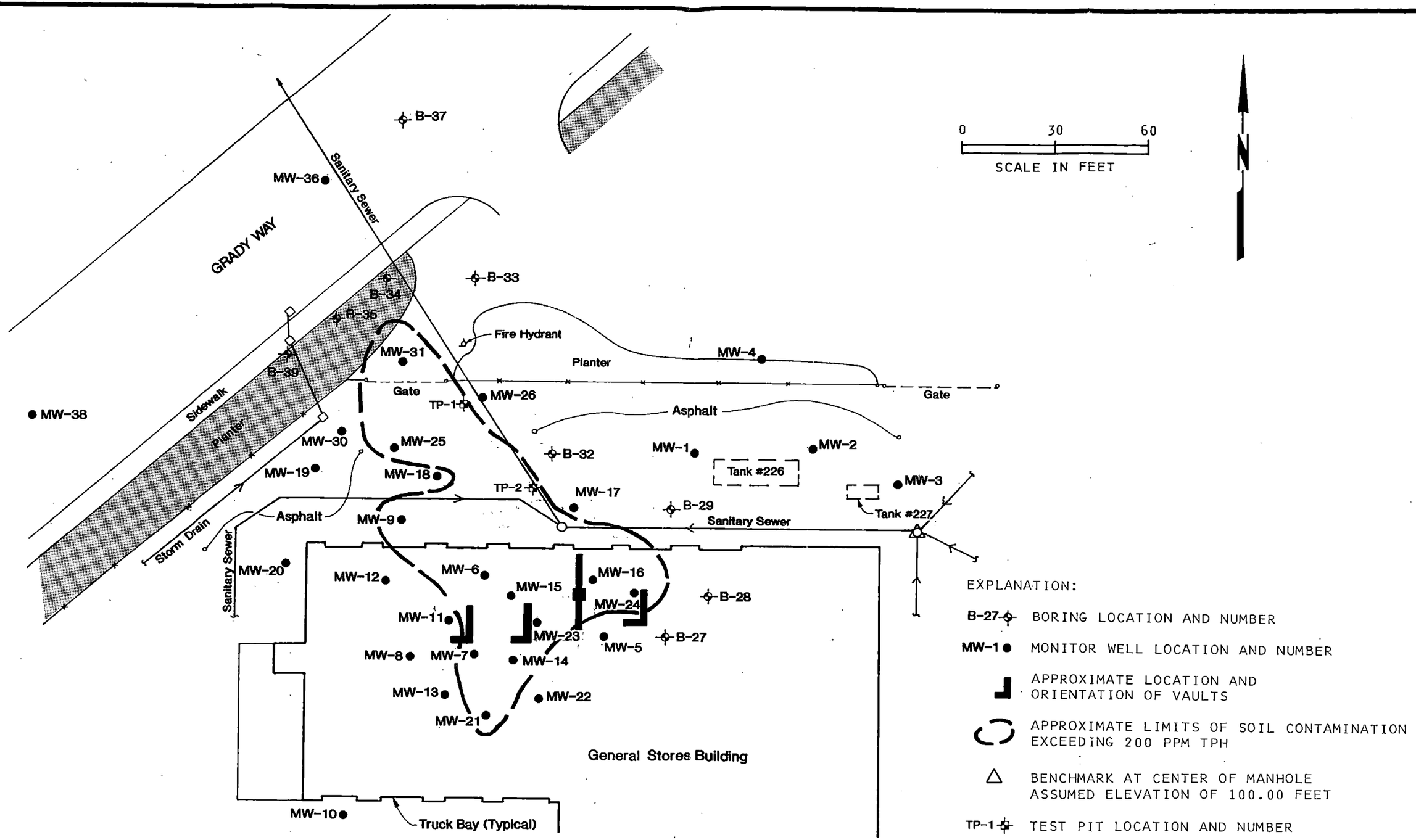
REFERENCE: USGS 7.5' TOPOGRAPHIC QUADRANGLE MAP "RENTON, WASH."

Geo Engineers

VICINITY MAP

FIGURE 1

0186-101-604 KSK:KKT 11-16-89



REFERENCE: DRAWING ENTITLED "RENTON TRANSPORTATION CENTER REMODEL", DATED 3/4/74, BY PUGET POWER AND SITE MEASUREMENTS MADE BY GEOENGINEERS, INC.

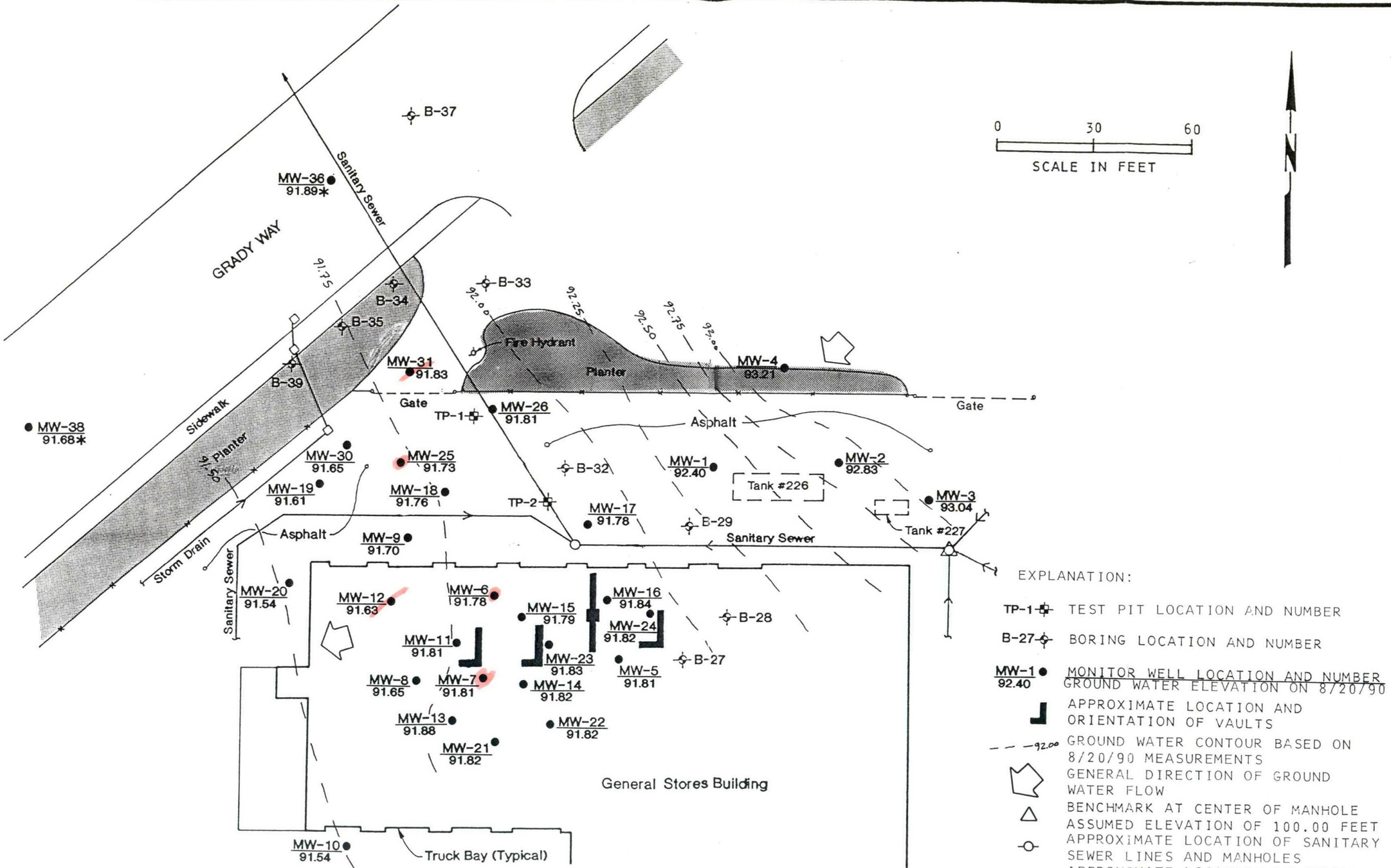
GeoEngineers

DETAILED SITE PLAN

FIGURE 2

6106-108 804 KSK:KH 6/20/90

0186·106·B04 KSK:KKT 6·20·90



EXPLANATION:

- TP-1 ⊕ TEST PIT LOCATION AND NUMBER
- B-27 ⊕ BORING LOCATION AND NUMBER
- MW-1 ● 92.40 MONITOR WELL LOCATION AND NUMBER GROUND WATER ELEVATION ON 8/20/90
- APPROXIMATE LOCATION AND ORIENTATION OF VAULTS
- 92.00 GROUND WATER CONTOUR BASED ON 8/20/90 MEASUREMENTS
- GENERAL DIRECTION OF GROUND WATER FLOW
- △ BENCHMARK AT CENTER OF MANHOLE ASSUMED ELEVATION OF 100.00 FEET
- APPROXIMATE LOCATION OF SANITARY SEWER LINES AND MANHOLES
- APPROXIMATE LOCATION OF STORM SEWER LINES AND CATCH BASINS
- * GROUND WATER ELEVATION ON 5/30/90

REFERENCE: DRAWING ENTITLED "RENTON TRANSPORTATION CENTER REMODEL", DATED 3/4/74, BY PUGET POWER AND SITE MEASUREMENTS MADE BY GEOENGINEERS, INC

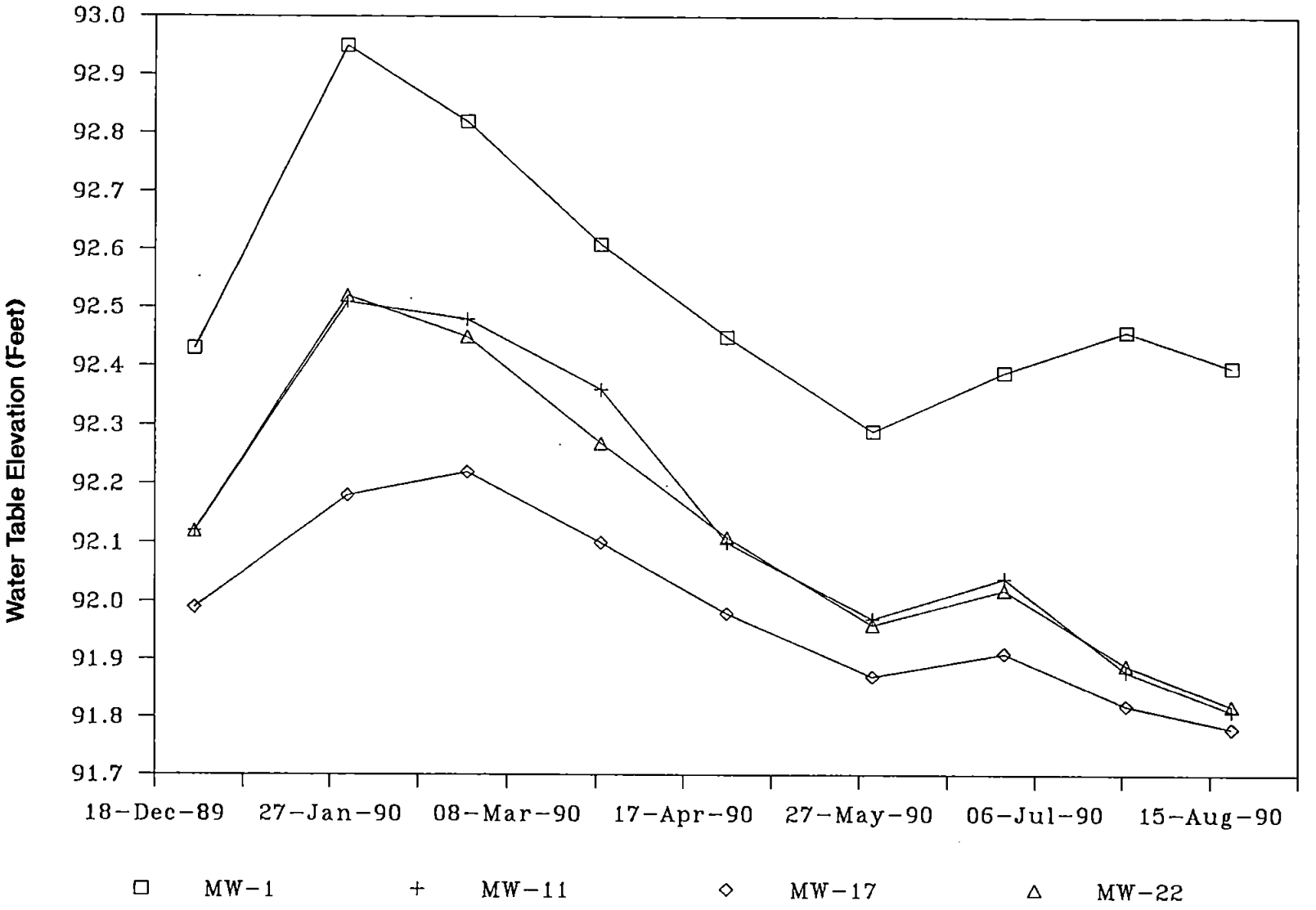
GeoEngineers

GROUND WATER CONTOUR MAP

FIGURE 3

0186-106-B69 GWM:BDH B.30.90

Geo Engineers



WATER TABLE ELEVATIONS FOR SELECTED WELLS

FIGURE 4

APPENDIX A

A P P E N D I X A

FIELD EXPLORATIONS

DRILLING AND SOIL SAMPLING PROGRAM

Subsurface conditions were explored by drilling two borings on May 14, 1990. The borings (B-32 and B-33) were drilled at the locations indicated in Figure 2 to a depth of 14.0 feet using truck-mounted, hollow-stem auger equipment owned and operated by GeoBoring and Development, Inc. The drilling and soil sampling equipment was cleaned with a hot-water pressure washer between each boring. The soil sampling equipment was cleaned in a trisodium phosphate detergent wash and distilled water rinse between each sampling attempt.

A geologist from our staff determined the boring and sampling locations, examined and classified the soils encountered, and prepared a detailed log of each boring. Soils encountered were classified visually in general accordance with ASTM D-2488-83, which is described in Figure A-1. An explanation of the boring log symbols is presented in Figure A-2. The boring logs are given in Figures A-3 and A-4.

Soil samples were obtained from each boring using a split-barrel sampler (1.375-inch-ID). The sampler was driven 18 inches by a 140-pound weight falling a vertical distance of approximately 30 inches. The number of blows needed to advance the sampler the final 12 inches is indicated to the left of the corresponding sample notations on the boring logs.

One soil sample from each boring was selected for chemical analysis. Samples from the borings that were tested are denoted in our boring logs with a "CA". The soil samples were transferred to jars in the field and kept cool during transport to the testing laboratory. Chain-of-custody procedures were observed during transport of the soil samples.

TEST PITS

Subsurface conditions were explored by completing two test pits at the locations indicated in Figure 2 on February 13, 1990. The test pits, TP-1 and TP-2, were excavated to depths of 7 and 8 feet, respectively, using a rubber-tired backhoe owned and operated by PSP&L. A geologist from our staff examined and classified the soils encountered, and prepared a detailed

log of each test pit. Soils encountered were classified visually in general accordance with ASTM D-2488-83, which is described in Figure A-1. The test pit logs are given in Figure A-5.

A sample of contaminated soil was obtained from each test pit and was composited into one large soil sample. This sample was subsequently delivered to ReTec to perform a biotreatability study.

FIELD SCREENING METHODS

A GeoEngineers representative conducted field screening on soil samples obtained from the exploratory borings and test pits. Field screening results are used as a general guideline to delineate areas of potential petroleum-related contamination in soils. In addition, screening results are often used as a basis for selecting soil samples for chemical analysis. The field screening methods employed included: (1) visual examination and (2) sheen testing.

Visual screening consists of inspecting the soil for the presence of stains indicative of residual fuel hydrocarbons. Visual screening is generally more effective in detecting the presence of heavier petroleum hydrocarbons such as motor oil, or when hydrocarbon concentrations are high. Sheen screening is a more sensitive method which has been effective in detecting residual fuel hydrocarbons at levels less than regulatory cleanup guidelines.

Sheen testing involves placing soil in water and observing the water surface for signs of sheen. Because of its sensitivity, the sheen method was tested on soils obtained from a portion of the site believed to be clean and unaffected by residual fuel hydrocarbons. The results of the sheen tests on these soils were established as the background level of sheen for the site.

Sheens are classified as follows:

NS - No Sheen -	No visible sheen. Note: background samples at the site were classified NS.
SS - Slight Sheen -	Light colorless film, spotty to globular; spread is irregular, not rapid; areas of no sheen remain; film dissipates rapidly.

MS - Moderate Sheen -	Light to heavy film, may have some color or iridescence, globular to stringy; spread is irregular to flowing.
HS - Heavy Sheen -	Heavy colorful film with iridescence; stringy, spread is rapid; sheen flows off the sample; most of water surface is covered.

The results of the sheen testing on soil samples from the borings and test pits are presented on the boring logs in Figures A-3 and A-4, and on the test pit logs in Figure A-5.

Field screening results are site specific and vary with soil type, soil moisture content, temperature and type of contaminant.

GROUND WATER ELEVATIONS

The depth to the ground water table relative to the monitor well casing rims was measured periodically during our ongoing ground water monitoring program. The site measurements were made using a weighted fiberglass tape and water-finding paste. Water table elevations were calculated by subtracting the water depth from the casing rim elevations. The water table elevations are presented in Table 2.

PRODUCT MONITORING AND RECOVERY PROGRAM

Product levels have been measured in the well casings for MW-6, MW-7 and MW-25 periodically during our monitoring program. Product thickness was measured using a fiberglass tape and water-finding paste and/or a product-water interface probe. Product was removed from the wells using a clear acrylic bailer until no measurable product remained, then placed in a secured, labeled container in the garage within the General Stores Building. Product thickness data is presented in Table 3.

GROUND WATER SAMPLING PROGRAM

Ground water samples were collected from MW-30 and MW-31 on May 16, 1990, and from MW-8, MW-12, MW-19, MW-20 and MW-21 on February 27, 1990. The water samples were collected with a stainless steel bailer after at least three well volumes of water were removed from each well casing. The

water samples were transferred to liter jars in the field and kept cool during transport to the testing laboratory. Chain-of-custody procedures were observed during transport of the water samples.

The bailer was cleaned prior to each sampling attempt with a fresh water rinse, a trisodium phosphate detergent wash, and a second fresh water rinse which was followed by a distilled water rinse.

CHEMICAL ANALYTICAL PROGRAM

Two soil samples from the borings, seven ground water samples from the monitor wells and one product sample from the hydraulic fluid reservoir were analyzed by Analytical Technologies, Inc. The soil samples and water samples were analyzed for total petroleum hydrocarbons (TPH) by freon extraction/infrared spectroscopy in accordance with EPA Method 418.1. The product sample was analyzed for semi-volatile organic compounds by gas chromatograph/mass spectrometer in accordance with EPA Method 8270 and for total metals by atomic absorption spectrophotometer/inductively coupled plasma in accordance with EPA Methods 7060, 7080, 7130, 7190, 7420, 7470, 7740, and 7760. The analytical chemistry data for the soil samples from the borings are summarized in Table 1. The analytical chemistry data for the water samples are summarized in Table 4. The analytical chemistry data for the product sample is summarized in Table 5. The laboratory data sheets are included in Appendix B.

SOIL CLASSIFICATION SYSTEM

MAJOR DIVISIONS			GROUP SYMBOL	GROUP NAME
COARSE GRAINED SOILS MORE THAN 50% RETAINED ON NO. 200 SIEVE	GRAVEL MORE THAN 50% OF COARSE FRACTION RETAINED ON NO. 4 SIEVE	CLEAN GRAVEL	GW	WELL-GRADED GRAVEL, FINE TO COARSE GRAVEL
			GP	POORLY-GRADED GRAVEL
		GRAVEL WITH FINES	GM	SILTY GRAVEL
			GC	CLAYEY GRAVEL
	SAND MORE THAN 50% OF COARSE FRACTION PASSES NO. 4 SIEVE	CLEAN SAND	SW	WELL-GRADED SAND, FINE TO COARSE SAND
			SP	POORLY-GRADED SAND
		SAND WITH FINES	SM	SILTY SAND
			SC	CLAYEY SAND
FINE GRAINED SOILS MORE THAN 50% PASSES NO. 200 SIEVE	SILT AND CLAY LIQUID LIMIT LESS THAN 50	INORGANIC	ML	SILT
			CL	CLAY
		ORGANIC	OL	ORGANIC SILT, ORGANIC CLAY
	SILT AND CLAY LIQUID LIMIT 50 OR MORE	INORGANIC	MH	SILT OF HIGH PLASTICITY, ELASTIC SILT
			CH	CLAY OF HIGH PLASTICITY, FAT CLAY
		ORGANIC	OH	ORGANIC CLAY, ORGANIC SILT
HIGHLY ORGANIC SOILS			PT	PEAT

NOTES:

1. Field classification is based on visual examination of soil in general accordance with ASTM D2488-83.
2. Soil classification using laboratory tests is based on ASTM D2487-83.
3. Descriptions of soil density or consistency are based on interpretation of blowcount data, visual appearance of soils, and/or test data.

SOIL MOISTURE MODIFIERS:

Dry – Absence of moisture, dusty, dry to the touch

Moist – Damp, but no visible water

Wet – Visible free water or saturated, usually soil is obtained from below water table

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SOIL CLASSIFICATION SYSTEM

FIGURE A-1

GEI 85-88

LABORATORY TESTS:

CA Chemical Analysis

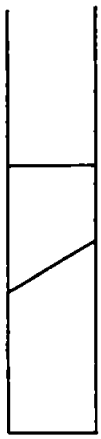
FIELD SCREENING TESTS:

Headspace vapor concentration data given in parts per million

Sheen classification system:

NS No Visible Sheen
SS Slight Sheen
MS Moderate Sheen
HS Heavy Sheen
NT Not Tested

SOIL GRAPH:



SM Soil Group Symbol (See Note 2)

Distinct Contact Between Soil Strata

Gradual or Approximate Location of Change Between Soil Strata

Water Level

Bottom of Boring

BLOW-COUNT/SAMPLE DATA:

Blows required to drive a 2.4-inch I.D. split-barrel sampler 12 inches or other indicated distances using a 300-pound hammer falling 30 inches.

22 — Location of relatively undisturbed sample

12 — Location of disturbed sample

17 — Location of sampling attempt with no recovery

Blows required to drive a 1.5-inch I.D. (SPT) split-barrel sampler 12 inches or other indicated distances using 140-pound hammer falling 30 inches.

10 — Location of sample obtained in general accordance with Standard Penetration Test (ASTM D-1586) procedures

26 — Location of SPT sampling attempt with no recovery

Location of grab sample

"P" indicates sampler pushed with weight of hammer or against weight of drill rig.

NOTES:

1. The reader must refer to the discussion in the report text, the Key to Boring Log Symbols and the exploration logs for a proper understanding of subsurface conditions.

2. Soil classification system is summarized in Figure A-1.

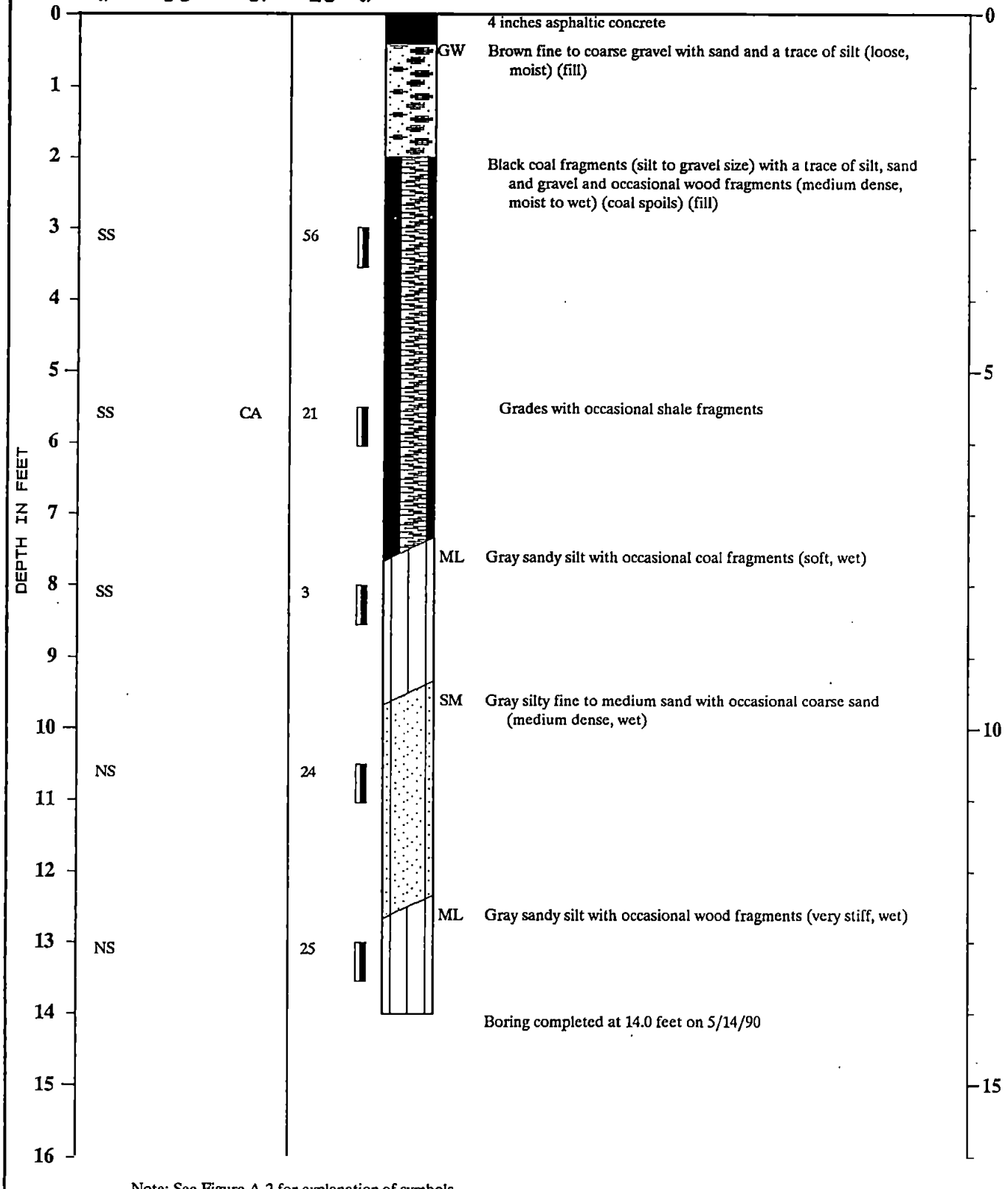
GEI 86-88 Rev. 6/90

Geo Engineers

KEY TO BORING LOG SYMBOLS

FIGURE A-2

BORING B-32



Note: See Figure A-2 for explanation of symbols

Geo Engineers

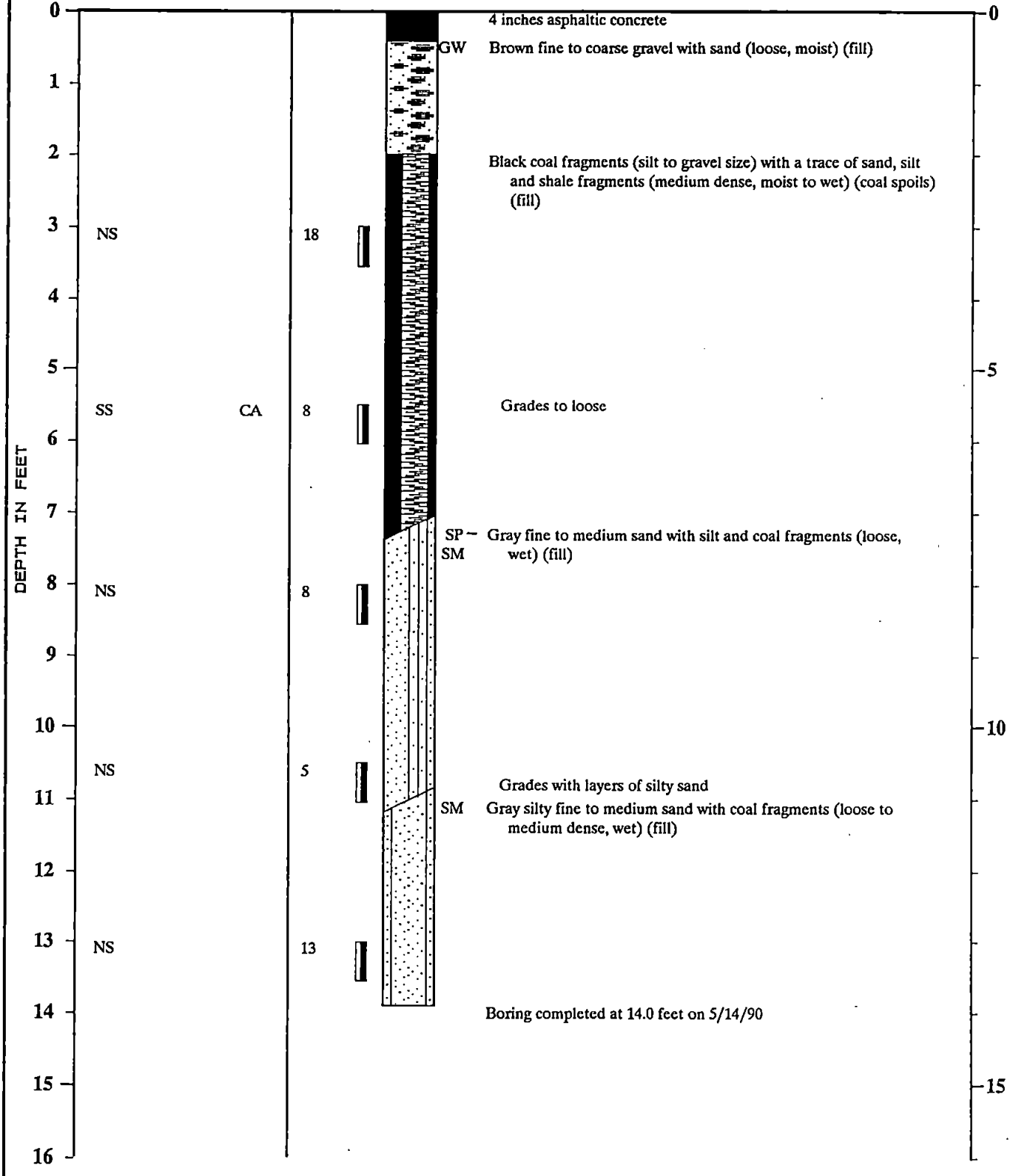
Log of Boring

Figure A-3

:GWM:KSK:KKT 9/12/90

0186-106-B69

BORING B-33



Note: See Figure A-2 for explanation of symbols

Geo Engineers

Log of Boring

Figure A-4

:GWM:KSK:KKT 9/17/90

0186-106-B69

LOG OF TEST PIT

DEPTH BELOW GROUND SURFACE (FEET)	SOIL GROUP CLASSIFICATION SYMBOL	DESCRIPTION
		TEST PIT 1
0.0 - 0.3		Asphaltic Concrete
0.3 - 3.0	SP-SM	Brown fine to coarse sand with silt and gravel (loose, moist) (fill)
3.0 - 7.0		Black coal fragments (silt to gravel size) with a trace of silt, sand and gravel (loose to medium dense, moist to wet) (coal spoils) (fill)
		Test pit completed at 7.0 feet on 02/13/90
		Rapid ground water seepage encountered from 6.0 to 7.0 feet
		No sheen observed on soil from 0 to 5.0 feet
		Heavy sheen observed on soil from 5.0 to 7.0 feet
		TEST PIT 2
0.0 - 0.3		Asphaltic Concrete
0.3 - 2.5	SP-SM	Brown fine to coarse sand with silt and occasional gravel (loose, moist) (fill)
2.5 - 8.0		Black coal fragments (silt to gravel size) with sand and silt (loose to medium dense, moist to wet) (coal spoils) (fill)
		Test pit completed at 8.0 feet on 02/13/90
		Rapid ground water seepage encountered from 6.0 to 8.0 feet
		Slight sheen observed from 0 to 5.0 feet
		Heavy sheen observed from 5.0 to 8.0 feet
		Sewer pipe (6") encountered at 8.0 feet.

THE DEPTHS ON THE TEST PIT LOGS, ALTHOUGH SHOWN TO 0.1 FOOT, ARE BASED ON AN AVERAGE OF MEASUREMENTS ACROSS THE TEST PIT AND SHOULD BE CONSIDERED ACCURATE TO 0.5 FOOT.

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LOG OF TEST PIT

FIGURE A-5

GEI 110-103

APPENDIX B

AnalyticalTechnologies,Inc. 560 Naches Avenue, S.W., Suite 101, Renton, WA 98055, (206) 228-8335

ATI I.D. # 8912-080

January 18, 1990

GeoEngineers
JAN 19 1990
Routing bsk
File

GeoEngineers, Inc.
2405 140th Avenue N.E.
Suite 105
Bellevue, WA 98005

Attention : Kathy Killman

Project Number : 186-106-B04

Project Name : PSP&L

On December 27, 1989 Analytical Technologies, Inc. received two water samples for analyses. The samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and the quality control data are enclosed.

Donna M. McKinney
Project Manager

Frederick W. Grothkopp
Technical Manager

FWG/pes

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
PROJECT # : 186-106-B04
PROJECT NAME : PSP&L

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
8912-080-1	MW-30	12/27/89	WATER
8912-080-2	MW-31	12/27/89	WATER

----- TOTALS -----

MATRIX	# SAMPLES
WATER	2

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 186-106-B04
PROJECT NAME : PSP&L

ANALYSIS	TECHNIQUE	REFERENCE/METHOD
PETROLEUM HYDROCARBONS	IR	EPA 418.1

GENERAL CHEMISTRY RESULTS

CLIENT : GEOENGINEERS, INC.
PROJECT # : 186-106-B04
PROJECT NAME : PSP&L

SAMPLE MATRIX : WATER
UNITS : mg/L

ATI I.D. #	CLIENT I.D.	PETROLEUM HYDROCARBONS
8912-080-1	MW-30	<0.05
8912-080-2	MW-31	8.6

GENERAL CHEMISTRY QUALITY CONTROL

CLIENT : GEOENGINEERS, INC.
PROJECT # : 186-106-B04
PROJECT NAME : PSP&L

SAMPLE MATRIX : WATER

PARAMETER	UNITS	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED CONC	SPIKE ADDED	% REC
PETROLEUM HYDROCARBONS	mg/L	8912-057-8	<0.05	<0.05	0	5.24	10.1	52

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

8912080

Analytical Technologies, Inc.
560 Naches Avenue SW, Suite 101 Renton, WA 98055

Chain of Custody

DATE 12/27/89 PAGE 1 OF 1

PROJECT MANAGER: Kathy Killman
COMPANY: GeoEngineers
ADDRESS: 2405 140th Ave. NE Suite 105
Bellevue, WA 98005
PHONE: 746-5200 SAMPLED BY: NLP

LABORATORY NUMBER:

SAMPLE DISPOSAL INSTRUCTIONS

☐ ATI Disposal @ $5.00 each ☐ Return ☐ Pickup (will call)

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	8010 Halogenated Volatiles	8020 Aromatic Volatiles	BETX ONLY	8240 GCMS Volatiles	8270 GCMS BNA	8310 HPLC PNA	8080 Pesticides & PCB's	PCB's ONLY	8140 Phosphate Pesticides	8150 Herbicides	WDOE PAH/HH (WAC 173)	418.1 (TPH)	413.2 Grease & Oil	8015 (Modified)	TOC 9060	TOX 9020	% Moisture	TCLP	Priority Pollutant Metals (13)	EPTOX Metals (8) Total	EP TOX Metals (8) EP EXT	NUMBER OF CONTAINERS
MW-30	12/27	1000	H_2O	-1												X										1
MW-31	12/27	1040	H_2O	-2												X										1

PROJECT INFORMATION

PROJECT NUMBER: 186-106-809
PROJECT NAME: PSPSL
PURCHASE ORDER NUMBER:
VIA:

SAMPLE RECEIPT

TOTAL NUMBER OF CONTAINERS	2
CHAIN OF CUSTODY SEALS Y/N/NA	N
INTACT? Y/N/NA	Y
RECEIVED GOOD COND./COLD	cold

TAT: ☐ 24HR ☐ 48 HRS ☐ 72 HRS ☐ 1 WK ☒ 2 WKS (Normal)

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH DATA

SPECIAL INSTRUCTIONS:

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Time: 1300	Signature: Time:	Signature: Time:
Printed Name: Norman Pun Date: 12/27/89	Printed Name: Date:	Printed Name: Date:
Company: GeoEngineers	Company:	Company:
RECEIVED BY: 1.	**RECEIVED BY: 2.**	**RECEIVED BY: (LAB) 3.**
Signature: Time:	Signature: Time:	Signature: Time: 1235
Printed Name: Date:	Printed Name: Date:	Printed Name: Mary Silva Date: 12/27/89
Company:	Company:	Analytical Technologies, Inc.

ATI Labs: San Diego (619)458-... • Phoenix (602)438-1500 • Se...(206)228-... • Pe... (904)...1 RIBL... Whi...ry - ...TICAL ...VOLC... INC. • ...ORIG...

B - 6

Analytical Technologies, Inc. 560 Naches Avenue, S.W., Suite 101, Renton, WA 98055, (206) 228-8335

ATI I.D. # 9001-078

GeoEngineers

FEB 16 1990

Routing

File 186-101-B64

February 15, 1990

GeoEngineers, Inc.
2405 140th Avenue N.E.
Suite 105
Bellevue, WA 98005

Attention : Kathy Killman

Project Number : 186-101-B4

Project Name : Puget Power Renton

On August 29, 1989 Analytical Technologies, Inc. received two soil samples and one product sample for analyses. The samples were analyzed with EPA methodology or equivalent methods as specified in the analytical schedule. The results, sample cross reference, and the quality control data were sent to you on September 11, 1989 under ATI accession #8908-130.

The samples were reaccessioned for additional tests on January 25, 1990. Enclosed is the report for the additional analyses.

Frederick W Grothkopp
for Mary C. Silva
Senior Project Manager

FWG/pes

Frederick W Grothkopp
Frederick W. Grothkopp
Technical Manager

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
PROJECT # : 186-101-B4
PROJECT NAME : PUGET POWER RENTON

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9001-078-1	HYDRAULIC FLUID TANK	08/28/89	PRODUCT

----- TOTALS -----

MATRIX	# SAMPLES
PRODUCT	1

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 186-101-B4
PROJECT NAME : PUGET POWER RENTON

ANALYSIS	TECHNIQUE	REFERENCE	LAB
SEMI-VOLATILE COMPOUNDS	GCMS	EPA 8270	R
ARSENIC	AA/GF	EPA 7060	R
BARIUM	AA/F	EPA 7080	R
CADMIUM	AA/F	EPA 7130	R
CHROMIUM	AA/F	EPA 7190	R
LEAD	AA/F	EPA 7420	R
MERCURY	AA/COLD VAPOR	EPA 7470	R
SELENIUM	AA/GF	EPA 7740	R
SILVER	AA/F	EPA 7760	R

SD = ATI - San Diego
R = ATI - Renton
T = ATI - Tempe
PNR = ATI - Pensacola

ATI I.D. # 9001-078

SEMI-VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 186-101-B4	DATE RECEIVED	: N/A
PROJECT NAME	: PUGET POWER RENTON	DATE EXTRACTED	: 01/26/90
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 01/29/90
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
EPA METHOD	: 8270	DILUTION FACTOR	: 300

RESULTS BASED ON "AS IS" BASIS

COMPOUND	RESULT
N-NITROSODIMETHYLAMINE	<51
PHENOL	<51
ANILINE	<51
BIS(2-CHLOROETHYL)ETHER	<51
2-CHLOROPHENOL	<51
1,3-DICHLOROBENZENE	<51
1,4-DICHLOROBENZENE	<51
BENZYL ALCOHOL	<51
1,2-DICHLOROBENZENE	<51
2-METHYLPHENOL	<51
BIS(2-CHLOROISOPROPYL)ETHER	<51
4-METHYLPHENOL	<51
N-NITROSO-DI-N-PROPYLAMINE	<51
HEXACHLOROETHANE	<51
NITROBENZENE	<51
ISOPHORONE	<51
2-NITROPHENOL	<51
2,4-DIMETHYLPHENOL	<51
BENZOIC ACID	<51
BIS(2-CHLOROETHOXY)METHANE	<51
2,4-DICHLOROPHENOL	<51
1,2,4-TRICHLOROBENZENE	<51
NAPHTHALENE	<51
4-CHLOROANILINE	<51
HEXACHLOROBUTADIENE	<51
4-CHLORO-3-METHYLPHENOL	<51
2-METHYLNAPHTHALENE	<51
HEXACHLOROCYCLOPENTADIENE	<51
2,4,6-TRICHLOROPHENOL	<51
2,4,5-TRICHLOROPHENOL	<51
2-CHLORONAPHTHALENE	<51
2-NITROANILINE	<51
DIMETHYLPHTHALATE	<51
ACENAPHTHYLENE	<51
3-NITROANILINE	<51
ACENAPHTHENE	<51
2,4-DINITROPHENOL	<51
4-NITROPHENOL	<51

CONTINUED NEXT PAGE

SEMI-VOLATILE ORGANICS ANALYSIS
DATA SUMMARY (CONTINUED)

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 186-101-B4	DATE RECEIVED	: N/A
PROJECT NAME	: PUGET POWER RENTON	DATE EXTRACTED	: 01/26/90
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 01/29/90
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
EPA METHOD	: 8270	DILUTION FACTOR	: 300

RESULTS BASED ON "AS IS" BASIS

COMPOUND	RESULT
DIBENZOFURAN	<51
2,4-DINITROTOLUENE	<51
2,6-DINITROTOLUENE	<51
DIETHYLPHTHALATE	<51
4-CHLOROPHENYL-PHENYLETHER	<51
FLUORENE	<51
4-NITROANILINE	<51
4,6-DINITRO-2-METHYLPHENOL	<51
N-NITROSODIPHENYLAMINE	<51
4-BROMOPHENYL-PHENYLETHER	<51
HEXACHLOROBENZENE	<51
PENTACHLOROPHENOL	<51
PHENANTHRENE	<51
ANTHRACENE	<51
DI-N-BUTYLPHTHALATE	<51
FLUORANTHENE	<51
BENZIDINE	<51
PYRENE	<51
BUTYLBENZYLPHTHALATE	<51
3,3-DICHLOROBENZIDINE	<51
BENZO(a)ANTHRACENE	<51
BIS(2-ETHYLHEXYL)PHTHALATE	<51
CHRYSENE	<51
DI-N-OCTYLPHTHALATE	<51
BENZO(b)FLUORANTHENE	<51
BENZO(k)FLUORANTHENE	<51
BENZO(a)PYRENE	<51
INDENO(1,2,3-cd)PYRENE	<51
DIBENZ(a,h,)ANTHRACENE	<51
BENZO(g,h,i)PERYLENE	<51

SURROGATE PERCENT RECOVERIES

NITROBENZENE-d5	87
2-FLUOROBIPHENYL	94
TERPHENYL-d14	100
PHENOL-d6	90
2-FLUOROPHENOL	103
2,4,6-TRIBROMOPHENOL	77

SEMI-VOLATILE ORGANICS ANALYSIS
TENTATIVELY IDENTIFIED COMPOUNDS

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: N/A
PROJECT #	: 186-101-B4	DATE RECEIVED	: N/A
PROJECT NAME	: PUGET POWER RENTON	DATE EXTRACTED	: 01/26/90
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 01/29/90
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
EPA METHOD	: 8270	DILUTION FACTOR	: 300

RESULTS BASED ON "AS IS" BASIS

COMPOUND	SCAN NUMBER	ESTIMATED CONCENTRATION

NO NON-HSL COMPOUNDS FOUND > 10% OF NEAREST INTERNAL STANDARD.

ATI I.D. # 9001-078-1

SEMI-VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 08/28/89
PROJECT #	: 186-101-B4	DATE RECEIVED	: 08/29/89
PROJECT NAME	: PUGET POWER RENTON	DATE EXTRACTED	: 01/26/90
CLIENT I.D.	: HYDRAULIC FLUID TANK	DATE ANALYZED	: 01/29/90
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
EPA METHOD	: 8270	DILUTION FACTOR	: 300

RESULTS BASED ON "AS IS" BASIS

COMPOUND	RESULT
N-NITROSODIMETHYLAMINE	<51
PHENOL	<51
ANILINE	<51
BIS(2-CHLOROETHYL)ETHER	<51
2-CHLOROPHENOL	<51
1,3-DICHLOROBENZENE	<51
1,4-DICHLOROBENZENE	<51
BENZYL ALCOHOL	<51
1,2-DICHLOROBENZENE	<51
2-METHYLPHENOL	<51
BIS(2-CHLOROISOPROPYL)ETHER	<51
4-METHYLPHENOL	<51
N-NITROSO-DI-N-PROPYLAMINE	<51
HEXACHLOROETHANE	<51
NITROBENZENE	<51
ISOPHORONE	<51
2-NITROPHENOL	<51
2,4-DIMETHYLPHENOL	<51
BENZOIC ACID	<51
BIS(2-CHLOROETHOXY)METHANE	<51
2,4-DICHLOROPHENOL	<51
1,2,4-TRICHLOROBENZENE	<51
NAPHTHALENE	<51
4-CHLOROANILINE	<51
HEXACHLOROBUTADIENE	<51
4-CHLORO-3-METHYLPHENOL	<51
2-METHYLNAPHTHALENE	<51
HEXACHLOROCYCLOPENTADIENE	<51
2,4,6-TRICHLOROPHENOL	<51
2,4,5-TRICHLOROPHENOL	<51
2-CHLORONAPHTHALENE	<51
2-NITROANILINE	<51
DIMETHYLPHTHALATE	<51
ACENAPHTHYLENE	<51
3-NITROANILINE	<51
ACENAPHTHENE	<51
2,4-DINITROPHENOL	<51
4-NITROPHENOL	<255

CONTINUED NEXT PAGE

SEMI-VOLATILE ORGANICS ANALYSIS
DATA SUMMARY (CONTINUED)

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 08/28/89
PROJECT #	: 186-101-B4	DATE RECEIVED	: 08/29/89
PROJECT NAME	: PUGET POWER RENTON	DATE EXTRACTED	: 01/26/90
CLIENT I.D.	: HYDRAULIC FLUID TANK	DATE ANALYZED	: 01/29/90
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
EPA METHOD	: 8270	DILUTION FACTOR	: 300

RESULTS BASED ON "AS IS" BASIS

COMPOUND	RESULT
DIBENZOFURAN	<51
2,4-DINITROTOLUENE	<51
2,6-DINITROTOLUENE	<51
DIETHYLPHTHALATE	<51
4-CHLOROPHENYL-PHENYLETHER	<51
FLUORENE	<51
4-NITROANILINE	<51
4,6-DINITRO-2-METHYLPHENOL	<51
N-NITROSODIPHENYLAMINE	<51
4-BROMOPHENYL-PHENYLETHER	<51
HEXACHLOROBENZENE	<51
PENTACHLOROPHENOL	<255
PHENANTHRENE	<51
ANTHRACENE	<51
DI-N-BUTYLPHTHALATE	<51
FLUORANTHENE	<51
BENZIDINE	<51
PYRENE	<51
BUTYLBENZYLPHTHALATE	<51
3,3-DICHLOROBENZIDINE	<51
BENZO(a)ANTHRACENE	<51
BIS(2-ETHYLHEXYL)PHTHALATE	<51
CHRYSENE	<51
DI-N-OCTYLPHTHALATE	<51
BENZO(b)FLUORANTHENE	<51
BENZO(k)FLUORANTHENE	<51
BENZO(a)PYRENE	<51
INDENO(1,2,3-cd)PYRENE	<51
DIBENZ(a,h,)ANTHRACENE	<51
BENZO(g,h,i)PERYLENE	<51

SURROGATE PERCENT RECOVERIES

NITROBENZENE-d5	80
2-FLUOROBIPHENYL	88
TERPHENYL-d14	43
PHENOL-d6	84
2-FLUOROPHENOL	96
2,4,6-TRIBROMOPHENOL	70

SEMI-VOLATILE ORGANICS ANALYSIS
TENTATIVELY IDENTIFIED COMPOUNDS

CLIENT	: GEOENGINEERS, INC.	DATE SAMPLED	: 08/28/89
PROJECT #	: 186-101-B4	DATE RECEIVED	: 08/29/89
PROJECT NAME	: PUGET POWER RENTON	DATE EXTRACTED	: 01/26/90
CLIENT I.D.	: HYDRAULIC FLUID TANK	DATE ANALYZED	: 01/29/90
SAMPLE MATRIX	: PRODUCT	UNITS	: mg/Kg
EPA METHOD	: 8270	DILUTION FACTOR	: 300

RESULTS BASED ON "AS IS" BASIS

COMPOUND	SCAN NUMBER	ESTIMATED CONCENTRATION
BRANCHED ALKANE	1148	2,100
HYDROCARBON	1285	7,500
HYDROCARBON	1300	12,000
HYDROCARBON	1382	24,000
HYDROCARBON	2173	6,000

SEMI-VOLATILE ORGANIC
QUALITY CONTROL DATA

CLIENT : GEOENGINEERS, INC.
PROJECT # : 186-101-B4
PROJECT NAME : PUGET POWER RENTON
EPA METHOD : 8270

SAMPLE I.D. : 9001-078-1
DATE EXTRACTED : 01/26/90
DATE ANALYZED : 01/29/90
MATRIX : PRODUCT
UNITS : mg/Kg

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % REC	RPD
1,2,4-TRICHLOROBENZENE	<51	100	79	79	83	83	5
ACENAPHTHENE	<51	100	74	74	74	74	0
2,4-DINITROTOLUENE	<51	100	47	47	54	54	14
PYRENE	<51	100	76	76	89	89	16
N-NITROSO-DI-N-PROPYLAMINE	<51	100	75	75	75	75	0
1,4-DICHLOROBENZENE	<51	100	86	86	86	86	0
PENTACHLOROPHENOL	<51	200	117	58	127	63	8
PHENOL	<51	200	144	72	149	74	3
2-CHLOROPHENOL	<51	200	148	74	153	76	3
4-CHLORO-3-METHYLPHENOL	<51	200	145	72	143	72	1
4-NITROPHENOL	<51	200	39	20	54	27	32

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Spiked Sample Result} - \text{Duplicate Spike Sample Result})}{\text{Average of Spiked Sample}} \times 100$$

ATI I.D.# 9001-078

METALS RESULTS

CLIENT : GEOENGINEERS, INC. MATRIX : PRODUCT
PROJECT # : 186-101-B4
PROJECT NAME : PUGET POWER RENTON UNITS : mg/Kg

ATI I.D. #	CLIENT I.D.	ARSENIC	BARIUM	CADMIUM	CHROMIUM
9001-078-1	HYDRAULIC FLUID TANK	<1	10	3.3	<3

ATI I.D.# 9001-078

METALS RESULTS

CLIENT : GEOENGINEERS, INC. MATRIX : PRODUCT
PROJECT # : 186-101-B4
PROJECT NAME : PUGET POWER RENTON UNITS : mg/Kg

ATI I.D. #	CLIENT I.D.	LEAD	MERCURY	SELENIUM	SILVER
9001-078-1	HYDRAULIC FLUID TANK	<15	<0.15	<1	<3

METALS QUALITY CONTROL

CLIENT : GEOENGINEERS, INC. MATRIX : PRODUCT
PROJECT # : 186-101-B4
PROJECT NAME : PUGET POWER RENTON UNITS : mg/Kg

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED SAMPLE	SPIKE CONC	% REC
ARSENIC	9001-078-1	<1	<1	0	3.0	4.1	73
BARIUM	9001-078-1	10	10	0	2870	3280	87
CADMIUM	9001-078-1	3.3	3.3	0	84	82	98
CHROMIUM	9001-078-1	<3	<3	0	318	328	97
LEAD	9001-078-1	<15	<15	0	1510	1640	92
MERCURY	9001-067-9	<0.15	<0.15	0	0.53	0.72	74
SELENIUM	9001-078-1	<1	<1	0	2.1	2.4	88
SILVER	9001-078-1	<3	<3	0	159	164	97

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Analytical Technologies, Inc.
560 Naches Avenue SW, Suite 101 Renton, WA 98055

Chain of Custody 9001-078

DATE 8/24/89 PAGE 1 OF

PROJECT MANAGER: Kathy Killmain
COMPANY: GEI
ADDRESS:
PHONE: 246-5200 SAMPLED BY: JGR

LABORATORY NUMBER: 8908-130

ANALYSIS REQUEST

SAMPLE DISPOSAL INSTRUCTIONS

☐ ATI Disposal @ $5.00 each ☐ Return ☐ Pickup (will call)

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	8010 Halogenated Volatiles	8020 Aromatic Volatiles	BETX ONLY	8240 — GCMS Volatiles	8270 GCMS BNA	8310 HPLC PNA	8080 Pesticides & PCB's	PCB's ONLY	8140 Phosphate Pesticides	8150 Herbicides	WDOE PAH/HH (WAC 173)	418.1 (TPH)	413.2 Grease & Oil	8015 (Modified)	TOC 9060	TOX 9020	% Moisture	TCLP	Priority Pollutant Metals (13)	EPTOX Metals (8) Total	EP TOX Metals (8) EP EXT	NUMBER OF CONTAINERS
#2245W1	8/24/89		Soil	-1	X	X	X									X		X								
#2246WW1	↓		↓	-2												X		X								
Hydraulic Fluid TMC	8/18/89	3:15	grab	-3					X									X						X		

REACCESSION FROM 8908-130

NEW ACCESSION IS 9001-078 KSS

PROJECT INFORMATION		SAMPLE RECEIPT	
PROJECT NUMBER: 18(-101-B4		TOTAL NUMBER OF CONTAINERS	2
PROJECT NAME: Puget Power Renton		CHAIN OF CUSTODY SEALS Y/N/NA	N
PURCHASE ORDER NUMBER:		INTACT? Y/N/NA	Y
VIA:		RECEIVED GOOD COND./COLD	Y

TAT: ☑ 24HR ☐ 48 HRS ☐ 72 HRS ☐ 1 WK ☐ 2 WKS (Normal)

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH DATA

SPECIAL INSTRUCTIONS:
Return soil for 30 days
RUSH
Please fax forms.

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Time:	Signature: Time:	Signature: Time:
Printed Name: Date: Tami York 8/24/89	Printed Name: Date:	Printed Name: Date:
Company: GEI	Company:	Company:
RECEIVED BY: 1.	**RECEIVED BY: 2.**	**RECEIVED BY: (LAB) 3.**
Signature: Time:	Signature: Time:	Signature: Time: Dayna K. Burkett 2:33
Printed Name: Date:	Printed Name: Date:	Printed Name: Date: Dayna Burkett 8/25/89
Company:	Company:	Analytical Technologies, Inc

ATI Labs: Diego (619)458-9141 • Phoenix (602)438-1530 • Seattle (2 :8-8335 • Pensacola (904 :001 DISTRIBUTION ite, Canary - ANALYTICAL TECHNOLOGIES, INC. • Pin NATOR

B - 20

AnalyticalTechnologies, Inc. 560 Naches Avenue, S.W., Suite 101, Renton, WA 98055, (206) 228-8335

ATI I.D. # 9002-117

March 21, 1990

GeoEngineers, Inc.
2405 140th Ave. N.E.
Suite 105
Bellevue, WA 98005

Attention : Kathy Killman

Project Number : 186-106-B04

Project Name : Puget Power

On February 27, 1990 Analytical Technologies, Inc. received five water samples for analysis. The samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and the quality control data are enclosed.

Donna M. McKinney
Project Manager

Frederick W. Grothkopp
Technical Manager

FWG/hbb

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
PROJECT # : 186-106-B04
PROJECT NAME : PUGET POWER

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9002-117-1	MW-8	02/27/90	WATER
9002-117-2	MW-12	02/27/90	WATER
9002-117-3	MW-19	02/27/90	WATER
9002-117-4	MW-20	02/27/90	WATER
9002-117-5	MW-21	02/27/90	WATER

----- TOTALS -----

MATRIX	# SAMPLES
WATER	5

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 186-106-B04
PROJECT NAME : PUGET POWER

ANALYSIS	TECHNIQUE	REFERENCE	LAB
PETROLEUM HYDROCARBONS	IR	EPA 418.1	R

R = ATI - Renton
SD = ATI - San Diego
T = ATI - Tempe
PNR = ATI - Pensacola
SUB = Subcontract

GENERAL CHEMISTRY RESULTS

CLIENT : GEOENGINEERS, INC. SAMPLE MATRIX : WATER
PROJECT # : 186-106-B04
PROJECT NAME : PUGET POWER UNITS : mg/L

ATI I.D. #	CLIENT I.D.	PETROLEUM HYDROCARBONS
9002-117-1	MW-8	<1
9002-117-2	MW-12	1.0
9002-117-3	MW-19	<1
9002-117-4	MW-20	<1
9002-117-5	MW-21	<1

GENERAL CHEMISTRY QUALITY CONTROL

CLIENT : GEOENGINEERS, INC. SAMPLE MATRIX : WATER
PROJECT # : 186-106-B04
PROJECT NAME : PUGET POWER UNITS : mg/L

PARAMETER	UNITS	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
PETROLEUM HYDROCARBONS	mg/L	9002-117-5	<1	<1	0	N/A	N/A	N/A
PETROLEUM HYDROCARBONS	mg/L	BLANK SPIKE	N/A	N/A	N/A	4.8	10	48

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

Analytical**Technologies,**Inc.
560 Naches Avenue SW, Suite 101 Renton,WA 98055

Chain of Custody

DATE 2/27/90 PAGE 1 OF 1

PROJECT MANAGER: Kathy Killman
COMPANY: Geo Engineers Inc.
ADDRESS: 7405 140th NE #105
Redmond WA 98005
PHONE: 746-5200 SAMPLED BY: JRB

LABORATORY NUMBER: 9002-117

SAMPLE DISPOSAL INSTRUCTIONS

☒ ATI Disposal @ $5.00 each ☐ Return ☐ Pickup (will call)

SAMPLE ID	DATE	TIME	MATRIX	LAB ID
MW-8	2/27/90		Water	-1
MW-12				-2
MW-19				-3
MW-20				-4
MW-21				-5
MW-18				-6

ANALYSIS REQUEST

8010 Halogenated Volatiles	8020 Aromatic Volatiles	BETX ONLY	8240 GCMS Volatiles	8270 GCMS BNA	8310 HPLC PNA	8080 Pesticides & PCB's	PCB's ONLY	8140 Phosphate Pesticides	8150 Herbicides	WDOE PAH/HH (WAC 173)	418.1 (TPH)	413.2 Grease & Oil	8015 (Modified)	TOC 9060	TOX 9020	% Moisture	TCLP	Priority Pollutant Metals (13)	EPTOX Metals (8) Total	EP TOX Metals (8) EP EXT	NUMBER OF CONTAINERS
											X										1
											X										1
											X										1
											X										1
											X										1
											X							Cancelled per Kathy Killman 2/28			1

PROJECT INFORMATION

PROJECT NUMBER: 186-106-B04
PROJECT NAME: Puget Power
PURCHASE ORDER NUMBER:
VIA: Personal Delivery
TAT: ☐ 24HR ☐ 48 HRS ☐ 72 HRS ☐ 1 WK ☑ 2 WKS (Normal)
PRIOR AUTHORIZATION IS REQUIRED FOR RUSH DATA
SPECIAL INSTRUCTIONS:

SAMPLE RECEIPT

TOTAL NUMBER OF CONTAINERS	6
CHAIN OF CUSTODY SEALS Y/N/NA	N
INTACT? Y/N/NA	Y
RECEIVED GOOD COND./COLD	Y

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Time: 1620	Signature: Time:	Signature: Time:
Printed Name: Jennifer Brown Date: 2/27/90	Printed Name: Date:	Printed Name: Date:
Company: Geo Engineers Inc.	Company:	Company:
RECEIVED BY: 1.	**RECEIVED BY: 2.**	**RECEIVED BY: (LAB) 3.**
Signature: Time:	Signature: Time:	Signature: Time:
Printed Name: Date:	Printed Name: Date:	Printed Name: Date: FREDERICK W G ROTH JR.
Company:	Company:	Analytical Technologies, Inc. 2/27/90 1620

ATI Labs: San Diego (619)458-9141 • Phoenix (602)438-1530 • Seattle (206)228-8335 • Pensacola (904)474-1001 DISTRIBUTION: White, Canary - ANALYTICAL TECHNOLOGIES, INC. • Pink - ORIGINATOR

Analytical Technologies, Inc. 560 Naches Avenue, S.W., Suite 101, Renton, WA 98055, (206) 228-8335

ATI I.D. # 9005-138

GeoEngineers

MAY 30 1990

Routing
File

May 30, 1990

GeoEngineers, Inc.
2405-140th Ave. NE
Suite 105
Bellevue, WA 98005

Attention : Kathy Killman

Project Number : 186-106-B09

Project Name : -

On May 14, 1990 Analytical Technologies, Inc. received four soil samples for analysis. The samples were analyzed with EPA methodology or equivalent methods as specified in the attached analytical schedule. The results, sample cross reference, and the quality control data are enclosed.

Donna M. McKinney
Project Manager

Frederick W. Grothkopp
Technical Manager

FWG/tc

SAMPLE CROSS REFERENCE SHEET

CLIENT : GEOENGINEERS, INC.
PROJECT # : 186-106-B09
PROJECT NAME : -

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9005-138-1	B-32	05/14/90	SOIL
9005-138-2	B-33	05/14/90	SOIL
9005-138-3	B-35	05/14/90	SOIL
9005-138-4	MW-36	05/14/90	SOIL

----- TOTALS -----

MATRIX	# SAMPLES
SOIL	4

ATI STANDARD DISPOSAL PRACTICE

The samples from this project will be disposed of in thirty (30) days from the date of this report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ANALYTICAL SCHEDULE

CLIENT : GEOENGINEERS, INC.
PROJECT # : 186-106-B09
PROJECT NAME : -

ANALYSIS	TECHNIQUE	REFERENCE	LAB
PETROLEUM HYDROCARBONS	IR	EPA 418.1	R

R = ATI - Renton
SD = ATI - San Diego
T = ATI - Tempe
PNR = ATI - Pensacola
FC = ATI - Fort Collins
SUB = Subcontract

GENERAL CHEMISTRY RESULTS

CLIENT : GEOENGINEERS, INC. SAMPLE MATRIX : SOIL
PROJECT # : 186-106-B09
PROJECT NAME : - UNITS : mg/Kg

ATI I.D. #	CLIENT I.D.	PETROLEUM HYDROCARBONS
9005-138-1	B-32	22
9005-138-2	B-33	59
9005-138-3	B-35	47
9005-138-4	MW-36	19

GENERAL CHEMISTRY QUALITY CONTROL

CLIENT : GEOENGINEERS, INC.
PROJECT # : 186-106-B09
PROJECT NAME : -

SAMPLE MATRIX : SOIL
UNITS : mg/Kg

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
PETROLEUM HYDROCARBONS	9005-154-3	22	15	38	278	242	106
PETROLEUM HYDROCARBONS	9005-154-4	29	25	15	310	259	108
PETROLEUM HYDROCARBONS	BLANK SPIKE	N/A	N/A	N/A	297	250	119
PETROLEUM HYDROCARBONS	BLANK SPIKE	N/A	N/A	N/A	693	579	120

$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

$$\text{RPD (Relative \% Difference)} = \frac{(\text{Sample Result} - \text{Duplicate Result})}{\text{Average Result}} \times 100$$

AnalyticalTechnologies, Inc.
560 Naches Avenue SW, Suite 101 Renton, WA 98055

Chain of Custody - 9005-138

DATE 5/14/90 PAGE 1 OF 1

PROJECT MANAGER: Kathy Killman
COMPANY: GeoEngineers
ADDRESS: 2405 140th Ave NE. Suite 105
Bellevue, Wa. 98005
PHONE: 746-5200 SAMPLED BY: Galan McEnelly

LABORATORY NUMBER:

SAMPLE DISPOSAL INSTRUCTIONS

☑ ATI Disposal @ $5.00 each ☐ Return ☐ Pickup (will call)

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID	8010 Halogenated Volatiles	8020 Aromatic Volatiles	BETX ONLY	8240 GCMS Volatiles	8270 GCMS BNA	8310 HPLC PNA	8080 Pesticides & PCB's	PCB's ONLY	8140 Phosphate Pesticides	8150 Herbicides	WDOE PAH/HH (WAC 173)	418.1 (TPH)	413.2 Grease & Oil	8015 (Modified)	TOC 9060	TOX 9020	% Moisture	TCLP	Priority Pollutant Metals (13)	EPTOX Metals (8) Total	EP TOX Metals (8) EP EXT	NUMBER OF CONTAINERS
B-32	5/14/90	1230	Soil	-1												X										1
B-33		0915		-2												X										1
B-35		1100		-3												X	Rogie 5/16									1
MW-36	↓	1350	↓	-4												X										1

B - 32

PROJECT INFORMATION		SAMPLE RECEIPT	
PROJECT NUMBER: 186-106-B09		TOTAL NUMBER OF CONTAINERS	4
PROJECT NAME:		CHAIN OF CUSTODY SEALS Y/N/NA	N
PURCHASE ORDER NUMBER:		INTACT? Y/N/NA	NA
VIA:		RECEIVED GOOD COND./COLD	Y/Y

TAT: ☐ 24HR ☐ 48 HRS ☐ 72 HRS ☐ 1 WK ☑ 2 WKS (Normal)

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH DATA

SPECIAL INSTRUCTIONS:

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Time: 1610	Signature: Time:	Signature: Time:
Printed Name: Galan McEnelly Date: 5/14/90	Printed Name: Date:	Printed Name: Date:
Company: GeoEngineers	Company:	Company:
RECEIVED BY: 1.	**RECEIVED BY: 2.**	**RECEIVED BY: (LAB) 3.**
Signature: Time:	Signature: Time:	Signature: Time: 1710
Printed Name: Date:	Printed Name: Date:	Printed Name: V. PENNICK Date: 5/14/90
Company:	Company:	Analytical Technologies, Inc.

ATI Labs: San Diego (619)458-9141 • Phoenix (602)438-1530 • Seattle (206)228-8335 • P... (90...1901 RIB... W... ary ... TIC ... INCL INC. ORI

APPENDIX C

TREATABILITY STUDY FOR A HYDRAULIC OIL-CONTAMINATED SOIL SAMPLE

prepared for:
Geo Engineers
Bellevue, Washington

prepared by:
Remediation Technologies, Inc.
Kent, Washington

April 1990

1.0 INTRODUCTION

The following is a report on the treatability study for a hydraulic oil-contaminated soil sample obtained by Geo Engineers. This program involved bench-scale land treatment for the contaminated soil to measure the losses of total petroleum hydrocarbons (TPH) under controlled laboratory conditions. Samples were analyzed initially, two weeks, four weeks and six weeks for TPH content.

On site land treatment, possibly with microbial inoculation, is the proposed method for site remediation. Land treatment involves tillage, fertilization and irrigation of the soil in a controlled treatment area to maximize biological degradation of the contaminants at the site. Land treatment has been used successfully throughout the United States. The process relies on aerobic digestion, generally by indigenous microorganisms, under conditions designed to maximize aerobic biological activity, though removal by volatilization and photodegradation may also occur.

The objectives of this bioremediation plan were to determine whether the concentrations of contaminants of interest can be reduced through biodegradation to acceptable levels. This treatability test is a screening technique designed to demonstrate the feasibility of the approach and provide information valuable to the design of a full-scale treatment system.

2.0 EXPERIMENTAL APPROACH

2.1 Waste Characterization

A bulk soil sample was collected by Geo Engineers and hand delivered to the ReTec laboratory on February 14, 1990. The soil sample was contained in a five-gallon bucket. The soil was homogenized and sieved through a 5/8 inch sieve. The texture appeared to be silty-sand.

Initial characterization performed on the soil included pH, enumeration of total microbial counts and dry weights. Initial soil samples were submitted for TPH analysis by IR (method 418.1).

2.2 Experimental Design

The bench scale land treatment study was performed to determine the extent of loss of constituents under controlled laboratory conditions. Duplicate soil pans were set up to simulate land treatment of the soil sample. The 18" x 12" polypropylene pans, labeled 'Pan A' and 'Pan B', each contained 1.5 kilograms (dry weight) of the sample soil. Initial microbial counts showed the soil contained low numbers of indigenous microorganisms ($1x10^{4}$ cells/g soil), so each pan was inoculated with 20 ml of known oil-and hydraulic oil-degraders.

Analysis of total volatile solids (TVS) was performed on the sample soil by burning the soil at 550°C. Determination of TVS gives an estimation of the organic matter content of the sample soil from which the required nutrient concentrations can be calculated using C:N:P ratios. A C:N:P ratio of 100:5:1 is considered optimal for biological treatment processes. Nutrients were added initially and at one week as 500 ppm nitrogen (as $(NH_4)_2SO_4$) and 300 ppm phosphorous (as KH_2PO_4 and K_2HPO_4).

The pans were covered with polyethylene film to reduce moisture losses while allowing transfer of respiratory gases. The pans were placed in an incubator at 35°C. The target weight of the pans were maintained by watering and tilling two to three times a week.

2.3 Monitoring

Monitoring of the soil pans included pH measurements, enumeration of total aerobic heterotrophic microorganisms and dry and volatile solids.

The pH of the soil was measured from a slurry made by mixing a small sample of the soil with deionized water. The pH of the soil was maintained between 6.5 and 7.0 by adding $Ca(OH)_2$. The initial pH of the soil was 5.4, so $Ca(OH)_2$ was added to raise the pH to approximately 6.5.

To enumerate for total aerobic heterotrophic microorganisms, a subsample was taken (one gram) from each soil pan, serially diluted and plated on a general growth media. The number of total microorganisms in the soil pans were initially low ($1x10^4$ cells/g soil), so inoculum of known hydraulic fuel and oil degraders was added (Table 1). After inoculation, the total numbers increased to $4x10^7$ cells/g soil, then decreased to $1x10^6$ cells/g soil at six weeks. The total numbers at six weeks were still typical of active landfarming operations (10^7-10^6 cells/g soil), which shows that toxicity or inhibition of biological activity is not a problem in this soil.

3.0 CHEMICAL ANALYSIS

3.1 TPH Losses

Each pan was sampled at time zero, two-weeks, four-weeks and six weeks. Duplicate samples were taken from each pan. One sample from each pan was analyzed for TPH (by method 418.1) and the other sample was saved for possible later analysis. Copies of the analytical reports are given in Appendix A.

The initial TPH concentrations of the sample soil was 621 mg/kg $\pm$ 3 as shown in Table 2 (an average of duplicate samples). At four weeks, the TPH concentration was 87 mg/kg $\pm$ 24 which represents a 86 percent loss of TPH. By six weeks, the TPH concentration was 43 mg/kg $\pm$ 17 which is well below levels of concern (100 mg/kg) and represents a 93 percent loss.

Comparison of TPH losses to the concentration of total microorganisms present during the treatment period shows a correlation. As the TPH concentrations decrease, the microorganisms also decrease most likely due to the decrease in carbon content.

Zero and first-order kinetic analysis was performed on the TPH data (Table 3). First-order kinetics had a much better correlation coefficient than zero-order as seen in Figure 1. The calculated half-life of TPHs, assuming first-order degradation rates, was 10 days.

3.2 QA/QC

The analytical procedures used to measure TPH concentrations was EPA method 418.1. U.S. EPA methods, controls and standards were followed and validated laboratory quality assurance was strictly adhered to.

Chain-of-custody procedures were used when submitting soil and water samples for analysis. Request for analysis forms were used to submit samples for analysis. Copies of all chain-of-custody and request for analysis forms used in this study can be found in Appendix A.

TABLE 1

Enumeration of Total Aerobic Heterotrophic Microorganisms for Geo Engineers Pan Treatability Study

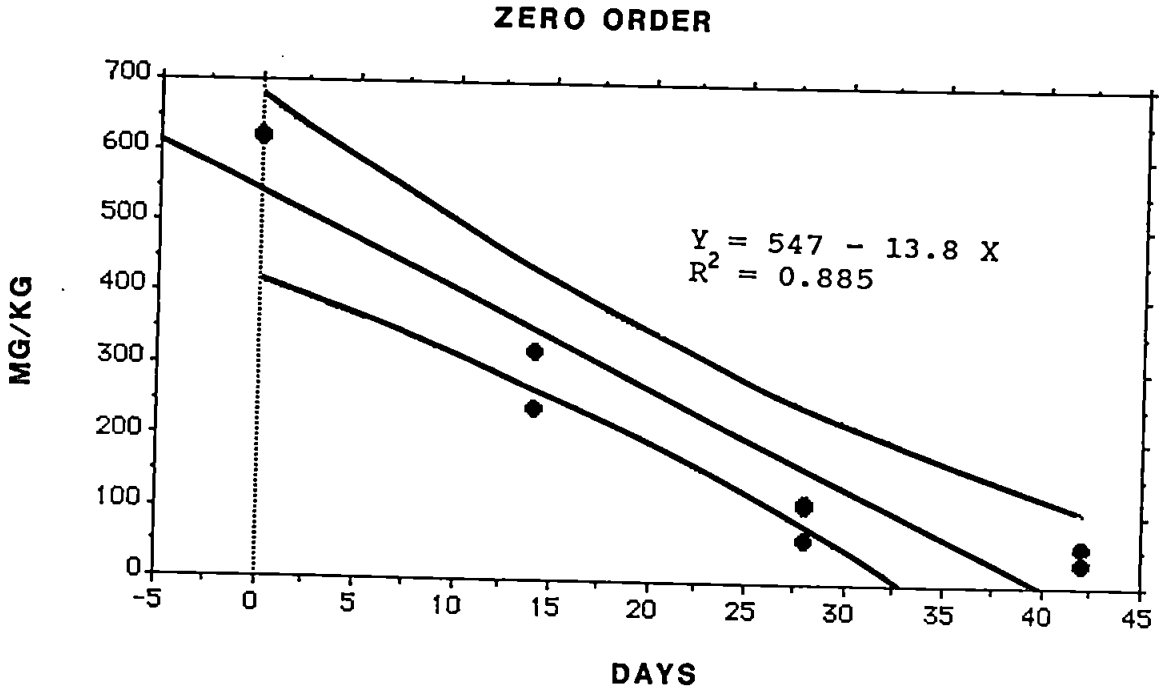
Sample ID	Initial Soil (10^4)	Week 2 (10^6)	Week 4 (10^6)	Week 6 (10^6)
		- - - - - - - - cells/g soil* - - - - - - -		
Initial Soil	1.0			
Pan A		40.3	19.5	1.2
Pan B		40.0	13.5	1.4
Mean		40.2	16.5	1.3
Std. Dev.		0.2	3.0	0.1

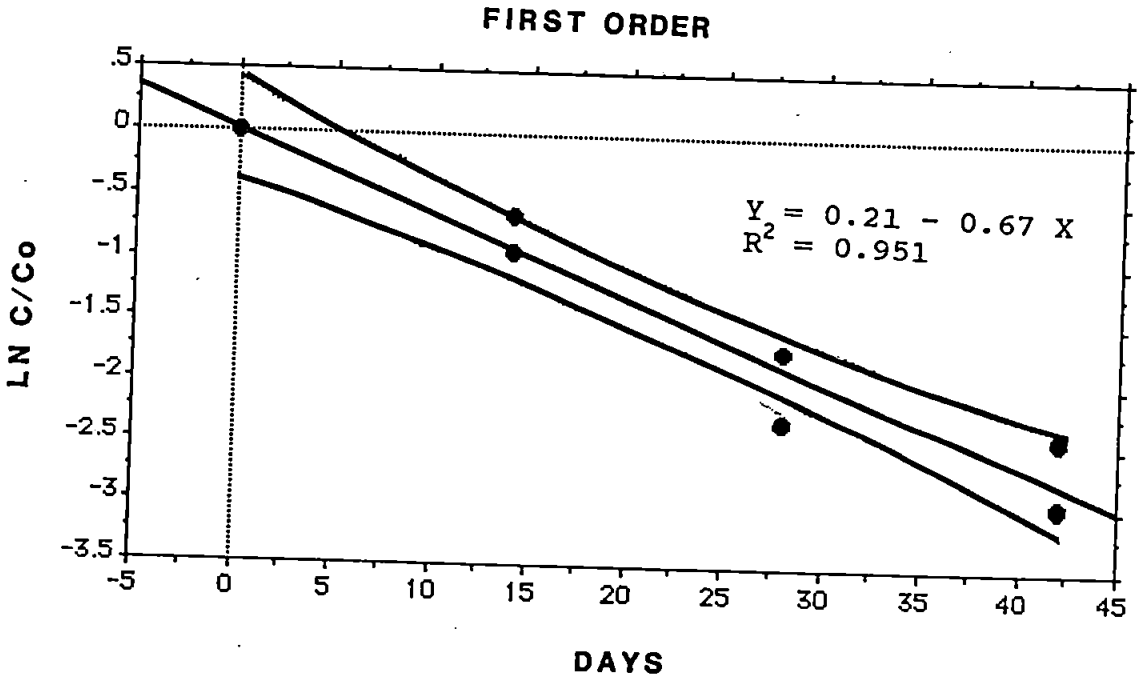
* Results reported as cells/gram of soil on a wet weight basis.

TABLE 2

Total Petroleum Hydrocabon (TPH) Concentrations in
Geo Engineers Pan Treatability Study

Sample ID	Time 0	Week 2	Week 4	Week 6
		(mg/kg)		
Pan A	623	242	63	31
Pan B	618	321	111	55
Mean	621	282	87	43
Std. Dev.	3	40	24	17





ZERO- AND FIRST-ORDER DEGRADATION RATES, WITH 95% CONFIDENCE INTERVALS	FIGURE 1

TABLE 3

Zero and First-Order Kinetic Coefficients and Corresponding R-Squared Values for TPH Measurements of Geo Engineers Treatability Project

First Order			Zero Order	
K (1/day)	R^2	1/2 life[1] (days)	K (1/day)	R^2
0.067	0.951	10	13.76	0.885

[1] 1/2 life = -ln 0.5/K

4.0 CONCLUSIONS AND RECOMMENDATIONS

The results showed that the proposed method of site remediation can successfully treat the hydraulic oil-contaminated soil collected by Geo Engineers.

Within four weeks of bench-scale land treatment, a TPH loss of 86 percent was seen resulting in a concentration of 87 mg/kg TPH which is below levels of concern (100 mg/kg). By six weeks, the TPH loss was 93 percent (to 43 $\pm$ 17 mg/kg).

The half-life of TPH in the contaminated soil was determined to be 10 days using first-order kinetics. The statistical evaluation indicated that this estimate provided an excellent fit to the data from the laboratory testing. These represent maximum loss rates, since the temperature was relatively high and constant, and moisture content could be carefully controlled.

In the field, our experience suggests that the loss rates would be expected to be roughly two to three times slower (a half life of roughly one month). Thus concentrations could be reduced from 600 mg/kg to under 200 mg/kg in approximately two months of treatment.

Initial microbial counts were low, so an inoculum of known hydraulic fuel and oil degraders was added. After the inoculum was added, a healthy population of microorganisms was sustained which shows that toxicity or inhibition of biological activity was not a problem in this soil.

For full-scale treatment in the field, we recommend fertilization to achieve the levels used in the laboratory testing (1000 ppm N and 600 ppm P, split into two applications at one-month intervals). Adjustment of the pH should also be done, since the initial pH in our samples (5.4) was below optimal levels. A target pH of 6.5-7.5 is generally considered optimal. Addition of 1000 ppm of calcium hydroxide was found to be sufficient to achieve a near-neutral pH (7.0) in this study.

Inoculation was performed in this study because our experience has indicated that hydraulic oils are generally difficult to degrade and inoculation is often effective. We cannot say from this study if inoculation was necessary for success in this testing. If the volume of contaminated materials warrants the effort, inoculation could be done on site to ensure effective treatment.

APPENDIX A

Analytical Reports

DESCRIPTION OF ANALYZED SAMPLES

ReTec ID	Sample ID	Description
02-019-01 02-019-05	GeoPan A1 T0 GeoPan B1 T0	Time zero samples submitted for TPH analysis (method 418.1)
02-019-08	GeoPan B4 T0	Time zero (saved) sample submitted for reanalysis of TPH (method 418.1)
02-030-01 02-030-04	GeoA-2A GeoB-2A	2-wk sample from pan A 2-wk sample from pan B Both samples submitted for analysis of TPH (method 418.1)
03-019-01 03-019-04	A1-wk4 B1-wk4	4-wk sample from pan A 4-wk sample from pan B Both samples submitted for analysis of TPH (method 418.1)
03-044-01A 03-044-02A	A-6wk-1 B-6wk-1	6-wk sample from pan A 6-wk sample from pan B Both samples submitted for analysis of TPH (method 418.1)

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS

4630 PACIFIC HIGHWAY EAST, SUITE B-14, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

Report To: RETEC Date: February 16, 1990

Report On: Analysis of Soil Lab No.: 9895

IDENTIFICATION:
Samples Received on 2-15-90
Project: GeoEngineers

ANALYSIS:

Lab Sample No: 1 Client ID: 02-019-01 Geo Pan A1

Total Petroleum Hydrocarbons, mg/kg 1,332
by EPA Method 418.1

Lab Sample No: 2 Client ID: 02-019-05 Geo Pan B1

Total Petroleum Hydrocarbons, mg/kg 618
by EPA Method 418.1

SOUND ANALYTICAL SERVICES

for Brent Nyquist
STAN P. PALMQUIST

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS

4630 PACIFIC HIGHWAY EAST, SUITE B-14, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922- 5047

QUALITY CONTROL REPORT

DUPLICATES

Lab No: 9895
Date: February 16, 1990
Client: RETEC
Client ID: 02-019-01 GEO Pan A1
Matrix: Soil
Units: mg/kg

Compound	Sample(S)	Duplicate(D)	RPD*
Total Petroleum Hydrocarbons	1,332	1,211	9.5

*RPD = relative percent difference
= [(S - D) / ((S + D) / 2)] x 100

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS

4630 PACIFIC HIGHWAY EAST, SUITE B-14, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

Report To: Retec Date: March 2, 1990

Report On: Analysis of Soil Lab No.: 10095

IDENTIFICATION:
Samples Received on 3-1-90
Project: K90-382 GeoEngineers

ANALYSIS:

Lab Sample No.	Client Identification	Total Petroleum Hydrocarbons, ppm by EPA Method 418.1
1	02-019-08 GEO PAN B4-TO	623
2	02-030-01 GEO A-2A	242
3	02-030-04 GEO B-2A	321

SOUND ANALYTICAL SERVICES

STAN P. PALMQUIST

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS

4630 PACIFIC HIGHWAY EAST, SUITE B-14, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

QUALITY CONTROL REPORT

DUPLICATES

Lab No: 10095
Date: March 2, 1990
Client: Retec

Client ID: 02-030-04 GEO B-2A
Matrix: Soil
Units: ppm

Compound	Sample(S)	Duplicate(D)	RPD*	
Total Petroleum Hydrocarbons	321	318	0.9	

*RPD = relative percent difference
= [(S - D) / ((S + D) / 2)] x 100

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS

4630 PACIFIC HIGHWAY EAST, SUITE B-14, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

Report To: Retec Date: March 15, 1990

Report On: Analysis of Soil Lab No.: 10308

IDENTIFICATION:
Samples Received on 3-14-90
Project: K90-382 GeoEngineers

ANALYSIS:

Lab Sample No.	Client ID	Total Petroleum Hydrocarbons, mg/kg by EPA Method 418.1
1	03-019-01	62.9
2	03-019-04	111

SOUND ANALYTICAL SERVICES

STAN P. PALMQUIST

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS

4630 PACIFIC HIGHWAY EAST, SUITE B-14, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

QUALITY CONTROL REPORT

DUPLICATES

Lab No: 10308
Date: March 15, 1990
Client: Retec

Client ID: 03-019-04
Matrix: Soil
Units: mg/kg

Compound	Sample(S)	Duplicate(D)	RPD*	
Total Petroleum Hydrocarbons	111	95.9	14.6	

*RPD = relative percent difference
= [(S - D) / ((S + D) / 2)] x 100

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS

4630 PACIFIC HIGHWAY EAST, SUITE B-14, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

Report To: Retec

Date: March 30, 1990

Report On: Analysis of Soil

Lab No.: 10573

IDENTIFICATION:
Samples Received on 3-29-90
Project: K90-382 GeoEngineers

ANALYSIS:

Lab Sample No.	Client ID	Total Petroleum Hydrocarbons, ppm by EPA Method 418.1
1	03-044-01A	31.3
2	03-044-02A	55.1

SOUND ANALYTICAL SERVICES

C. LARRY ZURAW

SOUND ANALYTICAL SERVICES, INC.

SPECIALIZING IN INDUSTRIAL & TOXIC WASTE ANALYSIS

4630 PACIFIC HIGHWAY EAST, SUITE B-14, TACOMA, WASHINGTON 98424 - TELEPHONE (206)922-2310 - FAX (206)922-5047

QUALITY CONTROL REPORT

DUPLICATES

Lab No: 10573
Date: March 30, 1990
Client: RETEC

Client ID: 03-044-02A
Matrix: Soil
Units: ppm

Compound	Sample(S)	Duplicate(D)	RPD*	
Total Petroleum Hydrocarbons	55.1	47.3	15.2	

*RPD = relative percent difference
= [(S - D) / ((S + D) / 2)] x 100

RETEC LABORATORY: TRAVELER TRAVELER NO. 02-019

DISTRIBUTION: SUB
☐ VOA ☒ TPH ☐ PAH ☐ PHENOLS ☐ MISC. _____
☐ EXT/PREP ☐ LAB MGR. ☑ P.M. (ACKNOWLEDGE) ☑ SUB. SOUND ANAL

PROJECT(CLIENT): Geo Eng. DATE RECEIVED: ~~Subbed out~~ 2/15/
PROJECT NUMBER: DATE COLLECTED: 2-14/90
PROJECT CONTACT: Heidi Anderson VERBAL (RUSH) DUE:
PHONE: REPORT DUE:

METHOD HOLDING TIME DUE DATES:
VOA: _____ EXT: _____
OTHER: _____

QUALITY CONTROLS REQUIRED:
☑ STANDARD
☐ BATCH SPECIFIC ☐ DUP ☐ MS ☐ MSD

DASH	FIELD (PROJECT) ID	MATRIX	SIZE-QUANT	LOC.	ANALYSIS-METHOD
01	Geo Pan A1 T0	Soil	40mL Vial	F6	TPH 8 (To Sound)
02	2				Save
03	3				
04	4				
05	B1				TPH (TO Sound)
06	2				Save
07	3				
08	4				

Nº 000754

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
	Geo Eng.

SAMPLERS: (Signature)
Heidi Anderson

SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CONTAINERS	TPH by IR	REMARKS
02-019-01	2-14		Geo Pan A1 (TØ)	1	✓	
02-0905	2-14		Geo Pan B1 (TØ)	1	✓	

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
		B. Grady			
Heidi Anderson	2-15-90				
B. Grady	2/15 1035	Sound Analytical			

Received for Laboratory by: (Signature)	Date / Time
	2/15/90 11:01

REMARKS:

REIEC
REMEDIATION TECHNOLOGIES INC

REMEDIATION TECHNOLOGIES
22419 72nd Avenue South
Kent, Washington 98032
(206) 872-0247

RETEC LABORATORY: TRAVELER TRAVELER NO. 02-030

DISTRIBUTION: SUB

☐ VOA ☒ TPH ☐ PAH ☐ PHENOLS ☐ MISC. _____

☐ EXT/PREP ☐ LAB MGR. ☐ P.M. (ACKNOWLEDGE) ☐ SUB. _____

PROJECT(CLIENT): Geo Engineers	DATE RECEIVED: 2-28
PROJECT NUMBER: K90-382	DATE COLLECTED:
PROJECT CONTACT: Heidi	VERBAL (RUSH) DUE:
PHONE:	REPORT DUE:

METHOD HOLDING TIME DUE DATES:

VOA: _____ EXT: _____

OTHER: _____

QUALITY CONTROLS REQUIRED:

☐ STANDARD

☐ BATCH SPECIFIC ☐ DUP ☐ MS ☐ MSD

DASH	FIELD (PROJECT) ID	MATRIX	SIZE-QUANT	LOC.	ANALYSIS-METHOD
01	Geo A - 2A	Soil	40ml vial	F6	TPH (Subbed)
02	↓ 2B	↓	↓		Save
03	↓ 2C				↓
04	Geo B - 2A				TPH (SUB)
05	↓ 2B				Save
06	↓ 2C	↓	↓		↓

No 000788

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
1490-38d	Geo-Engineers

SAMPLERS: (Signature) Heidi Anderson

SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CONTAINERS	TPH by IR	REMARKS
02-019-08	2-28		Geo PanB4-T0	1	✓	Results to Heidi Anderson
02-030-01	2-28		Geo A-2A	1	✓	
02-030-04	2-28		Geo B-2A	1	✓	

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Heidi Anderson	3-1-90 1021	R. Peterson EMA 76 Courier	R. Peterson	3/1/90 11:20 AM	Jay Bolan SAS
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time		

REMARKS:

REIEC
REMEDIATION TECHNOLOGIES INC

REMEDIATION TECHNOLOGIES
22419 72nd Avenue South
Kent, Washington 98032
(206) 872-0247

RETEC LABORATORY: TRAVELER TRAVELER NO. 03-019

DISTRIBUTION:
☐ VOA ☒ TPH ☐ PAH ☐ PHENOLS ☐ MISC. _____
☐ EXT/PREP ☐ LAB MGR. ☐ P.M. (ACKNOWLEDGE) ☒ SUB. _____

PROJECT(CLIENT): Geo Engineers	DATE RECEIVED:
PROJECT NUMBER: K90-387	DATE COLLECTED: 3-13-90
PROJECT CONTACT: Heidi	VERBAL (RUSH) DUE:
PHONE:	REPORT DUE:

METHOD HOLDING TIME DUE DATES:
VOA: _____ EXT: _____
OTHER: _____

QUALITY CONTROLS REQUIRED:
☐ STANDARD
☐ BATCH SPECIFIC ☐ DUP ☐ MS ☐ MSD

DASH	FIELD (PROJECT) ID	MATRIX	SIZE-QUANT	LOC.	ANALYSIS-METHOD
01	A1-WK4	Soil	1-40ml Vial	R6	TPH 418.1 SUB
02	A2-WK4	↓	↓	↓	Save ↓
03	A3-WK4				
04	B1-WK4				TPH 418.1 SUB
05	B2-				Save ↓
06	B3- ↓				

№ 000797

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
K90-380	Geo Engineers

SAMPLERS: (Signature)
Heidi Anderson

SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CONTAINERS	TPH by IR (418.1)	REMARKS
03-09-01	3-13		A1-WK4	1	✓	
03-09-04	"		B1-WK4	1	✓	Send Results to: Heidi Anderson

C - 27

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Heidi Anderson	3-13	Carrier		3/14/90 9:30	Joy Burns
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)		Date / Time	

REMARKS:

REIEC
REMEDIATION TECHNOLOGIES INC

REMEDIATION TECHNOLOGIES
22419 72nd Avenue South
Kent, Washington 98032
(206) 872-[illegible]

RETEC LABORATORY: TRAVELER TRAVELER NO. 03-044

DISTRIBUTION:
☐ VOA ☐ TPH ☐ PAH ☐ PHENOLS ☐ MISC. _____
☐ EXT/PREP ☐ LAB MGR. ☐ P.M. (ACKNOWLEDGE) ☒ SUB. TPH

PROJECT(CLIENT): Geo Eng	DATE RECEIVED:
PROJECT NUMBER: K90-	DATE COLLECTED: 3-28
PROJECT CONTACT: Heidi	VERBAL (RUSH) DUE:
PHONE:	REPORT DUE:

METHOD HOLDING TIME DUE DATES:
VOA: _____ EXT: _____
OTHER: _____

QUALITY CONTROLS REQUIRED:
☐ STANDARD
☐ BATCH SPECIFIC ☐ DUP ☐ MS ☐ MSD

DASH	FIELD (PROJECT) ID	MATRIX	SIZE-QUANT	LOC.	ANALYSIS-METHOD
-01A	A-6WK-1	Soil	1-40g		TPH-418.1-Sub
01B	-2	↓	↓		Save
01C	-3				↓
02A	B-6WK-1				TPH 418.1 Sub
02B	-2				Save
02C	-3				↓

N= 000020

CHAIN OF CUSTODY RECORD

PROJ. NO.	PROJECT NAME
K90-380	Geo Engineers

SAMPLERS: (Signature)
Heidi Anderson

SAMPLE NO.	DATE	TIME	SAMPLE LOCATION	NO. OF CONTAINERS	TPH by IR (418.1)						REMARKS
044-01A	3-28		A-6wk-1	1	✓						Please Send results to:
044-02A	↓		B-6wk-1	1	✓						Heidi Anderson

C L 29

Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Heidi Anderson	3-28-90	Carrier		3/29/90 12:30	Jeff Baker
Relinquished by: (Signature)	Date / Time	Received by: (Signature)	Relinquished by: (Signature)	Date / Time	Received by: (Signature)
Relinquished by: (Signature)	Date / Time	Received for Laboratory by: (Signature)	Date / Time		

REMARKS:

REIEC
REMEDIATION TECHNOLOGIES INC

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