HARTCROWSER

Earth and Environmental Technologies

Limited Phase II Environmental Assessment
Tacoma Metals, Inc.
Tacoma, Washington

Prepared for
Weiss, Jensen, Ellis, and Botteri

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J-3078

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LIMITED PHASE II ENVIRONMENTAL ASSESSMENT
TACOMA METALS, INC.
TACOMA, WASHINGTON

INTRODUCTION

This report was prepared for Weiss, Jensen, Ellis, and Botteri by Hart Crowser, Inc., and presents the results of our limited Phase II Environmental Assessment at the Tacoma Metals, Inc., facility in Tacoma, Washington (Figure 1). We understand that Weiss, Jensen, Ellis, and Botteri represent Churchill and Company. Churchill and Company is considering leasing the property from the current owner.

This limited Phase II assessment was conducted in accordance with the August 15, 1990, contract between Weiss, Jensen, Ellis, and Botteri and Hart Crowser (Number 91-47-1020). The purpose of the work was to install test pits, subsurface soil corings, and drive point wells on the property to evaluate whether releases and contamination on the site have adversely affected soils and groundwater beneath the property. We also evaluated existing data pertaining to the property, including the Phase I Environmental Site Investigation conducted by Alley, Young, and Baumgartner, Inc. (December 1989), and reports summarizing various Hart Crowser geotechnical studies in the vicinity of the project site.

Site Location

The project property lies directly west of the Puyallup River in an industrial section of the Tacoma tideflats area. The tideflat area was filled in stages beginning in the late 1800s.

The site is bounded on the east by a U.S. Army Corps of Engineers right-of-way and the Puyallup River; on the west by Portland Avenue; on the south by Lincoln Avenue; and on the north by 18th Street East.

Project Background

The limited Phase II Environmental Assessment was conducted as a follow-up to a Phase I Environmental Site Investigation of the property conducted by Alley, Young, and Baumgartner, Inc., (AYB) of

Brentwood, Tennessee. The Phase I investigation and discussions with current operators identified the following concerns at the site:

- The facility operated as a metal salvage yard for at least 40 years, accepting scrap metal for salvage including automotive parts, electrical equipment, batteries, lead ingots, and other recyclable metals.

- The entire site was unpaved during a number of these operational years. Presently all but the eastern edge of the facility is paved.

- In March 1988, the Washington State Department of Ecology (Ecology) collected samples from the site during a Toxic Substances Control Act (TSCA) inspection conducted for the U.S. Environmental Protection Agency (EPA). Elevated concentrations of polychlorinated biphenyls (PCBs) were detected on the property, and a cleanup action was conducted by Tacoma Metals to mitigate the problem. However, sampling by AYB during the Phase I investigation identified elevated PCB levels, as well as elevated petroleum hydrocarbon, cadmium, and/or lead concentrations, at the previous cleanup locations.

- Additional sampling conducted during the Phase I investigation identified elevated concentrations of PCBs, petroleum hydrocarbons, and/or metals at locations including the southeast corner of the yard, the northeast corner of the site, and a depression area at the center of the site along its eastern edge, where runoff water collects.

- A 1,000-gallon gasoline underground storage tank (UST) was removed from the facility between November 1989 and January 1990. Soil sampling conducted by the Tacoma/Pierce County Health Department during the UST removal identified elevated concentrations of total petroleum hydrocarbons (TPH) at the bottom and along the side walls of the excavation.

- A number of facilities in the vicinity of Tacoma Metals have been named as potentially responsible parties (PRPs) for the Commencement Bay Area Superfund Site.

Scope of Work

Hart Crowser assessed the potential impacts to the project property by installing a series of test pits, soil corings, and drive point wells at strategic locations in exposed soil areas on the site as shown on Figure 1. The following lists the test pits, hand corings, surface soil samples, and drive point wells installed, and associated areas of concern:

- Test pit TP-1 was installed at a location potentially impacted by surface runoff from the on-site furnace area. The furnace area was previously used as an aluminum sweat furnace, and for burning copper wire.

- Test pits TP-2, TP-3, and TP-4 were excavated in the fill area located at the northeast section of the site.

- Test pit TP-5 was excavated in the depression area near the eastern central section of the property where runoff water collects.

- Soil coring and drive point well HC-1 were installed at the southeast corner of the site. This area was originally slated for a test pit excavation; however, discarded Army shells were identified in the area, and the safety decision was made to collect soil samples from the area using a hand auger rather than heavy machinery.

- Drive point well HC-2 was installed at the TP-5 location in the on-site depression area.

- Drive point well HC-3 was installed in the filled area identified at the northeast section of the site, in the TP-4 location.

- Soil coring TANK-1 was installed using a hand auger in the location of the former gasoline UST. A sample was collected from the coring at the 4.5-foot-depth interval. Drive point well HC-4 was also installed at this location.

- Surface soil sample SLAG-1 was collected from a slag material pile on the site.

SUMMARY OF CHEMICAL FINDINGS

On-site soils were found to contain chemical contaminants including metals, TPH, PCBs, and the carcinogenic polynucleated aromatic hydrocarbons (PAHs) at concentrations above cleanup standards proposed under the Washington State Department of Ecology Model Toxics Control Act (MTCA) Cleanup Regulations and Proposed Amendments (Chapter 173-340 WAC), dated July 27, 1990. Moreover, some soil areas have levels of metals which would cause the soil to be designated as hazardous waste under the Toxicity Characteristics Leaching Procedure (TCLP) waste analysis protocol. These concerns are summarized below:

- Soil sample TP-1, S-1 (0- to 6-inch depth) was collected from the test pit excavated downgradient from the furnace area and contained elevated concentrations of a motor oil-like material (1,200 parts per million (ppm)), and total metals: lead (5,000 ppm), chromium (160 ppm), and cadmium (61 ppm). The soil sample also contained elevated TCLP concentrations of lead (15 mg/L). No significantly elevated contaminant concentrations were detected in the soil sample (TP-1, S-2) collected at the 11-foot-depth interval in this test pit.

- Soil sample TP-2, S-1 (0- to 6-inch depth) was collected from the test pit excavated in the fill area at the northeastern edge of the facility and contained elevated concentrations of a motor oil-like compound (1,500 ppm); total metals: lead (5,300 ppm), chromium (340 ppm), cadmium (75 ppm), arsenic (26 ppm); and PCBs (4.4 ppm). The soil sample also contained elevated TCLP concentrations of lead (22 mg/L). Elevated concentrations of a motor oil-like material (600 ppm), total metals: lead (770 ppm), and cadmium (11 ppm) were also identified in the soil sample (TP-2, S-2) collected at the 8-foot-depth interval in this test pit.

- Soil sample TP-3, S-1 (0- to 6-inch) was collected from a test pit excavated in the fill at the northeastern edge of the site and contained elevated concentrations of diesel/fuel oil No. 2 (2,400 ppm), a motor oil-like compound (870 ppm), and total lead (390 ppm). Elevated concentrations of diesel/fuel oil No. 2 (790 ppm) were also identified in the soil sample (TP-3, S-2) collected at the 10-foot-depth interval in this test pit.

- Soil sample TP-4, S-1 (0- to 6-inch depth) was collected from test pit excavated in the fill material at the northeastern corner of the site and contained elevated levels of a motor oil-like compound (1,400 ppm), diesel/fuel oil No. 2 (610 ppm); total metals: lead (15,000 ppm), chromium (130 ppm), cadmium (150 ppm); and PCBs (11 ppm). The soil sample also contained elevated TCLP concentrations of cadmium (2.2 mg/L) and lead (370 mg/L). Elevated concentrations of gasoline (640 to 1,100 ppm); diesel fuel (200 to 280 ppm); total metals: lead (620 to 760 ppm), and cadmium (9 to 11 ppm); PCBs (6.7 to 32 ppm); and carcinogenic PAH compounds (1.45 ppm) were also identified in the soil sample (TP-4, S-2) collected at the 9-foot-depth in this test pit. The carcinogenic PAH compounds include benzo(a)anthracene, benzo(a)pyrene, benzo(b)fluoranthene, benzo(k)fluoranthene, chrysene, dibenzo(a,h)anthracene, and indeno(1,2,3-cd)pyrene.

- Soil sample TP-5, S-1 (0- to 6-inch depth) was collected from test pit installed in the on-site depression where runoff water accumulates and contained elevated concentrations of total metals: lead (3,500 ppm), chromium (330 ppm), and cadmium (27 ppm). No significantly elevated concentrations of contaminants were identified in the soil sample (TP-5, S-2) collected at the 10-foot-depth interval in this test pit.

- The soil sample (TANK-1) collected at the 4.5-foot-depth interval from the soil coring installed at the former gasoline UST location contained elevated levels of a motor oil-like compound (580 ppm).

Groundwater beneath the project property was also found to contain contaminants at concentrations above proposed MTCA standards at the following locations:

- The groundwater sample collected from drive point well HC-1, installed at the southeastern corner of the site, contained elevated concentrations of lead (120 μg/L).

- The groundwater sample collected from drive point well HC-2, installed in the depression area on the site, contained elevated concentrations of the carcinogenic PAHs (0.51 μg/L).

- The groundwater sample collected from drive point well HC-3, installed at the northeastern edge of the site, contained elevated concentrations of a weathered gasoline material (1 to 8.7 μg/L), the

carcinogenic PAHs (2.5 μg/L), total PCBs (18.2 μg/L), arsenic (6 to 7 μg/L), cadmium (4.7 to 5 μg/L), and lead (6 to 8 μg/L).

- The groundwater sample collected from drive point well HC-4, installed in the location of the former gasoline UST, contained elevated concentrations of a motor oil-like compound (12.3 ppm) and the carcinogenic PAHs (0.31 μg/L)

Certification of analysis from both the Hart Crowser *FAST* Laboratory and Analytical Technologies, Inc., are presented in Appendix C.

DISCUSSION AND RECOMMENDATIONS

The data generated by this Phase II Environmental Assessment should be considered to be limited in nature because of the type of the screening analyses methods used for the assessment. Most of the samples collected during the investigation were submitted to the Hart Crowser *FAST* Laboratory for screening for the compounds of concern. In addition, drive point wells were installed as a screening mechanism for sample collection to provide a gross estimate of the presence and possible extent of the groundwater quality problems at the site. The data collected from the drive point wells should be considered to be limited, general water quality data. However, in combination with the soil quality data generated through the test pit installation and soil coring activities, the conclusion may be drawn that there are significant and extensive soil and groundwater quality problems associated with this site. The soil and groundwater data indicate a number of locations contaminated with metals, TPH, PCBs, and carcinogenic PAHs above proposed MTCA cleanup standards. Moreover, some soil areas have levels of metals which would cause the soil to be designated as hazardous waste under the TCLP waste analysis protocol.

Because of the documented impacts to groundwater from the site activities, the present site owner would be required under MTCA to notify Ecology of the findings of the assessment, and to further identify the extent of the contamination associated with this site.

Hart Crowser recommends that the site/owner/operator consult legal counsel regarding the notification of Ecology personnel of the groundwater contamination problems identified during the assessment, and that an extent-of-contamination study be conducted at this facility.

The study should include the installation of more permanent groundwater monitoring wells and additional soil borings to further characterize the nature and extent of the identified soil and groundwater quality problems at the site.

SITE CONDITIONS

The project property is situated in the Tacoma tideflats. This area was filled beginning in the late 1800s. The fill material generally used in the area consisted primarily of wood, sawdust, and other debris mixed with sand and silt as observed in the test pits. At some locations, the top several feet of fill was gravelly, silty sand. The fill material is underlain by marine deposits consisting primarily of silty sand and sandy silt. Site groundwater was encountered in the drive point wells at depths ranging from 9 to 12 feet. Groundwater levels apparently fluctuate with the tide. The groundwater flow direction as determined from drive point water elevations is indicated to be apparently southwest. However, the actual groundwater flow direction in the site vicinity is uncertain. It is possible the flow direction would be in the gradient toward the Puyallup River (northeast). Accurate logs of the subsurface stratigraphy, such as those which would be generated during more permanent groundwater monitoring well installations, are not available to confirm the groundwater flow direction.

SOIL SAMPLING AND ANALYSIS

Subsurface soil samples were collected between August 16 and 17, 1990, during soil coring and test pit excavations. A surface soil sample was also collected from a slag pile identified on the site. Sampling methods are delineated in Appendix A.

Soil samples were collected near the surface (0 to 0.5 foot) and at the bottom of each test pit. In addition, the soil samples collected during hand coring activities were obtained from the bottom of the corings.

A summary of the on-site soil sampling activities is presented in Table 1.

Table 1 - Summary of On-Site Soil Sampling Activities

Area Location	Test Pit Number	Sample Number	Sample Depth in Feet
Downgradient from furnace	TP-1	S-1 S-2	0.5 11.0
Fill Area at northeastern edge	TP-2	S-1 S-2	0.5 8.0
Fill area at northeastern edge	TP-3	S-1 S-2	0.5 10.0
Fill area at northeastern edge	TP-4	S-1 S-2	0.5 9.0
In-site depression area	TP-5	S-1 S-2	0.5 10.0
Southeastern site corner	--	HC-1	3.0
Location of former gasoline UST	--	TANK-1	4.5
On-site slag pile	--	SLAG-1	0.5

All collected soil samples, with the exception of the SLAG-1 sample, were submitted to the Hart Crowser *FAST* Laboratory for screening analyses for the volatile organic compounds (VOAs), PCBs, fuels, PAHs, and total metals: cadmium, chromium, and lead.

A split of each soil sample was also submitted to Analytical Technologies, Inc. (ATI) for analysis for arsenic content. In addition, splits of the following samples were submitted to ATI for analysis for the PAHs: TP-1, S-1; TP-1, S-2; TP-2, S-1; TP-2, S-2; TP-3, S-1; TP-4, S-1; and TP-4, S-2. Furthermore, splits of the soil samples TP-1, S-2 and TP-4, S-2 were submitted to ATI for confirmation analysis for PCBs, TPH, cadmium, chromium, and lead. Sample SLAG-1 was submitted to ATI for analysis for the Toxicity Characteristics Leaching Procedure (TCLP) for metals.

All collected samples were delivered to the laboratories following appropriate chain of custody procedures.

The following concerns were identified by the soil sample analyses:

- TPH concentrations were detected at elevated levels in the following soil samples (Table 3): TP-1, S-1 (1,200 ppm); TP-2, S-1 (1,597 ppm); TP-2, S-2 (636 ppm); TP-3, S-1 (3,270 ppm); TP-3, S-2 (790 ppm); TP-4, S-1 (2,010 to 2,400 ppm); TP-4, S-2 (840 to 1,380 ppm); and TANK-1 (580 ppm).

- Metals, including lead (Pb), arsenic (As), chromium (Cr), and/or cadmium (Cd) were detected at elevated concentrations in the following soil samples (Table 7): TP-1, S-1 (Pb, 5,0000 ppm; Cr, 160 ppm; Cd, 61 ppm); TP-2, S-1 (Pb, 5,300 ppm; As, 26 ppm; Cr, 340 ppm; Cd, 75 ppm); TP-2, S-2 (Pb, 770 ppm; Cd, 11 ppm); TP-3, S-1 (Pb, 390 ppm); TP-4, S-1 (Pb, 15,000 ppm; Cr, 130 ppm; Cd, 150 ppm); TP-4, S-2 (Pb, 620 to 760 ppm; Cd, 9 to 11 ppm); and TP-5, S-1 (As, 32 ppm; Pb, 3,500 ppm; Cr, 330 ppm; Cd, 22 ppm).

- PCBs were detected at elevated concentrations at the following sampling locations (Table 6): TP-2, S-1 (4.4 ppm); TP-4, S-1 (11 ppm); and TP-4, S-2 (6.7 to 32 ppm).

- The carcinogenic PAH compounds (Table 4) were detected at elevated concentrations in soil at the TP-4, S-2 location (1.45 ppm).

- VOA compounds, including methylene chloride (0.5 to 5.3 ppm) and benzene (74 to 110 ppb), were detected at elevated concentrations in each of the soil samples analyzed by the Hart Crowser *FAST* Laboratory (Table 5). However, these compounds were also detected in the method blank analyzed by the *FAST* Laboratory at similar concentrations, and are therefore considered an artifact of sample handling.

The chromatograms generated during the Hart Crowser *FAST* Laboratory screening of soil samples for fuel hydrocarbons indicated the probable presence of additional elevated concentrations of the PAH compounds in the following soil samples: TP-1, S-1; TP-2, S-1; TP-2, S-2; TP-3, S-1; and TP-4, S-1. These samples were therefore submitted to ATI for confirmation analysis. Elevated levels of the carcinogenic PAH compounds were found in each of the soil samples submitted for analysis at the following concentrations (Table 4): TP-1, S-1 (13.77 ppm); TP-2, S-1 (28.2 ppm); TP-2, S-2 (2.44 ppm); TP-3, S-1 (13.7 ppm); and TP-4, S-1 (9.71 ppm).

The elevated lead and cadmium concentrations detected in a number of the soil samples raised the concern that portions of the on-site soils may contain leachable quantities of these metals above TCLP standards. Therefore, soil samples TP-1, S-1; TP-2, S-1; and TP-4, S-1 were submitted to ATI for TCLP analysis for lead and cadmium.

- TCLP concentrations of lead were detected at elevated levels in each of the soil samples submitted for analysis at the following concentrations (Table 7): TP-1, S-1 (15 mg/L); TP-2, S-1 (22 mg/L); and TP-4, S-1 (370 mg/L).

- TCLP concentrations of cadmium (Table 7) were detected at a concentration of 2.2 mg/L in TP-4, S-1.

GROUNDWATER SAMPLING AND ANALYSIS

Following the installation and development of the drive point wells, the wells were purged by removing three casing volumes of water using a stainless steel bailer. They were then sampled within 2 hours of purging.

Groundwater samples collected for analysis for VOAs and for a fuel fingerprint screen were submitted to the Hart Crowser *FAST* Laboratory. Samples collected for analysis for the PAHs, PCBs, arsenic, cadmium, chromium, and lead were submitted to ATI. All collected samples were delivered to the laboratory following appropriate chain of custody protocol.

Elevated concentrations of TPH were detected in the groundwater samples from HC-3 (1 to 8.7 µg/L) and HC-4 (12.3 µg/L) (Table 9). In addition, elevated levels of the carcinogenic PAH compounds were detected in groundwater samples from HC-2 (0.51 µg/L), HC-3 (2.5 µg/L), and HC-4 (0.31 µg/L) (Table 10). Elevated concentrations of the PCB aroclors 1254 and 1260 (18.2 µg/L total PCBs) were detected in the groundwater sample from HC-3 (Table 12). Elevated arsenic, cadmium, and lead concentrations were also detected in the groundwater (Table 13). Arsenic was detected in groundwater from HC-3 at a concentration of 6 to 7 µg/L. Cadmium was detected at a concentration of 4.7 to 5 µg/L. Lead was detected in groundwater from HC-1 (120 µg/L) and HC-3 (6 to 8 µg/L).

The PAH compound anthracene was detected at low levels in each of the four drive point wells samples. However, this compound was also detected at a similar concentration in the method blank analyzed by ATI. Therefore, the detected concentrations are considered an artifact of sample handling.

Benzene was detected at a low level in the groundwater sample collected from drive point well HC-3, and in the method blank analyzed by the Hart Crowser *FAST* Laboratory at a similar concentration. The detected concentration is therefore also considered an artifact of sample handling.

The detection limit for TPH in groundwater (5 mg/L) available from the Hart Crowser *FAST* Laboratory is several orders of magnitude higher than the proposed MTCA standards for groundwater (1 mg/L). Therefore, the TPH concentrations in groundwater from the HC-1 and HC-2 drive point wells may also conceivably exceed the proposed MTCA standard.

INTERPRETATION OF PROPERTY ENVIRONMENTAL CONCERNS

Comparative Environmental Quality Criteria

Under MTCA, Ecology has recently (July 27, 1990) proposed cleanup standards for soil, groundwater, and other environmental media. The proposed standards are generally based on protection of the most restrictive beneficial use potentially associated with each type of media. Groundwater standards, for example, are based on a consideration of drinking water uses. The soil quality standards address both groundwater protection (e.g., due to contaminant leaching) and human health concerns resulting from direct soil contact. The soil standards also consider whether the site may support industrial or residential uses. Although the industrial soil standards in some cases are less restrictive than residential criteria, Ecology may require that deed restrictions be placed on the land title before the industrial standards can be applied.

The proposed MTCA cleanup standards can be used as a basis to evaluate soil and groundwater data collected during this environmental assessment. Key cleanup standards (derived either from tabulated

Method A values or computed from risk equations, as appropriate) are presented in Table 2.

A special analytical test for designating hazardous waste is the TCLP measurement for leachable metals and organics. The test is used to identify materials that must be handled as a designated hazardous waste. Because of the elevated total metal concentrations detected by screening methods in soil and groundwater at the site, selected soil samples were submitted for laboratory analysis for the TCLP metals. The results for the TCLP analyses and the regulatory levels for the compounds of concern are presented in Table 8.

Soil Quality Concerns

The analytical results for the soil samples collected and analyzed during this study are summarized in Table 3 (TPH), Table 4 (PAH), Table 5 (VOA), Table 6 (PCBs), Table 7 (Total Metals), and Table 8 (TCLP Metals). Relative to the proposed MTCA cleanup standards and the TCLP analytical results, the following concerns are identified:

- Each of the samples submitted for TCLP analysis contain lead concentrations (15 to 370 mg/L) exceeding the 5 mg/L TCLP standard. In addition, surface soils from TP-4, S-1 contain TCLP cadmium concentration (2.2 mg/L) at a level exceeding the 1 mg/L standard for cadmium.

- Surface and subsurface soils at most of the sampled locations contain TPH concentrations (580 to 3,270 ppm) exceeding the proposed MTCA standard (100 to 200 ppm) for groundwater protection. Exceptions include the following soil sample locations: TP-1, S-2; TP-5, S-2; and HC-1.

- Surface and subsurface soils at most of the sampled locations contain lead (370 to 14,000 ppm) and cadmium (6 to 140 ppm) concentrations exceeding the proposed MTCA residential soil standard (Pb=250 ppm; Cd=2 ppm), based on direct soil contact exposures. In addition, all of the test pits with the exception of TP-3 contain lead (2,800 to 14,000 ppm) and cadmium (22 to 140 ppm) concentrations in surface soils that exceed the proposed MTCA industrial soil standard (Pb=1,000 ppm; Cd=10 ppm).

- Surface soils at each of the test pit locations, with the exception of TP-3, contain chromium concentrations (120 to 300 ppm) exceeding the proposed MTCA residential soil standard (100 ppm), based on direct soil contact exposures.

- Surface soil arsenic concentrations exceeding the proposed MTCA residential soil standard (20 ppm), based on direct soil contact exposures at the following locations: TP-2 (26 ppm) and TP-5 (32 ppm).

- Surface and subsurface soils contain PCB concentrations (3.8 to 10 ppm) exceeding the proposed MTCA residential soil standard (1 ppm) at the following locations: TP-2, S-1; TP-4, S-1; and TP-4, S-2. The Industrial soil standard (10 ppm) was exceeded in only TP-4, S-1 (11 ppm).

- Surface and subsurface soils contain the carcinogenic PAH concentrations (1.45 to 28.2 ppm) exceeding the proposed MTCA residential soil standard (1 ppm) at the following locations: TP-1, S-1; TP-2, S-1; TP-2, S-2; TP-3, S-1; TP-4, S-1; and TP-4, S-2. In addition, surface soils at the TP-2 location contain carcinogenic PAH levels (28.2 ppm) exceeding the proposed MTCA industrial soil standard (20 ppm).

Other Soil Quality Issues

Low-level contaminant concentrations were detected at other on-site surface and subsurface sampling locations. However, relative to the proposed MTCA cleanup standards listed in Table 2, the detected concentrations do not present a significant environmental threat through direct soil contact or impacts to groundwater. Low-level contamination was detected at the following locations:

- Low-level diesel fuel concentrations were detected in the following test pit samples: TP-2, S-1 (97 ppm) and TP-2, S-2 (36 ppm).

- Low-level concentrations of the non-carcinogenic PAH compounds were detected in the following test pit samples: TP-1, S-1 (20.38 ppm); TP-1, S-2 (0.024 ppm); TP-2, S-1 (55 ppm); TP-2, S-2 (2.79 ppm); TP-3, S-1 (8.13 ppm); TP-4, S-1 (8.92 ppm); and TP-4, S-2 (1.092 ppm).

- Low-level toluene and xylene concentrations were detected in the following test pit samples: TP-2, S-1 (toluene=45 ppb; xylene=150 ppb); TP-4, S-1 (toluene=51 ppb; xylene=58 ppb); and TP-4, S-2 (toluene=290 ppb; xylene=1.1 ppm).

- Low-level PCB concentrations were detected in the following test pit samples: TP-1, S-1 (0.6 ppm); TP-2, S-2 (0.7 ppm); TP-3, S-1 (0.4 ppm); and TP-5, S-1 (0.1 ppm).

- Low-level lead concentrations were detected in the following test pit samples: TP-1, S-2 (53 ppm); TP-3, S-2 (29 ppm); and TP-5, S-2 (51 ppm).

- Low-level arsenic concentrations (1.2 to 9.3 ppm) were detected in surface and subsurface soils in each of the test pit samples.

- Low-level chromium concentrations were detected in the following soil samples: TP-1, S-2 (11 ppm); TP-2, S-2 (69 ppm); TP-3, S-1 (30 ppm); TP-3, S-2 (11 ppm); TP-4, S-2 (18 to 19 ppm); TP-5, S-2 (15 ppm); and HC-1 (13 ppm).

Groundwater Quality Concerns

The analytical results for the groundwater samples collected and analyzed during this study are summarized in Table 9 (TPH), Table 10 (PAH), Table 11 (VOA), Table 12 (PCB), and Table 13 (Total Metals). Relative to the proposed MTCA cleanup standards, the following concerns are identified:

- Groundwater from the HC-3 and HC-4 drive point wells contain TPH concentrations (1 to 12.3 mg/L) exceeding the proposed MTCA standard (1 mg/L).

- Groundwater from the HC-2 drive point well contains total carcinogenic PAH compounds (0.51 μg/L) at concentrations exceeding the proposed MTCA standard (0.1 μg/L). In addition, groundwater from the HC-3 drive point well contains carcinogenic PAH compounds at concentrations (2.5 μg/L) exceeding the proposed MTCA standard. Groundwater from the HC-4 drive point well also contains the carcinogenic PAH compound chrysene (0.31 μg/L) at a concentration exceeding the proposed MTCA standard.

- Groundwater from the HC-3 drive point well contains the PCB aroclors 1254 (12 μg/L) and 1260 (6.2 μg/L) at concentrations exceeding the proposed MTCA standard (0.1 μg/L).

- Groundwater from the HC-1 drive point well contains lead (120 μg/L) at a concentration exceeding the proposed MTCA standard (5 μg/L). Groundwater from the HC-3 drive point well also contains lead (6 to 8 μg/L) and cadmium (4.7 to 5 μg/L) at an elevated concentration. In addition, arsenic levels at the HC-3 well (6 to 7 μg/L) exceed the proposed MTCA standard (5 μg/L).

Other Groundwater Quality Issues

Low-level contaminant concentrations were detected at other drive point well locations. However, relative to the proposed MTCA cleanup standards listed in Table 2, the detected concentrations do not present a significant environmental threat to groundwater. Low-level contamination was detected at the following locations:

- Low-level concentrations of the non-carcinogenic PAH compounds were detected in drive point wells HC-2, HC-3, and HC-4. These included fluoranthene (2.2 μg/L), phenanthrene (0.42 μg/L), and pyrene (1.4 μg/L), detected in HC-2; acenaphthene (1.5 μg/L), fluoranthene (1.9 μg/L), fluorene (0.1 μg/L), naphthalene (2.4 μg/L), phenanthrene (0.5 μg/L), and pyrene (1.1 μg/L), detected in HC-3; and phenanthrene (0.22 μg/L) and pyrene (0.77 μg/L), detected in HC-4.

- Low-level concentrations of the VOA compounds were detected in drive point wells HC-2 and HC-3. These included chlorobenzene (23 μg/L), detected in HC-2; and toluene (9 μg/L) and xylene (14 μg/L), detected in HC-3.

  Low-level concentration of cadmium were detected in drive point wells HC-1 (0.6 μg/L) and HC-2 (1.7 μg/L).

REPORT LIMITATIONS

Work for this project was performed, and this report prepared, in accordance with generally accepted professional practices for the nature and conditions of the work completed, in the same and similar localities,

at the time the work was performed. It is intended for the exclusive use of Weiss, Jensen, Ellis, and Botteri. This report is not meant to express a legal opinion. No other warranty, express or implied, is made.

It should be noted that Hart Crowser relied on verbal and written information regarding historical on-site operations at the subject property. Hart Crowser can only relay this information and cannot be responsible for its accuracy or completeness.

Any questions regarding the field work or this report, the presentation of the information, and the interpretation of the data are welcome and should be referred to Elaine Atkinson or John Funderburk at (206) 324-9530.

We trust that this report meets your needs.

Sincerely,

HART CROWSER, INC.

Elaine P. Atkinson

ELAINE P. ATKINSON
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EPA/JRF:ob

PHASEIILFR

Table 2 - Proposed Washington Model Toxics Control Act
Compliance Cleanup Levels

Parameter	Residential Soil Standard*	Industrial Soil Standard*	Groundwater Standard**
Tabulated Method A Values			
Arsenic	20.0	200.0	5.0
Cadmium	2.0	10.0	5.0
Chromium	100.0	500.0	50.0
Lead	250.0	1,000.0	5.0
PAHs (Carcinogenic)	1.0	20.0	0.1
PCB Mixtures	1.0	10.0	0.1
Toluene	40.0	40.0	40.0
TPH (Total)	—	—	1.0
TPH (Gasoline)	100.0	100.0	—
TPH (Diesel)	200.0	200.0	—
TPH (Other)	200.0	200.0	—
Xylenes	20.0	20.0	20.0
Computed Cleanup Levels from Risk Equations			
Acenaphthrene	4,800	84,000	960-2,100
Anthracene	24,000	—	4,800-10,500
Fluoranthene	3,200	56,000	640-1,400
Fluorene	3,200	56,000	640-1,400
Naphthalene	320	5,600	64-140
Pyrene	2,400	42,000	480-1,050

* Soil standard concentrations are mg/kg (ppm).

** Groundwater standard concentrations are ug/L (ppb).

3078T2.wk1

Table 3 - Summary of Total Petroleum Hydrocarbon (TPH) Analytical Results for Soil

Test Pit, Sampling Location	Concentration in ppm (wet weight)			
	Oil	Diesel/No.2 Fuel	Gasoline	Total Petroleum Hydrocarbons
TP-1, S-1	1,200	25U	25U	1,200
TP-1, S-2	25U	25U	25U	
TP-1, S-2*	5U	5U	5U	5U
TP-2, S-1	1,500	97	25U	1,597
TP-2, S-2	600	36	25U	636
TP-3, S-1	870	2,400	25U	3,270
TP-3, S-2	25U	790	25U	790
TP-4, S-1	1,400	610	25U	2,010
TP-4, S-1*	NA	NA	NA	2,400
TP-4, S-2	25U	200	640	840
TP-4, S-2*	NA	280	1,100	1,380
TP-5, S-1	25U	25U	25U	
TP-5, S-2	25U	25U	25U	
TP-5, S-2*	NA	NA	NA	18
TANK-1	580	25U	25U	580
HC-1	25U	25U	25U	

Notes:

Analysis conducted by Hart Crowser FAST Laboratory

* Confirmation analysis by Analytical Technologies, Inc.

U denotes that analyte was not detected; value presented is the method detection limit.

NA = Not Analyzed

3078T3a.wk1

Table 4 - Summary of Polycyclic Aromatic Hydrocarbon (PAH) Analytical Results for Soil

Parameter	Concentration in ppb						
	Test Pit, Soil Sample						
	TP-1, S-1	TP-1, S-2	TP-2, S-1	TP-2, S-2	TP-3, S-1	TP-4, S-1	TP-4, S-2
Sample Depth in Feet	0.5	11.0	0.5	8.0	0.5	0.5	9.0
Acenaphthene	1,700U	170U	3,400U	1,700U	1,700U	3,400U	270U
Acenaphthylene	1,700U	170U	3,400U	1,700U	1,700U	3,400U	270U
Anthracene	710	8.3U	1,700	83U	220	220	13U
Benzo(a)anthracene	2,700	17U	4,800	300	1,200	1,200	45
Benzo(b)fluoranthene	1,700	17U	2,500	370	2,800	2,700	420
Benzo(k)fluoranthene	970	17U	1,600	190	1,500	710	27U
Benzo(g,h,i)perylene	1,800	17U	3,900	930	3,000	1,900	290
Benzo(a)pyrene	2,500	17U	5,500	500	3,800	1,800	270
Chrysene	2,900	17U	7,400	460	1,500	1,600	110
Dibenz(a,h)anthracene	1,500	34U	3,400	340U	340U	680U	350
Fluoranthene	7,600	17U	21,000	840	2,000	3,000	390
Fluorene	370	17U	1,400	170U	170U	340U	27U
Indeno(1,2,3-cd)pyrene	1,500	17U	3,000	620	2,900	1,700	270
Naphthalene	830U	83U	1,700U	830U	830U	1,700U	130U
Phenanthrene	2,800	8.3U	8,000	200	610	1,300	82
Pyrene	7,100	24	19,000	820	2,300	2,500	330

Notes:

Analysis conducted by Analytical Technologies, Inc.

B indicates that analyte was detected in the method blank at a similar concentration.

U denotes that analyte was not detected; value presented is the method detection limit.

3078T4a.wk1

Table 5 – Summary of Volatile Organic (VOA) Analytical Results for Soil

Parameter	Concentration in ppb (dry weight)												
	Test Pit, Soil Sample												
	TP-1, S-1	TP-1, S-2	TP-1, S-2*	TP-2, S-1	TP-2, S-2	TP-3, S-1	TP-3, S-2	TP-4, S-1	TP-4, S-2	TP-4, S-2*	TP-5, S-1	TP-5, S-2	HC-1
Acetone	NA	NA	1.00U	NA	NA	NA	NA	NA	NA	1.60U	NA	NA	NA
Bromodichloromethane	200U	200U	0.05U	200U	200U	200U	200U	200U	200U	0.08U	200U	200U	200U
Bromoform	200U	200U	0.25U	200U	200U	200U	200U	200U	200U	0.39U	200U	200U	200U
Bromomethane	NA	NA	0.50U	NA	NA	NA	NA	NA	NA	0.78U	NA	NA	NA
2-Butanone	NA	NA	0.50U	NA	NA	NA	NA	NA	NA	0.78U	NA	NA	NA
Carbon Disulfide	NA	NA	0.05U	NA	NA	NA	NA	NA	NA	0.08U	NA	NA	NA
Carbon Tetrachloride	50U	50U	0.05U	50U	50U	50U	50U	50U	50U	0.08U	50U	140	50U
Chlorobenzene	50U	50U	0.05U	50U	50U	50U	50U	50U	50U	0.08U	50U	50U	50U
Chloroethane	NA	NA	0.05U	NA	NA	NA	NA	NA	NA	0.08U	NA	NA	NA
Chloroform	50U	50U	0.05U	50U	50U	50U	50U	50U	50U	0.08U	50U	50U	50U
Chloromethane	NA	NA	0.50U	NA	NA	NA	NA	NA	NA	0.78U	NA	NA	NA
Dibromochloromethane	200U	200U	0.05U	200U	200U	200U	200U	200U	200U	0.08U	200U	200U	200U
1,1-Dichloroethane	50U	50U	0.05U	50U	50U	50U	50U	50U	50U	0.08U	50U	50U	50U
1,2-Dichloroethane	200U	200U	0.05U	200U	200U	200U	200U	200U	200U	0.08U	200U	200U	200U
1,1-Dichloroethene	50U	50U	0.05U	50U	50U	50U	50U	50U	50U	0.08U	50U	50U	50U
1,2-Dichloroethene	NA	NA	0.05U	NA	NA	NA	NA	NA	NA	0.08U	NA	NA	NA
1,2-Dichloropropane	50U	50U	0.05U	50U	50U	50U	50U	50U	50U	0.08U	50U	50U	50U
cis-1,3-Dichloropropene	200U	200U	0.05U	200U	200U	200U	200U	200U	200U	0.08U	200U	200U	200U
trans-1,3-Dichloropropene	200U	200U	0.05U	200U	200U	200U	200U	200U	200U	0.08U	200U	200U	200U
2-Hexanone	NA	NA	0.50U	NA	NA	NA	NA	NA	NA	0.78U	NA	NA	NA
4-Methyl-2-Pentanone	NA	NA	0.50U	NA	NA	NA	NA	NA	NA	0.78U	NA	NA	NA
Methylene Chloride	5,300B	1,200B	0.25U	1,400B	1,400B	1,200B	500B	1,200B	2,000B	0.39U	830B	1,100B	230B
Styrene	NA	NA	0.05U	NA	NA	NA	NA	NA	NA	0.08U	NA	NA	NA
1,1,2,2-Tetrachloroethane	200U	200U	0.05U	200U	200U	200U	200U	200U	200U	0.08U	200U	200U	200U
Tetrachloroethene	50U	50U	0.05U	50U	50U	50U	50U	50U	50U	0.08U	50U	50U	50U
1,1,1-Trichloroethane	50U	50U	0.05U	50U	50U	50U	50U	50U	50U	0.08U	50U	50U	50U
1,1,2-Trichloroethane	50U	50U	0.05U	50U	50U	50U	50U	50U	50U	0.08U	50U	50U	50U
Trichloroethene	50U	50U	0.05U	50U	50U	50U	50U	50U	50U	0.08U	50U	50U	50U
Trichlorofluoromethane	50U	50U	NA	50U	50U	50U	50U	50U	50U	NA	50U	50U	50U
Vinyl Acetate	NA	NA	0.50U	NA	NA	NA	NA	NA	NA	0.78U	NA	NA	NA
Vinyl Chloride	NA	NA	0.05U	NA	NA	NA	NA	NA	NA	0.08U	NA	NA	NA
Benzene	110B	110B	0.05U	110B	110B	100B	74B	120B	190B	0.08U	120B	100B	110B
Ethylbenzene	50U	50U	0.05U	50U	50U	50U	50U	50U	50U	0.08U	50U	50U	50U
Toluene	50U	50U	0.05U	51	50U	50U	50U	55	410	0.08U	50U	50U	50U
Xylene	50U	50U	0.05U	170	50U	50U	50U	62	1,600	0.08U	50U	50U	50U

Notes:

Analysis conducted by Hart Crowser FAST Laboratory.

* Confirmation analysis conducted by Analytical Technologies, Inc.

B indicates analyte detected in the method blank at a similar concentration.

U denotes analyte not detected; value presented is the method detection limit.

Table 6 - Summary of PCB Analytical Results for Soil

Sampling Location	Concentration in ppm (dry weight) PCB Aroclor								
	A1016	A1221	A1232	A1242	A1248	A1254	A1260	A1262	A1268
TP-1, S-1	0.5U	0.5U	0.5U	0.5U	0.2U	0.2U	0.6	0.2U	0.2U
TP-1, S-2	0.5U	0.5U	0.5U	0.5U	0.2U	0.2U	0.2U	0.2U	0.2U
TP-1, S-2*	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	0.03U	NA	NA
TP-2, S-1	0.5U	0.5U	0.5U	0.5U	0.2U	0.2U	4.4	0.2U	0.2U
TP-2, S-2	0.5U	0.5U	0.5U	0.5U	0.2U	0.2U	0.8	0.2U	0.2U
TP-3, S-1	0.5U	0.5U	0.5U	0.5U	0.2U	0.2U	0.4	0.2U	0.2U
TP-3, S-2	0.5U	0.5U	0.5U	0.5U	0.2U	0.2U	0.2U	0.2U	0.2U
TP-4, S-1	0.5U	0.5U	0.5U	0.5U	0.2U	0.2U	11	0.2U	0.2U
TP-4, S-2	0.5U	0.5U	0.5U	0.5U	0.2U	0.2U	6.7	0.2U	0.2U
TP-4, S-2*	3.91U	3.91U	3.91U	3.91U	3.91U	3.91U	32	NA	NA
TP-5, S-1	0.5U	0.5U	0.5U	0.5U	0.2U	0.1	0.2U	0.2U	0.2U
TP-5, S-2	0.5U	0.5U	0.5U	0.5U	0.2U	0.2U	0.2U	0.2U	0.2U
HC-1	0.5U	0.5U	0.5U	0.5U	0.2U	0.2U	0.2U	0.2U	0.2U

Notes:

Analysis conducted by Hart Crowser FAST Laboratory
* Analysis conducted by Analytical Technologies, Inc., Laboratory
NA = Not Analyzed

3078T6b.wk1

Table 7 - Summary of Total Metals Analytical Results for Soil

Test Pit Soil Sample	Concentration in ppm (dry weight)			
	Arsenic (1)	Cadmium (2)	Chromium (2)	Lead (2)
TP-1, S-1	9.3	61	160	5,000
TP-1, S-2*	1.4	1.5U	11	10U
TP-2, S-1	26	75	340	5,300
TP-2, S-2	6.4	11	69	770
TP-3, S-1	2.3	3	30	390
TP-3, S-2	1.2	1.5U	11	29
TP-4, S-1	10	150	130	15,000
TP-4, S-2**	2.6	9	19	760
TP-5, S-1	32	27	330	3,500
TP-5, S-2	1.4	1.5U	15	51
HC-1	1.7	1.5U	13	10U

Notes:

(1) Analysis conducted by Analytical Technologies, Inc.
(2) Analysis conducted by Hart Crowser FAST Laboratory
* Confirmation analysis by Analytical Technologies, Inc. detected cadmium at 1.3 ppm; chromium at 15 ppm; and lead at 53 ppm.
** Confirmation analysis conducted by Analytical Technologies, Inc. detected cadmium at 11 ppm; chromium at 18 ppm; and lead at 620 ppm.
U denotes analyte not detected; value presented is the laboratory detection limit.

3078T7a.wk1

Table 8 - Summary of Toxicity Characteristics Leaching Procedure (TCLP) Metals Analytical Results

Parameter	Concentration in mg/L (dry weight)				
	SLAG-1	TP-1, S-1	TP-2, S-1	TP-4, S-1	Regulatory Limit
Arsenic	0.005U	NA	NA	NA	5.0
Barium	0.36	NA	NA	NA	100.0
Cadmium	0.01	0.95	0.77	2.2	1.0
Chromium	0.02U	NA	NA	NA	5.0
Lead	0.64	15	22	370	5.0
Mercury	0.0005U	NA	NA	NA	0.2
Selenium	0.005U	NA	NA	NA	1.0
Silver	0.02U	NA	NA	NA	5.0

Notes:

Analysis conducted by Analytical Technologies, Inc.
NA = not analyzed
U denotes analyte not detected; value presented is the laboratory detection limit

3078T8a.wk1

Table 9 - Summary of Total Petroleum Hydrocarbon (TPH) Analytical Results for Groundwater

Sampling Location	Concentration in mg/L		
	Oil	Diesel/No. 2 Fuel	Gasoline
HC-1	5U	5U	5U
HC-2	5U	5U	5U
HC-3*	5U	5U	8.7
HC-4	12.3	5U	5U

Notes:

Analysis conducted by Hart Crowser FAST Laboratory.
* Confirmation analysis conducted by Analytical Technologies, Inc. detected gasoline at 1 mg/L.
U denotes analyte not detected; value presented is the laboratory detection limit.

3078T9a.wk1

Table 10 - Summary of Polycyclic Aromatic Hydrocarbon (PAH) Analytical Results for Groundwater

Parameter	Concentration in ug/L (ppb) Sampling Location HC-1	HC-2	HC-3	HC-4
Acenaphthene	1.0U	1.0U	1.5	1.0U
Acenaphthylene	1.0U	1.0U	1U	1.0U
Anthracene	0.08B	0.06B	0.08B	0.05B
Benzo(a)anthracene	0.1U	0.1U	0.1U	0.1U
Benzo(b)fluoranthene	0.1U	0.1U	0.5	0.1U
Benzo(k)fluoranthene	0.1U	0.17	0.4	0.1U
Benzo(g,h,i)perylene	0.1U	0.1U	0.2	0.1U
Benzo(a)pyrene	0.1U	0.1U	0.2	0.1U
Chrysene	0.1U	0.34	0.7	0.31
Dibenz(a,h)anthracene	0.2U	0.2U	0.4	0.2U
Fluoranthene	0.1U	2.2	1.9	0.1U
Fluorene	0.1U	0.1U	0.1	0.1U
Indeno(1,2,3-cd)pyrene	0.1U	0.1U	0.3	0.1U
Naphthalene	0.5U	0.5U	2.4	0.5U
Phenanthrene	0.05U	0.42	0.5	0.22
Pyrene	0.1U	1.4	1.1	0.77

Notes:

Analysis conducted by Analytical Technologies, Inc.

U denotes that analyte was not detected; value presented is the method detection limit.

B indicates that analyte was detected in the method blank at a similar concentration.

3078T10a.wk1

Table 11 - Summary of Volatile Organic (VOA) Analytical Results for Groundwater

Parameter	Concentration in ug/L (ppb)			
	Sampling Location			
	HC-1	HC-2	HC-3	HC-4
Bromodichloromethane	5U	5U	5U	5U
Bromoform	5U	5U	5U	5U
Carbon Tetrachloride	1U	1U	1U	1U
Chlorobenzene	1U	23	1U	1U
Chloroform	1U	1U	1U	1U
Dibromochloromethane	5U	5U	5U	5U
1,1-Dichloroethane	1U	1U	1U	1U
1,1-Dichloroethylene	1U	1U	1U	1U
1,2-Dichloroethane	5U	5U	5U	5U
t-1,2-Dichloroethylene	1U	1U	1U	1U
1,2-Dichloropropane	1U	1U	1U	1U
c&t-1,3-Dichloropropene	5U	5U	5U	5U
Methylene Chloride	1U	1U	1U	1U
Tetrachloroethylene	1U	1U	1U	1U
1,1,1-Trichloroethane	1U	1U	1U	1U
1,1,2-Trichloroethane	1U	1U	1U	1U
1122-Tetrachloroethane	5U	5U	5U	5U
Trichloroethylene	1U	1U	1U	1U
Trichlorofluoromethane	1U	1U	1U	1U
Benzene	1U	1U	4B	1U
Toluene	1U	1U	9	1U
Ethylbenzene	1U	1U	1U	1U
Xylenes	1U	1U	14	1U

Notes:

Analysis conducted by Hart Crowser FAST Laboratory.

U denotes that analyte was not detected; value presented is the method detection limit.

B denotes that analyte was detected in the method blank run by the laboratory

3078T11a.wk1

Table 12 - Summary of PCB Analytical Results for Groundwater

Sampling Location	Concentration in ug/L						
	PCB Aroclor						
	A1016	A1221	A1232	A1242	A1248	A1254	A1260
HC-1	1U	1U	1U	1U	1U	1U	1U
HC-2	1U	1U	1U	1U	1U	1U	1U
HC-3	1U	1U	1U	1U	1U	12	6.2
HC-4	1U	1U	1U	1U	1U	1U	1U

Note:

Analysis conducted by Analytical Technologies, Inc.
U denotes that analyte was not detected; value presented is the method detection limit.

3078T12a.wk

Table 13 - Summary of Total Metals Analytical Results for Groundwater

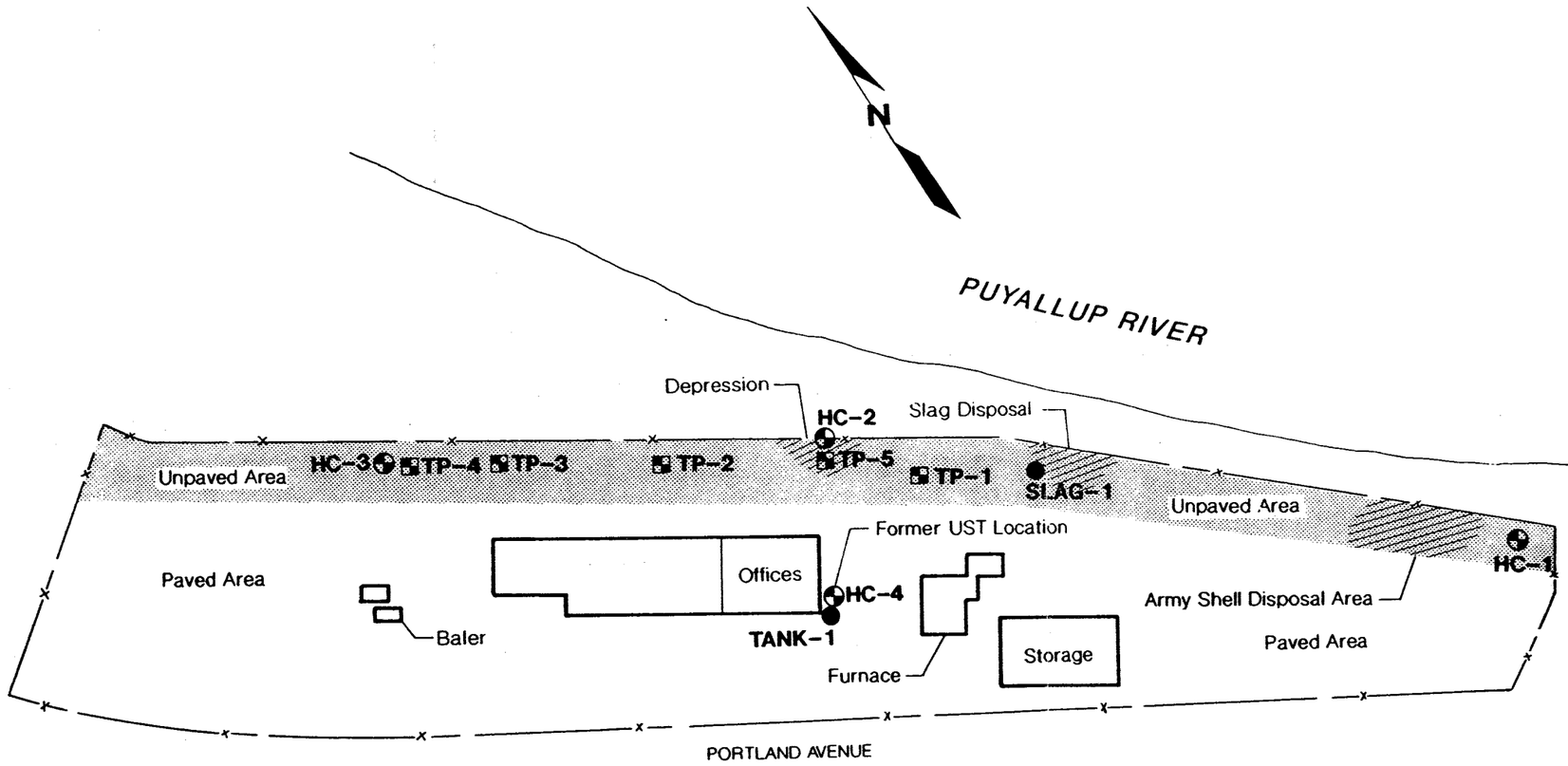
Sampling Location	Concentration in ug/L			
	Arsenic	Cadmium	Chromium	Lead
HC-1	5U	0.6	20U	120
HC-2	5U	1.7	20U	5U
HC-3	6-7	4.7-5	20U	6-8
HC-4	5U	0.3U	20U	5U

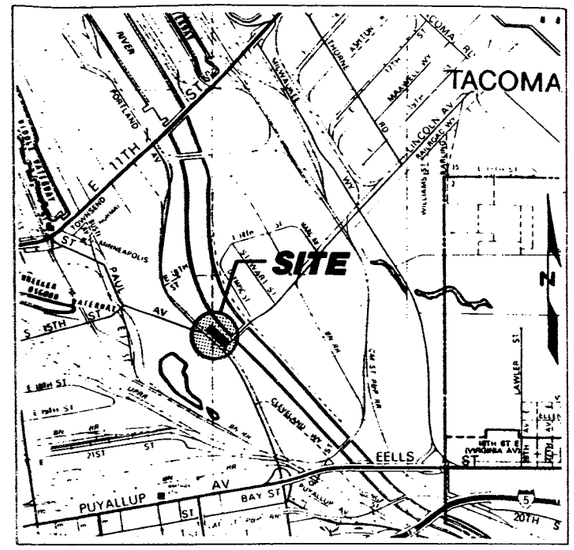
Notes:

Analysis conducted by Analytical Technologies, Inc.
U denotes that analyte was not detected; value presented is the method detection limit.

3078T13.wk1

Site and Exploration Plan





Vicinity Map

0 1/2 1
Scale in Miles

HC–1 Drive Point Well Location and Number

TP–1 Test Pit Location and Number

SLAG–1 Soil Sampling Location and Number

TANK–1 Soil Sampling Location and Number

0 100 200
Scale in Feet

HARTCROWSER
J–3078 8/90
Figure 1

APPENDIX A
FIELD EXPLORATIONS

APPENDIX A
FIELD EXPLORATIONS

The field work for this project was conducted between August 16 to 21, 1990, by Hart Crowser and its subconsultants. Hart Crowser's field manager for this project was Elaine Atkinson.

WT Services Company of Seattle, Washington, under subcontract to Hart Crowser, completed the test pit excavations for the project. Soil and groundwater samples were analyzed by Analytical Technologies, Inc. (ATI) and by the Hart Crowser *FAST* Laboratory.

On-site Hart Crowser personnel and subcontractors had received OSHA-approved 40-hour health and safety training.

Introduction

This appendix provides a description of the specific test pit excavation, soil coring, drive point installation, and sampling procedures used during our work at Tacoma Metals. The exploration program for this study included the excavation of five test pits, soil coring with a hand-held auger for sample collection at two locations, the installation of four drive point wells, and collection of soil and groundwater samples. Test pit, soil coring, drive point well, and surface soil sampling locations are presented on Figure 2.

Test Pit Excavations

Five test pits (TP-1 through TP-5) were completed on between August 16 to 17, 1990, at the locations shown on Figure 1. The excavations were completed with a backhoe loader. Test pit locations, depth, and sampling activities were directed by the Hart Crowser field representative. Soils were described in general accordance with ASTM D 2488 as depicted on Figure A-1. Logs of test pits are presented on Figures A-2 through A-4 at the end of this appendix.

Backfilling of the test pits was completed the same day as the excavation. Soils were returned to the approximate depths from which they were removed. The backhoe bucket was used to compact replaced soils.

Soil Coring Activities

Shallow surface soil samples were collected using a hand-held auger/post hole digger at the following on-site areas:

- A sample was collected at the 3-foot-depth from the southeast corner of the site (HC-1).
- A sample was collected at the 4.5-foot-depth from the location of the former gasoline UST on the property (TANK-1).

All samples were thoroughly mixed prior to transfer to the appropriate sample containers. A representative portion of the collected samples was then placed into a 4-ounce glass sample container for submittal to ATI for analysis for total arsenic. The remainder of the individual samples was placed into a 16-ounce glass sample container for submittal to the Hart Crowser *FAST* Laboratory for screening for VOAs, PAHs, PCBs, fuel compounds, cadmium, chromium, and lead.

Surface Soil Sampling

A surface soil sample was collected from the slag material deposited on the site using a stainless steel spoon. The sample was collected to a depth of approximately 4 inches. The slag was placed into a stainless steel pan for thorough mixing prior to transfer to a 16-ounce glass sample container. The collected sample was submitted to ATI for analysis for the Toxicity Characteristics Leaching Procedure (TCLP) for metals.

Equipment Decontamination

The backhoe was decontaminated with a steam cleaner after the installation of each test pit to minimize cross-contamination on the site. All sampling equipment was also cleaned after each sampling event. The stainless steel pan, spoon, hand auger, and post hole digger were scrubbed with an Alconox/water solution and rinsed with deionized water between each sample location.

H-Nu Measurements

Sample jar headspace organic vapor measurements were made from all collected soil samples using an H-Nu Photoionization Detector to assess the presence of volatile compounds. Each headspace jar was filled half-full with the soil sample and covered with aluminum foil prior to capping. H-Nu measurements were made by pushing the probe through the foil cover after allowing the jar samples to sit for 15 to 20 minutes. The H-Nu was calibrated using a manufacturer supplied standard gas prior to making the measurements. The H-Nu readings for all test pit samples are recorded on Figures A-2 through A-4 at their respective sample depths. No H-Nu readings were detected for all other collected soil samples.

Drive Point Well Installation

Four galvanized steel, 1¼-inch drive point wells were installed on the Tacoma Metals property between August 16 to 17, 1990, at the following locations:

- A 12-foot drive point (HC-1) was installed using a jackhammer at the southeast corner of the site.
- A 12-foot drive point (HC-2) was installed using a jackhammer at the TP-5 test pit location in the runoff water catchment basin on the site.
- A 12-foot drive point (HC-3) was installed by hand at the TP-4 test pit location in the fill area at the northeast corner of the site.
- A 15-foot drive point (HC-4) was installed by hand at the former gasoline UST location on the property .

The drive point wells were installed as temporary structures, and were abandoned following the completion of sampling activities.

Water Level Measurements

Water level measurements were made in the newly installed drive point wells to a measured accuracy of about 0.05 foot with an Olympic Model 150 Electric Well Probe and a decimally graduated tape measure. The probe was lowered down the drive point until water was encountered,

and the depth to the water table was recorded. The tip of the well probe was routinely rinsed with deionized water between wells in order to prevent chemical cross contamination.

The depth to water table elevations detected during well sampling activities on June 20, 1990, were as follows:

Well Number	Depth to Water Table in Feet
HC-1	10.23
HC-2	10.20
HC-3	8.70
HC-4	12.07

Groundwater Sampling

Prior to sampling, the four drive point wells were developed by removing ten casing volumes of water from each using a stainless steel bailer or peristaltic pump. All wells except well number HC-1 were sampled at least 24 hours after development. Three casing volumes of water were removed from the wells prior to sampling.

All drive point wells, with the exception of well number HC-1, were developed and sampled using a stainless steel bailer. Well number HC-1 was installed using a jackhammer, and the casing was damaged, thereby not allowing for the collection of water using a bailer. A peristaltic pump was therefore used to develop and sample this well. In addition, the peristaltic pump was used to collect water samples from each of the wells for total metals analysis. Well numbers HC-2 through HC-4 were turbid, and the water samples were therefore filtered using a 0.45 micron filter attached to the peristaltic pump prior to sample collection. All other well samples were collected by pouring water directly from the stainless steel bailer into the sample bottles.

Between each drive point well, the stainless steel bailer was washed in an Alconox solution and double rinsed with deionized water to minimize the potential of cross contamination. The nylon rope used on the bailer was dedicated to each well to minimize cross contamination. Separate

tubing and filters were used for the collection of groundwater samples with the peristaltic pump.

Sample Protocol

Pre-washed sample containers were used for all sample collections. The project name, project number, time, date, initials of sampler, and sampling location were recorded on all sample labels.

Samples were placed in coolers containing blue ice immediately after sampling. Samples were maintained in Hart Crowser's custody until they were delivered to the analytical laboratories. A Sample Custody Record Form was completed when samples were delivered to the laboratories. At a minimum, the form included the name of the persons receiving the samples, the condition of transport and sample containers, a verification of sample containers and Chain of Custody Record, the time and date the samples were delivered to the laboratory, and the required sample analyses. Copies of Sample Custody Records are presented along with analytical results in Appendix B.

Survey

The tops of three of the four drive point wells were surveyed for vertical control by Hart Crowser representatives. The survey elevations were based on an assumed reference elevation of 10 feet. All well and ground surface elevations were referenced from this assumed elevation datum.

Well Number	Relative Top of Casing Elevation in Feet
HC-1	10.30
HC-2	10.35
HC-4	12.10

Key to Exploration Logs

Sample Descriptions

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

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

Density/Consistency

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

SAND or GRAVEL Density	Standard Penetration Resistance in Blows/Foot	SILT or CLAY Consistency	Standard Penetration Resistance in Blows/Foot	Approximate Shear Strength in TSF
Very loose	0 - 4	Very soft	0 - 2	<0.125
Loose	4 - 10	Soft	2 - 4	0.125 - 0.25
Medium dense	10 - 30	Medium stiff	4 - 8	0.25 - 0.5
Dense	30 - 50	Stiff	8 - 15	0.5 - 1.0
Very dense	>50	Very stiff	15 - 30	1.0 - 2.0
		Hard	>30	>2.0

Moisture

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

Minor Constituents

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

Legends

Sampling

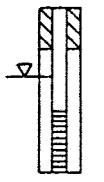
BORING SAMPLES

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

TEST PIT SAMPLES

- Grab (Jar)
- Bag
- Shelby Tube

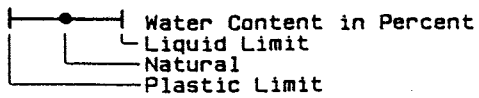
Ground Water Observations



- Surface Seal
- Ground Water Level on Date (ATD) At Time of Drilling
- Observation Well Tip or Slotted Section
- Ground Water Seepage (Test Pits)

Test Symbols

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

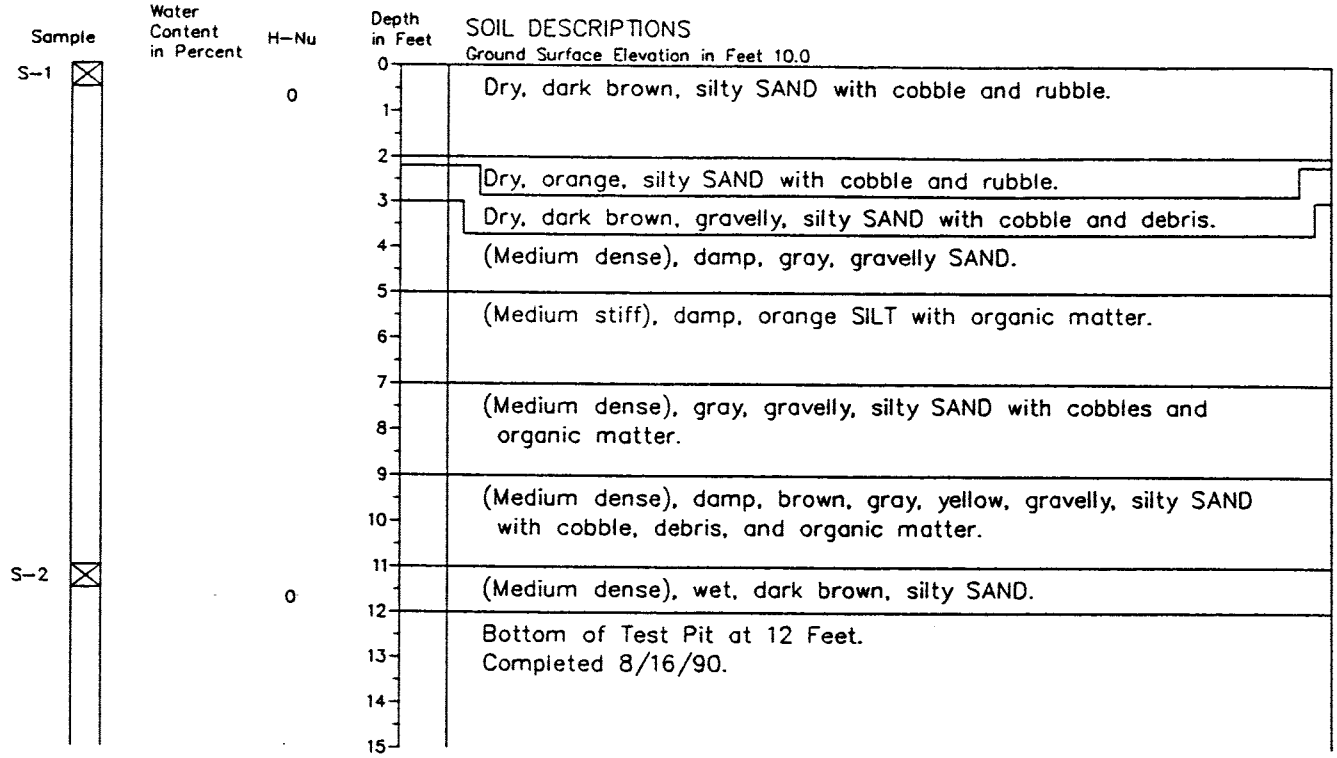


HARTCROWSER

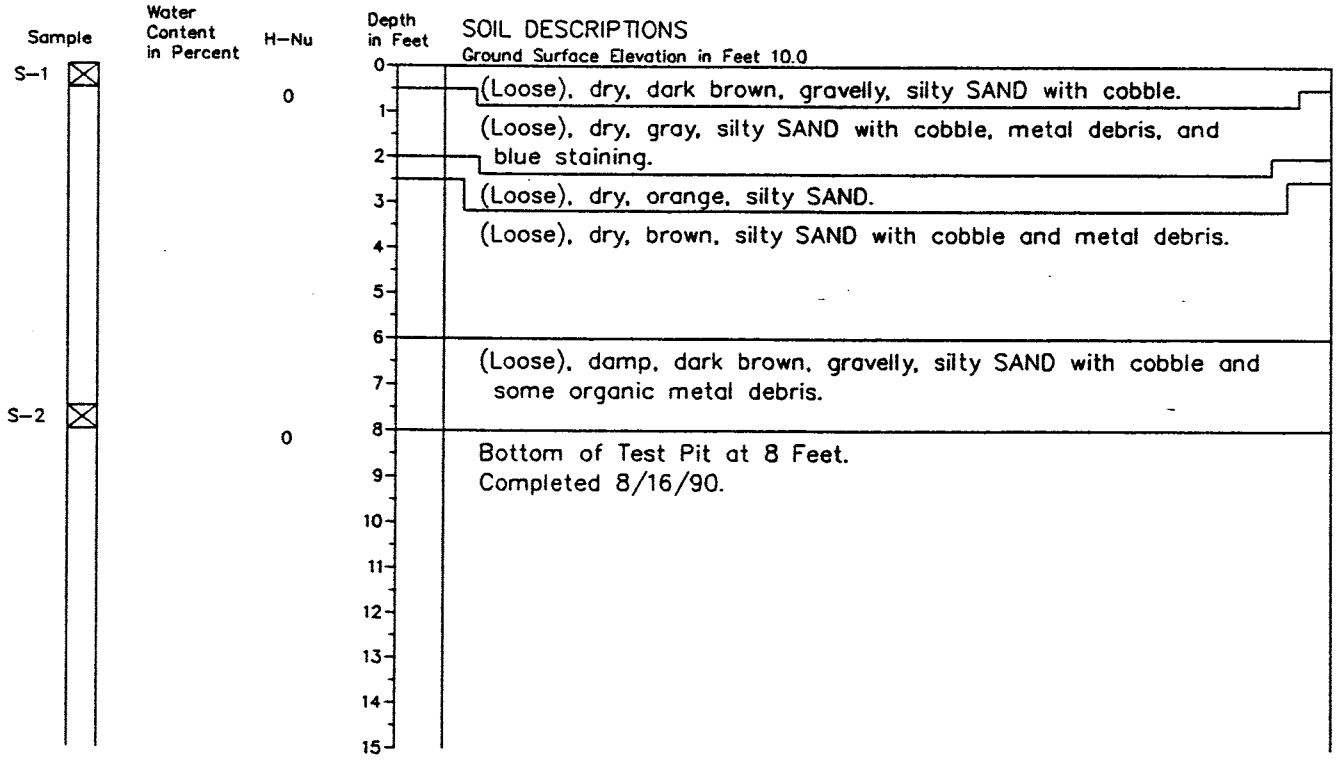
J-3078 9/90

Figure A-1

Test Pit Log TP-1



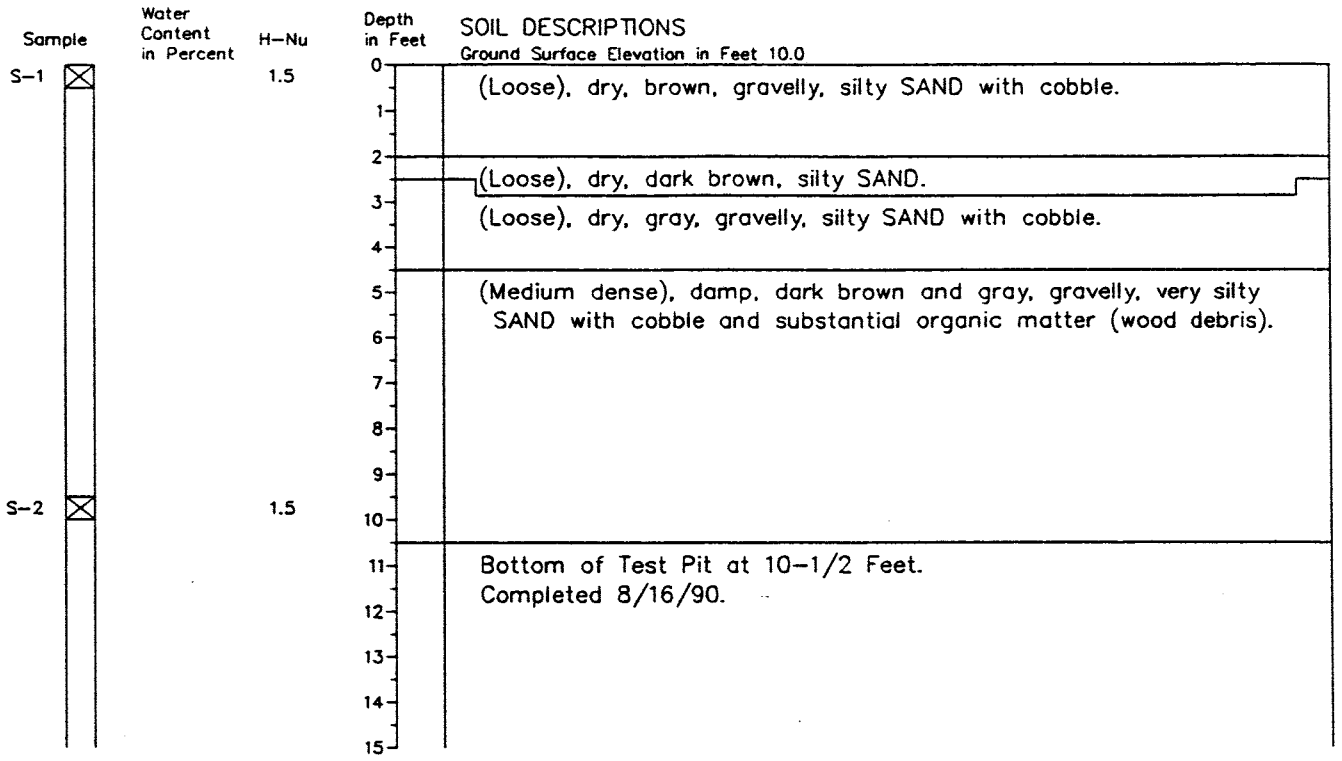
Test Pit Log TP-2



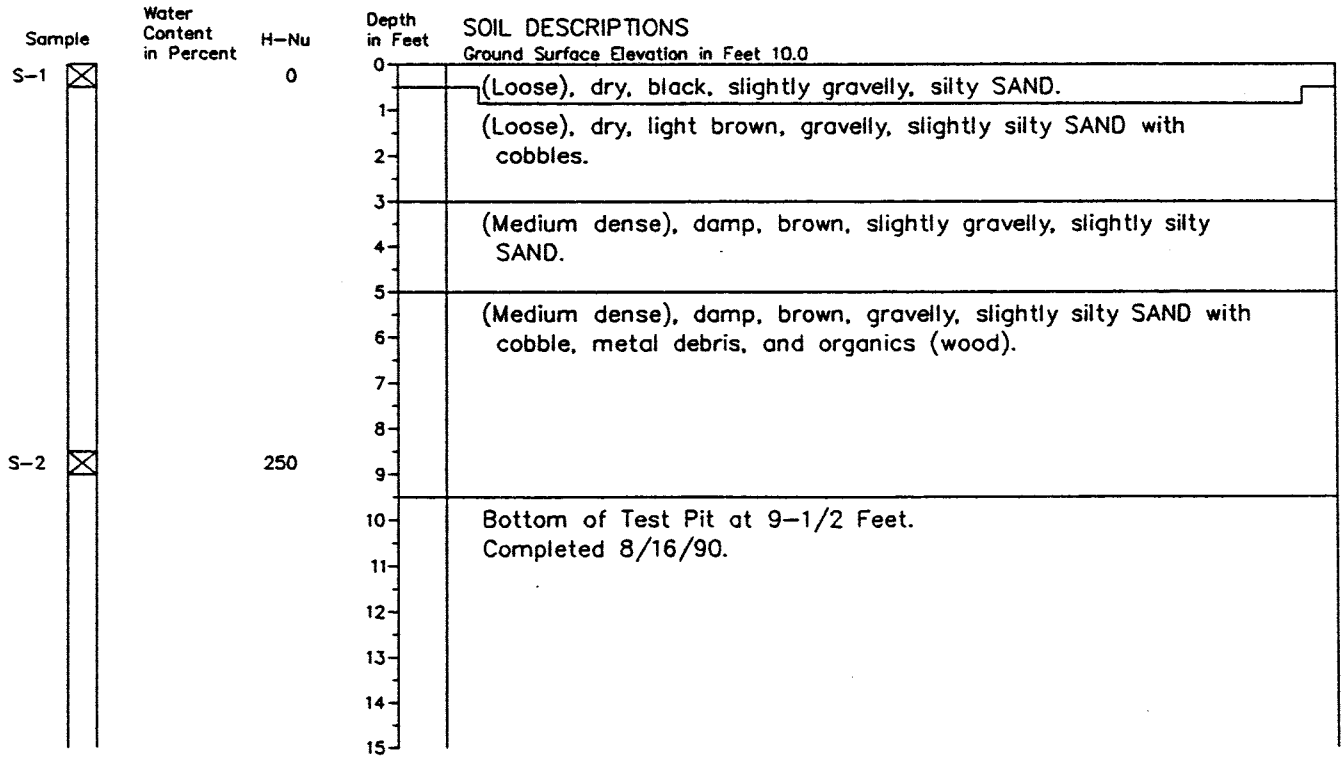
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at time of excavation. Conditions may vary with time.

HARTCROWSER
J-3078 8/90
Figure A-2

Test Pit Log TP-3



Test Pit Log TP-4



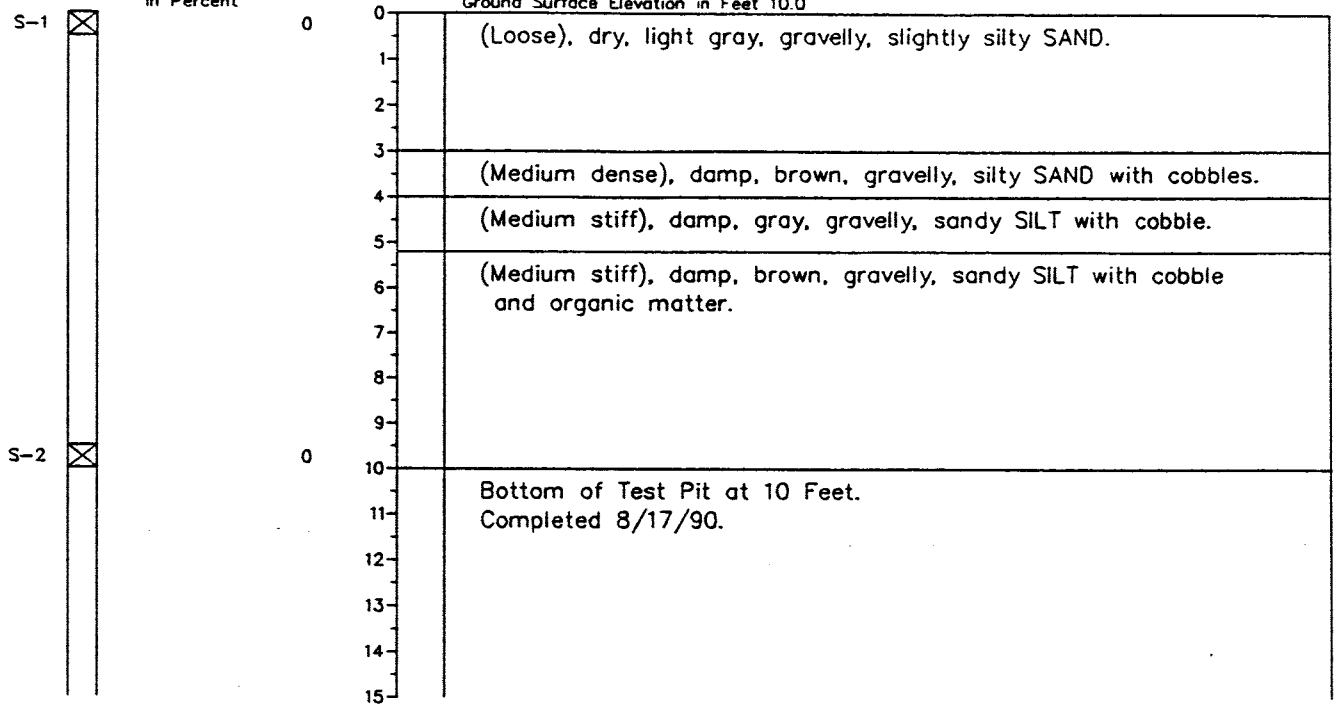
1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at time of excavation. Conditions may vary with time.

HARTCROWSER

J-3078 8/90

Figure A-3

Test Pit Log TP-5



1. Refer to Figure A-1 for explanation of descriptions and symbols.
2. Soil descriptions and stratum lines are interpretive and actual changes may be gradual.
3. Groundwater conditions, if indicated, are at time of excavation. Conditions may vary with time.

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J-3078 8/90

Figure A-4

APPENDIX B
REFERENCES

APPENDIX B
REFERENCES

Alley, Young, and Baumgartner, 1989. BNZ Materials, Inc., Tacoma Metals, Inc., Tacoma, Washington, Phase I Environmental Site Investigation, dated December 1989.

Hart Crowser, 1975. Proposed National Distribution Company Warehouse, Tacoma, Washington, J-178 dated April 3, 1975.

Hart Crowser, 1983. Draft Report for Preliminary Hydrogeologic Assessment of "Tar Pits" Site, Tacoma, Washington, J-1179 dated March 30, 1983.

Hart Crowser, 1986a. G and M Investments, Preliminary Soil Contamination Assessment, Proposed Development of 65 Acre Parcel, Tacoma, Washington, J-1638 dated February 18, 1986.

Hart Crowser, 1986b. Geotechnical and Geochemical Site Feasibility Study, Proposed 65 Acre Development, Port of Tacoma, Washington, J-1763 dated August 1, 1986.

Washington State Department of Ecology, 1990. The Model Toxics Control Act Cleanup Regulation and Proposed Amendments, Chapter 173-340 WAC dated July 27, 1990.

APPENDIX C
CERTIFICATES OF ANALYSIS
HART CROWSER *FAST* LABORATORY
AND ANALYTICAL TECHNOLOGIES, INC.

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

ATI I.D. # 9008-202

September 12, 1990

Hart Crowser, Inc.
1910 Fairview Avenue E.
Seattle, Wa 98102-3699

Attention : Elaine Atkinson

Project Number : J-3078

Project Name : Tacoma Metals

On August 27, 1990, Analytical Technologies, Inc. received five 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.

Mary C. Silva
Senior Project Manager

Frederick W. Grothkopp
Technical Manager

FWG/tc

SAMPLE CROSS REFERENCE SHEET

CLIENT : HART CROWSER, INC.
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9008-202-1	TP-1, S-1	08/16/90	SOIL
9008-202-2	TP-2, S-1	08/16/90	SOIL
9008-202-3	TP-2, S-2	08/16/90	SOIL
9008-202-4	TP-3, S-1	08/16/90	SOIL
9008-202-5	TP-4, S-1	08/16/90	SOIL

----- TOTALS -----

MATRIX	# SAMPLES
SOIL	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 : HART CROWSER, INC.
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS

ANALYSIS	TECHNIQUE	REFERENCE	LAB
POLYNUCLEAR AROMATIC HYDROCARBONS	HPLC/UV	EPA 8310	R
CADMIUM	AA/F	EPA 7130	R
LEAD	AA/F	EPA 7420	R
MOISTURE	GRAVIMETRIC	METHOD 7-2.2	R

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

POLYNUCLEAR AROMATICS

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: N/A
PROJECT #	: J-3078	DATE RECEIVED	: N/A
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/30/90
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 09/04/90
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8310	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
NAPHTHALENE	<0.083
ACENAPHTHYLENE	<0.17
ACENAPHTHENE	<0.17
FLUORENE	<0.017
PHENANTHRENE	<0.0083
ANTHRACENE	<0.0083
FLUORANTHENE	<0.017
PYRENE	<0.017
BENZO(a)ANTHRACENE	<0.017
CHRYSENE	<0.017
BENZO(b)FLUORANTHENE	<0.017
BENZO(k)FLUORANTHENE	<0.017
BENZO(a)PYRENE	<0.017
DIBENZ(a,h)ANTHRACENE	<0.034
BENZO(g,h,i)PERYLENE	<0.017
INDENO(1,2,3-cd)PYRENE	<0.017

SURROGATE PERCENT RECOVERY

2-CHLOROANTHRACENE	73

POLYNUCLEAR AROMATICS

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/16/90
PROJECT #	: J-3078	DATE RECEIVED	: 08/27/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/30/90
CLIENT I.D.	: TP-1, S-1	DATE ANALYZED	: 09/05/90
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8310	DILUTION FACTOR	: 10

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
NAPHTHALENE	<0.83
ACENAPHTHYLENE	<1.7
ACENAPHTHENE	<1.7
FLUORENE	0.37
PHENANTHRENE	2.8
ANTHRACENE	0.71
FLUORANTHENE	7.6
PYRENE	7.1
BENZO(a)ANTHRACENE	2.7
CHRYSENE	2.9
BENZO(b)FLUORANTHENE	1.7
BENZO(k)FLUORANTHENE	0.97
BENZO(a)PYRENE	2.5
DIBENZ(a,h)ANTHRACENE	1.5
BENZO(g,h,i)PERYLENE	1.8
INDENO(1,2,3-cd)PYRENE	1.5

SURROGATE PERCENT RECOVERY

2-CHLOROANTHRACENE	187 **

** Out of limits due to matrix interference.

POLYNUCLEAR AROMATICS

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/16/90
PROJECT #	: J-3078	DATE RECEIVED	: 08/27/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/30/90
CLIENT I.D.	: TP-2, S-1	DATE ANALYZED	: 09/05/90
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8310	DILUTION FACTOR	: 10

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
NAPHTHALENE	<1.7
ACENAPHTHYLENE	<3.4
ACENAPHTHENE	<3.4
FLUORENE	1.4
PHENANTHRENE	8.0
ANTHRACENE	1.7
FLUORANTHENE	21
PYRENE	19
BENZO(a)ANTHRACENE	4.8 *
CHRYSENE	7.4 *
BENZO(b)FLUORANTHENE	2.5
BENZO(k)FLUORANTHENE	1.6
BENZO(a)PYRENE	5.5
DIBENZ(a,h)ANTHRACENE	3.4
BENZO(g,h,i)PERYLENE	3.9
INDENO(1,2,3-cd)PYRENE	3.0

SURROGATE PERCENT RECOVERY

2-CHLOROANTHRACENE	217 *

* Dilution factor = 100.

** Out of limits due to matrix interference.

Please note : Higher reporting limits are due to the need to reduce the sample size from 30 grams to 15 grams for extraction.

POLYNUCLEAR AROMATICS

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/16/90
PROJECT #	: J-3078	DATE RECEIVED	: 08/27/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/30/90
CLIENT I.D.	: TP-2, S-2	DATE ANALYZED	: 09/05/90
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8310	DILUTION FACTOR	: 10

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
NAPHTHALENE	<0.83
ACENAPHTHYLENE	<1.7
ACENAPHTHENE	<1.7
FLUORENE	<0.17
PHENANTHRENE	0.20
ANTHRACENE	<0.083
FLUORANTHENE	0.84
PYRENE	0.82
BENZO(a)ANTHRACENE	0.30
CHRYSENE	0.46
BENZO(b)FLUORANTHENE	0.37
BENZO(k)FLUORANTHENE	0.19
BENZO(a)PYRENE	0.50
DIBENZ(a,h)ANTHRACENE	<0.34
BENZO(g,h,i)PERYLENE	0.93
INDENO(1,2,3-cd)PYRENE	0.62

SURROGATE PERCENT RECOVERY

2-CHLOROANTHRACENE	103

POLYNUCLEAR AROMATICS

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/16/90
PROJECT #	: J-3078	DATE RECEIVED	: 08/27/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/30/90
CLIENT I.D.	: TP-3, S-1	DATE ANALYZED	: 09/05/90
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8310	DILUTION FACTOR	: 10

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
NAPHTHALENE	<0.83
ACENAPHTHYLENE	<1.7
ACENAPHTHENE	<1.7
FLUORENE	<0.17
PHENANTHRENE	0.61
ANTHRACENE	0.22
FLUORANTHENE	2.0
PYRENE	2.3
BENZO(a)ANTHRACENE	1.2
CHRYSENE	1.5
BENZO(b)FLUORANTHENE	2.8
BENZO(k)FLUORANTHENE	1.5
BENZO(a)PYRENE	3.8
DIBENZ(a,h)ANTHRACENE	<0.34
BENZO(g,h,i)PERYLENE	3.0
INDENO(1,2,3-cd)PYRENE	2.9

SURROGATE PERCENT RECOVERY

2-CHLOROANTHRACENE	142 **

** Out of limits due to matrix interference.

POLYNUCLEAR AROMATICS

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/16/90
PROJECT #	: J-3078	DATE RECEIVED	: 08/27/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/30/90
CLIENT I.D.	: TP-4, S-1	DATE ANALYZED	: 09/05/90
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8310	DILUTION FACTOR	: 10

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
NAPHTHALENE	<1.7
ACENAPHTHYLENE	<3.4
ACENAPHTHENE	<3.4
FLUORENE	<0.34
PHENANTHRENE	1.3
ANTHRACENE	0.22
FLUORANTHENE	3.0
PYRENE	2.5
BENZO(a)ANTHRACENE	1.2
CHRYSENE	1.6
BENZO(b)FLUORANTHENE	2.7
BENZO(k)FLUORANTHENE	0.71
BENZO(a)PYRENE	1.8
DIBENZ(a,h)ANTHRACENE	<0.68
BENZO(g,h,i)PERYLENE	1.9
INDENO(1,2,3-cd)PYRENE	1.7

SURROGATE PERCENT RECOVERY

2-CHLOROANTHRACENE	97

Please note : Higher reporting limits are due to the need to reduce the sample size from 30 grams to 15 grams for extraction.

POLYNUCLEAR AROMATICS
QUALITY CONTROL DATA

CLIENT	: HART CROWSER, INC.	SAMPLE I.D.	: 9007-213-1
PROJECT #	: J-3078	DATE EXTRACTED	: 08/24/90
PROJECT NAME	: TACOMA METALS	DATE ANALYZED	: 08/29/90
EPA METHOD	: 8310	MATRIX	: SOIL
		UNITS	: mg/Kg

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % REC	RPD
ACENAPHTHYLENE	<3.4	17	12.7	75	10.5	62	19
PHENANTHRENE	5.0	1.7	8.10	182*	6.47	86	65*
PYRENE	17	1.7	25.6	506*	21.2	247*	19
BENZO(k)FLUORANTHENE	<0.34	1.7	2.48	150*	1.73	102	36
DIBENZ(a,h)ANTHRACENE	<0.68	1.7	1.32	78	1.21	71	9

* Out of limits.

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

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

POLYNUCLEAR AROMATICS
QUALITY CONTROL DATA

CLIENT	: HART CROWSER, INC.	SAMPLE I.D.	: BLANK SPIKE
PROJECT #	: J-3078	DATE EXTRACTED	: 08/24/90
PROJECT NAME	: TACOMA METALS	DATE ANALYZED	: 08/27/90
EPA METHOD	: 8310	MATRIX	: SOIL
		UNITS	: mg/Kg

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % REC	RPD
ACENAPHTHYLENE	<0.17	17	4.90	29*	N/A	N/A	N/A
PHENANTHRENE	<0.0083	1.7	0.653	38	N/A	N/A	N/A
PYRENE	<0.017	1.7	0.895	53	N/A	N/A	N/A
BENZO(k)FLUORANTHENE	<0.017	1.7	1.17	69	N/A	N/A	N/A
DIBENZ(a,h)ANTHRACENE	<0.034	1.7	1.25	74	N/A	N/A	N/A

* Out of limits.

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

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

POLYNUCLEAR AROMATICS
QUALITY CONTROL DATA

CLIENT	: HART CROWSER, INC.	SAMPLE I.D.	: BLANK SPIKE
PROJECT #	: J-3078	DATE EXTRACTED	: 08/30/90
PROJECT NAME	: TACOMA METALS	DATE ANALYZED	: 09/04/90
EPA METHOD	: 8310	MATRIX	: SOIL
		UNITS	: mg/Kg

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % REC	RPD
ACENAPHTHYLENE	<0.17	17	5.42	32	N/A	N/A	N/A
PHENANTHRENE	<0.0083	1.7	0.709	42	N/A	N/A	N/A
PYRENE	<0.017	1.7	0.920	54	N/A	N/A	N/A
BENZO(k)FLUORANTHENE	<0.017	1.7	1.12	66	N/A	N/A	N/A
DIBENZ(a,h)ANTHRACENE	<0.034	1.7	1.22	72	N/A	N/A	N/A

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

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

METALS RESULTS

CLIENT : HART CROWSER, INC. MATRIX : TCLP EXTRACT
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS UNITS : mg/L

ATI I.D. #	CLIENT I.D.	CADMIUM	LEAD
9008-202-1	TP-1, S-1	0.95	15
9008-202-2	TP-2, S-1	0.77	22
9008-202-5	TP-4, S-1	2.2	370

METALS QUALITY CONTROL

CLIENT : HART CROWSER, INC. MATRIX : TCLP EXTRACT
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS UNITS : mg/L

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED SAMPLE	SPIKE CONC	% REC
CADMIUM	9008-202-5	2.2	2.3	4	**	**	**
LEAD	9008-202-5	370	350	6	**	**	**

** Due to the necessary dilution of the sample, result was not attainable.

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

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

GENERAL CHEMISTRY RESULTS

CLIENT : HART CROWSER, INC. SAMPLE MATRIX : SOIL
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS UNITS : %

ATI I.D.#	CLIENT I.D.	MOISTURE
9008-202-1	TP-1, S-1	13
9008-202-2	TP-2, S-1	12
9008-202-3	TP-2, S-2	19
9008-202-4	TP-3, S-1	6.6
9008-202-5	TP-4, S-1	8.7

GENERAL CHEMISTRY QUALITY CONTROL

CLIENT : HART CROWSER, INC. SAMPLE MATRIX : SOIL
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS UNITS : %

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
MOISTURE	9008-202-3	19	20	5	N/A	N/A	N/A

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

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

Sample Custody Record

DATE 3/22/90 PAGE 1 OF 1

HARTCROWSER

Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, Washington 98102-3699

JOB NUMBER J-7078 LAB NUMBER

PROJECT MANAGER John Barnbrook

PROJECT NAME T[illegible] Dock

SAMPLED BY:

LAB NO.	SAMPLE	TIME	STATION	MATRIX	TESTING	NO. OF CONTAINERS	OBSERVATIONS/COMMENTS/ COMPOSITING INSTRUCTIONS
	[illegible]	[illegible]	[illegible]	Soil	X	1	[illegible]
	[illegible]	1035			X	1	[illegible]
	[illegible]	1120			X	1	
	[illegible]	1310			X	1	
	[illegible]	p.m.			X	1	

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE	3/22/90	SIGNATURE	
PRINTED NAME	TIME	PRINTED NAME	TIME
COMPANY	1615	COMPANY	

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE		SIGNATURE	3/23/90
PRINTED NAME	TIME	PRINTED NAME	TIME
COMPANY		COMPANY ATI	4/20/90

TOTAL NUMBER OF CONTAINERS 5

METHOD OF SHIPMENT

SPECIAL SHIPMENT/HANDLING OR STORAGE REQUIREMENTS

[illegible]

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J-3078

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FAST

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

Field Analytical Services and Technologies

FAST Laboratory Analytical Report

FROM: James Herndon, Analytical Chemist
TO: John R. Funderburk III, Associate
DATE: September 7, 1990
CLIENT: Weiss, Jensen, Ellis
SITE: Tacoma Metals, Phase II
RE: 3078
CC: Elaine Atkinson, Sr. Staff Environmental Scientist
CC: Philip Spadaro, Associate Environmental Chemist

Attached are the compiled results from screening analysis conducted on samples received 8/16/90, 8/17/90, and 8/20/90. Screening analysis was performed for Volatiles, Fuel Concentration Estimate (FCE), and Metals. This report contains:

- Results for 12 soil samples.
- Results for 4 water samples.
- Results for method blanks.
- Recoveries for spiked samples.
- Differences for duplicate analyses.

The appendix to this report contains:

- Detection limits.
- Descriptions of the analytical methods.
- Copies of chromatograms from fuel screen.

Analytical Limitations

Analysis of the samples were performed using screening techniques. Quantitations are estimates, compound identifications are tentative.

Site: Tacoma Metals Phase II
Job #: 3078

Analytical Results

Results in ppm (mg/kg or mg/l)

Compound	TP1-S1	TP1-S2	TP2-S1	TP2-S2
Matrix	Soil	Soil	Soil	Soil
Percent Moisture	12%	25%	12%	16%
Gasoline	-	-	-	-
Kerosene/Jet A	-	-	-	-
Diesel/Fuel Oil #2	-	-	97	36
Bunker C	-	-	-	-
Oil	1,200	-	1,500	600
Unknown	-	-	-	-
Total Concentration	1,200	-	1,597	637
Cadmium	61	-	75	11
Chromium	160	11	340	69
Lead	5,000	-	5,300	770
A1016	-	-	-	-
A1221	-	-	-	-
A1232	-	-	-	-
A1242	-	-	-	-
A1248	-	-	-	-
A1254	-	-	-	-
A1260	0.6	-	4.4	0.8
A1262	-	-	-	-
A1268	-	-	-	-

Identifications are tentative. Quantitations are estimates.
- = below detection limit
n/t = test not performed. n/a = not applicable.

Analytical Results, continued

Results in ppb (ug/kg or ug/l)

Compound	TP1-S1	TP1-S2	TP2-S1	TP2-S2
Matrix	Soil	Soil	Soil	Soil
Percent Moisture	12%	25%	12%	16%
Bromodichloromethane	-	-	-	-
Bromoform	-	-	-	-
Carbon Tetrachloride	-	-	-	-
Chlorobenzene	-	-	-	-
Chloroform	-	-	-	-
Dibromochloromethane	-	-	-	-
1,1-Dichloroethane	-	-	-	-
1,1-Dichloroethylene	-	-	-	-
1,2-Dichloroethane	-	-	-	-
t-1,2-Dichloroethylene	-	-	-	-
1,2-Dichloropropane	-	-	-	-
c&t-1,3-Dichloropropene	-	-	-	-
Methylene Chloride	5,300	1,200	1,400	1,400
Tetrachloroethylene	-	-	-	-
1,1,1-Trichloroethane	-	-	-	-
1,1,2-Trichloroethane	-	-	-	-
1122-Tetrachloroethane	-	-	-	-
Trichloroethylene	-	-	-	-
Trichlorofluoromethane	-	-	-	-
Benzene	110	110	110	110
Toluene	-	-	51	-
Ethylbenzene	-	-	-	-
Xylenes	-	-	170	-

Identifications are tentative. Quantitations are estimates.
- = below detection limit
n/t = test not performed. n/a = not applicable.

Site: Tacoma Metals Phase II
Job #: 3078

Analytical Results, continued

Results in ppm (mg/kg or mg/l)

Compound	TP3-S1	TP3-S2	TP4-S1	TP4-S2
Matrix	Soil	Soil	Soil	Soil
Percent Moisture	6%	28%	7%	30%
Gasoline	-	-	-	640
Kerosene/Jet A	-	-	-	-
Diesel/Fuel Oil #2	2,400	790	610	200
Bunker C	-	-	-	-
Oil	870	-	1,400	-
Unknown	-	-	-	-
Total Concentration	3,270	790	2,010	840
Cadmium	3	-	150	9
Chromium	30	11	130	19
Lead	390	29	15,000	760
A1016	-	-	-	-
A1221	-	-	-	-
A1232	-	-	-	-
A1242	-	-	-	-
A1248	-	-	-	-
A1254	-	-	-	-
A1260	0.4	-	11.0	6.7
A1262	-	-	-	-
A1268	-	-	-	-

Identifications are tentative. Quantitations are estimates.
- = below detection limit
n/t = test not performed. n/a = not applicable.

Site: Tacoma Metals Phase II
Job #: 3078

Analytical Results, continued

Results in ppb (ug/kg or ug/l)

Compound	TP3-S1	TP3-S2	TP4-S1	TP4-S2
Matrix	Soil	Soil	Soil	Soil
Percent Moisture	6%	28%	7%	30%
Bromodichloromethane	-	-	-	-
Bromoform	-	-	-	-
Carbon Tetrachloride	-	-	-	-
Chlorobenzene	-	-	-	-
Chloroform	-	-	-	-
Dibromochloromethane	-	-	-	-
1,1-Dichloroethane	-	-	-	-
1,1-Dichloroethylene	-	-	-	-
1,2-Dichloroethane	-	-	-	-
t-1,2-Dichloroethylene	-	-	-	-
1,2-Dichloropropane	-	-	-	-
c&t-1,3-Dichloropropene	-	-	-	-
Methylene Chloride	1,200	500	1,200	2,000
Tetrachloroethylene	-	-	-	-
1,1,1-Trichloroethane	-	-	-	-
1,1,2-Trichloroethane	-	-	-	-
1122-Tetrachloroethane	-	-	-	-
Trichloroethylene	-	-	-	-
Trichlorofluoromethane	-	-	-	-
Benzene	100	74	120	190
Toluene	-	-	55	410
Ethylbenzene	-	-	-	-
Xylenes	-	-	62	1,600

Identifications are tentative. Quantitations are estimates.
- = below detection limit
n/t = test not performed. n/a = not applicable.

Site: Tacoma Metals Phase II
Job #: 3078

Analytical Results, continued

Results in ppm (mg/kg or mg/l)

Compound	TP5-S1	TP5-S2	HC-01	TANK-01
Matrix	Soil	Soil	Soil	Soil
Percent Moisture	19%	32%	7%	n/t
Gasoline	-	-	-	-
Kerosene/Jet A	-	-	-	-
Diesel/Fuel Oil #2	-	-	-	-
Bunker C	-	-	-	-
Oil	-	-	-	580
Unknown	-	-	-	-
Total Concentration	-	-	-	580
Cadmium	27	-	-	n/t
Chromium	330	15	13	n/t
Lead	3,500	51	-	n/t
A1016	-	-	-	n/t
A1221	-	-	-	n/t
A1232	-	-	-	n/t
A1242	-	-	-	n/t
A1248	-	-	-	n/t
A1254	0.1	-	-	n/t
A1260	-	-	-	n/t
A1262	-	-	-	n/t
A1268	-	-	-	n/t

Identifications are tentative. Quantitations are estimates.
- = below detection limit
n/t = test not performed. n/a = not applicable.

Site: Tacoma Metals Phase II
Job #: 3078

Analytical Results, continued

Results in ppb (ug/kg or ug/l)

Compound	TP5-S1	TP5-S2	HC-01	TANK-01
Matrix	Soil	Soil	Soil	Soil
Percent Moisture	19%	32%	7%	n/t
Bromodichloromethane	-	-	-	n/t
Bromoform	-	-	-	n/t
Carbon Tetrachloride	-	-	-	n/t
Chlorobenzene	-	-	-	n/t
Chloroform	-	-	-	n/t
Dibromochloromethane	-	-	-	n/t
1,1-Dichloroethane	-	140	-	n/t
1,1-Dichloroethylene	-	-	-	n/t
1,2-Dichloroethane	-	-	-	n/t
t-1,2-Dichloroethylene	-	-	-	n/t
1,2-Dichloropropane	-	-	-	n/t
c&t-1,3-Dichloropropene	-	-	-	n/t
Methylene Chloride	830	1,100	230	n/t
Tetrachloroethylene	-	-	-	n/t
1,1,1-Trichloroethane	-	-	-	n/t
1,1,2-Trichloroethane	-	-	-	n/t
1122-Tetrachloroethane	-	-	-	n/t
Trichloroethylene	-	-	-	n/t
Trichlorofluoromethane	-	-	-	n/t
Benzene	120	100	110	n/t
Toluene	-	-	-	n/t
Ethylbenzene	-	-	-	n/t
Xylenes	-	-	-	n/t

Identifications are tentative. Quantitations are estimates.
- = below detection limit
n/t = test not performed. n/a = not applicable.

Site: Tacoma Metals Phase II
Job #: 3078

Analytical Results, continued

Results in ppm (mg/kg or mg/l)

Compound	HC-01	HC-02	HC-03	HC-04
Matrix	Water	Water	Water	Water
Gasoline	-	-	8.7	-
Kerosene/Jet A	-	-	-	-
Diesel/Fuel Oil #2	-	-	-	-
Bunker C	-	-	-	-
Oil	-	-	-	12.3
Unknown	-	-	-	-
Total Concentration	-	-	8.7	12.3
Cadmium	n/t	n/t	n/t	n/t
Chromium	n/t	n/t	n/t	n/t
Lead	n/t	n/t	n/t	n/t
A1016	-	-	-	-
A1221	-	-	-	-
A1232	-	-	-	-
A1242	-	-	-	-
A1248	-	-	-	-
A1254	-	-	-	-
A1260	-	-	-	-
A1262	-	-	-	-
A1268	-	-	-	-

Identifications are tentative. Quantitations are estimates.
- = below detection limit
n/t = test not performed. n/a = not applicable.

Site: Tacoma Metals Phase II
Job #: 3078

Analytical Results, continued

Results in ppb (ug/kg or ug/l)

Compound	HC-01	HC-02	HC-03	HC-04
Matrix	Water	Water	Water	Water
Bromodichloromethane	-	-	-	-
Bromoform	-	-	-	-
Carbon Tetrachloride	-	-	-	-
Chlorobenzene	-	23	-	-
Chloroform	-	-	-	-
Dibromochloromethane	-	-	-	-
1,1-Dichloroethane	-	-	-	-
1,1-Dichloroethylene	-	-	-	-
1,2-Dichloroethane	-	-	-	-
t-1,2-Dichloroethylene	-	-	-	-
1,2-Dichloropropane	-	-	-	-
c&t-1,3-Dichloropropene	-	-	-	-
Methylene Chloride	-	-	-	-
Tetrachloroethylene	-	-	-	-
1,1,1-Trichloroethane	-	-	-	-
1,1,2-Trichloroethane	-	-	-	-
1122-Tetrachloroethane	-	-	-	-
Trichloroethylene	-	-	-	-
Trichlorofluoromethane	-	-	-	-
Benzene	-	-	4	-
Toluene	-	-	9	-
Ethylbenzene	-	-	-	-
Xylenes	-	-	14	-

Identifications are tentative. Quantitations are estimates.
- = below detection limit
n/t = test not performed. n/a = not applicable.

Site: Tacoma Metals Phase II
Job #: 3078

Method Blanks

Results in ppm (mg/kg or mg/l)

Compound		
Matrix	Soil	Water
A1016	-	-
A1221	-	-
A1232	-	-
A1242	-	-
A1248	-	-
A1254	-	-
A1260	-	-
A1262	-	-
A1268	-	-

Identifications are tentative. Quantitations are estimates.
- = below detection limit
n/t = test not performed. n/a = not applicable.

Method Blanks, continued

Results in ppb (ug/kg or ug/l)

Compound		
Matrix	Soil	Water
Bromodichloromethane	-	-
Bromoform	-	-
Carbon Tetrachloride	-	-
Chlorobenzene	-	-
Chloroform	-	-
Dibromochloromethane	-	-
1,1-Dichloroethane	-	-
1,1-Dichloroethylene	-	-
1,2-Dichloroethane	-	-
t-1,2-Dichloroethylene	-	-
1,2-Dichloropropane	-	-
c&t-1,3-Dichloropropene	-	-
Methylene Chloride	3,800	27
Tetrachloroethylene	-	-
1,1,1-Trichloroethane	-	-
1,1,2-Trichloroethane	-	-
1122-Tetrachloroethane	-	-
Trichloroethylene	-	-
Trichlorofluoromethane	-	-
Benzene	120	1
Toluene	-	-
Ethylbenzene	-	-
Xylenes	-	-

Identifications are tentative. Quantitations are estimates.
- = below detection limit
n/t = test not performed. n/a = not applicable.

Site: Tacoma Metals Phase II
Job #: 3078

Spikes

Compound	% Recovery TP1-S2	NBS-QC
Matrix	Soil	Soil
Diesel/Fuel Oil #2	109%	n/t
Cadmium	87%	104%
Chromium	77%	45%
Lead	70%	82%
A1254	67%	n/t
Carbon Tetrachloride	119%	n/t
Chlorobenzene	71%	n/t
Chloroform	38%	n/t
Dibromochloromethane	28%	n/t
1,1-Dichloroethane	151%	n/t
1,2-Dichloropropane	40%	n/t
Tetrachloroethylene	62%	n/t
1,1,2-Trichloroethane	42%	n/t
Trichloroethylene	71%	n/t
Benzene	42%	n/t
Xylenes	65%	n/t

Site: Tacoma Metals Phase II
Job #: 3078

Duplicates

Compound	% Difference TP1-S2
Matrix	Soil
Diesel/Fuel Oil #2	17%
Cadmium	-
Chromium	10%
Lead	0%
A1254	1%
Carbon Tetrachloride	7%
Chlorobenzene	1%
Chloroform	13%
Dibromochloromethane	18%
1,1-Dichloroethane	5%
1,2-Dichloropropane	12%
Tetrachloroethylene	2%
1,1,2-Trichloroethane	7%
Trichloroethylene	1%
Benzene	5%
Xylenes	1%

- = below detection limit

Site: Tacoma Metals Phase II
Job #: 3078

Hart Crowser *FAST* Mobile Laboratory
FUEL FINGERPRINT \ CONCENTRATION ESTIMATE SCREEN

Fuel analysis is performed using a simple solvent extraction to prepare the sample. Quantitation and identification are performed using a gas chromatograph (GC) with a Flame Ionization Detector (FID). Approximate concentrations and tentative identifications derived from this screening method should be confirmed using EPA method 418.1, or 8015 modified.

Detection Limits

Fuel	Routine Detection Limits* ppm in soil	water
Unleaded Gasoline	25	5
Super Unleaded Gasoline	25	5
Regular Leaded Gasoline	25	5
Aviation Fuel	25	5
Jet A	25	5
Diesel Fuel	25	5
Kerosene	25	5
Heating Oil	25	5
Bunker C	25	5

* = Wet Weight Basis

Sample Extraction Technique

Five gms of soil are placed in a culture tube. Reagent water is added to break the soil. Five mls of freon are added. The tube is capped and agitated for ten minutes. The tube is then placed in a centrifuge to settle particulates and separate the phases.

For water samples, 100 mls of water are placed in a volumetric flask. Five mls of freon are added to the sample. The flask is shaken for 5 minutes.

Chromatography Equipment

Analysis is performed using a Hewlett Packard 5890A gas chromatograph with an autosampler. The analytical column is a fused silica capillary column. The detector is a Flame Ionization Detector (FID). Sample capacity 30 samples per day.

Identification and Quantitation

Identification of the fuels are made by comparison to chromatograms of fuel standards made in our lab. All identifications are tentative. Quantitation of fuels is made using a single concentration calibration standard and the area under the peaks found in a time band specific to the fuel type. All quantitations are estimates.

Quality Control

Method blank	One per day or matrix
Matrix spike	One per 20 samples, sample set or matrix
Duplicate	One per 20 samples, sample set or matrix
Target QC Values	Recovery +/- 50% Relative Difference <25%
Confirmation Samples	Recommend 10 to 20% samples split to confirming lab.

Site: Tacoma Metals Phase II
Job #: 3078

Hart Crowser *FAST* Laboratory
VOLATILES SCREEN

Volatiles are analyzed using a purge and trap system connected to a gas chromatograph. Compounds are detected with a Photon Ionization Detector (PID) and an Electrolytic Conductivity Detector (Hall or ELCD). Approximate concentrations and tentative identifications derived from this screening method should be confirmed using EPA method 601, 602, 624, 8010, 8015, 8020, or 8240.

Detection Limits	Routine Detection Limits*		
	low	medium	
Compound	ppb in soil	soil	water
Methylene Chloride	1	50	1
1,1-Dichloroethylene	1	50	1
1,1-Dichloroethane	1	50	1
Chloroform	1	50	1
Carbon Tetrachloride	1	50	1
1,2-Dichloropropane	1	50	1
Trichloroethylene	1	50	1
1,1,2-Trichloroethane	1	50	1
Dibromochloromethane	5	200	5
Tetrachloroethylene	1	50	1
Chlorobenzene	1	50	1
Trichlorofluoromethane	1	50	1
trans-1,2-Dichloroethylene	1	50	1
1,2-Dichloroethane	5	200	5
1,1,1-Trichloroethane	1	50	1
Bromodichloromethane	5	200	5
cis and trans-1,3-Dichloropropene	5	200	5
Bromoform	5	200	5
1,1,2,2-Tetrachloroethane	5	200	5
Benzene	1	50	1
Toluene	1	50	1
Ethylbenzene	1	50	1
Xylenes	1	50	1

* = Wet Weight Basis

Volatiles Screen

Sample Extraction

Medium Level, Soil

Five gms of soil are placed in a centrifuge tube. Methanol is added to soils. The sample is vortexed and centrifuged. One hundred microliters or less of the methanol extract is injected into surrogate spiked carbon free water.

Low Level, Soil and Water

Five gms of soil or five mls of water are placed in a centrifuge tube. Surrogate spiked carbon free water is added to soils. Surrogate mix is spiked into each water sample.

Sample Preparation

The sample is stripped of volatile compounds by sparging with helium. Volatiles are trapped on a small packed column. After sample sparging the trap column is flash heated and the volatiles are transferred to the chromatograph.

Chromatography Equipment

Analysis is performed using a Hewlett Packard 5890À gas chromatograph. The analytical column is a fused silica capillary column. The detectors are a Photoionzation Detector (PID) and an Electrolytic Conductivity Detector (ELCD or Hall) connected in series.

Identification and Quantitation

Identification of the volatiles are made by retention time comparisons to standards run during the analytical sequence. All identifications are tentative. Quantitation of volatiles are made using a single external concentration calibration standard. All quantitations are estimates.

Quality Control

Method blank	One per day or matrix
Matrix spike	One per 20 samples, sample set or matrix
Duplicate	One per 20 samples, sample set or matrix
Target QC Values	Recovery +/- 50% Relative Difference <25%
Confirmation Samples	Recommend 10 to 20% samples split to confirming lab.

Site: Tacoma Metals Phase II
Job #: 3078

Hart Crowser *FAST* Laboratory
PESTICIDE / PCBs SCREEN

Polychlorinated Biphenyls (PCBs) and Pesticides are analyzed using a simple solvent extraction and acid cleanup procedure to prepare the sample. Quantitation and identification are performed using a gas chromatograph (GC) with an Electron Capture Detector (ECD). Approximate concentrations and tentative identifications derived from this screening method should be confirmed using EPA method 608, 612, 617, 625, 8120, or 8270.

Detection Limits Compound	Routine Detection Limits* ppb in soil	water
Aroclor 1016	500	4.0
Aroclor 1221	500	4.0
Aroclor 1232	500	4.0
Aroclor 1242	500	4.0
Aroclor 1248	200	2.0
Aroclor 1254	200	2.0
Aroclor 1260	200	2.0
Aroclor 1262	200	2.0
Aldrin	20	0.1
alpha-BHC	20	0.1
beta-BHC	20	0.1
gamma-BHC (Lindane)	20	0.1
delta-BHC	20	0.1
4,4'-DDD	30	0.2
4,4'-DDE	30	0.2
4,4'-DDT	30	0.2
Dieldrin	30	0.2
Endosulfan I	20	0.1
Endosulfan II	30	0.2
Endosulfan Sulfate	30	0.2
Endrin	30	0.2
Endrin Aldehyde	30	0.2
Heptachlor	20	0.1
Heptachlor Epoxide	20	0.1

* = Wet Weight Basis

Sample Extraction Technique

Five gms of soil are placed in culture tube. One half ml of methanol is added to bind water. Five mls of hexane are added to the sample. The tube is capped and agitated for fifteen minutes. The tube is then placed in a centrifuge to settle particulates and seperate the phases.

For PCB analysis, a two ml aliquot of the extract is transferred to a second container. One ml of concentrated sulfuric acid is added and the extract agitated. The vessel is placed in a centrifuge to settle the acid.

For pesticide analysis acid cleanup procedure is not used. Acid causes degradation of some pesticides.

Analytical Equipment

Analysis is performed using a Hewlett Packard 5890A gas chromatograph with an autosampler. The analytical column is a fused silica capillary column. The detector is an Electron Capture Detector (ECD). Sample capacity 35 samples per day.

Identification and Quantitation

Identification of PCBs are made by comparison to chromatograms of PCB standards analyzed on our GCs. All identifications are tentative. Quantitation of PCBs are made using a single concentration calibration standard for each PCB and five characteristic peaks for each standard. All quantitations are estimates.

Identification of pesticides are made by retention time comparisons to standards run during the analytical sequence. All identifications are tentative. Quantitation of volatiles are made using a single external concentration calibration standard. All quantitations are estimates.

Quality Control

Method blank	One per day or matrix
Matrix spike	One per 20 samples, sample set or matrix
Duplicate	One per 20 samples, sample set or matrix.
Target QC Values	Recovery +/- 50% Relative Difference <25%
Confirmation Samples	Recommend 10 to 20% samples split to confirming lab.

Site: Tacoma Metals Phase II
Job #: 3078

Hart Crowser *FAST* Laboratory
METALS

Metals analysis is performed using a quick microware digestion, if necessary, to prepare the sample. Quantitation and identification are performed using a flame atomic absorption spectrophotometer (flame AA). Approximate concentrations and tentative identifications derived from this screening method should be confirmed using EPA method 6010 or 7000.

Detection Limits

Metal	Routine Detection Limit* ppm in soil	ppb in water
Cadmium	1.5	15
Chromium	0.5	5
Copper	1.0	10
Lead	10	100
Nickel	1.5	15
Zinc	3.6	36

* = Wet Weight Basis

Sample Preperation

A one gm soil sample is placed in a teflon vessel with ten mls of concentrated nitric acid. The vessel is place in a microwave oven for twelve minutes. The vessel is allowed to cool and five mls of concentrated hydrogen peroxide is added. After bubbling ceases the digestate is filtered through 0.45 micron filter paper and diluted to 100 ml.

If digestion is requested for waters, fifty mls of sample is placed in a teflon vessel with three mls of concentrated nitric acid and two mls of hydrochloric acid. The vessel is placed in a microwave oven for thirty minutes. The vessel is allowed to cool, then shaken for thirty seconds and digestate filtered through 0.45 micron filter paper.

MIBK Water Extraction

An alternative method of water sample preparation is by treatment of 100 mls water with seven mls of chelating agent (diethyldithiocarbamate) followed by extraction with fifteen mls of Methyl Isobutyl Ketone (MIBK).

Spectrophotometer

Analysis of soil, water and MIBK extracted water samples is performed on a Perkin Elmer 2380 Flame Atomic Absorption Spectrophotometer. Sample capacity for flame AA performing a single metal analysis is 50 samples per day.

Identification and Quantitation

Samples are analyzed at the primary absorption frequency of the metal specific hollow cathode lamp. A single standard is analyzed at a concentration within the proven linear range of the instrument and or sufficient to give an absorbance of 0.2. All quantitations are estimates.

Quality Control

Method blank	One per day or matrix
Matrix spike	One per 20 samples, sample set or matrix
Duplicate	One per 20 samples, sample set or matrix
Target QC Values	Recovery +/- 50% Relative Difference <25%
Confirmation Samples	Recommend 10 to 20% samples split to confirming lab.

Sample Custody Record

DATE 8/20/90 PAGE 1 OF 1

HART CROWSER

Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, Washington 98102-3699

JOB NUMBER J-3078 LAB NUMBER

PROJECT MANAGER JRF

PROJECT NAME Tacoma Metals

SAMPLED BY: EPA

LAB NO.	SAMPLE	TIME	STATION	MATRIX	TESTING: PAHs	TESTING: PCBs	TESTING: VOAs	TESTING: Arsenic, Cadmium, Chromium, Lead, Mercury, Silver	NO. OF CONTAINERS	OBSERVATIONS/COMMENTS/ COMPOSITING INSTRUCTIONS
	HC-1	1258	Drive point well	water	x			x	2	In R-4
	HC-2	1515			x			x	2	
	HC-3	1645 1405			x			x	2	
	HC-4	[redacted]			x			x	2	

RELINQUISHED BY	DATE	RECEIVED BY	DATE
Elaine Atkinson	8/21/90		
SIGNATURE		SIGNATURE	
Elaine Atkinson	TIME		TIME
PRINTED NAME		PRINTED NAME	
Hart Crowser	0945		
COMPANY		COMPANY	

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE		SIGNATURE	
	TIME		TIME
PRINTED NAME		PRINTED NAME	
COMPANY		COMPANY	

TOTAL NUMBER OF CONTAINERS 8

METHOD OF SHIPMENT

SPECIAL SHIPMENT/HANDLING OR STORAGE REQUIREMENTS

DISTRIBUTION:

1. PROVIDE WHITE AND YELLOW COPIES TO LABORATORY
2. RETURN PINK COPY TO PROJECT MANAGER
3. LABORATORY TO FILL IN SAMPLE NUMBER AND SIGN FOR RECEIPT
4. LABORATORY TO RETURN WHITE COPY TO HART CROWSER

Sample Custody Record

DATE 8/17/90 PAGE 1 OF 1

HARTCROWSER

Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, Washington 98102-3699

JOB NUMBER J-3075 LAB NUMBER

PROJECT MANAGER JRF 3

PROJECT NAME Tacoma Metals

SAMPLED BY: EPA

LAB NO.	SAMPLE	TIME	STATION	MATRIX	TESTING: ~~PAHs~~ Fuel ID	PCBs	Fuel fingerprint scan	Cd, Cr, Pb	VOAs	NO. OF CONTAINERS	OBSERVATIONS/COMMENTS/ COMPOSITING INSTRUCTIONS
	TP5,S-1	1005	Test pit 5	Soil	X	X	X	X	X	1	To R-4
	TP5,S-2	1025	"	"	X	X	X	X	X	1	
	HC-01	1345	Drive point HC-1	Soil	X	X	X	X	X	1	

RELINQUISHED BY	DATE	RECEIVED BY	DATE
Elaine Atkinson	~~8/20/90~~		
SIGNATURE		SIGNATURE	
Elaine Atkinson	TIME		TIME
PRINTED NAME		PRINTED NAME	
Hart Crowser	0930		
COMPANY		COMPANY	

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE		SIGNATURE	
	TIME		TIME
PRINTED NAME		PRINTED NAME	
COMPANY		COMPANY	

TOTAL NUMBER OF CONTAINERS 3

METHOD OF SHIPMENT

SPECIAL SHIPMENT/HANDLING OR STORAGE REQUIREMENTS

DISTRIBUTION:

1. PROVIDE WHITE AND YELLOW COPIES TO LABORATORY
2. RETURN PINK COPY TO PROJECT MANAGER
3. LABORATORY TO FILL IN SAMPLE NUMBER AND SIGN FOR RECEIPT
4. LABORATORY TO RETURN WHITE COPY TO HART CROWSER

Sample Custody Record

DATE 8/16/90 PAGE 1 OF 1

HARTCROWSER

Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, Washington 98102-3699

JOB NUMBER J-3078 LAB NUMBER

PROJECT MANAGER JRF3

PROJECT NAME Tacoma Metals

SAMPLED BY: EPA

LAB NO.	SAMPLE	TIME	STATION	MATRIX	TESTING: Tot. As, Pb, Cd, Cr	Fuel fingerprint	PNAs	PCBs	VOAs	Ecology EP Tox	Available S	NO. OF CONTAINERS	OBSERVATIONS/COMMENTS/ COMPOSITING INSTRUCTIONS
	TP-1, S-1	0855	Test pit	Soil	X	X	X	X	X			2	All samples in R-4
	TP-1, S-2	0925			X	X	X	X	X			2	
	TP-2, S-1	1035			X	X	X	X	X			2	
	TP-2, S-2	1120			X	X	X	X	X			2	
	TP-3, S-1	1250			X	X	X	X	X			2	
	TP-3, S-2	1335			X	X	X	X	X			2	
	TP-4, S-1	1410			X	X	X	X	X			2	
	TP-4, S-2	1440			X	X	X	X	X			2	Strong petroleum/creosote odor
	TANK-01	1355	Hand auger	Soil		X						1	

RELINQUISHED BY	DATE	RECEIVED BY	DATE
Elaine P. Atkinson (SIGNATURE)	8/17/90	(SIGNATURE)	
Elaine P. Atkinson (PRINTED NAME)	TIME	(PRINTED NAME)	TIME
Hart Crowser (COMPANY)	0715	(COMPANY)	

RELINQUISHED BY	DATE	RECEIVED BY	DATE
(SIGNATURE)		(SIGNATURE)	
(PRINTED NAME)	TIME	(PRINTED NAME)	TIME
(COMPANY)		(COMPANY)	

TOTAL NUMBER OF CONTAINERS 16

METHOD OF SHIPMENT

SPECIAL SHIPMENT/HANDLING OR STORAGE REQUIREMENTS

DISTRIBUTION:

1. PROVIDE WHITE AND YELLOW COPIES TO LABORATORY
2. RETURN PINK COPY TO PROJECT MANAGER
3. LABORATORY TO FILL IN SAMPLE NUMBER AND SIGN FOR RECEIPT
4. LABORATORY TO RETURN WHITE COPY TO HART CROWSER

Hart Crowser
J-3078-

ANALYTICAL TECHNOLOGIES, INC.

Analytical Technologies, Inc. [illegible] (206) 228-8335

ATI I.D. # 9008-130

August 31, 1990

Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, WA 98102-3699

Attention : John Funderburk

Project Number : 3078

Project Name : Tacoma Metals

On August 17, 1990 Analytical Technologies, Inc. received eight 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/elf

SAMPLE CROSS REFERENCE SHEET

CLIENT : HART CROWSER, INC.
PROJECT # : 3078
PROJECT NAME : TACOMA METALS

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9008-130-1	TP1 S1	08/16/90	SOIL
9008-130-2	TP1 S2	08/16/90	SOIL
9008-130-3	TP2 S1	08/16/90	SOIL
9008-130-4	TP2 S2	08/16/90	SOIL
9008-130-5	TP3 S1	08/16/90	SOIL
9008-130-6	TP3 S2	08/16/90	SOIL
9008-130-7	TP4 S1	08/16/90	SOIL
9008-130-8	TP4 S2	08/16/90	SOIL

----- TOTALS -----

MATRIX	# SAMPLES
SOIL	8

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 : HART CROWSER, INC.
PROJECT # : 3078
PROJECT NAME : TACOMA METALS

ANALYSIS	TECHNIQUE	REFERENCE	LAB
VOLATILE ORGANIC COMPOUNDS	GCMS	EPA 8240	R
POLYCHLORINATED BIPHENYLS (PCBs)	GC/ECD	EPA 8080	R
POLYCHLORINATED BIPHENYLS (PCBs)	GC/ECD	EPA 8080	SD
POLYNUCLEAR AROMATIC HYDROCARBONS	HPLC/UV	EPA 8310	R
FUEL HYDROCARBONS	GC/FID	EPA 8015 MODIFIED	R
ARSENIC	AA/F	EPA 7060	R
CADMIUM	AA/F	EPA 7130	R
CHROMIUM	AA/F	EPA 7190	R
LEAD	AA/F	EPA 7420	R
MOISTURE	GRAVIMETRIC	METHOD 7-2.2	R

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

ATI I.D. # 9008-130

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: N/A
PROJECT #	: 3078	DATE RECEIVED	: N/A
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/20/90
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 08/21/90
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8240	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
ACETONE	<1.0
BENZENE	<0.050
BROMODICHLOROMETHANE	<0.050
BROMOFORM	<0.25
BROMOMETHANE	<0.50
2-BUTANONE (MEK)	<0.50
CARBON DISULFIDE	<0.050
CARBON TETRACHLORIDE	<0.050
CHLOROBENZENE	<0.050
CHLOROETHANE	<0.050
CHLOROFORM	<0.050
CHLOROMETHANE	<0.50
DIBROMOCHLOROMETHANE	<0.050
1,1-DICHLOROETHANE	<0.050
1,2-DICHLOROETHANE	<0.050
1,1-DICHLOROETHENE	<0.050
1,2-DICHLOROETHENE (TOTAL)	<0.050
1,2-DICHLOROPROPANE	<0.050
CIS-1,3-DICHLOROPROPENE	<0.050
TRANS-1,3-DICHLOROPROPENE	<0.050
ETHYLBENZENE	<0.050
2-HEXANONE (MBK)	<0.50
4-METHYL-2-PENTANONE (MIBK)	<0.50
METHYLENE CHLORIDE	<0.25
STYRENE	<0.050
1,1,2,2-TETRACHLOROETHANE	<0.050
TETRACHLOROETHENE	<0.050
TOLUENE	<0.050
1,1,1-TRICHLOROETHANE	<0.050
1,1,2-TRICHLOROETHANE	<0.050
TRICHLOROETHENE	<0.050
VINYL ACETATE	<0.50
VINYL CHLORIDE	<0.050
TOTAL XYLENES	<0.050

SURROGATE PERCENT RECOVERIES

1,2-DICHLOROETHANE-d4	107
TOLUENE-d8	99
BROMOFLUOROBENZENE	91

ATI I.D. # 9008-130

VOLATILE ORGANICS ANALYSIS
TENTATIVELY IDENTIFIED COMPOUNDS

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: N/A
PROJECT #	: 3078	DATE RECEIVED	: N/A
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/20/90
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 08/21/90
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8240	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	SCAN NUMBER	ESTIMATED CONCENTRATION

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

ATI I.D. # 9008-130-2

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/16/90
PROJECT #	: 3078	DATE RECEIVED	: 08/17/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/20/90
CLIENT I.D.	: TP1 S2	DATE ANALYZED	: 08/21/90
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8240	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
ACETONE	<1.0
BENZENE	<0.050
BROMODICHLOROMETHANE	<0.050
BROMOFORM	<0.25
BROMOMETHANE	<0.50
2-BUTANONE (MEK)	<0.50
CARBON DISULFIDE	<0.050
CARBON TETRACHLORIDE	<0.050
CHLOROBENZENE	<0.050
CHLOROETHANE	<0.050
CHLOROFORM	<0.050
CHLOROMETHANE	<0.50
DIBROMOCHLOROMETHANE	<0.050
1,1-DICHLOROETHANE	<0.050
1,2-DICHLOROETHANE	<0.050
1,1-DICHLOROETHENE	<0.050
1,2-DICHLOROETHENE (TOTAL)	<0.050
1,2-DICHLOROPROPANE	<0.050
CIS-1,3-DICHLOROPROPENE	<0.050
TRANS-1,3-DICHLOROPROPENE	<0.050
ETHYLBENZENE	<0.050
2-HEXANONE (MBK)	<0.50
4-METHYL-2-PENTANONE (MIBK)	<0.50
METHYLENE CHLORIDE	<0.25
STYRENE	<0.050
1,1,2,2-TETRACHLOROETHANE	<0.050
TETRACHLOROETHENE	<0.050
TOLUENE	<0.050
1,1,1-TRICHLOROETHANE	<0.050
1,1,2-TRICHLOROETHANE	<0.050
TRICHLOROETHENE	<0.050
VINYL ACETATE	<0.50
VINYL CHLORIDE	<0.050
TOTAL XYLENES	<0.050

SURROGATE PERCENT RECOVERIES

1,2-DICHLOROETHANE-d4	94
TOLUENE-d8	82
BROMOFLUOROBENZENE	81

ATI I.D. # 9008-130-2

VOLATILE ORGANICS ANALYSIS
TENTATIVELY IDENTIFIED COMPOUNDS

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/16/90
PROJECT #	: 3078	DATE RECEIVED	: 08/17/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/20/90
CLIENT I.D.	: TP1 S2	DATE ANALYZED	: 08/21/90
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8240	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	SCAN NUMBER	ESTIMATED CONCENTRATION

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

ATI I.D. # 9008-130-8

VOLATILE ORGANICS ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/16/90
PROJECT #	: 3078	DATE RECEIVED	: 08/17/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/20/90
CLIENT I.D.	: TP4 S2	DATE ANALYZED	: 08/21/90
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8240	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
ACETONE	<1.6
BENZENE	<0.078
BROMODICHLOROMETHANE	<0.078
BROMOFORM	<0.39
BROMOMETHANE	<0.78
2-BUTANONE (MEK)	<0.78
CARBON DISULFIDE	<0.078
CARBON TETRACHLORIDE	<0.078
CHLOROBENZENE	<0.078
CHLOROETHANE	<0.078
CHLOROFORM	<0.078
CHLOROMETHANE	<0.78
DIBROMOCHLOROMETHANE	<0.078
1,1-DICHLOROETHANE	<0.078
1,2-DICHLOROETHANE	<0.078
1,1-DICHLOROETHENE	<0.078
1,2-DICHLOROETHENE (TOTAL)	<0.078
1,2-DICHLOROPROPANE	<0.078
CIS-1,3-DICHLOROPROPENE	<0.078
TRANS-1,3-DICHLOROPROPENE	<0.078
ETHYLBENZENE	<0.078
2-HEXANONE (MBK)	<0.78
4-METHYL-2-PENTANONE (MIBK)	<0.78
METHYLENE CHLORIDE	<0.39
STYRENE	<0.078
1,1,2,2-TETRACHLOROETHANE	<0.078
TETRACHLOROETHENE	<0.078
TOLUENE	<0.078
1,1,1-TRICHLOROETHANE	<0.078
1,1,2-TRICHLOROETHANE	<0.078
TRICHLOROETHENE	<0.078
VINYL ACETATE	<0.78
VINYL CHLORIDE	<0.078
TOTAL XYLENES	<0.078

SURROGATE PERCENT RECOVERIES

1,2-DICHLOROETHANE-d4	83
TOLUENE-d8	66 *
BROMOFLUOROBENZENE	66

* Out of limits due to matrix effects.

VOLATILE ORGANICS ANALYSIS
TENTATIVELY IDENTIFIED COMPOUNDS

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/16/90
PROJECT #	: 3078	DATE RECEIVED	: 08/17/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/20/90
CLIENT I.D.	: TP4 S2	DATE ANALYZED	: 08/21/90
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8240	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	SCAN NUMBER	ESTIMATED CONCENTRATION
HYDROCARBON	1171	52
HYDROCARBON	1437	35
BRANCHED HYDROCARBON	1557	32
C10-C11 BRANCHED ALKANE	1385	31
HYDROCARBON	1800	28

ATI I.D. # 9008-130

VOLATILE ORGANICS
QUALITY CONTROL DATA

CLIENT	: HART CROWSER, INC.	SAMPLE I.D.	: 9008-086-2
PROJECT #	: 3078	DATE EXTRACTED	: 08/16/90
PROJECT NAME	: TACOMA METALS	DATE ANALYZED	: 08/16/90
EPA METHOD	: 8240	MATRIX	: SOIL
		UNITS	: mg/Kg

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % REC	RPD
1,1-DICHLOROETHENE	<0.05	2.50	1.92	77	1.87	75	3
TRICHLOROETHENE	<0.05	2.50	1.88	75	1.88	75	0
BENZENE	<0.05	2.50	1.56	62	1.49	60	5
TOLUENE	<0.05	2.50	1.55	62	1.51	60	3
CHLOROBENZENE	<0.05	2.50	1.55	62	1.51	60	3

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

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

ATI I.D. # 9008-130

POLYCHLORINATED BIPHENYLS (PCB) ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: N/A
PROJECT #	: 3078	DATE RECEIVED	: N/A
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/21/90
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 08/22/90
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8080 (PCB)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
PCB 1016	<0.033
PCB 1221	<0.033
PCB 1232	<0.033
PCB 1242	<0.033
PCB 1248	<0.033
PCB 1254	<0.033
PCB 1260	<0.033

SURROGATE PERCENT RECOVERY

DIBUTYLCHLORENDATE	73
DECACHLOROBIPHENYL	84

ATI I.D. # 9008-130

POLYCHLORINATED BIPHENYLS (PCB) ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: N/A
PROJECT #	: 3078	DATE RECEIVED	: N/A
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/29/90
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 08/30/90
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8080 (PCB)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
PCB 1016	<0.033
PCB 1221	<0.033
PCB 1232	<0.033
PCB 1242	<0.033
PCB 1248	<0.033
PCB 1254	<0.033
PCB 1260	<0.033

ATI I.D. # 9008-130-2

POLYCHLORINATED BIPHENYLS (PCB) ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/16/90
PROJECT #	: 3078	DATE RECEIVED	: 08/17/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/21/90
CLIENT I.D.	: TP1 S2	DATE ANALYZED	: 08/22/90
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8080 (PCB)	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
PCB 1016	<0.033
PCB 1221	<0.033
PCB 1232	<0.033
PCB 1242	<0.033
PCB 1248	<0.033
PCB 1254	<0.033
PCB 1260	<0.033

SURROGATE PERCENT RECOVERY

DIBUTYLCHLORENDATE	44
DECACHLOROBIPHENYL	51

ATI I.D. # 9008-130-8

POLYCHLORINATED BIPHENYLS (PCB) ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/16/90
PROJECT #	: 3078	DATE RECEIVED	: 08/17/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/29/90
CLIENT I.D.	: TP4 S2	DATE ANALYZED	: 08/31/90
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8080 (PCB)	DILUTION FACTOR	: 100

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
PCB 1016	<3.91
PCB 1221	<3.91
PCB 1232	<3.91
PCB 1242	<3.91
PCB 1248	<3.91
PCB 1254	<3.91
PCB 1260	32

POLYCHLORINATED BIPHENYLS (PCB)
QUALITY CONTROL

CLIENT	: HART CROWSER, INC.	SAMPLE ID	: 9008-130-2
PROJECT #	: 3078	DATE EXTRACTED	: 08/21/90
PROJECT NAME	: TACOMA METALS	DATE ANALYZED	: 08/22/90
EPA METHOD	: 8080 (PCB)	MATRIX	: SOIL
		UNITS	: mg/Kg

COMPOUND	SAMPLE RESULT	CONC SPIKED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % RECOVERY	RPD
PCB 1260	<0.033	0.43	0.231	54*	0.277	64*	18

* Out of limits.

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

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

POLYCHLORINATED BIPHENYLS (PCB)
QUALITY CONTROL

CLIENT	: HART CROWSER, INC.	SAMPLE ID	: 9008-130-8
PROJECT #	: 3078	DATE EXTRACTED	: 08/29/90
PROJECT NAME	: TACOMA METALS	DATE ANALYZED	: 08/31/90
EPA METHOD	: 8080 (PCB)	MATRIX	: SOIL
		UNITS	: mg/Kg

COMPOUND	SAMPLE RESULT	CONC SPIKED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % RECOVERY	RPD
PCB 1260	32	0.520	62	*	31	*	67*

* Out of limits due to matrix interference.

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

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

POLYCHLORINATED BIPHENYLS (PCB)
QUALITY CONTROL

CLIENT	: HART CROWSER, INC.	SAMPLE ID	: BLANK SPIKE
PROJECT #	: 3078	DATE EXTRACTED	: 08/21/90
PROJECT NAME	: TACOMA METALS	DATE ANALYZED	: 08/22/90
EPA METHOD	: 8080 (PCB)	MATRIX	: SOIL
		UNITS	: mg/Kg

COMPOUND	SAMPLE RESULT	CONC SPIKED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % RECOVERY	RPD
PCB 1260	<0.033	0.33	0.302	91	N/A	N/A	N/A

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

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

POLYNUCLEAR AROMATICS

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: N/A
PROJECT #	: 3078	DATE RECEIVED	: N/A
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/22/90
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 08/24/90
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8310	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
NAPHTHALENE	<0.083
ACENAPHTHYLENE	<0.17
ACENAPHTHENE	<0.17
FLUORENE	<0.017
PHENANTHRENE	<0.0083
ANTHRACENE	<0.0083
FLUORANTHENE	<0.017
PYRENE	<0.017
BENZO(a)ANTHRACENE	<0.017
CHRYSENE	<0.017
BENZO(b)FLUORANTHENE	<0.017
BENZO(k)FLUORANTHENE	<0.017
BENZO(a)PYRENE	<0.017
DIBENZ(a,h)ANTHRACENE	<0.034
BENZO(g,h,i)PERYLENE	<0.017
INDENO(1,2,3-cd)PYRENE	<0.017

SURROGATE PERCENT RECOVERY	
2-CHLOROANTHRACENE	83

ATI I.D. # 9008-130-2

POLYNUCLEAR AROMATICS

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/16/90
PROJECT #	: 3078	DATE RECEIVED	: 08/17/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/22/90
CLIENT I.D.	: TP1 S2	DATE ANALYZED	: 08/24/90
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8310	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
NAPHTHALENE	<0.083
ACENAPHTHYLENE	<0.17
ACENAPHTHENE	<0.17
FLUORENE	<0.017
PHENANTHRENE	<0.0083
ANTHRACENE	<0.0083
FLUORANTHENE	<0.017
PYRENE	0.024
BENZO(a)ANTHRACENE	<0.017
CHRYSENE	<0.017
BENZO(b)FLUORANTHENE	<0.017
BENZO(k)FLUORANTHENE	<0.017
BENZO(a)PYRENE	<0.017
DIBENZ(a,h)ANTHRACENE	<0.034
BENZO(g,h,i)PERYLENE	<0.017
INDENO(1,2,3-cd)PYRENE	<0.017

SURROGATE PERCENT RECOVERY	
2-CHLOROANTHRACENE	81

ATI I.D. # 9008-130-8

POLYNUCLEAR AROMATICS

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/16/90
PROJECT #	: 3078	DATE RECEIVED	: 08/17/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/22/90
CLIENT I.D.	: TP4 S2	DATE ANALYZED	: 08/24/90
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8310	DILUTION FACTOR	: 1

RESULTS BASED ON DRY WEIGHT

COMPOUND	RESULT
NAPHTHALENE	<0.13
ACENAPHTHYLENE	<0.27
ACENAPHTHENE	<0.27
FLUORENE	<0.027
PHENANTHRENE	0.082
ANTHRACENE	<0.013
FLUORANTHENE	0.39
PYRENE	0.33
BENZO(a)ANTHRACENE	0.045
CHRYSENE	0.11
BENZO(b)FLUORANTHENE	0.42
BENZO(k)FLUORANTHENE	<0.027
BENZO(a)PYRENE	0.27
DIBENZ(a,h)ANTHRACENE	0.35
BENZO(g,h,i)PERYLENE	0.29
INDENO(1,2,3-cd)PYRENE	0.27

SURROGATE PERCENT RECOVERY

2-CHLOROANTHRACENE	68

POLYNUCLEAR AROMATICS
QUALITY CONTROL DATA

CLIENT	: HART CROWSER, INC.	SAMPLE I.D.	: 9008-027-4
PROJECT #	: 3078	DATE EXTRACTED	: 08/13/90
PROJECT NAME	: TACOMA METALS	DATE ANALYZED	: 08/14/90
EPA METHOD	: 8310	MATRIX	: SOIL
		UNITS	: mg/Kg

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % REC	RPD
ACENAPHTHYLENE	<0.17	17	10.7	63	10.9	64	2
PHENANTHRENE	<0.0083	1.7	1.06	62	1.14	67	7
PYRENE	<0.017	1.7	1.06	62	1.16	68	9
BENZO(k)FLUORANTHENE	<0.017	1.7	0.924	54	1.05	62	13
DIBENZ(a,h)ANTHRACENE	<0.034	1.7	1.03	61	1.16	68	12

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

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

ATI I.D. # 9008-130

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: N/A
PROJECT #	: 3078	DATE RECEIVED	: N/A
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/20/90
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 08/28/90
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	DIESEL

ATI I.D. # 9008-130-2

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/16/90
PROJECT #	: 3078	DATE RECEIVED	: 08/17/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/20/90
CLIENT I.D.	: TP1 S2	DATE ANALYZED	: 08/25/90
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	DIESEL

ATI I.D. # 9008-130-8

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/16/90
PROJECT #	: 3078	DATE RECEIVED	: 08/17/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/20/90
CLIENT I.D.	: TP4 S2	DATE ANALYZED	: 08/25/90
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	1,100
HYDROCARBON RANGE	C6 - C14
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	280
HYDROCARBON RANGE	C14 - C24
HYDROCARBONS QUANTITATED USING	DIESEL

BEST ESTIMATE OF FUEL TYPE - 4 PARTS GASOLINE : 1 PART DIESEL

FUEL HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: HART CROWSER, INC.	SAMPLE I.D.	: 9008-129-2
PROJECT #	: 3078	DATE EXTRACTED	: 08/17/90
PROJECT NAME	: TACOMA METALS	DATE ANALYZED	: 08/28/90
EPA METHOD	: 8015 MODIFIED	MATRIX	: SOIL
		UNITS	: mg/Kg

COMPOUND	SAMPLE RESULT	CONC SPIKED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % RECOVERY	RPD
FUEL HYDROCARBONS	<5	500	489	98	471	94	4

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

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

METALS RESULTS

CLIENT : HART CROWSER, INC. MATRIX : SOIL
PROJECT # : 3078
PROJECT NAME : TACOMA METALS UNITS : mg/Kg

ATI I.D. #	CLIENT I.D.	ARSENIC	CADMIUM
9008-130-1	TP1 S1	9.3	-
9008-130-2	TP1 S2	1.4	1.3
9008-130-3	TP2 S1	26	-
9008-130-4	TP2 S2	6.4	-
9008-130-5	TP3 S1	2.3	-
9008-130-6	TP3 S2	1.2	-
9008-130-7	TP4 S1	10	-
9008-130-8	TP4 S2	2.6	11

METALS RESULTS

CLIENT : HART CROWSER, INC. MATRIX : SOIL
PROJECT # : 3078
PROJECT NAME : TACOMA METALS UNITS : mg/Kg

ATI I.D. #	CLIENT I.D.	CHROMIUM	LEAD
9008-130-2	TP1 S2	15	53
9008-130-8	TP4 S2	18	620

METALS QUALITY CONTROL

CLIENT : HART CROWSER, INC. MATRIX : SOIL
PROJECT # : 3078
PROJECT NAME : TACOMA METALS UNITS : mg/Kg

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED SAMPLE	SPIKE CONC	% REC
ARSENIC	9008-130-7	10	8.5	16	**	**	**
ARSENIC	BLANK SPIKE	N/A	N/A	N/A	3.0	2.5	120
CADMIUM	9008-101-17	<1	<1	0	13	14	93
CHROMIUM	9008-101-17	21	25	17	66	57	79
LEAD	9008-101-17	27	30	10	312	287	99

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

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

GENERAL CHEMISTRY RESULTS

CLIENT : HART CROWSER, INC. SAMPLE MATRIX : SOIL
PROJECT # : 3078
PROJECT NAME : TACOMA METALS UNITS : %

ATI I.D.#	CLIENT I.D.	MOISTURE
9008-130-1	TP1 S1	14
9008-130-2	TP1 S2	22
9008-130-3	TP2 S1	12
9008-130-4	TP2 S2	15
9008-130-5	TP3 S1	7.0
9008-130-6	TP3 S2	31
9008-130-7	TP4 S1	7.8
9008-130-8	TP4 S2	36

GENERAL CHEMISTRY QUALITY CONTROL

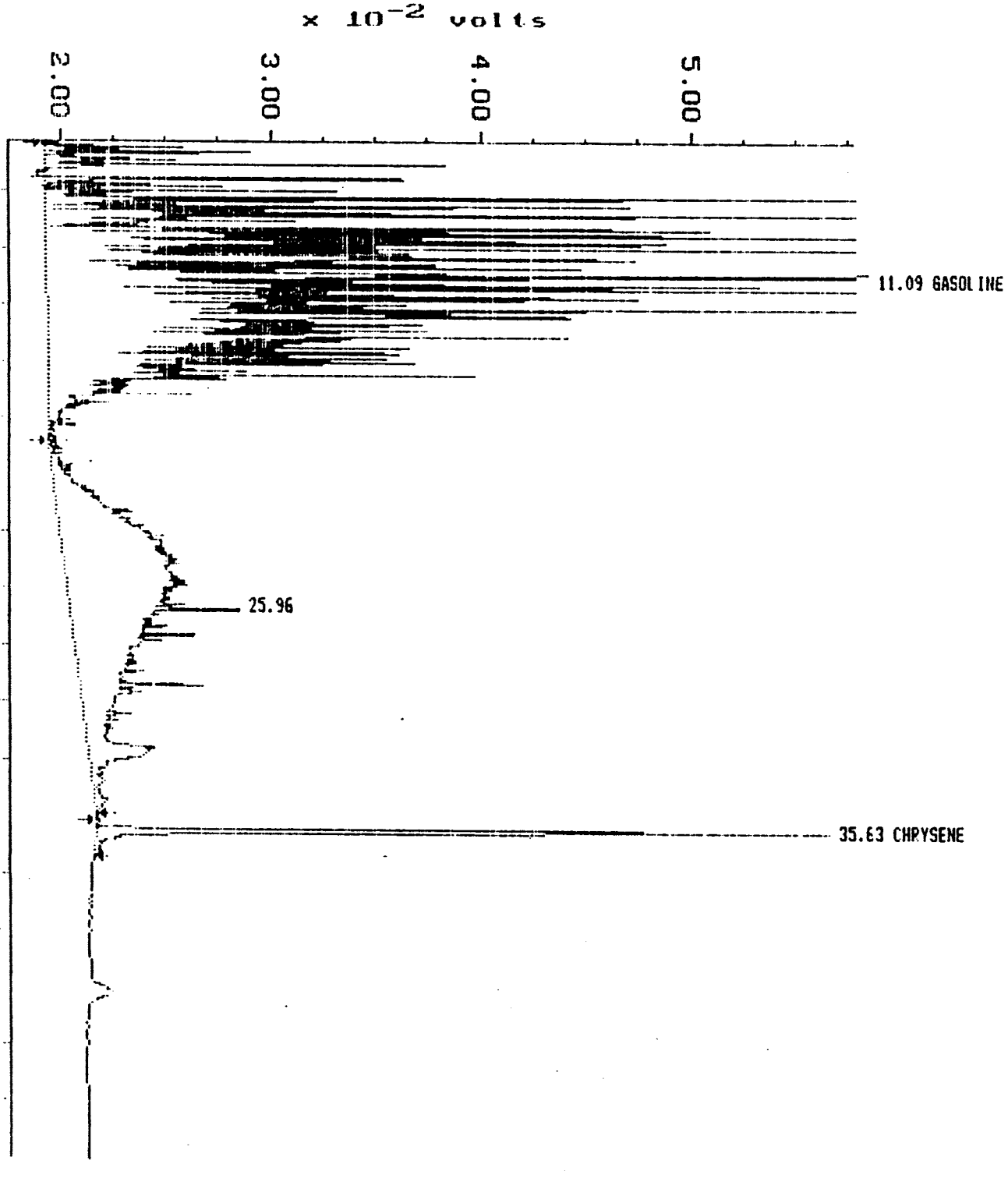
CLIENT : HART CROWSER, INC. SAMPLE MATRIX : SOIL
PROJECT # : 3078
PROJECT NAME : TACOMA METALS UNITS : %

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
MOISTURE	9008-130-8	36	33	9	N/A	N/A	N/A

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

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

Sample: 9008-130-8 R Channel: FID REAR-B Filename: 0FR03016
Acquired: 25-AUG-90 22:56 Method: M:\MAIDATA\PACK-R\FUEL825 Operator: LAL
Dilution: 1 : 5.000
Comments: 8015 FUEL FINGEPRINT/ 3 ul INJECT ON PACKIE



Sample Custody Record

DATE [illegible] PAGE 1 OF 1

HARTCROWSER

Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, Washington 98102-3699

JOB NUMBER ______ LAB NUMBER ______

PROJECT MANAGER [illegible]

PROJECT NAME [illegible]

SAMPLED BY: [illegible]

LAB NO.	SAMPLE	TIME	STATION	MATRIX	TESTING [illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]					NO. OF CONTAINERS	OBSERVATIONS/COMMENTS/ COMPOSITING INSTRUCTIONS
					X										1	
																Metals via ICP
					X	X	X	X	X	X					1	
					X										1	
					X										1	
					X										1	
					X										1	
					X										1	
					X	X	X	X	X	X					1	

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE [illegible]	[illegible]	SIGNATURE	
PRINTED NAME [illegible]	TIME [illegible]	PRINTED NAME	TIME
COMPANY		COMPANY	

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE		SIGNATURE [illegible]	[illegible]
PRINTED NAME	TIME	PRINTED NAME	TIME [illegible]
COMPANY		COMPANY	

TOTAL NUMBER OF CONTAINERS 8

METHOD OF SHIPMENT [illegible]

SPECIAL SHIPMENT/HANDLING OR STORAGE REQUIREMENTS [illegible]

DISTRIBUTION:

1. PROVIDE WHITE AND YELLOW COPIES TO LABORATORY
2. RETURN PINK COPY TO PROJECT MANAGER
3. LABORATORY TO FILL IN SAMPLE NUMBER AND SIGN FOR RECEIPT
4. LABORATORY TO RETURN WHITE COPY TO HART CROWSER

Analytical Technologies, Inc. [illegible] 206) 228-8335

ATI I.D. # 9008-131

September 4, 1990

Hart Crowser, Inc.
1910 Fairview Ave. East
Seattle, Wa 98102-3699

Attention : John Funderburk

Project Number : J-3078

Project Name : Tacoma Metals

On August 17, 1990 Analytical Technologies, Inc. received two soil samples and one slag sample 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 : HART CROWSER, INC.
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9008-131-1	TP-4, S-1	08/16/90	SOIL
9008-131-2	TP-5, S-2	08/17/90	SOIL
9008-131-3	SLAG-01	08/16/90	SLAG

----- TOTALS -----

MATRIX	# SAMPLES
SOIL	2
SLAG	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 : HART CROWSER, INC.
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS

ANALYSIS	TECHNIQUE	REFERENCE	LAB
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 7471	R
SELENIUM	AA/GF	EPA 7740	R
SILVER	AA/F	EPA 7760	R
PETROLEUM HYDROCARBONS	IR	EPA 418.1	R
MOISTURE	GRAVIMETRIC	METHOD 7-2.2	R

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

ATI I.D. # 9008-131

TCLP
METALS RESULTS

CLIENT : HART CROWSER, INC.
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS

MATRIX : TCLP EXTRACT
UNITS : mg/L

PARAMETER	SLAG-01 -3
ARSENIC	<0.005
BARIUM	0.36
CADMIUM	0.01
CHROMIUM	<0.02
LEAD	0.64
MERCURY	<0.0005
SELENIUM	<0.005
SILVER	<0.02

TCLP
METALS QUALITY CONTROL

CLIENT : HART CROWSER, INC. MATRIX : TCLP EXTRACT
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS UNITS : mg/L

COMPOUND	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED SAMPLE	SPIKE CONC	% REC
ARSENIC	9008-041-1	<0.005	<0.005	0	0.027	0.025	108
BARIUM	9008-144-1	0.36	0.38	5	23.4	20.0	115
CADMIUM	9008-144-1	<0.01	<0.01	0	0.48	0.50	96
CHROMIUM	9008-144-1	<0.02	<0.02	0	2.07	2.00	104
LEAD	9008-144-1	<0.1	<0.1	0	9.8	10.0	98
MERCURY	9008-131-3	<0.0005	<0.0005	0	0.0017	0.0020	85
SELENIUM	9008-041-1	<0.005	<0.005	0	0.036	0.050	72
SILVER	9008-144-1	<0.02	<0.02	0	0.96	1.00	96

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

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

GENERAL CHEMISTRY RESULTS

CLIENT : HART CROWSER, INC. SAMPLE MATRIX : SOIL
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS UNITS : mg/Kg

ATI I.D. #	CLIENT I.D.	PETROLEUM HYDROCARBONS
9008-131-1	TP-4, S-1	2,400
9008-131-2	TP-5, S-2	18

GENERAL CHEMISTRY QUALITY CONTROL

CLIENT : HART CROWSER, INC. SAMPLE MATRIX : SOIL
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS UNITS : mg/Kg

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
PETROLEUM HYDROCARBONS	9008-137-3	11	11	0	316	261	117

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

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

GENERAL CHEMISTRY RESULTS

CLIENT : HART CROWSER, INC. SAMPLE MATRIX : SOIL
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS UNITS : %

ATI I.D. #	CLIENT I.D.	MOISTURE
9008-131-1	TP-4, S-1	8.7
9008-131-2	TP-5, S-2	32

GENERAL CHEMISTRY QUALITY CONTROL

CLIENT : HART CROWSER, INC.
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS

SAMPLE MATRIX : SOIL
UNITS : %

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
MOISTURE	9008-131-2	32	32	0	N/A	N/A	N/A

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

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

Analytical**Technologies,**Inc.

560 Naches Avenue SW, Suite 101 Renton,WA 98055 (206)228-8335

Chain of Custody

DATE 8/17/90 PAGE ___ OF ___

LABORATORY NUMBER: 9008-121

PROJECT MANAGER: John Funderburk

COMPANY: Hart Crowser, Inc.

ADDRESS: 1910 Fairview Ave E
Seattle WA 98102

PHONE: 329-9530 SAMPLED BY: E. Atkinson

SAMPLE DISPOSAL INSTRUCTIONS

☐ ATI Disposal @ $5.00 each ☒ Return

ANALYSIS REQUEST

SAMPLE ID	DATE	TIME	MATRIX	LAB ID
HP-21, S-1	8/16/90	1410	Soil	-1
HP-[illegible] S-2	8/17/90	1025	Soil	-2
SLAG-01	8/16/90	1010	Slag	-3

SAMPLE 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	EP TOX Metals (8) EP EXT	Priority Pollutant Metals (13)	TCLP ONLY: 8080 Pesticide (4)	TCLP ONLY: 8240 ZH-EXT	TCLP ONLY: 8270	TCLP ONLY: 8150 Herbicides (2)	TCLP ONLY: Metals (8)			NUMBER OF CONTAINERS
HP-21, S-1		10/90	X	X	X			X				X		X			X		Cr Pb						Pb		2
HP-[illegible] S-2			X	X	X			X				X		X			X		Cr Pb						Pb		2
SLAG-01																								X			1

PROJECT INFORMATION

PROJECT NUMBER: J-3075

PROJECT NAME: Tacoma Metals

PURCHASE ORDER NUMBER:

ONGOING PROJECT? YES ☐ NO ☒

SAMPLE RECEIPT

TOTAL NUMBER OF CONTAINERS: 5

COC SEALS/INTACT? Y/N/NA: Y

RECEIVED GOOD COND./COLD: Y/Y

RECEIVED VIA: Client

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH PROJECTS

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

GREATER THAN 24 HR. NOTICE? YES ☐ NO ☐ (LAB USE ONLY)

SPECIAL INSTRUCTIONS:

~~8240's + TCLP T. HI (SPLASH)~~ Cancelled

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Time: Elaine P. Atkinson 1704	Signature: Time:	Signature: Time:
Printed Name: Date: Elaine Atkinson 8/17/90	Printed Name: Date:	Printed Name: Date:
Company: Hart Crowser	Company:	Company:
RECEIVED BY: 1.	**RECEIVED BY: 2.**	**RECEIVED BY: (LAB) 3.**
Signature: Time: SCJ [illegible]	Signature: Time:	Signature: Time:
Printed Name: Date: 8-17-90 [illegible]	Printed Name: Date:	Printed Name: Date:
Company: HTI	Company:	Company: Analytical Technologies, Inc.

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

№ 1764

Analytical Technologies, Inc. 5811 Northeast Hemlock, Suite 101, Renton, WA 98059, (206) 228-8335

ATI I.D. # 9008-150

September 6, 1990

Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, WA 98102-3699

Attention : John Funderburk

Project Number : J-3078

Project Name : Tacoma Metals

On August 21, 1990 Analytical Technologies, Inc. received three soil samples and 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/elf

SAMPLE CROSS REFERENCE SHEET

CLIENT : HART CROWSER, INC.
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9008-150-1	HC-1	08/17/90	SOIL
9008-150-2	TP-5, S-1	08/17/90	SOIL
9008-150-3	TP-5, S-2	08/17/90	SOIL
9008-150-4	HC-1	08/20/90	WATER
9008-150-5	HC-2	08/20/90	WATER
9008-150-6	HC-3	08/20/90	WATER
9008-150-7	HC-3A	08/20/90	WATER
9008-150-8	HC-4	08/20/90	WATER

----- TOTALS -----

MATRIX	# SAMPLES
SOIL	3
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 : HART CROWSER, INC.
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS

ANALYSIS	TECHNIQUE	REFERENCE	LAB
POLYCHLORINATED BIPHENYLS (PCBs)	GC/ECD	EPA 8080	R
POLYNUCLEAR AROMATIC HYDROCARBONS	HPLC/UV	EPA 8310	R
FUEL HYDROCARBONS	GC/FID	EPA 8015 MODIFIED	R
ARSENIC	AA/GF	EPA 7060	R
CADMIUM	AA/GF	EPA 7131	R
CHROMIUM	AA/F	EPA 7190	R
LEAD	AA/GF	EPA 7421	R
MOISTURE	GRAVIMETRIC	METHOD 7-2.2	R

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

ATI I.D. # 9008-150

POLYCHLORINATED BIPHENYLS (PCB) ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: N/A
PROJECT #	: J-3078	DATE RECEIVED	: N/A
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/22/90
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 08/24/90
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8080 (PCB)	DILUTION FACTOR	: 1

COMPOUND	RESULT
PCB 1016	<1.0
PCB 1221	<1.0
PCB 1232	<1.0
PCB 1242	<1.0
PCB 1248	<1.0
PCB 1254	<1.0
PCB 1260	<1.0

SURROGATE PERCENT RECOVERY

DIBUTYLCHLORENDATE	108
DECACHLOROBIPHENYL	89

POLYCHLORINATED BIPHENYLS (PCB) ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/20/90
PROJECT #	: J-3078	DATE RECEIVED	: 08/21/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/22/90
CLIENT I.D.	: HC-3	DATE ANALYZED	: 08/24/90
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8080 (PCB)	DILUTION FACTOR	: 1

COMPOUND	RESULT
PCB 1016	<1.0
PCB 1221	<1.0
PCB 1232	<1.0
PCB 1242	<1.0
PCB 1248	<1.0
PCB 1254	12
PCB 1260	6.2

SURROGATE PERCENT RECOVERY

DIBUTYLCHLORENDATE	68
DECACHLOROBIPHENYL	42

POLYCHLORINATED BIPHENYLS (PCB)
QUALITY CONTROL

CLIENT	: HART CROWSER, INC.	SAMPLE ID	: 9008-153-1
PROJECT #	: J-3078	DATE EXTRACTED	: 08/22/90
PROJECT NAME	: TACOMA METALS	DATE ANALYZED	: 08/24/90
EPA METHOD	: 8080 (PCB)	MATRIX	: WATER
		UNITS	: ug/L

COMPOUND	SAMPLE RESULT	CONC SPIKED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % RECOVERY	RPD
PCB 1260	<1.0	5.2	5.62	108	5.37	103	5

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

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

ATI I.D. # 9008-150

POLYNUCLEAR AROMATICS ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: N/A
PROJECT #	: J-3078	DATE RECEIVED	: N/A
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/22/90
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 08/26/90
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8310	DILUTION FACTOR	: 1

COMPOUND	RESULT
NAPHTHALENE	<0.50
ACENAPHTHYLENE	<1.0
ACENAPHTHENE	<1.0
FLUORENE	<0.10
PHENANTHRENE	<0.05
ANTHRACENE	0.07
FLUORANTHENE	<0.10
PYRENE	<0.10
BENZO(a)ANTHRACENE	<0.10
CHRYSENE	<0.10
BENZO(b)FLUORANTHENE	<0.10
BENZO(k)FLUORANTHENE	<0.10
BENZO(a)PYRENE	<0.10
DIBENZ(a,h)ANTHRACENE	<0.20
BENZO(g,h,i)PERYLENE	<0.10
INDENO(1,2,3-cd)PYRENE	<0.10

SURROGATE PERCENT RECOVERY	
2-CHLOROANTHRACENE	92

ATI I.D. # 9008-150-6

POLYNUCLEAR AROMATICS ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/20/90
PROJECT #	: J-3078	DATE RECEIVED	: 08/21/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/22/90
CLIENT I.D.	: HC-3	DATE ANALYZED	: 08/29/90
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8310	DILUTION FACTOR	: 1

COMPOUND	RESULT
NAPHTHALENE	2.4
ACENAPHTHYLENE	<1.0
ACENAPHTHENE	1.5
FLUORENE	0.12
PHENANTHRENE	0.49
ANTHRACENE	0.084 B
FLUORANTHENE	1.9
PYRENE	1.1
BENZO(a)ANTHRACENE	<0.10
CHRYSENE	0.67
BENZO(b)FLUORANTHENE	0.49
BENZO(k)FLUORANTHENE	0.44
BENZO(a)PYRENE	0.22
DIBENZ(a,h)ANTHRACENE	0.43
BENZO(g,h,i)PERYLENE	0.21
INDENO(1,2,3-cd)PYRENE	0.28

SURROGATE PERCENT RECOVERY

2-CHLOROANTHRACENE	28

B = Also found in blank.

POLYNUCLEAR AROMATICS
QUALITY CONTROL DATA

CLIENT	: HART CROWSER, INC.	SAMPLE I.D.	: 9008-153-2
PROJECT #	: J-3078	DATE EXTRACTED	: 08/22/90
PROJECT NAME	: TACOMA METALS	DATE ANALYZED	: 08/26/90
EPA METHOD	: 8310	MATRIX	: WATER
		UNITS	: ug/L

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % REC	RPD
ACENAPHTHYLENE	<1.0	48	47.2	98	49.7	104*	5
PHENANTHRENE	0.42	4.8	4.63	88	4.42	83	5
PYRENE	1.4	4.8	4.27	60*	3.93	53*	8
BENZO(k)FLUORANTHENE	0.17	4.8	1.64	31*	1.62	30*	1
DIBENZ(a,h)ANTHRACENE	<0.20	4.8	2.12	44*	1.89	39*	11

* Out of limits.

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

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

POLYNUCLEAR AROMATICS
QUALITY CONTROL DATA

CLIENT	: HART CROWSER, INC.	SAMPLE I.D.	: BLANK SPIKE
PROJECT #	: J-3078	DATE EXTRACTED	: 08/22/90
PROJECT NAME	: TACOMA METALS	DATE ANALYZED	: 08/26/90
EPA METHOD	: 8310	MATRIX	: WATER
		UNITS	: ug/L

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % REC	RPD
ACENAPHTHYLENE	<1.0	50	56.2	112*	N/A	N/A	N/A
PHENANTHRENE	<0.05	5.0	5.86	117	N/A	N/A	N/A
PYRENE	<0.10	5.0	7.18	144*	N/A	N/A	N/A
BENZO(k)FLUORANTHENE	<0.10	5.0	7.69	154*	N/A	N/A	N/A
DIBENZ(a,h)ANTHRACENE	<0.20	5.0	8.45	169*	N/A	N/A	N/A

* Out of limits.

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

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

ATI I.D. # 9008-150

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: N/A
PROJECT #	: J-3078	DATE RECEIVED	: N/A
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/23/90
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 09/05/90
SAMPLE MATRIX	: WATER	UNITS	: mg/L
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	DIESEL

ATI I.D. # 9008-150-6

FUEL HYDROCARBONS ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/20/90
PROJECT #	: J-3078	DATE RECEIVED	: 08/21/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/23/90
CLIENT I.D.	: HC-3	DATE ANALYZED	: 08/31/90
SAMPLE MATRIX	: WATER	UNITS	: mg/L
EPA METHOD	: 8015 MODIFIED	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	1
HYDROCARBON RANGE	C6 - C12
HYDROCARBONS QUANTITATED USING	GASOLINE
FUEL HYDROCARBONS	<1
HYDROCARBON RANGE	-
HYDROCARBONS QUANTITATED USING	DIESEL

FUEL HYDROCARBONS
QUALITY CONTROL DATA

CLIENT	: HART CROWSER, INC.	SAMPLE I.D.	: 9008-150-6
PROJECT #	: J-3078	DATE EXTRACTED	: 08/23/90
PROJECT NAME	: TACOMA METALS	DATE ANALYZED	: 08/31/90
EPA METHOD	: 8015 MODIFIED	MATRIX	: WATER
		UNITS	: mg/L

COMPOUND	SAMPLE RESULT	CONC SPIKED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % RECOVERY	RPD
FUEL HYDROCARBONS	<1	100	122	122	111	111	9

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

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

ATI I.D.# 9008-150

METALS RESULTS

CLIENT : HART CROWSER, INC. MATRIX : WATER
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS UNITS : mg/L

PARAMETER	HC-1 -4	HC-2 -5	HC-3 -6	HC-3A -7	HC-4 -8
ARSENIC	<0.005	<0.005	0.006	0.007	<0.005
CADMIUM	0.0006	0.0017	0.0050	0.0047	<0.0003
CHROMIUM	<0.02	<0.02	<0.02	<0.02	<0.02
LEAD	0.12	<0.005	0.006	0.008	<0.005

METALS QUALITY CONTROL

CLIENT : HART CROWSER, INC. MATRIX : WATER
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS UNITS : mg/L

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED SAMPLE	SPIKE CONC	% REC
ARSENIC	9008-150-8	<0.005	<0.005	0	0.048	0.050	96
CADMIUM	9008-150-8	<0.0003	<0.0003	0	0.0021	0.0020	105
CHROMIUM	9008-090-2	<0.02	<0.02	0	1.99	2.00	100
LEAD	9008-150-8	<0.005	<0.005	0	0.053	0.050	106

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

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

ATI I.D.# 9008-150

METALS RESULTS

CLIENT : HART CROWSER, INC. MATRIX : SOIL
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS UNITS : mg/Kg

PARAMETER	HC-1 -1	TP-5, S-1 -2	TP-5, S-2 -3
ARSENIC	1.7	32	1.4

METALS QUALITY CONTROL

CLIENT : HART CROWSER, INC. MATRIX : SOIL
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS UNITS : mg/Kg

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED SAMPLE	SPIKE CONC	% REC
ARSENIC	9008-150-3	1.4	1.2	15	4.3	3.5	83

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

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

ATI I.D. # 9008-150

GENERAL CHEMISTRY RESULTS

CLIENT : HART CROWSER, INC. SAMPLE MATRIX : SOIL
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS UNITS : %

PARAMETER	HC-1 -1	TP-5, S-1 -2	TP-5, S-2 -3
MOISTURE	5.9	19	30

GENERAL CHEMISTRY QUALITY CONTROL

CLIENT : HART CROWSER, INC. SAMPLE MATRIX : SOIL
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS UNITS : %

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
MOISTURE	9008-150-3	30	28	7	N/A	N/A	N/A

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

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

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

Chain of Custody 9008-150

DATE 8/21/90 PAGE 1 OF 1

PROJECT MANAGER: John Funderburk
COMPANY: Hart Crowser
ADDRESS: 1910 Fairview Ave E
Seattle, WA 98102
PHONE: 324-9530 SAMPLED BY: E. Atkinson

LABORATORY NUMBER:

SAMPLE DISPOSAL INSTRUCTIONS

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

SAMPLE ID	DATE	TIME	MATRIX	LAB ID
HC-1	8/17/90	1345	soil	-1
TP-5, S-1	8/17/90	1005	soil	2
TP-5, S-2	8/17/90	1025	soil	3
HC-1	8/20/90	1258	water	4
HC-2	8/20/90	1515	water	5
HC-3	8/20/90	1645	water	6
HC-3A	8/20/90	1700	water	7
HC-4	8/20/90	1405	water	8
HC-3	8/20/90	1645	water	9 (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	Total organic only	Tot. As Cd Cr Pb						NUMBER OF CONTAINERS
HC-1																	X					X							1
TP-5, S-1																	X					X							1
TP-5, S-2																	X					X							1
HC-1				Cancelled 8/23	Cancelled 8/23	Cancelled 8/22																	X						1
HC-2																							X						1
HC-3																							X						1
HC-3A																							X						1
HC-4																							X						1
HC-3				X	X	X		X						X															9

PROJECT INFORMATION

PROJECT NUMBER:	J-3078
PROJECT NAME:	Tacoma Metals
PURCHASE ORDER NUMBER:	
VIA:	

SAMPLE RECEIPT

TOTAL NUMBER OF CONTAINERS	17
CHAIN OF CUSTODY SEALS Y/N/NA	4
INTACT? Y/N/NA	4
RECEIVED GOOD COND./COLD	4/4

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

PRIOR AUTHORIZATION IS REQUIRED FOR RUSH DATA

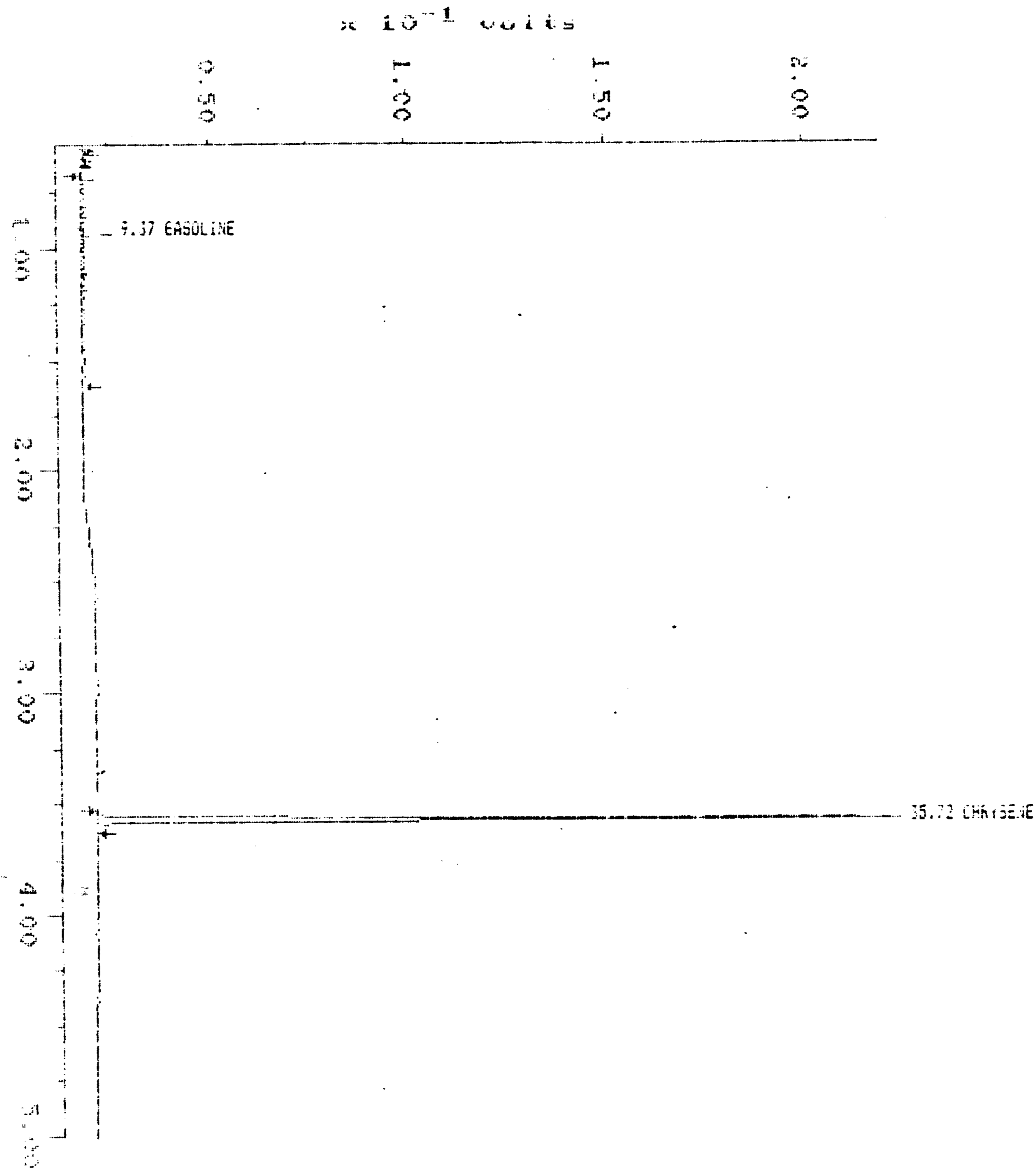
SPECIAL INSTRUCTIONS:

Was unpreserved, no headspace

RELINQUISHED BY: 1.	RELINQUISHED BY: 2.	RELINQUISHED BY: 3.
Signature: Elaine Atkinson Time: 0930	Signature: Time:	Signature: Time:
Printed Name: Elaine Atkinson Date: 8/21/90	Printed Name: Date:	Printed Name: Date:
Company: Hart Crowser	Company:	Company:
RECEIVED BY: 1.	**RECEIVED BY: 2.**	**RECEIVED BY: (LAB) 3.**
Signature: Time: 1030A	Signature: Time:	Signature: Time:
Printed Name: V. LENNICE Date: 8/21/90	Printed Name: Date:	Printed Name: Date:
Company: ATI	Company:	Analytical Technologies, Inc.

9008-150-6

Sample: 9008-150-6 R **Channel:** FID REAR-B **Filename:** OPR0C124
Acquired: 30-Aug-90 10:41 **Method:** 1:\MAXDATA\FACK-R\OAFUEL **Operator:** LAL
Comments: 5015 FUEL FINGERPRINT/ 3 ul INJECT ON PACKIE



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

ATI I.D. # 9008-153

September 5, 1990

Hart Crowser, Inc.
1910 Fairview Avenue E.
Seattle, WA 98102-3699

Attention : John Funderburk

Project Number : J-3078

Project Name : Tacoma Metals

On August 21, 1990 Analytical Technologies, Inc. received three 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/tc

SAMPLE CROSS REFERENCE SHEET

CLIENT : HART CROWSER, INC.
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9008-153-1	HC-1 DRIVE POINT	08/20/90	WATER
9008-153-2	HC-2 DRIVE POINT	08/20/90	WATER
9008-153-3	HC-4 DRIVE POINT	08/20/90	WATER

----- TOTALS -----

MATRIX	# SAMPLES
WATER	3

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 : HART CROWSER, INC.
PROJECT # : J-3078
PROJECT NAME : TACOMA METALS

ANALYSIS	TECHNIQUE	REFERENCE	LAB
POLYCHLORINATED BIPHENYLS (PCBs)	GC/ECD	EPA 8080	R
POLYNUCLEAR AROMATIC HYDROCARBONS	HPLC/UV	EPA 8310	R

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

POLYCHLORINATED BIPHENYLS (PCB) ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: N/A
PROJECT #	: J-3078	DATE RECEIVED	: N/A
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/22/90
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 08/24/90
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8080 (PCB)	DILUTION FACTOR	: 1

COMPOUND	RESULT
PCB 1016	<1.0
PCB 1221	<1.0
PCB 1232	<1.0
PCB 1242	<1.0
PCB 1248	<1.0
PCB 1254	<1.0
PCB 1260	<1.0

SURROGATE PERCENT RECOVERY

DIBUTYLCHLORENDATE	108
DECACHLOROBIPHENYL	89

POLYCHLORINATED BIPHENYLS (PCB) ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/20/90
PROJECT #	: J-3078	DATE RECEIVED	: 08/21/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/22/90
CLIENT I.D.	: HC-1 DRIVE POINT	DATE ANALYZED	: 08/24/90
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8080 (PCB)	DILUTION FACTOR	: 1

COMPOUND	RESULT
PCB 1016	<1.0
PCB 1221	<1.0
PCB 1232	<1.0
PCB 1242	<1.0
PCB 1248	<1.0
PCB 1254	<1.0
PCB 1260	<1.0

SURROGATE PERCENT RECOVERY

DIBUTYLCHLORENDATE	95
DECACHLOROBIPHENYL	60

POLYCHLORINATED BIPHENYLS (PCB) ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/20/90
PROJECT #	: J-3078	DATE RECEIVED	: 08/21/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/22/90
CLIENT I.D.	: HC-2 DRIVE POINT	DATE ANALYZED	: 08/24/90
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8080 (PCB)	DILUTION FACTOR	: 1

COMPOUND	RESULT
PCB 1016	<1.0
PCB 1221	<1.0
PCB 1232	<1.0
PCB 1242	<1.0
PCB 1248	<1.0
PCB 1254	<1.0
PCB 1260	<1.0

SURROGATE PERCENT RECOVERY

DIBUTYLCHLORENDATE	46
DECACHLOROBIPHENYL	63

POLYCHLORINATED BIPHENYLS (PCB) ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/20/90
PROJECT #	: J-3078	DATE RECEIVED	: 08/21/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/22/90
CLIENT I.D.	: HC-4 DRIVE POINT	DATE ANALYZED	: 08/24/90
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8080 (PCB)	DILUTION FACTOR	: 1

COMPOUND	RESULT
PCB 1016	<1.0
PCB 1221	<1.0
PCB 1232	<1.0
PCB 1242	<1.0
PCB 1248	<1.0
PCB 1254	<1.0
PCB 1260	<1.0

SURROGATE PERCENT RECOVERY

DIBUTYLCHLORENDATE	72
DECACHLOROBIPHENYL	75

POLYCHLORINATED BIPHENYLS (PCB)
QUALITY CONTROL

CLIENT	: HART CROWSER, INC.	SAMPLE ID	: 9008-153-1
PROJECT #	: J-3078	DATE EXTRACTED	: 08/22/90
PROJECT NAME	: TACOMA METALS	DATE ANALYZED	: 08/24/90
EPA METHOD	: 8080 (PCB)	MATRIX	: WATER
		UNITS	: ug/L

COMPOUND	SAMPLE RESULT	CONC SPIKED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % RECOVERY	RPD
PCB 1260	<1.0	5.2	5.62	108	5.37	103	5

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

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

POLYNUCLEAR AROMATICS ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: N/A
PROJECT #	: J-3078	DATE RECEIVED	: N/A
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/22/90
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 08/26/90
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8310	DILUTION FACTOR	: 1

COMPOUND	RESULT
NAPHTHALENE	<0.50
ACENAPHTHYLENE	<1.0
ACENAPHTHENE	<1.0
FLUORENE	<0.10
PHENANTHRENE	<0.05
ANTHRACENE	0.07
FLUORANTHENE	<0.10
PYRENE	<0.10
BENZO(a)ANTHRACENE	<0.10
CHRYSENE	<0.10
BENZO(b)FLUORANTHENE	<0.10
BENZO(k)FLUORANTHENE	<0.10
BENZO(a)PYRENE	<0.10
DIBENZ(a,h)ANTHRACENE	<0.20
BENZO(g,h,i)PERYLENE	<0.10
INDENO(1,2,3-cd)PYRENE	<0.10

SURROGATE PERCENT RECOVERY

2-CHLOROANTHRACENE	92

POLYNUCLEAR AROMATICS ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/20/90
PROJECT #	: J-3078	DATE RECEIVED	: 08/21/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/22/90
CLIENT I.D.	: HC-1 DRIVE POINT	DATE ANALYZED	: 08/26/90
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8310	DILUTION FACTOR	: 1

COMPOUND	RESULT
NAPHTHALENE	<0.50
ACENAPHTHYLENE	<1.0
ACENAPHTHENE	<1.0
FLUORENE	<0.10
PHENANTHRENE	<0.05
ANTHRACENE	0.083 B
FLUORANTHENE	<0.10
PYRENE	<0.10
BENZO(a)ANTHRACENE	<0.10
CHRYSENE	<0.10
BENZO(b)FLUORANTHENE	<0.10
BENZO(k)FLUORANTHENE	<0.10
BENZO(a)PYRENE	<0.10
DIBENZ(a,h)ANTHRACENE	<0.20
BENZO(g,h,i)PERYLENE	<0.10
INDENO(1,2,3-cd)PYRENE	<0.10

SURROGATE PERCENT RECOVERY

2-CHLOROANTHRACENE	91

B = Also found in blank.

POLYNUCLEAR AROMATICS ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/20/90
PROJECT #	: J-3078	DATE RECEIVED	: 08/21/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/22/90
CLIENT I.D.	: HC-2 DRIVE POINT	DATE ANALYZED	: 08/26/90
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8310	DILUTION FACTOR	: 1

COMPOUND	RESULT
NAPHTHALENE	<0.50
ACENAPHTHYLENE	<1.0
ACENAPHTHENE	<1.0
FLUORENE	<0.10
PHENANTHRENE	0.42
ANTHRACENE	0.057 B
FLUORANTHENE	2.2
PYRENE	1.4
BENZO(a)ANTHRACENE	<0.10
CHRYSENE	0.34
BENZO(b)FLUORANTHENE	<0.10
BENZO(k)FLUORANTHENE	0.17
BENZO(a)PYRENE	<0.10
DIBENZ(a,h)ANTHRACENE	<0.20
BENZO(g,h,i)PERYLENE	<0.10
INDENO(1,2,3-cd)PYRENE	<0.10

SURROGATE PERCENT RECOVERY

2-CHLOROANTHRACENE	*

B = Also found in blank.

* Out of limits.

POLYNUCLEAR AROMATICS ANALYSIS
DATA SUMMARY

CLIENT	: HART CROWSER, INC.	DATE SAMPLED	: 08/20/90
PROJECT #	: J-3078	DATE RECEIVED	: 08/21/90
PROJECT NAME	: TACOMA METALS	DATE EXTRACTED	: 08/22/90
CLIENT I.D.	: HC-4 DRIVE POINT	DATE ANALYZED	: 08/29/90
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8310	DILUTION FACTOR	: 1

COMPOUND	RESULT
NAPHTHALENE	<0.50
ACENAPHTHYLENE	<1.0
ACENAPHTHENE	<1.0
FLUORENE	<0.10
PHENANTHRENE	0.22
ANTHRACENE	0.053 B
FLUORANTHENE	<0.10
PYRENE	0.77
BENZO(a)ANTHRACENE	<0.10
CHRYSENE	0.31
BENZO(b)FLUORANTHENE	<0.10
BENZO(k)FLUORANTHENE	<0.10
BENZO(a)PYRENE	<0.10
DIBENZ(a,h)ANTHRACENE	<0.20
BENZO(g,h,i)PERYLENE	<0.10
INDENO(1,2,3-cd)PYRENE	<0.10

SURROGATE PERCENT RECOVERY

2-CHLOROANTHRACENE	57

B = Also found in blank.

POLYNUCLEAR AROMATICS
QUALITY CONTROL DATA

CLIENT	: HART CROWSER, INC.	SAMPLE I.D.	: 9008-153-2
PROJECT #	: J-3078	DATE EXTRACTED	: 08/22/90
PROJECT NAME	: TACOMA METALS	DATE ANALYZED	: 08/26/90
EPA METHOD	: 8310	MATRIX	: WATER
		UNITS	: ug/L

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % REC	RPD
ACENAPHTHYLENE	<1.0	48	47.2	98	49.7	104*	5
PHENANTHRENENE	0.42	4.8	4.63	88	4.42	83	5
PYRENE	1.4	4.8	4.27	60*	3.93	53*	8
BENZO(k)FLUORANTHENE	0.17	4.8	1.64	31*	1.62	30*	1
DIBENZ(a,h)ANTHRACENE	<0.20	4.8	2.12	44*	1.89	39*	11

* Out of limits.

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

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

POLYNUCLEAR AROMATICS
QUALITY CONTROL DATA

CLIENT	: HART CROWSER, INC.	SAMPLE I.D.	: BLANK SPIKE
PROJECT #	: J-3078	DATE EXTRACTED	: 08/22/90
PROJECT NAME	: TACOMA METALS	DATE ANALYZED	: 08/26/90
EPA METHOD	: 8310	MATRIX	: WATER
		UNITS	: ug/L

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED SAMPLE	% REC	DUP SPIKED SAMPLE	DUP % REC	RPD
ACENAPHTHYLENE	<1.0	50	56.2	112*	N/A	N/A	N/A
PHENANTHRENE	<0.05	5.0	5.86	117	N/A	N/A	N/A
PYRENE	<0.10	5.0	7.18	144*	N/A	N/A	N/A
BENZO(k)FLUORANTHENE	<0.10	5.0	7.69	154*	N/A	N/A	N/A
DIBENZ(a,h)ANTHRACENE	<0.20	5.0	8.45	169*	N/A	N/A	N/A

* Out of limits.

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

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

Sample Custody Record

DATE 7/1/1 PAGE 1 OF 1

HARTCROWSER

Hart Crowser, Inc.
1910 Fairview Avenue East
Seattle, Washington 98102-3699

JOB NUMBER _____ LAB NUMBER _____

PROJECT MANAGER _____

PROJECT NAME _____

SAMPLED BY:

LAB NO.	SAMPLE	TIME	STATION	MATRIX	TESTING										NO. OF CONTAINERS	OBSERVATIONS/COMMENTS/ COMPOSITING INSTRUCTIONS
	1	7/1/90	1	1	X		X									
	1	1	1	1	X		X									
	1	1	1	1	X		X									

RELINQUISHED BY	DATE	RECEIVED BY	DATE
SIGNATURE	7/1/1	SIGNATURE	
	TIME		TIME
PRINTED NAME	1500	PRINTED NAME	
COMPANY		COMPANY	
RELINQUISHED BY	**DATE**	**RECEIVED BY**	**DATE**
SIGNATURE		SIGNATURE	
	TIME		TIME
PRINTED NAME		PRINTED NAME	
COMPANY		COMPANY	

TOTAL NUMBER OF CONTAINERS

METHOD OF SHIPMENT

SPECIAL SHIPMENT/HANDLING OR STORAGE REQUIREMENTS

DISTRIBUTION:

1. PROVIDE WHITE AND YELLOW COPIES TO LABORATORY
2. RETURN PINK COPY TO PROJECT MANAGER
3. LABORATORY TO FILL IN SAMPLE NUMBER AND SIGN FOR RECEIPT
4. LABORATORY TO RETURN WHITE COPY TO HART CROWSER

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