HARTCROWSER

Earth and Environmental Technologies

Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, Washington 98102-3699
Fax 206.328.5581
Tel 206.324.9530

J-3763-05

February 21, 1995

Mr. Kyle McCleary
Duwamish Shipyard, Inc.
5658 West Marginal Way SW
Seattle, Washington 98106

Re: Seasonal Groundwater Monitoring Results
Alaska Marine Lines Parcel
Duwamish Shipyards
Seattle, Washington

Dear Kyle:

This letter presents the results of the two most recent rounds of post-remediation groundwater quality monitoring conducted on the Duwamish Shipyard property located in Seattle, Washington (Figure 1). This work was performed in accordance with our July 29, 1994, approved proposal. The primary objective of this monitoring program is to verify that residual petroleum-containing soils present in the portion of the site leased by Alaska Marine Lines are not impacting groundwater quality. In the following sections, we present a brief summary of cleanup actions performed on the site and discuss the scope and results of the October and December 1994 post-remediation groundwater monitoring rounds. Laboratory analytical reports are included in Attachment A to this letter.

INDEPENDENT CLEANUP ACTIONS PERFORMED

In October of 1993, Hart Crowser assisted Duwamish Shipyard in performing an independent cleanup action to remove petroleum-containing soils present in the portion of the site leased by Alaska Marine Lines (Figure 2). The cleanup action included excavating and transporting approximately 650 cubic yards of petroleum-containing soil to the Holman, Inc. Seattle plant to be recycled into concrete. Eight of the 12 soil

verification samples collected from the side walls and bottom of the excavation contained concentrations of total petroleum hydrocarbons (TPH) below the MTCA Method A cleanup level of 200 mg/kg. As discussed in the Independent Remedial Action Closure Report dated June 29, 1994, some petroleum-containing soil could not be excavated because of the presence of existing structures (including a 26 KV buried utility line and the graving dock foundation) and a shallow groundwater table. Areas where soils containing petroleum hydrocarbon concentrations exceeding Method A cleanup levels could not be removed were capped with asphalt.

As part of the cleanup action program, two rounds of groundwater quality monitoring were conducted in February of 1994. Groundwater samples were collected from wells MW-1, MW-2, MW-4, and MW-5 (Figure 3) and analyzed for TPH, volatile aromatics (including benzene, toluene, ethylbenzene, and xylenes [BTEX]), and polynuclear aromatic hydrocarbons (PAHs). Static groundwater levels measured beneath the site ranged from 4 to 10 feet below ground surface. Groundwater within the uppermost water-bearing zone appeared to flow in a northeasterly direction.

Results of the February 1994 groundwater monitoring rounds indicated that shallow groundwater quality did not appear to be significantly impacted by the presence of petroleum-containing soils in the Alaskan Marine Lines lease area. No petroleum constituents were detected at concentrations exceeding MTCA groundwater or surface water cleanup levels. Low concentrations of diesel-range hydrocarbons were detected in well MW-2 (0.32 to 0.39 mg/L) located upgradient of the excavation area and in well MW-4 (0.37 to 0.66 mg/L) located downgradient of excavation area. Non-carcinogenic PAHs were detected in wells MW-1 and MW-4 at concentrations well below MTCA Method B surface water cleanup levels (Table 1). No volatile aromatic compounds were detected.

FIELD ACTIVITIES: DRY SEASON AND WET SEASON SAMPLING ROUNDS

As part of this work, two rounds of groundwater sampling were conducted to verify that site groundwater quality is not being impacted under high and low groundwater level conditions. The dry (low water) and wet season (high water) monitoring rounds were conducted on October 7 and December 8, 1994, respectively. Groundwater samples were collected from wells MW-1, MW-2, MW-4, and MW-5 using a stainless steel bailer. Purge water was drummed for subsequent disposal in the on-site wastewater treatment system. Blind replicate samples were collected from wells MW-5 (dry season event) and

MW-4 (wet season event). Groundwater pH, temperature, and specific conductivity were measured in the field.

To evaluate potential changes in groundwater flow directions, water levels were measured prior to sampling the wells. Static groundwater levels measured in the wells during the dry season sampling round ranged from 5.63 to 9.77 feet below ground surface (Table 1). Groundwater levels in the wet season were typically 1.5 feet higher than in the dry season with depths ranging from 4.07 to 8.22 feet below ground surface. Groundwater in the upper water-bearing zone appears to flow in a northeasterly direction during dry and wet season conditions (Figure 3). This flow direction is consistent with the conditions observed during the February 1994 sampling rounds.

GROUNDWATER QUALITY TESTING RESULTS

Groundwater samples were submitted for both sampling rounds to Laucks Testing Laboratories (Laucks) of Seattle, Washington, using standard chain of custody procedures. Samples were analyzed for total dissolved solids (EPA Method 160.1), diesel- and oil-range petroleum hydrocarbons (WTPH-D Extended), volatile aromatics including BTEX (EPA Method 8020), and PAHs (EPA Method 8310). This analytical program is consistent with the testing performed as part of the February 1994 sampling rounds.

Data Quality Review

Groundwater quality results produced by the laboratory were reviewed by an environmental geochemist to evaluate the validity of the data. The data quality review included evaluating sample holding times, method blank results, matrix spike and surrogate recoveries, and duplicate relative percent differences (RPDs). Laucks in-house control limits were used to evaluate surrogate and spike recoveries as well as duplicate RPDs. EPA Data Validation Functional Guidelines were used as guidance for qualifying the data, as appropriate.

The data were determined to be acceptable for the purposes of this work. Groundwater quality testing results, including data qualifiers, are summarized in Table 1.

Groundwater Compliance Data Results

Based on the results of the four post-remediation groundwater sampling rounds, residual petroleum hydrocarbons present in the Alaskan Marine Lines excavation area do not appear to be significantly impacting groundwater quality. Concentrations of petroleum hydrocarbons detected in wells MW-4 and MW-5 located downgradient of the excavation area are below MTCA surface water cleanup levels and are generally less than upgradient (wells MW-1 and MW-2) groundwater concentrations (Table 1).

Concentrations of diesel- and oil-range hydrocarbons and PAHs detected in wells MW-1 and MW-2 during the two most recent sampling rounds were higher than those observed during the February sampling rounds. No petroleum hydrocarbons or PAHs were detected in groundwater samples collected from well MW-1 during the February sampling rounds. Total concentrations of diesel- and oil-range hydrocarbons measured in well MW-1 during the October (15.9 mg/L) and December (127 mg/L) sampling rounds exceed the MTCA Method A groundwater cleanup level of 1 mg/L. Chromatograms of the hydrocarbons detected in well MW-1 do not contain fingerprint patterns indicative of common fuel or oil products. No strong petroleum odors or sheens were observed during sample collection.

Total carcinogenic PAH (cPAH) concentrations in well MW-1 also exceed the MTCA Method A groundwater cleanup level of 0.1 μg/L. The concentration of cPAHs in well MW-1 have increased from not detected during the February sampling rounds to 861 and 3,800 μg/L during the October and December 1994 sampling rounds, respectively.

Concentrations of total petroleum hydrocarbons and PAHs detected in well MW-2 appear to have increased slightly over the February sampling results. Total diesel- and oil-range hydrocarbons (1.47 mg/L) detected in the well MW-2 during the December sampling round slightly exceeds the MTCA Method A groundwater cleanup level of 1.0 mg/L. As with well MW-1, common fuel or oil product fingerprints were not observed in the sample chromatograms and no sheens or strong petroleum odors were detected during sampling of well MW-2.

Possible Sources of Hydrocarbons in Wells MW-1 and MW-2

We have identified several possible sources of hydrocarbons to wells MW-1 and MW-2 including subsurface accumulations of severely weathered or non-standard petroleum products, matrix interferences caused by the presence of peat and clay deposits, and surface water discharge. Boring logs of wells MW-1 and MW-2 created by

Environmental Service, Ltd. indicate that oil-like odors and staining were observed in well MW-2 but not in well MW-1. Diesel- and oil-range hydrocarbons were detected in several soil samples collected from well MW-2. The analytical laboratory indicated that the samples exhibited either a partial diesel or unresolved hydrocarbon pattern. No soil samples collected from well MW-1 were analyzed for petroleum hydrocarbons. It is possible that the relatively low concentration of petroleum hydrocarbons detected in well MW-2 groundwater are derived from residual, highly weathered petroleum that is present in nearby soils.

Peat and other naturally occurring organic material present beneath the site also may be the source of the elevated hydrocarbon detections. The presence of significant accumulations of naturally occurring organics often interferes with the accurate quantitation of total petroleum hydrocarbons and PAHs. The boring log from well MW-1 indicates that several layers of soil containing abundant "fresh wood" and other organics were present. Groundwater sampled in well MW-1 during the last two sampling rounds appeared to be much more turbid than during the February sampling rounds and exhibited a "black coffee-like" appearance. The presence of high concentrations of suspended organic particulates may result in elevated petroleum hydrocarbon and PAH detections. The lack of strong petroleum odors or sheens and the unusual hydrocarbon fingerprint observed in well MW-1 indicate that organics may be causing the observed hydrocarbon detections. The presence of suspended organics may also be impacting the quantitation of hydrocarbons in well MW-2 groundwater.

Surface water runoff entering MW-1 and MW-2 well casings may also act as a source of hydrocarbons. Wells MW-1 and MW-2 are flush-mounted and are located in low spots where surface water accumulation can occur. During the December sampling round, we observed that well MW-1 had a significant accumulation of oily grime around the opening to the 2-inch PVC casing and that surface water was entering into the MW-2 well casing. The area surrounding wells MW-1 and MW-2 is paved and is exposed to vehicle traffic. Surface water runoff from this area would likely periodically contain detectable concentrations of petroleum hydrocarbons.

CONCLUSIONS AND RECOMMENDATIONS

Based on the results of the groundwater quality testing conducted to date, residual petroleum hydrocarbons present in the Alaskan Marine Lines excavation area do not appear to be significantly impacting groundwater quality. However, we recommend that groundwater monitoring be continued on an annual basis for the next four years to

confirm these findings. Sampling should conducted using techniques that will provide a more realistic assessment of groundwater quality in wells MW-1 and MW-2. The wells should be redeveloped to remove sediment that has accumulated in the well screens and samples should be collected using a pump to minimize turbidity. In addition, actions should be taken to eliminate potential surface water discharge into wells MW-1 and MW-2. A reasonable solution would be to extend the 2-inch PVC casing upward several inches in both wells by means of couplings and possibly altering surface water drainage in the vicinity of the wells.

I will contact you in the next few weeks to arrange a meeting at which we can discuss these recommendations. Meanwhile, if you have any questions or comments concerning this report, I can be reached at (206) 324-9530.

Sincerely,

HART CROWSER, INC.

David W. Templeton

DAVID W. TEMPLETON
Project Manager

Scott S. Shock

SCOTT S. SHOCK
Staff Hydrogeologist

Michael W. Ehlebracht

MIKE W. EHLEBRACHT
Environmental Geochemist

DWT/SSS/MWE:sde
ALASMARI.ltr

Attachments:

Table 1 - Summary of Groundwater Quality Testing Data
Figure 1 - Vicinity Map
Figure 2 - Site Plan
Figure 3 - Groundwater Elevation Contour Map

Table 1 - Summary of Groundwater Quality Testing Data

	MW-1				MW-2				MTCA
	02/08/1994	02/14/1994	10/07/1994	12/08/1994	02/08/1994	02/14/1994	10/7/199	12/8/1994	Cleanup
Relative Water Level	low	high	low	high	low	high	low	high	Level (1)
Depth to Water	4.64	4.19	5.75	4.24	4.48	4.04	5.63	4.07	
Field Parameters									
Temperature in °C	10	7	19	10	10	7	17	9	< 21
pH	7.2	7.2	6.6	6.6	7.2	7.6	6.6	6.7	6.5-8.5
Conductivity in µmhos	740	550	680	880	740	110	410	710	NDA
Total Dissolved Solids in mg/L	NA	340	420	570	380	77	290	420	NDA
Petroleum Hydrocarbons (WTPH-D ext) in mg/L									
Diesel (C12-C24)	0.25 U	0.25 U	4.9	31 J	0.32	0.39	0.39	0.64	1.0
Oil (C24-C36)	0.75 U	0.75 U	11	86 J	0.75 U	0.75 U	0.75 U	0.83	1.0
BTEX (EPA Method 8020) in µg/L									
Benzene	0.5 U	0.5 U	0.45 U	0.45 U	0.5 U	0.5 U	0.45 U	0.45 U	71
Toluene	0.5 U	0.5 U	0.55 U	0.55 U	0.5 U	0.5 U	0.55 U	0.55 U	48,500
Ethylbenzene	0.5 U	0.5 U	0.50 U	0.50 U	0.5 U	0.5 U	0.50 U	0.50 U	6,900
Xylenes	0.5 U	0.5 U	1.4 U	1.4 U	0.5 U	0.5 U	1.4 U	1.4 U	500,000

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Table 1 - Summary of Groundwater Quality Testing Data

	MW-4				MW-5				MTCA
	02/08/1994	02/14/1994	10/07/1994	12/08/1994	02/08/1994	02/14/1994	10/07/1994	12/08/1994	Cleanup
Relative Water Level	low	high	low	high	low	high	low	high	Level (1)
Depth to Water	8.92	8.41	9.77	8.22	8.53	10.02	9.23	7.9	
Field Parameters									
Temperature in °C	9	6	18	16	11	11	15	13	< 21
pH	7.5	7.4	7.1	5.8	7.2	7.1	6.5	6.8	6.5-8.5
Conductivity in µmhos	370	190	31	240	1610	1450	1290	1470	NDA
Total Dissolved Solids in mg/L	110	130	220	160	1100	1100	1100	1000	NDA
Petroleum Hydrocarbons (WTPH-D ext) in mg/L									
Diesel (C12-C24)	0.66	0.37	0.62	0.55	0.25 U	0.25 U	0.25 U	0.25 U	1.0
Oil (C24-C36)	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	0.75 U	1.0
BTEX (EPA Method 8020) in µg/L									
Benzene	0.5 U	0.5 U	0.45 U	0.45 U	0.5 U	0.5 U	0.45 U	0.45 U	71
Toluene	0.5 U	0.5 U	0.55 U	0.55 U	0.5 U	0.5 U	0.55 U	0.55 U	48,500
Ethylbenzene	0.5 U	0.5 U	0.50 U	0.50 U	0.5 U	0.5 U	0.50 U	0.50 U	6,900
Xylenes	0.5 U	0.5 U	1.4 U	1.4 U	0.5 U	0.5 U	1.4 U	1.4 U	500,000

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Table 1 - Summary of Groundwater Quality Testing Data

	MW-1				MW-2				MTCA
	02/08/1994	02/14/1994	10/07/1994	12/08/1994	02/08/1994	02/14/1994	10/7/199	12/8/1994	Cleanup
Relative Water Level	low	high	low	high	low	high	low	high	Level (1)
Polynuclear Aromatic Hydrocarbons (EPA 8310) in µg/L									
Naphthalene	0.49 U	0.48 U	17 J	250 J	0.49 U	0.48 U	1.9 U	1.8 U	988
Acenaphthylene	0.98 U	0.96 U	9.7 J	95 U	0.97 U	0.96 U	0.98 U	0.95 U	NDA
1-Methylnaphthalene	0.49 U	0.48 U	NA	NA	0.49 U	0.48 U	NA	NA	NDA
2-Methylnaphthalene	0.49 U	0.48 U	NA	NA	0.49 U	0.48 U	NA	NA	NDA
Acenaphthene	0.90	0.88	8.7 U	85 U	0.49 U	0.48 U	0.88 U	0.85 U	643
Fluorene	0.098 U	0.096 U	4.1	54	0.097 U	0.096 U	0.027 J	0.048 J	3,460
Phenanthrene	0.049 U	0.11	120	660	0.049 U	0.048 U	0.14	0.32	NDA
Anthracene	0.049 U	0.048 U	15 J	5.5 U	0.049 U	0.048 U	0.020 J	0.10 J	25,900
Fluoranthene	0.098 U	0.096 U	650	4000 J	0.097 U	0.096 U	0.28 J	1.3 J	90
Pyrene	0.098 U	0.096 U	480	2300	0.097 U	0.096 U	0.15 J	1.2	2,590
+ Benzo(a)anthracene	0.098 U	0.096 U	100	590	0.097 U	0.096 U	0.038 J	0.28	0.030
+ Chrysene	0.098 U	0.096 U	230	1300	0.097 U	0.096 U	0.10 J	0.63	0.030
+ Benzo(b)fluoranthene	0.098 U	0.096 U	200	9.5 U	0.097 U	0.096 U	0.12	0.095 U	0.030
+ Benzo(k)fluoranthene	0.098 U	0.096 U	83	580	0.097 U	0.096 U	0.027 J	0.21	0.030
+ Benzo(a)pyrene	0.098 U	0.096 U	110	630	0.097 U	0.096 U	0.10	0.39	0.030
+ Dibenzo(ah)anthracene	0.2 U	0.19 U	28 J	170	0.19 U	0.19 U	0.11 U	0.11 U	0.030
Benzo(ghi)perylene	0.098 U	0.096 U	160	780	0.097 U	0.096 U	0.12 J	0.65 J	NDA
+ Indeno(1,2,3-cd)pyrene	0.098 U	0.096 U	110	530	0.097 U	0.096 U	0.079	0.40	0.030
Total cPAH (2)	ND	ND	861	3800	ND	ND	0.46	1.91	0.1

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Table 1 - Summary of Groundwater Quality Testing Data

	MW-4				MW-5				MTCA
	02/08/1994	02/14/1994	10/07/1994	12/08/1994	02/08/1994	02/14/1994	10/07/1994	12/08/1994	Cleanup
Relative Water Level	low	high	low	high	low	high	low	high	Level (1)
Polynuclear Aromatic Hydrocarbons (EPA 8310) in µg/L									
Naphthalene	8.9	0.97	22	1.7 J	0.49 U	0.48 U	1.8 U	1.8 U	988
Acenaphthylene	3.4	1.4	0.98 U	0.95 U	0.97 U	0.96 U	0.96 U	0.95 U	NDA
1-Methylnaphthalene	1.8	0.55	NA	NA	0.49 U	0.48 U	NA	NA	NDA
2-Methylnaphthalene	4.8	4.1	NA	NA	0.49 U	0.48 U	NA	NA	NDA
Acenaphthene	4.2	2.8	16	2.9	0.49 U	0.48 U	0.86 U	0.85 U	643
Fluorene	4.8	3.3	13	1.9	0.097 U	0.096 U	0.041 J	0.064 J	3,460
Phenanthrene	1.7	1.2	4.0	0.29	0.049 U	0.048 U	0.11	0.062 J	NDA
Anthracene	0.2	0.15	0.95	0.055 U	0.049 U	0.048 U	0.013 J	0.017 J	25,900
Fluoranthene	0.097 U	0.096 U	1.2 J	0.29 J	0.097 U	0.096 U	0.16 J	0.30 U	90
Pyrene	0.097 U	0.13	0.25 J	0.12 U	0.097 U	0.096 U	0.074 J	0.12 U	2,590
+ Benzo(a)anthracene	0.097 U	0.096 U	0.023 J	0.020 J	0.097 U	0.096 U	0.024 J	0.060 U	0.030
+ Chrysene	0.097 U	0.096 U	0.031 U	0.025 J	0.097 U	0.096 U	0.035 J	0.014 J	0.030
+ Benzo(b)fluoranthene	0.097 U	0.096 U	0.098 U	0.095 U	0.097 U	0.096 U	0.096 U	0.095 U	0.030
+ Benzo(k)fluoranthene	0.097 U	0.096 U	0.082 U	0.080 U	0.097 U	0.096 U	0.081 U	0.080 U	0.030
+ Benzo(a)pyrene	0.097 U	0.096 U	0.093 U	0.090 U	0.097 U	0.096 U	0.023 J	0.090 U	0.030
+ Dibenzo(ah)anthracene	0.19 U	0.19 U	0.11 U	0.11 U	0.19 U	0.19 U	0.11 U	0.11 U	0.030
Benzo(ghi)perylene	0.097 U	0.096 U	0.16 U	0.079 J	0.097 U	0.096 U	0.16 U	0.16 U	NDA
+ Indeno(1,2,3-cd)pyrene	0.097 U	0.096 U	0.077 U	0.026 J	0.097 U	0.096 U	0.076 U	0.075 U	0.030
Total cPAH (2)	ND	ND	0.023	0.071	ND	ND	0.082	0.014	0.1

U = Not detected at the detection limit indicated

J = Estimated value

NDA = No data available to calculate a cleanup level

+ = Carcinogenic Polynuclear Aromatic Hydrocarbon (cPAH)

ND = Not detected above the analytical detection limit

NA = Not Available

(1) Based on protection of surface water (MTCA Method B)

(2) Total cPAHs calculated using detected values only.

376305/WQ-DATA.xls

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Vicinity Map

0 1/2 1

Scale in Miles

N

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Figure 1

cvd 2/22/95 1=200 HC.pcp

37630401

Site Plan

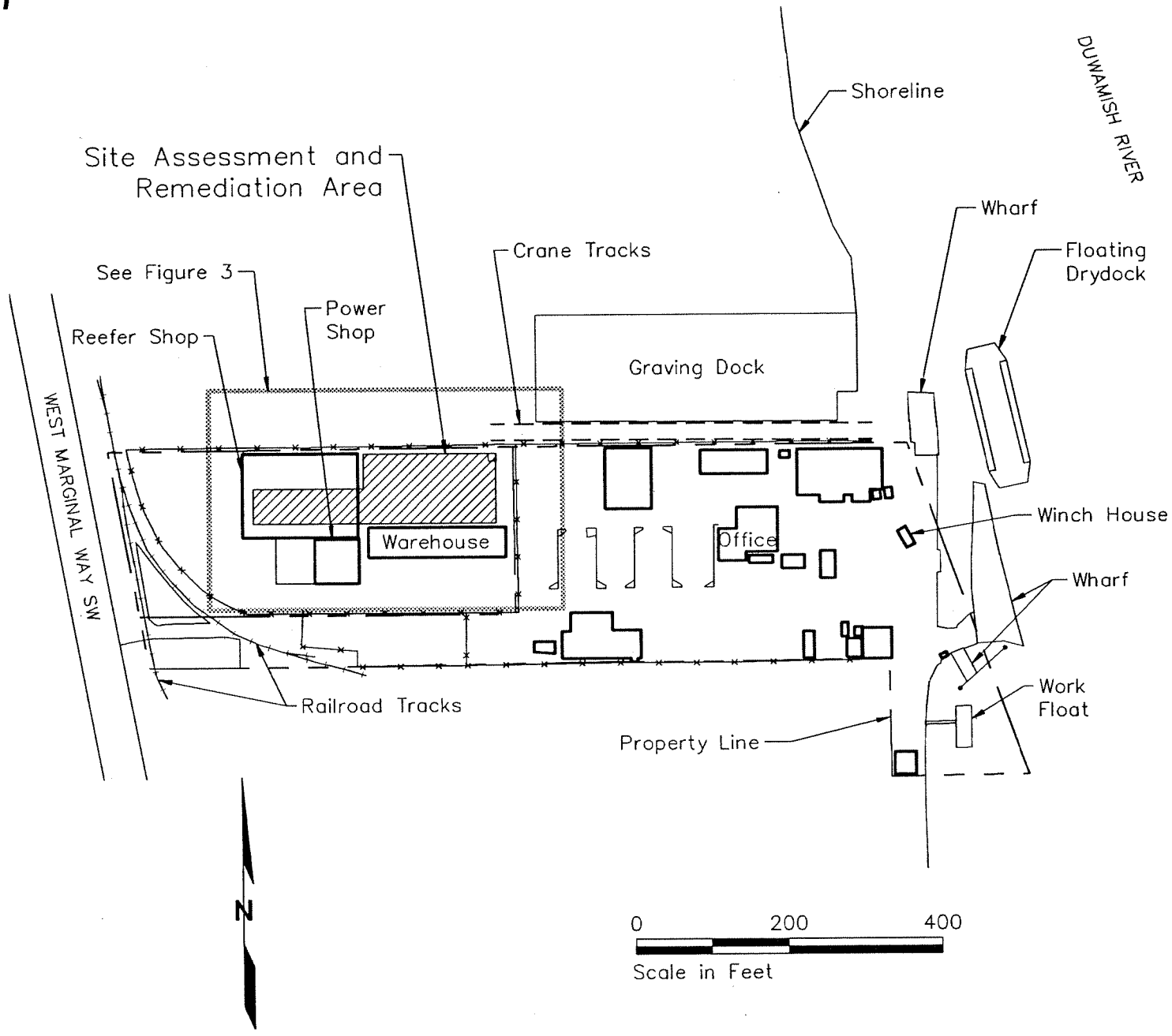

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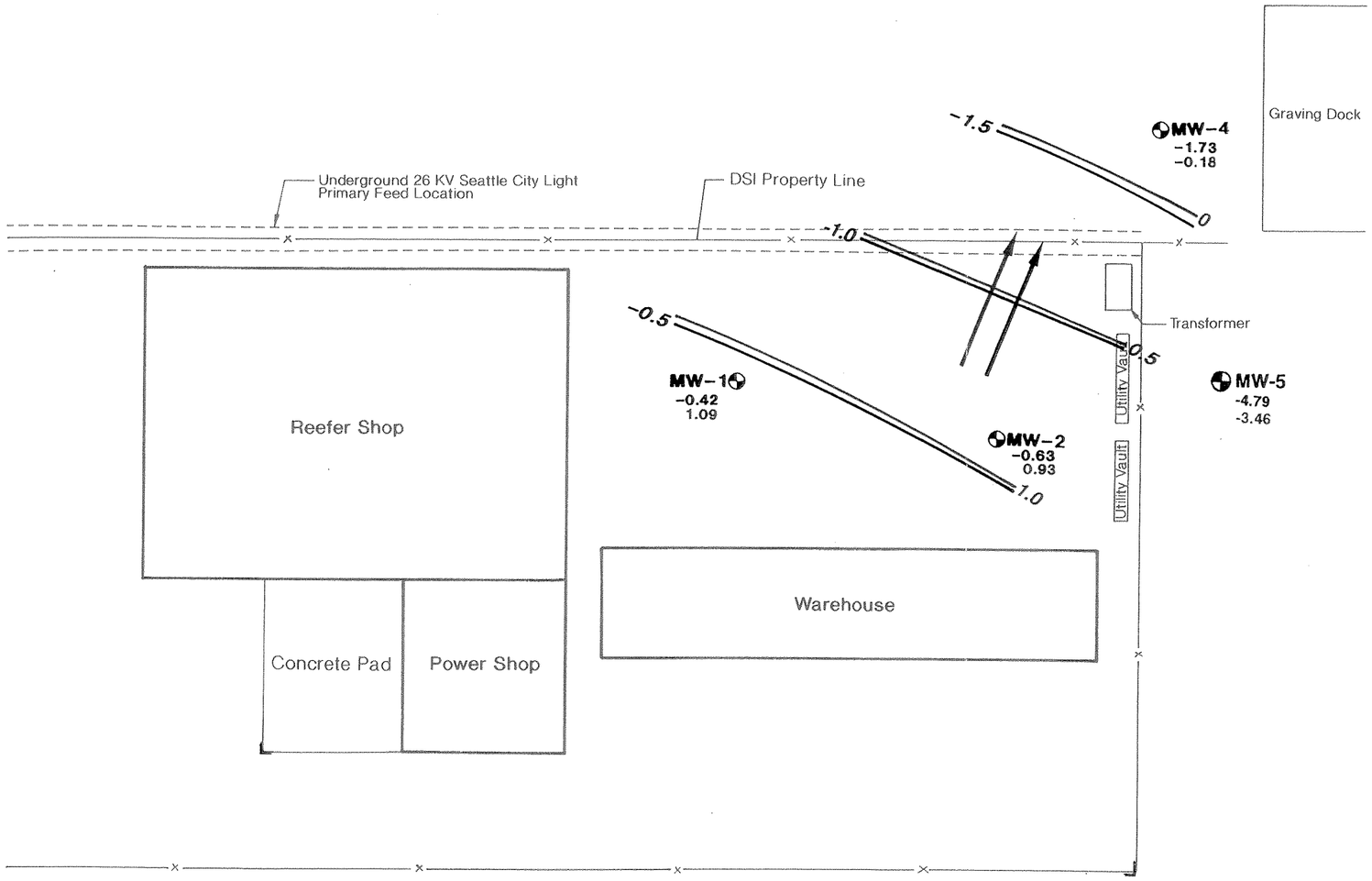
Figure 2

Groundwater Elevation Contour Map



MW-1 Monitoring Well Location and Number

Groundwater Elevation in Feet

-0.42 Dry Season 1.09 Wet Season

Groundwater Elevation Contour in Feet

—1.5— Dry Season —0.5— Wet Season

Groundwater Flow Direction

Dry Season Wet Season

Notes: 1. Dry season measurements were made on 10/7/94. Wet season measurements were make on 12/8/94.

2. Water level data from well MW-5 was not used to develop the groundwater elevation contours because it appears to be screened in a different water-bearing zone than the other wells.

0 50 100

Scale in Feet

N

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Figure 3

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ATTACHMENT A
LABORATORY CERTIFICATES OF ANALYSIS
ANALYTICAL TECHNOLOGIES, INC.

Laucks Since 1908
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX (206) 767-5063
Chemistry, Microbiology, and Technical Services

Certificate of Analysis

CLIENT: Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, WA 98102

ATTN : David Templeton

Work Order# : 94-10-270
DATE RECEIVED : 10/07/94
DATE OF REPORT: 11/02/94
CLIENT JOB ID : Job No. 3763-05/Templeton

Work ID : Duwamish Shipyards
Taken By : Client
Transported by: Hand Delivered
Type : Water

SAMPLE IDENTIFICATION:

	Sample Description	Collection Date
01	MW-1	10/07/94 12:15
02	MW-2	10/07/94 12:30
03	MW-4	10/07/94 11:00
04	MW-5	10/07/94 13:30
05	MW-6	10/07/94 13:45
06	Trip Blank	10/07/94 12:00

GENERAL COMMENTS ON METHOD 8310 QUANTITATION:

Sample quantitation is made from the UV detector responses. Confirmation is made from the fluorescence detector. To be reported as a detected value, all analytes except acenaphthylene, fluorene, chrysene, and indeno(123-cd)pyrene, which do not give a fluorescence response, are confirmed by the fluorescence detector.

COMMENTS ON VOLATILE ANALYSIS:

The pH measurement of sample 9410270-01 was 6 for both sample vials. Since the sample was analyzed within seven days from the date of collection, the elevated pH of sample -01 does not negatively impact the data. The pH measurement for all other samples was 2.

Laucks Since 1908
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX (206) 767-5063
Chemistry, Microbiology, and Technical Services

CLIENT : Hart Crowser, Inc.

Certificate of Analysis

Work Order# : 94-10-270

COMMENTS ON 8310 ANALYSIS:

Naphthalene and phenanthrene demonstrated low recoveries in the MS/MSD pair. Fluorene recovery could not be quantitated in the MS and the RPD was out of control due to MS/MSD dilutions and high levels of this analyte in the native sample. All blank spike recoveries were within control limits.

ATTACHMENTS:

Following presentation of sample results, the following appendices are attached to this report:

Appendix A: Method Blanks & Surrogate Recoveries Reports
Appendix B: MS/MSD, MS/Duplicate & Duplicate Reports
Appendix C: Blank Spike Recovery Report
Appendix D: Chain-of-Custody

Unless otherwise instructed all samples will be discarded on 12/05/94

Respectfully submitted,
Laucks Testing Laboratories, Inc.

John M. Buerger

Laucks Since 1908
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX (206) 767-5063
Chemistry, Microbiology, and Technical Services

USING OUR REPORTS

Laucks uses an electronic Laboratory Information Management System that produces both our reports and invoices. The following information and definitions will help you understand our reports, and we encourage you to call us if your questions are not answered here.

SAMPLE IDENTIFICATION - Sample IDs are recorded as they appear on your sample containers or chain-of-custody documents.

TEST RESULTS - Analyses that result in a single data point are shown in alphabetical order in the body of the report. Tests that yield multiple results are generally reported on separate pages, on a sample-by-sample basis.

MEASUREMENT UNITS - The reporting units are shown to the right of the analyte name. In the event that a different unit was more appropriate to a specific sample, that exception is shown immediately beneath the test result. Units commonly employed are mg/kg (solids) or mg/L (liquids), comparable to parts per million; ug/kg (solids) or ug/L (liquids), comparable to parts per billion; and percent (%).

METHODS OF ANALYSIS - The EPA or Standard Methods method number is shown in parentheses after the analyte name when field size allows; or, for analyses that yield multiple data points, in the header information on the individual report page.

ABBREVIATIONS - Several abbreviations can appear in our reports. The most commonly employed abbreviations are:

U : The analyte of interest was not detected, to the limit of detection indicated.

B : The analyte of interest was detected in the method blank associated with the sample, as well as in the sample itself. The B flag is applied without regard to the relative concentrations detected in the blank and sample.

J : The analyte of interest was detected below the routine reporting limit. This value should be regarded as an estimate.

T : The flagged values represent the SUM of two co-eluting compounds. The SUM of these two values is shown as though it were a result for each of them. The two figures should not be added together.

Laucks Since 1908
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX (206) 767-5063
Chemistry, Microbiology, and Technical Services

E : The flagged value was reported from an analysis which exceeded the linear range of the instrument. See additional comments for further discussion of the circumstances. Values so flagged should be considered estimates.

D : The value reported derives from analysis of a diluted sample or sample extract.

P : When a dual column GC technique is employed, this flag indicates that test results from the two columns differ by more than 25%. Generally, we report the lower value.

C : The flagged analyte has been confirmed by GC/MS analysis. The value reported may be derived from either the initial or confirmatory (GC/MS) analysis. See specific report comments for details.

SDL : Sample Detection Limit. The SDL can vary from sample to sample, depending on sample size, matrix interferences, moisture content and other sample-specific conditions.

PQL : Practical Quantitation Limit. This limit is drawn from the test method and usually represents the SDL multiplied by a matrix-specific factor.

CRQL : Client Requested Quantitation Limit, usually the limit of detection specified at your request. Might also be referred to as Contract Required Quantitation Limit.

DB : Dry Basis. The value reported has been back-calculated to normalize for the moisture content of the sample.

AR : As-Received. The value has NOT been normalized for moisture.

Other abbreviations, used in special applications, are defined where they appear.

DISPOSAL DATE - Our reports now include the date on which we will dispose of your samples. (In limited instances, we may require that the samples be returned to your custody.) If you wish to have the samples back, or would like to have them stored for a longer period, please notify us before the disposal date.

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CLIENT : Hart Crowser, Inc.

Certificate of Analysis

Work Order # 94-10-270

TESTS PERFORMED AND RESULTS:

Analyte	Units	01	02	03	04
Total Dissolved Solids	mg/L	420.	290.	220.	1100.

Analyte	Units	05
Total Dissolved Solids	mg/L	1100.

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Lab Sample ID : 9410270-01 Date Collected: 10/07/94
Client Sample ID: MW-1 Date Received : 10/07/94

---------- WTPH-D ----------

Preparation Date: 10/11/94
Analysis Date : 10/13/94

	Result	SDL
Diesel Range.....	4.9 D	0.50 mg/L

Surrogate recoveries	% Rec	LCL	UCL
2-Fluorobiphenyl	95	50	150
p-Terphenyl	130	50	150

Comments: There is no apparent diesel pattern.

Oil Range Result mg/L: 11 SDL=0.75

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Lab Sample ID : 9410270-02 Date Collected: 10/07/94
Client Sample ID: MW-2 Date Received : 10/07/94

---------- WTPH-D ----------

Preparation Date: 10/11/94
Analysis Date : 10/13/94

	Result	SDL
Diesel Range.....	0.39	0.25 mg/L

Surrogate recoveries	% Rec	LCL	UCL
2-Fluorobiphenyl	90	50	150
p-Terphenyl	90	50	150

Comments:

Oil Range Result mg/L: 0.75 U SDL=0.75

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Lab Sample ID : 9410270-03 Date Collected: 10/07/94
Client Sample ID: MW-4 Date Received : 10/07/94

---------- WTPH-D ----------

Preparation Date: 10/11/94
Analysis Date : 10/13/94

	Result	SDL
Diesel Range.....	0.62	0.25 mg/L

Surrogate recoveries	% Rec	LCL	UCL
2-Fluorobiphenyl	79	50	150
p-Terphenyl	84	50	150

Comments: There is a partial diesel pattern present.

Oil Range Result mg/L: 0.75 U SDL=0.75

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Lab Sample ID : 9410270-04 Date Collected: 10/07/94
Client Sample ID: MW-5 Date Received : 10/07/94

---------- WTPH-D ----------

Preparation Date: 10/11/94
Analysis Date : 10/13/94

	Result	SDL
Diesel Range.....	0.25 U	0.25 mg/L

Surrogate recoveries	% Rec	LCL	UCL
2-Fluorobiphenyl	92	50	150
p-Terphenyl	92	50	150

Comments:

Oil Range Result mg/L: 0.75 U SDL=0.75

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Lab Sample ID : 9410270-05 Date Collected: 10/07/94
Client Sample ID: MW-6 Date Received : 10/07/94

---------- WTPH-D ----------

Preparation Date: 10/11/94
Analysis Date : 10/13/94

	Result	SDL
Diesel Range.....	0.25 U	0.25 mg/L

Surrogate recoveries	% Rec	LCL	UCL
2-Fluorobiphenyl	88	50	150
p-Terphenyl	88	50	150

Comments:

Oil Range Result mg/L: 0.75 U SDL=0.75

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REPORT ON SAMPLE: 9410270-01A
Client Sample ID: MW-1

Collection Date : 10/07/94
Date Received : 10/07/94
Date Analyzed : 10/18/94
Date Confirmed : 10/18/94

Test Code : BTEX_W
Test Method : SW 8020
Extraction Method : N/A
Report Units : ug/L

Analyte	Result		SDL	PQL
Benzene	0.45	U	0.09	0.45
Toluene	0.55	U	0.11	0.55
Ethylbenzene	0.50	U	0.10	0.50
m+p-Xylene	1.4	U	0.29	1.4
o-Xylene	0.60	U	0.12	0.60
Total Xylene	1.4	U	0.29	1.4

Surrogate recovery report for sample

Surrogate	Percent Recovery	Limits: Min.	Max.
4-Bromofluorobenzene	100	85	114
1,2,3-Trichlorobenzene	107	66	145

* = Indicates that recovery is outside control limits

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REPORT ON SAMPLE: 9410270-02A
Client Sample ID: MW-2

Collection Date : 10/07/94
Date Received : 10/07/94
Date Analyzed : 10/18/94
Date Confirmed : 10/18/94

Test Code : BTEX_W
Test Method : SW 8020
Extraction Method : N/A
Report Units : ug/L

Analyte	Result		SDL	PQL
Benzene	0.45	U	0.09	0.45
Toluene	0.55	U	0.11	0.55
Ethylbenzene	0.50	U	0.10	0.50
m+p-Xylene	1.4	U	0.29	1.4
o-Xylene	0.60	U	0.12	0.60
Total Xylene	1.4	U	0.29	1.4

Surrogate recovery report for sample

Surrogate	Percent Recovery	Limits: Min.	Max.
4-Bromofluorobenzene	105	85	114
1,2,3-Trichlorobenzene	116	66	145

* = Indicates that recovery is outside control limits

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REPORT ON SAMPLE: 9410270-03A
Client Sample ID: MW-4

Collection Date : 10/07/94
Date Received : 10/07/94
Date Analyzed : 10/18/94
Date Confirmed : 10/18/94

Test Code : BTEX_W
Test Method : SW 8020
Extraction Method : N/A
Report Units : ug/L

Analyte	Result		SDL	PQL
Benzene	0.45	U	0.09	0.45
Toluene	0.55	U	0.11	0.55
Ethylbenzene	0.50	U	0.10	0.50
m+p-Xylene	1.4	U	0.29	1.4
o-Xylene	0.60	U	0.12	0.60
Total Xylene	1.4	U	0.29	1.4

Surrogate recovery report for sample

Surrogate	Percent Recovery	Limits: Min.	Max.
4-Bromofluorobenzene	107	85	114
1,2,3-Trichlorobenzene	117	66	145

* = Indicates that recovery is outside control limits

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REPORT ON SAMPLE: 9410270-04A
Client Sample ID: MW-5

Collection Date : 10/07/94
Date Received : 10/07/94
Date Analyzed : 10/18/94
Date Confirmed : 10/18/94

Test Code : BTEX_W
Test Method : SW 8020
Extraction Method : N/A
Report Units : ug/L

Analyte	Result		SDL	PQL
Benzene	0.45	U	0.09	0.45
Toluene	0.55	U	0.11	0.55
Ethylbenzene	0.50	U	0.10	0.50
m+p-Xylene	1.4	U	0.29	1.4
o-Xylene	0.60	U	0.12	0.60
Total Xylene	1.4	U	0.29	1.4

Surrogate recovery report for sample

Surrogate	Percent Recovery	Limits: Min.	Max.
4-Bromofluorobenzene	100	85	114
1,2,3-Trichlorobenzene	103	66	145

* = Indicates that recovery is outside control limits

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REPORT ON SAMPLE: 9410270-05A
Client Sample ID: MW-6

Collection Date : 10/07/94
Date Received : 10/07/94
Date Analyzed : 10/18/94
Date Confirmed : 10/18/94

Test Code : BTEX_W
Test Method : SW 8020
Extraction Method : N/A
Report Units : ug/L

Analyte	Result		SDL	PQL
Benzene	0.45	U	0.09	0.45
Toluene	0.55	U	0.11	0.55
Ethylbenzene	0.50	U	0.10	0.50
m+p-Xylene	1.4	U	0.29	1.4
o-Xylene	0.60	U	0.12	0.60
Total Xylene	1.4	U	0.29	1.4

Surrogate recovery report for sample

Surrogate	Percent Recovery	Limits: Min.	Max.
4-Bromofluorobenzene	104	85	114
1,2,3-Trichlorobenzene	103	66	145

* = Indicates that recovery is outside control limits

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REPORT ON SAMPLE: 9410270-06A
Client Sample ID: Trip Blank

Collection Date : 10/07/94
Date Received : 10/07/94
Date Analyzed : 10/19/94
Date Confirmed : 10/19/94

Test Code : BTEX_W
Test Method : SW 8020
Extraction Method : N/A
Report Units : ug/L

Analyte	Result		SDL	PQL
Benzene	0.45	U	0.09	0.45
Toluene	0.55	U	0.11	0.55
Ethylbenzene	0.50	U	0.10	0.50
m+p-Xylene	1.4	U	0.29	1.4
o-Xylene	0.60	U	0.12	0.60
Total Xylene	1.4	U	0.29	1.4

Surrogate recovery report for sample

Surrogate	Percent Recovery	Limits: Min.	Max.
4-Bromofluorobenzene	102	85	114
1,2,3-Trichlorobenzene	98	66	145

* = Indicates that recovery is outside control limits

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REPORT ON SAMPLE: 9410270-01A
Client Sample ID: MW-1

Collection Date : 10/07/94
Date Received : 10/07/94
Date Extracted : 10/10/94
Date Analyzed : 10/21/94

Test Code : 8310_W
Test Method : SW 8310
Extraction Method : SW 3510

Report Units : ug/L

Analyte	Result		SDL	PQL
Naphthalene	17	JP	3.6	18
Acenaphthylene	9.7	U	1.9	9.7
Acenaphthene	8.7	U	1.7	8.7
Fluorene	4.1	D	0.22	1.1
Phenanthrene	120	D	2.0	10
Anthracene	15	PD	0.11	0.56
Fluoranthene	650	D	6.0	31
Pyrene	480	D	2.3	12
Benzo(a)anthracene	100	D	1.2	6.1
Chrysene	230	D	0.60	3.1
Benzo(b)fluoranthene ..	200	D	1.9	9.7
Benzo(k)fluoranthene ..	83	D	1.6	8.2
Benzo(a)pyrene	110	D	1.8	9.2
Dibenzo(ah)anthracene .	28	PD	0.22	1.1
Benzo(ghi)perylene	160	D	3.4	16
Indeno(123,cd)pyrene ..	110	D	1.5	7.7

Surrogate recovery report for sample 9410270-01A

Surrogate	Percent Recovery		Limits: Min.	Max.
9,10-Diphenylanthracene	0	*	20	134
1-Fluoronaphthalene	85		20	160

* = Indicates that recovery is outside control limits

PQL = Practical Quantitation Limit SDL = Sample Detection Limit

Comments:Recovery for the surrogate 9,10-diphenylanthracene could not be accurately calculated due to matrix interference and sample dilution.

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REPORT ON SAMPLE: 9410270-02A
Client Sample ID: MW-2

Collection Date : 10/07/94
Date Received : 10/07/94
Date Extracted : 10/10/94
Date Analyzed : 10/21/94

Test Code : 8310_W
Test Method : SW 8310
Extraction Method : SW 3510

Report Units : ug/L

Analyte	Result		SDL	PQL
Naphthalene	1.9	U	0.36	1.9
Acenaphthylene	0.98	U	0.20	0.98
Acenaphthene	0.88	U	0.18	0.88
Fluorene	0.027	J	0.023	0.11
Phenanthrene	0.14		0.021	0.10
Anthracene	0.020	J	0.011	0.057
Fluoranthene	0.28	J	0.061	0.31
Pyrene	0.15	P	0.024	0.12
Benzo(a)anthracene	0.038	JP	0.012	0.062
Chrysene	0.10	P	0.006	0.031
Benzo(b)fluoranthene ..	0.12		0.020	0.098
Benzo(k)fluoranthene ..	0.027	JP	0.016	0.082
Benzo(a)pyrene	0.10		0.019	0.093
Dibenzo(ah)anthracene .	0.11	U	0.023	0.11
Benzo(ghi)perylene	0.12	JP	0.034	0.16
Indeno(123,cd)pyrene ..	0.079		0.015	0.077

Surrogate recovery report for sample 9410270-02A

Surrogate	Percent Recovery	Limits: Min.	Max.
9,10-Diphenylanthracene	52	20	134
1-Fluoronaphthalene	82	20	160

* = Indicates that recovery is outside control limits

PQL = Practical Quantitation Limit SDL = Sample Detection Limit

Comments:

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REPORT ON SAMPLE: 9410270-03A
Client Sample ID: MW-4

Collection Date : 10/07/94
Date Received : 10/07/94
Date Extracted : 10/10/94
Date Analyzed : 10/21/94

Test Code : 8310_W
Test Method : SW 8310
Extraction Method : SW 3510

Report Units : ug/L

Analyte	Result		SDL	PQL
Naphthalene	22		0.36	1.9
Acenaphthylene	0.98	U	0.20	0.98
Acenaphthene	16		0.18	0.88
Fluorene	13	D	0.23	1.1
Phenanthrene	4.0		0.021	0.10
Anthracene	0.95		0.011	0.057
Fluoranthene	1.2	P	0.061	0.31
Pyrene	0.25	P	0.024	0.12
Benzo(a)anthracene	0.023	JP	0.012	0.062
Chrysene	0.031	U	0.006	0.031
Benzo(b)fluoranthene ..	0.098	U	0.020	0.098
Benzo(k)fluoranthene ..	0.082	U	0.016	0.082
Benzo(a)pyrene	0.093	U	0.019	0.093
Dibenzo(ah)anthracene .	0.11	U	0.023	0.11
Benzo(ghi)perylene	0.16	U	0.034	0.16
Indeno(123,cd)pyrene ..	0.077	U	0.015	0.077

Surrogate recovery report for sample 9410270-03A

Surrogate	Percent Recovery	Limits: Min.	Max.
9,10-Diphenylanthracene	59	20	134
1-Fluoronaphthalene	126	20	160

* = Indicates that recovery is outside control limits

PQL = Practical Quantitation Limit SDL = Sample Detection Limit

Comments:

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REPORT ON SAMPLE: 9410270-04A
Client Sample ID: MW-5

Collection Date : 10/07/94
Date Received : 10/07/94
Date Extracted : 10/10/94
Date Analyzed : 10/22/94

Test Code : 8310_W
Test Method : SW 8310
Extraction Method : SW 3510

Report Units : ug/L

Analyte	Result		SDL	PQL
Naphthalene	1.8	U	0.35	1.8
Acenaphthylene	0.96	U	0.19	0.96
Acenaphthene	0.86	U	0.17	0.86
Fluorene	0.041	J	0.022	0.11
Phenanthrene	0.11		0.020	0.10
Anthracene	0.013	J	0.011	0.056
Fluoranthene	0.16	J	0.060	0.30
Pyrene	0.074	JP	0.023	0.12
Benzo(a)anthracene	0.024	J	0.012	0.061
Chrysene	0.035	P	0.006	0.030
Benzo(b)fluoranthene ..	0.096	U	0.019	0.096
Benzo(k)fluoranthene ..	0.081	U	0.016	0.081
Benzo(a)pyrene	0.023	J	0.018	0.091
Dibenzo(ah)anthracene .	0.11	U	0.022	0.11
Benzo(ghi)perylene	0.16	U	0.033	0.16
Indeno(123,cd)pyrene ..	0.076	U	0.015	0.076

Surrogate recovery report for sample 9410270-04A

Surrogate	Percent Recovery	Limits: Min.	Max.
9,10-Diphenylanthracene	39	20	134
1-Fluoronaphthalene	82	20	160

* = Indicates that recovery is outside control limits

PQL = Practical Quantitation Limit SDL = Sample Detection Limit

Comments:

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REPORT ON SAMPLE: 9410270-05A
Client Sample ID: MW-6

Collection Date : 10/07/94
Date Received : 10/07/94
Date Extracted : 10/10/94
Date Analyzed : 10/22/94

Test Code : 8310_W
Test Method : SW 8310
Extraction Method : SW 3510

Report Units : ug/L

Analyte	Result		SDL	PQL
Naphthalene	1.9	U	0.36	1.9
Acenaphthylene	0.99	U	0.20	0.99
Acenaphthene	0.89	U	0.18	0.89
Fluorene	0.031	J	0.023	0.11
Phenanthrene	0.084	J	0.021	0.10
Anthracene	0.057	U	0.011	0.057
Fluoranthene	0.11	J	0.061	0.31
Pyrene	0.054	JP	0.024	0.12
Benzo(a)anthracene	0.022	J	0.012	0.062
Chrysene	0.048		0.006	0.031
Benzo(b)fluoranthene ..	0.099	U	0.020	0.099
Benzo(k)fluoranthene ..	0.083	U	0.017	0.083
Benzo(a)pyrene	0.020	JP	0.019	0.094
Dibenzo(ah)anthracene .	0.11	U	0.023	0.11
Benzo(ghi)perylene	0.17	U	0.034	0.17
Indeno(123,cd)pyrene ..	0.078	U	0.016	0.078

Surrogate recovery report for sample 9410270-05A

Surrogate	Percent Recovery	Limits: Min.	Max.
9,10-Diphenylanthracene	34	20	134
1-Fluoronaphthalene	70	20	160

* = Indicates that recovery is outside control limits

PQL = Practical Quantitation Limit SDL = Sample Detection Limit

Comments:

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APPENDIX A

Method Blanks & Surrogate Recoveries Reports

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Quality Control Report
Method Blanks for Work Order 9410270

Blank Name	Samples Verified	Test Description	Result	Units	Control Limit
B101294_TDS_W01	1-5	Total Dissolved Solids	2.0 U	mg/L	4.0
B101094_HPN_W01	1-5	Naphthalene	0.35 U	ug/L	1.8
		Acenaphthylene	0.19 U		0.95
		Acenaphthene	0.17 U		0.85
		Fluorene	0.022 U		0.11
		Phenanthrene	0.020 U		0.10
		Anthracene	0.011 U		0.055
		Fluoranthene	0.059 U		0.30
		Pyrene	0.023 U		0.12
		Benzo(a)anthracene	0.012 U		0.060
		Chrysene	0.0059 U		0.030
		Benzo(b)fluoranthene	0.019 U		0.095
		Benzo(k)fluoranthene	0.016 U		0.080
		Benzo(a)pyrene	0.018 U		0.090
		Dibenzo(ah)anthracene	0.022 U		0.11
		Benzo(ghi)perylene	0.033 U		0.16
		Indeno(123,cd)pyrene	0.015 U		0.075
		2-Methylnaphthalene	0.35 U		1.8
B101194_GSV_W01	1-5	Diesel range, as diesel	0.25 U	mg/L	0.25
B101894_GVO_W01	1-6	Benzene	0.090 U	ug/L	0.45
		Toluene	0.11 U		0.55
		Ethylbenzene	0.10 U		0.50
		m+p-Xylene	0.29 U		1.4
		o-Xylene	0.12 U		0.60
		Total Xylene	0.29 U		1.4

A method blank can validate more than one analyte on more than one work order. The method blanks in this report may validate analytes not determined on this work order, but nonetheless determined in the associated blank.

Because they validate more than one work order, method blank results are not always reported in the same concentration units or to the same detection limits that are used for sample results.

* = blank exceeds control limit

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Quality Control Report
Multi-Component Method Blanks
Surrogate Recoveries for Work Order 9410270

Blank Name	Test Description	Surrogate Compound	Recov	LCL	UCL
B101094_HPN_W01	Method 8310 HPLC PNAs in water	9,10-Diphenylanthracene	85	20	134
		1-Fluoronaphthalene	79	20	160
B101194_GSV_W01	WTPH diesel in water	2-Fluorobiphenyl	91	50	150
		p-Terphenyl	92	50	150
B101894_GVO_W01	BTEX in Water	4-Bromofluorobenzene	108	85	114
		Trifluorotoluene	106	66	145

* = Recovery exceeds control limit

Recov = Percent recovery of surrogate compound
LCL = Lower Control Limit
UCL = Upper Control Limit

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APPENDIX B

MS/MSD, MS/Duplicate & Duplicate Reports

Laucks Since 1908
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Quality Control Report
MS/MSD Report for Work Order 9410270

MS/MSD Name	Sample Fractions Verified	MS/MSD Sample	Analyte	Percent Recovery MS	MSD	RPD	Cont. Limits LCL	UCL	RPD
K101094_HPNW01	1-5	9410270-03	Naphthalene	39*	39 *	0	51	121	18
			Acenaphthylene	127	113	12	20	160	50
			Acenaphthene	59	59	0	20	160	50
			Fluorene	-1	49	200*	20	160	50
			Phenanthrene	59*	59 *	0	69	115	13
			Anthracene	74	74	0	20	160	50
			Fluoranthene	74	78	6	20	160	50
			Pyrene	103	103	0	64	120	15
			Benzo(a)anthracene	87	88	1	63	113	50
			Chrysene	87	91	5	65	105	13
			Benzo(b)fluoranthene	78	78	0	51	109	50
			Benzo(k)fluoranthene	74	75	1	44	117	50
			Benzo(a)pyrene	71	72	1	43	122	50
			Dibenzo(ah)anthracene	73	73	0	20	123	50
			Benzo(g,h,i)perylene	66	66	0	20	160	50
			Indeno(1,2,3-c,d)pyrene	66	68	3	20	160	50
K101894_GVOW02	1-5,6Q	9410157-01	Benzene	92	95	3	73	121	10
			Toluene	92	96	3	60	129	14
			Ethylbenzene	92	96	4	75	118	10
			m+p-Xylene	91	94	4	60	129	14
			o-Xylene	92	96	4	77	118	10

* = Value Exceeds Control Limit
RPD = Relative Percent Difference
LCL = Lower Control Limit
UCL = Upper Control Limit
-1 for recovery value indicates that recovery could not be calculated

An MS/MSD pair can validate the results for more than one work order. For this reason, results for analytes not requested on this work order may appear in this MS/MSD report.

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Quality Control Report
Matrix Spike/Duplicate Report for Work Order 9410270

MS/Dupe Name	Sample Fractions Verified	Sample	Analyte	RPD	MS Recov	Cont. Limits RPD	LCL	UCL
M101194_GSVW01	1-5	9410270-03	Diesel range, as diesel	0.5 L	99	1.2	20	160

* = Value Exceeds Control Limit
RPD = Relative Percent Difference
LCL = Lower Control Limit
UCL = Upper Control Limit
L = RPD control limit for this analyte is 5x the detection limit. The value appearing in the RPD column is the absolute difference of the duplicates.
-1 for recovery value indicates that recovery could not be calculated

An MS/Duplicate pair can validate the results for more than one work order. For this reason, results for analytes not requested on this work order may appear in this MS/Duplicate report.

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Quality Control Report
Duplicate Report for Work Order 9410270

Duplicate Name	Sample Fractions Verified	Sample	Analyte	RPD	Limit
D101294_TDSW02	1-5	9410270-01	Total Dissolved Solids	0	30

* = Value Exceeds Control Limit
RPD = Relative Percent Difference
L = RPD control limit for this analyte is 5x the detection limit. The value appearing in the RPD column is the absolute difference of the duplicates.
-1 for recovery value indicates that recovery could not be calculated

A duplicate pair can validate the results for more than one work order. For this reason, results for analytes not requested on this work order may appear in this duplicate report.

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APPENDIX C

Blank Spike Recovery Report

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Quality Control Report
Blank Spike Report for Work Order 9410270

Blank Spike Names Database	Lab Assigned	Fractions Verified	Analyte Name	Recov	LCL	UCL
S101094_HPNW01	S1010HPNWLQ	1-5	Acenaphthene	84	20	160
			Acenaphthylene	83	20	160
			Anthracene	84	20	160
			Benzo(a)anthracene	98	63	113
			Benzo(a)pyrene	83	43	122
			Benzo(b)fluoranthene	94	51	109
			Benzo(g,h,i)perylene	114	20	160
			Benzo(k)fluoranthene	92	44	117
			Chrysene	89	65	105
			Dibenzo(a,h)anthracene	80	20	123
			Fluoranthene	90	20	160
			Fluorene	84	20	160
			Indeno(1,2,3-c,d)pyrene	103	20	160
			Naphthalene	83	51	121
			Phenanthrene	86	69	115
			Pyrene	80	64	120
S101194_GSVW01	S1011GSVWLQ	1-5	Diesel	106	20	160
S101894_GVOW01	S1018GVO.WN1	1-5,6Q	Benzene	93	73	121
			Ethylbenzene	92	75	118
			Toluene	92	60	129
			m+p-Xylene	90	60	129
			o-Xylene	92	77	118

* = Value Exceeds Control Limit
LCL = Lower Control Limit
UCL = Upper Control Limit

A blank spike can validate the results for more than one work order. For this reason, results for analytes not requested on this work order may appear in this blank spike report.

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APPENDIX D

Chain-of-Custody

col. in tact

CHAIN OF CUSTODY RECORD

WORK ORDER ID# Q4410270 PAGE 1 OF 1

DATE 10-7-94

Laucks Testing Laboratories, Inc.

SUBMITTED AT:
- [X] 940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX 767-5063
- [ ] 1106 Ledwich Ave., Yakima, WA 98902 (509) 248-4695 FAX 452-1265

THIS INFORMATION WILL BE USED FOR REPORTING/BILLING* (SEE BELOW)

NAME: Hart Crowser
ADDRESS: 1910 Fairview Ave E
Seattle Wa 98103
ATTENTION: David Templeton
PROJECT NAME: Duwamish Shipyards
PROJECT CONTACT: David W. Templeton
TELEPHONE/FAX: 324-9530
JOB/P.O. NO.: 3763-05
SAMPLER (SIGNATURE): Anne Fitzpatrick (PRINTED NAME)

LAB SA#	SAMPLE ID / LOCATION	DATE	TIME	BTEX (EPA 8020)	WTPH-D Ext	PAHs (EPA 8310)	TDS (EPA 160.1)	NO. OF CONTAINERS	OBSERVATIONS, COMMENTS, SPECIAL INSTRUCTIONS
	MW-1 water	10-7-94	1215	X	X	X	X	6	
	MW-2		1290	X	X	X	X	6	
	MW-4		1100	X	X	X	X	7	QAQC bottle
	MW-5		1330	X	X	X	X	7	QAQC bottle
	MW-6		1345	X	X	X	X	6	
	Trip Blank	10-7-94	1200	X				1	

Normal TAT. Please refer to lab work order for detection limits, + QAQC requirements, ~~and other Sp~~

INSTRUCTIONS
1. USE ONE LINE PER SAMPLE.
2. BE SPECIFIC IN TEST REQUESTS.
3. CHECK OFF TESTS TO BE PERFORMED FOR EACH SAMPLE.

***BILLING INFORMATION, IF DIFFERENT THAN ABOVE**
NAME ~~Same~~ ADDRESS Scott Shock
ATTN: CITY, STATE, ZIP

TURNAROUND REQUEST
- [ ] 24-48 HRS (100% SUR)
- [ ] 5-DAYS (50% SUR)
- [X] STD. 10-14 DAYS
- [ ] OTHER

33 TOTAL NO. OF CONTAINERS

CHAIN OF CUSTODY SEALS?
- [ ] YES [ ] NO [ ] NA

SHIPPED VIA:
- [ ] UPS [ ] FED-EX [ ] BUS
- [X] HAND [ ]

TEMPERATURE
- [ ] AMBIENT [ ] REPRESENTATIVE

RELINQUISHED BY (SIGN AND PRINT)	DATE / TIME	RECEIVED BY (SIGN AND PRINT)	DATE / TIME
Anne G. Fitzpatrick	10-7-94 1505	TRACIE GRIGGS	10-7-94 3:10p
		LAUCKS TESTING LABS	

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Certificate of Analysis

CLIENT: Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, WA 98102

ATTN : Scott Shock

Work Order# : 94-12-279
DATE RECEIVED : 12/08/94
DATE OF REPORT: 01/03/95
CLIENT JOB ID : Job No. 3763-05/Shock

Work ID : Duwamish Shipyards
Taken By : Client
Transported by: Hand Delivered
Type : Water

SAMPLE IDENTIFICATION:

	Sample Description	Collection Date
01	MW-4	12/08/94 10:00
02	MW-6	12/08/94 10:30
03	MW-1	12/08/94 13:40
04	MW-2	12/08/94 15:00
05	MW-5	12/08/94 11:50
06	Trip Blank	12/08/94

GENERAL COMMENTS ON METHOD 8310 QUANTITATION:

Sample quantitation is made from the UV detector responses. Confirmation is made from the fluorescence detector. To be reported as a detected value, all analytes except acenaphthylene, fluorene, chrysene, and indeno(123-cd)pyrene, which do not give a fluorescence response, are confirmed by the fluorescence detector.

COMMENTS ON TOTAL DISSOLVED SOLIDS BLANK:

The blank for the total dissolved solids analysis exceed the established control limit. However, the associated sample level was so large that it rendered any contribution from the blank insignificant. Therefore, no further action was taken.

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CLIENT : Hart Crowser, Inc.

Certificate of Analysis

Work Order# : 94-12-279

COMMENTS ON 8310 ANALYSIS:

The RPDs for naphthalene and phenanthrene were outside of control limits in the MS/MSD pair. All remaining RPDs and MS/MSD recoveries were within control limits and no action was taken.

ATTACHMENTS:

Following presentation of sample results, the following appendices are attached to this report:

Appendix A: Method Blanks & Surrogate Recoveries Reports
Appendix B: MS/MSD & Duplicate Reports
Appendix C: Blank Spike Recovery Report
Appendix D: Chain-of-Custody

Unless otherwise instructed all samples will be discarded on 02/05/95

Respectfully submitted,
Laucks Testing Laboratories, Inc.

John M. Buerger

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USING OUR REPORTS

Laucks uses an electronic Laboratory Information Management System that produces both our reports and invoices. The following information and definitions will help you understand our reports, and we encourage you to call us if your questions are not answered here.

SAMPLE IDENTIFICATION - Sample IDs are recorded as they appear on your sample containers or chain-of-custody documents.

TEST RESULTS - Analyses that result in a single data point are shown in alphabetical order in the body of the report. Tests that yield multiple results are generally reported on separate pages, on a sample-by-sample basis.

MEASUREMENT UNITS - The reporting units are shown to the right of the analyte name. In the event that a different unit was more appropriate to a specific sample, that exception is shown immediately beneath the test result. Units commonly employed are mg/kg (solids) or mg/L (liquids), comparable to parts per million; ug/kg (solids) or ug/L (liquids), comparable to parts per billion; and percent (%).

METHODS OF ANALYSIS - The EPA or Standard Methods method number is shown in parentheses after the analyte name when field size allows; or, for analyses that yield multiple data points, in the header information on the individual report page.

ABBREVIATIONS - Several abbreviations can appear in our reports. The most commonly employed abbreviations are:

U : The analyte of interest was not detected, to the limit of detection indicated.

B : The analyte of interest was detected in the method blank associated with the sample, as well as in the sample itself. The B flag is applied without regard to the relative concentrations detected in the blank and sample.

J : The analyte of interest was detected below the routine reporting limit. This value should be regarded as an estimate.

T : The flagged values represent the SUM of two co-eluting compounds. The SUM of these two values is shown as though it were a result for each of them. The two figures should not be added together.

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E : The flagged value was reported from an analysis which exceeded the linear range of the instrument. See additional comments for further discussion of the circumstances. Values so flagged should be considered estimates.

D : The value reported derives from analysis of a diluted sample or sample extract.

P : When a dual column GC technique is employed, this flag indicates that test results from the two columns differ by more than 25%. Generally, we report the lower value.

C : The flagged analyte has been confirmed by GC/MS analysis. The value reported may be derived from either the initial or confirmatory (GC/MS) analysis. See specific report comments for details.

SDL : Sample Detection Limit. The SDL can vary from sample to sample, depending on sample size, matrix interferences, moisture content and other sample-specific conditions.

PQL : Practical Quantitation Limit. This limit is drawn from the test method and usually represents the SDL multiplied by a matrix-specific factor.

CRQL : Client Requested Quantitation Limit, usually the limit of detection specified at your request. Might also be referred to as Contract Required Quantitation Limit.

DB : Dry Basis. The value reported has been back-calculated to normalize for the moisture content of the sample.

AR : As-Received. The value has NOT been normalized for moisture.

Other abbreviations, used in special applications, are defined where they appear.

DISPOSAL DATE - Our reports now include the date on which we will dispose of your samples. (In limited instances, we may require that the samples be returned to your custody.) If you wish to have the samples back, or would like to have them stored for a longer period, please notify us before the disposal date.

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CLIENT : Hart Crowser, Inc.

Certificate of Analysis

Work Order # 94-12-279

TESTS PERFORMED AND RESULTS:

Analyte	Units	01	02	03	04
Total Dissolved Solids	mg/L	160.	150.	570.	420.

Analyte	Units	05
Total Dissolved Solids	mg/L	1000.

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REPORT ON SAMPLE: 9412279-01A
Client Sample ID: MW-4

Collection Date	: 12/08/94	Test Code	: TPHDWX
Date Received	: 12/08/94	Test Method	: WTPHD
Date Analyzed	: 12/13/94	Extraction Method	: SW 3510

Analyte	Result (mg/L)	PQL (mg/L)
Diesel range, as diesel	0.55	0.25
Oil range, as oil	0.75 U	0.75

Surrogate recovery report for sample 9412279-01A

Surrogate	Percent Recovery	Limits: Min.	Max.
2-Fluorobiphenyl	89	50	150
p-Terphenyl	93	50	150

* = Indicates that recovery is outside control limits

Comments: There is no apparent diesel pattern.

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REPORT ON SAMPLE: 9412279-02A
Client Sample ID: MW-6

Collection Date	: 12/08/94	Test Code	: TPHDWX
Date Received	: 12/08/94	Test Method	: WTPHD
Date Analyzed	: 12/13/94	Extraction Method	: SW 3510

Analyte	Result (mg/L)	PQL (mg/L)
Diesel range, as diesel	0.53	0.25
Oil range, as oil	0.75 U	0.75

Surrogate recovery report for sample 9412279-02A

Surrogate	Percent Recovery	Limits: Min.	Max.
2-Fluorobiphenyl	85	50	150
p-Terphenyl	86	50	150

* = Indicates that recovery is outside control limits

Comments: There is no apparent diesel pattern.

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REPORT ON SAMPLE: 9412279-03A
Client Sample ID: MW-1

Collection Date	: 12/08/94	Test Code	: TPHDWX
Date Received	: 12/08/94	Test Method	: WTPHD
Date Analyzed	: 12/13/94	Extraction Method	: SW 3510

Analyte	Result (mg/L)	PQL (mg/L)
Diesel range, as diesel	31 D	2.5
Oil range, as oil	86 D	7.5

Surrogate recovery report for sample 9412279-03A

Surrogate	Percent Recovery	Limits: Min.	Max.
2-Fluorobiphenyl	84	50	150
p-Terphenyl	304 *	50	150

* = Indicates that recovery is outside control limits

Comments: The surrogate p-terphenyl is above control limits due to matrix interference. The majority of the response in the diesel range is a result of heavy oil range hydrocarbons.

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REPORT ON SAMPLE: 9412279-04A
Client Sample ID: MW-2

Collection Date	: 12/08/94	Test Code	: TPHDWX
Date Received	: 12/08/94	Test Method	: WTPHD
Date Analyzed	: 12/13/94	Extraction Method	: SW 3510

Analyte	Result (mg/L)	PQL (mg/L)
Diesel range, as diesel	0.64	0.25
Oil range, as oil	0.83	0.75

Surrogate recovery report for sample 9412279-04A

Surrogate	Percent Recovery	Limits: Min.	Max.
2-Fluorobiphenyl	86	50	150
p-Terphenyl	88	50	150

* = Indicates that recovery is outside control limits

Comments: There is no apparent diesel pattern.

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REPORT ON SAMPLE: 9412279-05A
Client Sample ID: MW-5

Collection Date	: 12/08/94	Test Code	: TPHDWX
Date Received	: 12/08/94	Test Method	: WTPHD
Date Analyzed	: 12/13/94	Extraction Method	: SW 3510

Analyte	Result (mg/L)	PQL (mg/L)
Diesel range, as diesel	0.25 U	0.25
Oil range, as oil	0.75 U	0.75

Surrogate recovery report for sample 9412279-05A

Surrogate	Percent Recovery	Limits: Min.	Max.
2-Fluorobiphenyl	84	50	150
p-Terphenyl	84	50	150

* = Indicates that recovery is outside control limits

Comments:

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REPORT ON SAMPLE: 9412279-01A
Client Sample ID: MW-4

Collection Date : 12/08/94
Date Received : 12/08/94
Date Analyzed : 12/13/94
Date Confirmed : 12/13/94

Test Code : BTEX_W
Test Method : SW 8020
Extraction Method : N/A
Report Units : ug/L

Analyte	Result		SDL	PQL
Benzene	0.45	U	0.09	0.45
Toluene	0.55	U	0.11	0.55
Ethylbenzene	0.50	U	0.10	0.50
m+p-Xylene	1.4	U	0.29	1.4
o-Xylene	0.60	U	0.12	0.60
Total Xylene	1.4	U	0.29	1.4

Surrogate recovery report for sample

Surrogate	Percent Recovery	Limits: Min.	Max.
4-Bromofluorobenzene	102	85	114
1,2,3-Trichlorobenzene	112	66	145

* = Indicates that recovery is outside control limits

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REPORT ON SAMPLE: 9412279-02A
Client Sample ID: MW-6

Collection Date : 12/08/94
Date Received : 12/08/94
Date Analyzed : 12/13/94
Date Confirmed : 12/13/94

Test Code : BTEX_W
Test Method : SW 8020
Extraction Method : N/A
Report Units : ug/L

Analyte	Result		SDL	PQL
Benzene	0.45	U	0.09	0.45
Toluene	0.55	U	0.11	0.55
Ethylbenzene	0.50	U	0.10	0.50
m+p-Xylene	1.4	U	0.29	1.4
o-Xylene	0.60	U	0.12	0.60
Total Xylene	1.4	U	0.29	1.4

Surrogate recovery report for sample

Surrogate	Percent Recovery	Limits: Min.	Max.
4-Bromofluorobenzene	102	85	114
1,2,3-Trichlorobenzene	109	66	145

* = Indicates that recovery is outside control limits

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REPORT ON SAMPLE: 9412279-03A
Client Sample ID: MW-1

Collection Date : 12/08/94
Date Received : 12/08/94
Date Analyzed : 12/13/94
Date Confirmed : 12/13/94

Test Code : BTEX_W
Test Method : SW 8020
Extraction Method : N/A
Report Units : ug/L

Analyte	Result		SDL	PQL
Benzene	0.45	U	0.09	0.45
Toluene	0.55	U	0.11	0.55
Ethylbenzene	0.50	U	0.10	0.50
m+p-Xylene	1.4	U	0.29	1.4
o-Xylene	0.60	U	0.12	0.60
Total Xylene	1.4	U	0.29	1.4

Surrogate recovery report for sample

Surrogate	Percent Recovery	Limits: Min.	Max.
4-Bromofluorobenzene	101	85	114
1,2,3-Trichlorobenzene	105	66	145

* = Indicates that recovery is outside control limits

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REPORT ON SAMPLE: 9412279-04A
Client Sample ID: MW-2

Collection Date : 12/08/94
Date Received : 12/08/94
Date Analyzed : 12/13/94
Date Confirmed : 12/13/94

Test Code : BTEX_W
Test Method : SW 8020
Extraction Method : N/A
Report Units : ug/L

Analyte	Result		SDL	PQL
Benzene	0.45	U	0.09	0.45
Toluene	0.55	U	0.11	0.55
Ethylbenzene	0.50	U	0.10	0.50
m+p-Xylene	1.4	U	0.29	1.4
o-Xylene	0.60	U	0.12	0.60
Total Xylene	1.4	U	0.29	1.4

Surrogate recovery report for sample

Surrogate	Percent Recovery	Limits: Min.	Max.
4-Bromofluorobenzene	100	85	114
1,2,3-Trichlorobenzene	105	66	145

* = Indicates that recovery is outside control limits

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REPORT ON SAMPLE: 9412279-05A
Client Sample ID: MW-5

Collection Date : 12/08/94
Date Received : 12/08/94
Date Analyzed : 12/13/94
Date Confirmed : 12/13/94

Test Code : BTEX_W
Test Method : SW 8020
Extraction Method : N/A
Report Units : ug/L

Analyte	Result		SDL	PQL
Benzene	0.45	U	0.09	0.45
Toluene	0.55	U	0.11	0.55
Ethylbenzene	0.50	U	0.10	0.50
m+p-Xylene	1.4	U	0.29	1.4
o-Xylene	0.60	U	0.12	0.60
Total Xylene	1.4	U	0.29	1.4

Surrogate recovery report for sample

Surrogate	Percent Recovery	Limits: Min.	Max.
4-Bromofluorobenzene	97	85	114
1,2,3-Trichlorobenzene	98	66	145

* = Indicates that recovery is outside control limits

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REPORT ON SAMPLE: 9412279-06A
Client Sample ID: Trip Blank

Collection Date : 12/08/94
Date Received : 12/08/94
Date Analyzed : 12/13/94
Date Confirmed : 12/13/94

Test Code : BTEX_W
Test Method : SW 8020
Extraction Method : N/A
Report Units : ug/L

Analyte	Result		SDL	PQL
Benzene	0.45	U	0.09	0.45
Toluene	0.55	U	0.11	0.55
Ethylbenzene	0.50	U	0.10	0.50
m+p-Xylene	1.4	U	0.29	1.4
o-Xylene	0.60	U	0.12	0.60
Total Xylene	1.4	U	0.29	1.4

Surrogate recovery report for sample

Surrogate	Percent Recovery	Limits: Min.	Max.
4-Bromofluorobenzene	103	85	114
1,2,3-Trichlorobenzene	107	66	145

* = Indicates that recovery is outside control limits

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REPORT ON SAMPLE: 9412279-01A
Client Sample ID: MW-4

Collection Date : 12/08/94
Date Received : 12/08/94
Date Extracted : 12/13/94
Date Analyzed : 12/16/94

Test Code : 8310_W
Test Method : SW 8310
Extraction Method : SW 3510

Report Units : ug/L

Analyte	Result		SDL	PQL
Naphthalene	1.7	J	0.35	1.8
Acenaphthylene	0.95	U	0.19	0.95
Acenaphthene	2.9		0.17	0.85
Fluorene	1.9		0.022	0.11
Phenanthrene	0.29		0.020	0.10
Anthracene	0.055	U	0.011	0.055
Fluoranthene	0.29	JP	0.059	0.30
Pyrene	0.12	U	0.023	0.12
Benzo(a)anthracene	0.020	JP	0.012	0.060
Chrysene	0.025	JP	0.006	0.030
Benzo(b)fluoranthene ..	0.095	U	0.019	0.095
Benzo(k)fluoranthene ..	0.080	U	0.016	0.080
Benzo(a)pyrene	0.090	U	0.018	0.090
Dibenzo(ah)anthracene .	0.11	U	0.022	0.11
Benzo(ghi)perylene	0.079	J	0.033	0.16
Indeno(123,cd)pyrene ..	0.026	J	0.015	0.075

Surrogate recovery report for sample 9412279-01A

Surrogate	Percent Recovery	Limits: Min.	Max.
9,10-Diphenylanthracene	50	20	134
1-Fluoronaphthalene	72	20	160

* = Indicates that recovery is outside control limits

PQL = Practical Quantitation Limit SDL = Sample Detection Limit

Comments:

Laucks Since 1908
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX (206) 767-5063
Chemistry, Microbiology, and Technical Services

REPORT ON SAMPLE: 9412279-02A
Client Sample ID: MW-6

Collection Date : 12/08/94
Date Received : 12/08/94
Date Extracted : 12/13/94
Date Analyzed : 12/16/94

Test Code : 8310_W
Test Method : SW 8310
Extraction Method : SW 3510

Report Units : ug/L

Analyte	Result		SDL	PQL
Naphthalene	2.3		0.35	1.8
Acenaphthylene	0.95	U	0.19	0.95
Acenaphthene	3.2		0.17	0.85
Fluorene	2.2		0.022	0.11
Phenanthrene	0.40		0.020	0.10
Anthracene	0.21	P	0.011	0.055
Fluoranthene	0.29	JP	0.059	0.30
Pyrene	0.092	JP	0.023	0.12
Benzo(a)anthracene	0.020	JP	0.012	0.060
Chrysene	0.030	U	0.006	0.030
Benzo(b)fluoranthene ..	0.095	U	0.019	0.095
Benzo(k)fluoranthene ..	0.080	U	0.016	0.080
Benzo(a)pyrene	0.090	U	0.018	0.090
Dibenzo(ah)anthracene .	0.11	U	0.022	0.11
Benzo(ghi)perylene	0.071	J	0.033	0.16
Indeno(123,cd)pyrene ..	0.075	U	0.015	0.075

Surrogate recovery report for sample 9412279-02A

Surrogate	Percent Recovery	Limits: Min.	Max.
9,10-Diphenylanthracene	57	20	134
1-Fluoronaphthalene	80	20	160

* = Indicates that recovery is outside control limits

PQL = Practical Quantitation Limit SDL = Sample Detection Limit

Comments:

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Chemistry, Microbiology, and Technical Services

REPORT ON SAMPLE: 9412279-03A
Client Sample ID: MW-1

Collection Date : 12/08/94
Date Received : 12/08/94
Date Extracted : 12/13/94
Date Analyzed : 12/16/94

Test Code : 8310_W
Test Method : SW 8310
Extraction Method : SW 3510

Report Units : ug/L

Analyte	Result		SDL	PQL
Naphthalene	250	PD	35	180
Acenaphthylene	95	U	19	95
Acenaphthene	85	U	17	85
Fluorene	54	D	2.2	11
Phenanthrene	660	D	20	100
Anthracene	5.5	U	1.1	5.5
Fluoranthene	4000	PD	59	300
Pyrene	2300	D	23	120
Benzo(a)anthracene	590	D	12	60
Chrysene	1300	D	5.9	30
Benzo(b)fluoranthene ..	9.5	U	1.9	9.5
Benzo(k)fluoranthene ..	580	D	16	80
Benzo(a)pyrene	630	D	18	90
Dibenzo(ah)anthracene .	170	D	2.2	11
Benzo(ghi)perylene	780	D	33	160
Indeno(123,cd)pyrene ..	530	D	15	75

Surrogate recovery report for sample 9412279-03A

Surrogate	Percent Recovery		Limits: Min.	Max.
9,10-Diphenylanthracene	0	*	20	134
1-Fluoronaphthalene	0	*	20	160

* = Indicates that recovery is outside control limits

PQL = Practical Quantitation Limit SDL = Sample Detection Limit

Comments: No surrogate recovery possible due to dilutions.

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REPORT ON SAMPLE: 9412279-04A
Client Sample ID: MW-2

Collection Date : 12/08/94
Date Received : 12/08/94
Date Extracted : 12/13/94
Date Analyzed : 12/16/94

Test Code : 8310_W
Test Method : SW 8310
Extraction Method : SW 3510

Report Units : ug/L

Analyte	Result		SDL	PQL
Naphthalene	1.8	U	0.35	1.8
Acenaphthylene	0.95	U	0.19	0.95
Acenaphthene	0.85	U	0.17	0.85
Fluorene	0.048	J	0.022	0.11
Phenanthrene	0.32		0.020	0.10
Anthracene	0.10	P	0.011	0.055
Fluoranthene	1.3	P	0.059	0.30
Pyrene	1.2		0.023	0.12
Benzo(a)anthracene	0.28		0.012	0.060
Chrysene	0.63		0.006	0.030
Benzo(b)fluoranthene ..	0.095	U	0.019	0.095
Benzo(k)fluoranthene ..	0.21		0.016	0.080
Benzo(a)pyrene	0.39		0.018	0.090
Dibenzo(ah)anthracene .	0.11	U	0.022	0.11
Benzo(ghi)perylene	0.65	P	0.033	0.16
Indeno(123,cd)pyrene ..	0.40		0.015	0.075

Surrogate recovery report for sample 9412279-04A

Surrogate	Percent Recovery	Limits: Min.	Max.
9,10-Diphenylanthracene	56	20	134
1-Fluoronaphthalene	68	20	160

* = Indicates that recovery is outside control limits

PQL = Practical Quantitation Limit SDL = Sample Detection Limit

Comments:

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Chemistry, Microbiology, and Technical Services

REPORT ON SAMPLE: 9412279-05A
Client Sample ID: MW-5

Collection Date : 12/08/94
Date Received : 12/08/94
Date Extracted : 12/13/94
Date Analyzed : 12/16/94

Test Code : 8310_W
Test Method : SW 8310
Extraction Method : SW 3510

Report Units : ug/L

Analyte	Result		SDL	PQL
Naphthalene	1.8	U	0.35	1.8
Acenaphthylene	0.95	U	0.19	0.95
Acenaphthene	0.85	U	0.17	0.85
Fluorene	0.064	J	0.022	0.11
Phenanthrene	0.062	JP	0.020	0.10
Anthracene	0.017	J	0.011	0.055
Fluoranthene	0.30	U	0.059	0.30
Pyrene	0.12	U	0.023	0.12
Benzo(a)anthracene	0.060	U	0.012	0.060
Chrysene	0.014	J	0.006	0.030
Benzo(b)fluoranthene ..	0.095	U	0.019	0.095
Benzo(k)fluoranthene ..	0.080	U	0.016	0.080
Benzo(a)pyrene	0.090	U	0.018	0.090
Dibenzo(ah)anthracene .	0.11	U	0.022	0.11
Benzo(ghi)perylene	0.16	U	0.033	0.16
Indeno(123,cd)pyrene ..	0.075	U	0.015	0.075

Surrogate recovery report for sample 9412279-05A

Surrogate	Percent Recovery	Limits: Min.	Max.
9,10-Diphenylanthracene	27	20	134
1-Fluoronaphthalene	67	20	160

* = Indicates that recovery is outside control limits

PQL = Practical Quantitation Limit SDL = Sample Detection Limit

Comments:

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APPENDIX A

Method Blanks & Surrogate Recoveries Reports

Laucks Since 1908
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX (206) 767-5063
Chemistry, Microbiology, and Technical Services

Quality Control Report
Method Blanks for Work Order 9412279

Blank Name	Samples Verified	Test Description	Result		Units	Control Limit
B121494_TDS_W01	1-5	Total Dissolved Solids	5.0	*	mg/L	4.0
B121294_GSV_W01	1-5	Diesel range, as diesel	0.25 U		mg/L	0.25
		Oil range, as oil	0.75 U			0.75
B121394_GVO_W03	1-6	Benzene	0.090 U		ug/L	0.45
		Toluene	0.11 U			0.55
		Ethylbenzene	0.10 U			0.50
		m+p-Xylene	0.29 U			1.4
		o-Xylene	0.12 U			0.60
		Total Xylene	0.29 U			1.4
B121394_HPN_W01	1 - 5	Naphthalene	0.35 U		ug/L	1.8
		Acenaphthylene	0.19 U			0.95
		Acenaphthene	0.17 U			0.85
		Fluorene	0.022 U			0.11
		Phenanthrene	0.020 U			0.10
		Anthracene	0.011 U			0.055
		Fluoranthene	0.059 U			0.30
		Pyrene	0.023 U			0.12
		Benzo(a)anthracene	0.012 U			0.060
		Chrysene	0.0059 U			0.030
		Benzo(b)fluoranthene	0.019 U			0.095
		Benzo(k)fluoranthene	0.016 U			0.080
		Benzo(a)pyrene	0.018 U			0.090
		Dibenzo(ah)anthracene	0.022 U			0.11
		Benzo(ghi)perylene	0.033 U			0.16
		Indeno(123,cd)pyrene	0.015 U			0.075
		2-Methylnaphthalene	0.35 U			1.8

A method blank can validate more than one analyte on more than one work order. The method blanks in this report may validate analytes not determined on this work order, but nonetheless determined in the associated blank.

Because they validate more than one work order, method blank results are not always reported in the same concentration units or to the same detection limits that are used for sample results.

* = blank exceeds control limit

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Testing Laboratories, Inc.
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Quality Control Report
Multi-Component Method Blanks
Surrogate Recoveries for Work Order 9412279

Blank Name	Test Description	Surrogate Compound	Recov	LCL	UCL
B121294_GSV_W01	WA TPH Diesel Extended	2-Fluorobiphenyl	80	50	150
		p-Terphenyl	85	50	150
B121394_GVO_W03	BTEX in Water	4-Bromofluorobenzene	102	85	114
		Trifluorotoluene	106	66	145
B121394_HPN_W01	Method 8310 HPLC PNAs in water	9,10-Diphenylanthracene	80	20	134
		1-Fluoronaphthalene	53	20	160

* = Recovery exceeds control limit

Recov = Percent recovery of surrogate compound
LCL = Lower Control Limit
UCL = Upper Control Limit

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APPENDIX B

MS/MSD & Duplicate Reports

Laucks Since 1908
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX (206) 767-5063
Chemistry, Microbiology, and Technical Services

Quality Control Report
MS/MSD Report for Work Order 9412279

MS/MSD Name	Sample Fractions Verified	MS/MSD Sample	Analyte	Percent Recovery MS	MSD	RPD	Cont. Limits LCL	UCL	RPD
K121294_GVOW01	1-5	9412279-02	Diesel	90	72	22	20	160	50
K121394_GVOW02	1-6	9412279-02	Benzene	96	97	2	73	121	10
			Toluene	96	110	13	60	129	14
			Ethylbenzene	96	98	3	75	118	10
			m+p-Xylene	91	98	7	60	129	14
			o-Xylene	96	99	3	77	118	10
K121394_HPNW01	1 - 5	9412279-02	Naphthalene	83	68	20*	51	121	18
			Acenaphthylene	104	89	15	20	160	50
			Acenaphthene	90	74	19	20	160	50
			Fluorene	93	73	24	20	160	50
			Phenanthrene	88	76	15*	69	115	13
			Anthracene	87	78	11	20	160	50
			Fluoranthene	91	83	9	20	160	50
			Pyrene	90	84	7	64	120	15
			Benzo(a)anthracene	90	83	9	63	113	50
			Chrysene	94	87	9	65	105	13
			Benzo(b)fluoranthene	90	82	10	51	109	50
			Benzo(k)fluoranthene	80	75	6	44	117	50
			Benzo(a)pyrene	84	79	7	43	122	50
			Dibenzo(ah)anthracene	78	68	13	20	123	50
			Benzo(g,h,i)perylene	80	72	11	20	160	50
			Indeno(1,2,3-c,d)pyrene	67	66	0	20	160	50

* = Value Exceeds Control Limit
RPD = Relative Percent Difference
LCL = Lower Control Limit
UCL = Upper Control Limit
-1 for recovery value indicates that recovery could not be calculated

An MS/MSD pair can validate the results for more than one work order. For this reason, results for analytes not requested on this work order may appear in this MS/MSD report.

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Testing Laboratories, Inc.
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Chemistry, Microbiology, and Technical Services

Quality Control Report
Duplicate Report for Work Order 9412279

Duplicate Name	Sample Fractions Verified	Sample	Analyte	RPD		Limit
D121294_GSVW01	1-5	9412279-02	Diesel range, as diesel	0.030	L	1.2
			Heavy hydrocarbons, as oil	0	L	5.0
D121494_TDSW01	1-5	9412277-01	Total Dissolved Solids	6.7		30

* = Value Exceeds Control Limit
RPD = Relative Percent Difference
L = RPD control limit for this analyte is 5x the detection limit. The value appearing in the RPD column is the absolute difference of the duplicates.
-1 for recovery value indicates that recovery could not be calculated

A duplicate pair can validate the results for more than one work order. For this reason, results for analytes not requested on this work order may appear in this duplicate report.

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APPENDIX C

Blank Spike Recovery Report

Laucks Since 1908
Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX (206) 767-5063
Chemistry, Microbiology, and Technical Services

Quality Control Report
Blank Spike Report for Work Order 9412279

Blank Spike Names Database	Lab Assigned	Fractions Verified	Analyte Name	Recov	LCL	UCL
S121294_GSVW01	S1212GSVWLY	1-5	Diesel	92	20	160
S121394_GVOW02	S1213GVO.WN1	1-6	1,2-Dichlorobenzene	96	69	125
			1,3-Dichlorobenzene	94	81	116
			1,4-Dichlorobenzene	92	78	117
			Benzene	97	73	121
			Chlorobenzene	98	74	119
			Ethylbenzene	96	75	118
			Toluene	98	60	129
			m+p-Xylene	97	60	129
			o-Xylene	97	77	118
S121394_HPNW01	S1213HPNWLC	1 - 5	Acenaphthene	79	20	160
			Acenaphthylene	77	20	160
			Anthracene	83	20	160
			Benzo(a)anthracene	90	63	113
			Benzo(a)pyrene	88	43	122
			Benzo(b)fluoranthene	91	51	109
			Benzo(g,h,i)perylene	92	20	160
			Benzo(k)fluoranthene	89	44	117
			Chrysene	90	65	105
			Dibenzo(a,h)anthracene	97	20	123
			Fluoranthene	89	20	160
			Fluorene	80	20	160
			Indeno(1,2,3-c,d)pyrene	87	20	160
			Naphthalene	75	51	121
			Phenanthrene	85	69	115
			Pyrene	88	64	120
S122094_HPNW01	S1220HPNWLQ	5 REX	Acenaphthene	90	20	160
			Acenaphthylene	91	20	160
			Anthracene	91	20	160
			Benzo(a)anthracene	95	63	113
			Benzo(a)pyrene	90	43	122
			Benzo(b)fluoranthene	92	51	109

* = Value Exceeds Control Limit
LCL = Lower Control Limit
UCL = Upper Control Limit

A blank spike can validate the results for more than one work order. For this reason, results for analytes not requested on this work order may appear in this blank spike report.

Laucks Since 1908
Testing Laboratories, Inc.
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Chemistry, Microbiology, and Technical Services

Quality Control Report
Blank Spike Report for Work Order 9412279

Blank Spike Names						
Database	Lab Assigned	Fractions Verified	Analyte Name	Recov	LCL	UCL
			Benzo(g,h,i)perylene	96	20	160
			Benzo(k)fluoranthene	95	44	117
			Chrysene	95	65	105
			Dibenzo(a,h)anthracene	94	20	123
			Fluoranthene	92	20	160
			Fluorene	92	20	160
			Indeno(1,2,3-c,d)pyrene	96	20	160
			Naphthalene	89	51	121
			Phenanthrene	93	69	115
			Pyrene	90	64	120

* = Value Exceeds Control Limit
LCL = Lower Control Limit
UCL = Upper Control Limit

A blank spike can validate the results for more than one work order. For this reason, results for analytes not requested on this work order may appear in this blank spike report.

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APPENDIX D

Chain-of-Custody

CHAIN OF CUSTODY RECORD

Laucks Testing Laboratories, Inc.
940 South Harney St., Seattle, WA 98108 (206) 767-5060 FAX 767-5063
1106 Ledwich Ave., Yakima, WA 98902 (509) 248-4695 FAX 452-1265

WORK ORDER ID# 4384 PAGE 1 OF 1

DATE 12/8/94 SUBMITTED AT:

THIS INFORMATION WILL BE USED FOR REPORTING/BILLING* (SEE BELOW)

NAME: HART CROWSER
ADDRESS: 1910 FAIRVIEW AVE E, SEATTLE, WA 98102
ATTENTION: SCOTT SHOCK
PROJECT NAME: SUQUAMISH SHIPYARDS
PROJECT CONTACT: SCOTT SHOCK
TELEPHONE/FAX: 324-9530
JOB/P.O. NO.: 3763-05
SAMPLER (SIGNATURE): Scott S. Shock (PRINTED NAME): SCOTT S. SHOCK

LAB SA#	SAMPLE ID / LOCATION	DATE	TIME	BTEX (EPA 8020)	WTPH-D EXT	PAHs (EPA 8310)	TDS (EPA 160.1)	NO. OF CONTAINERS	OBSERVATIONS, COMMENTS, SPECIAL INSTRUCTIONS
1	MW-4	12/8	1000	X	X	X	X	6	
2	MW-6	12/8	1030	X	X	X	X	11	
(6) 2	TRIP BLANK	12/8		X				2	
3	MW-1	12/8	1340	X	X	X	X	6	
4	MW-2	12/8	1500	X	X	X	X	6	
5	*MW-5	12/8	1150	X	X	X	X	6	* Per Scott 12/9/94 8:33 added MW-5 Sample with associated tests.
								37	
								31	TOTAL NO. OF CONTAINERS

2 coolers

Sample Receipt acknowledged pending verification of sample count. You will be notified within one working day of any discrepancies found.
Signed [illegible] Date 12/8 Time 4:50 p

INSTRUCTIONS
1. USE ONE LINE PER SAMPLE.
2. BE SPECIFIC IN TEST REQUESTS.
3. CHECK OFF TESTS TO BE PERFORMED FOR EACH SAMPLE.

***BILLING INFORMATION, IF DIFFERENT THAN ABOVE**
NAME ADDRESS
ATTN: CITY, STATE, ZIP

TURNAROUND REQUEST
- ☐ 24-48 HRS (100% SUR)
- ☐ 5-DAYS (50% SUR)
- ☒ STD. 10-14 DAYS
- ☐ OTHER

CHAIN OF CUSTODY SEALS? ☐ YES ☐ NO ☐ NA

SHIPPED VIA: ☐ UPS ☐ FED-EX ☐ BUS ☐ HAND ☐

TEMPERATURE ☐ AMBIENT ☐ REPRESENTATIVE

RELINQUISHED BY (SIGN AND PRINT)	DATE / TIME	RECEIVED BY (SIGN AND PRINT)	DATE / TIME
Scott S. Shock SCOTT S. SHOCK	12/8/94 1653		
		LAUCKS TESTING LABS	12/8/94 4:50

FINAL REPORT COPY