*Petroleum-Contaminated Soil Investigation*
*Former Tank No. 7-CMBPN*
*Building No. 4475*
*Camp Bonneville*
*Vancouver, Washington*

*Prepared for*
*Seattle District*
*U.S. Army Corps of Engineers*

*Contract No. DACA 67-93-D-1004*
*Delivery Order No. 53*

*September 11, 1996*
*J-3933-53*

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# PETROLEUM-CONTAMINATED SOIL INVESTIGATION FORMER TANK NO. 7-CMBPN, BUILDING NO. 4475 CAMP BONNEVILLE VANCOUVER, WASHINGTON

## EXECUTIVE SUMMARY

As part of the removal of former UST No. 7-CMBPN, side wall and bottom samples were collected from the excavation and analyzed for total petroleum hydrocarbons quantified as diesel. Results of analysis indicated soil from the excavation bottom and south side wall contained diesel concentrations above the Washington State Department of Ecology's (Ecology) Model Toxics Control Act (MTCA) Method A cleanup level of 200 mg/kg. To further determine the extent of petroleum-contaminated soil (PCS) associated with the former UST, we performed a limited subsurface investigation, including the drilling and sampling of four soil borings, collecting one test pit sample from an associated drainage ditch, and chemical analysis of the samples.

The results of soil sampling and laboratory analysis indicate two areas of PCS: the bottom and southern area of the former UST area; and the associated drainage ditch. Using the former excavation soil samples and our soil boring samples to bound the PCS, we estimate a total of approximately 40 to 50 cubic yards of PCS remain on the site from the former UST. The quantity of PCS associated with the drainage ditch is unknown, since few samples were collected and analyzed; however, the quantity is presumably low and less than the quantity estimated for the former UST area. Our recommend remedial approach for the PCS is strategic excavation followed by verification sampling and analysis. The excavated PCS, recognizing that the estimated quantity is low, could be hauled off site and disposed of at a licensed landfill or PCS treatment facility.

## 1.0 INTRODUCTION

This report presents the results of the limited subsurface investigation conducted by Hart Crowser at the former underground storage tank (UST) No. 7-CMBPN, located near Building 4475, in Camp Bonneville, Vancouver, Washington (See Figure 1). To complete this work, we advanced four soil borings, screened and sampled soil samples from the borings, collected one sample from an associated drainage ditch, and analyzed these soil samples. This limited subsurface investigation was performed on June 27 and 28, 1996, in the presence of Mr. Grady May (BRAC Environmental Coordinator) and Mr. Jim McBane (Corps representative). This work was accomplished in general accordance with our Management Plan, dated May 23, 1996 (revised June 17, 1996).

In February 1993, UST No. 7-CMPBN was removed and six soil samples (see Figure 2) were collected from the excavation side walls, bottom, and soil stockpile (removed previously by others). The samples were analyzed for diesel-range hydrocarbons using Ecology Method WTPH-D. The analytical results indicate the soil from the bottom and southern end of the UST excavation contained concentrations of petroleum hydrocarbons in soil above Ecology's MTCA Method A cleanup standard of 200 mg/kg. The purpose of this limited subsurface investigation was to further assess the horizontal and vertical extent of PCS exceeding MTCA Method A cleanup levels at the former UST No. 7-CMPBN.

Hart Crowser is performing this work as specified under Contract No. DACA 67-93-D-1004, Delivery Order No. 53, dated March 26, 1996, for the Seattle District, U.S. Army Corps of Engineers.

## 2.0 EXPLORATORY SOIL BORINGS AND SOIL SAMPLING

### *2.1 Soil Boring Locations*

Previous soil sampling and analysis during the UST excavation and removal indicate that TPH concentrations in the north and east side walls of the former UST excavation were below the cleanup level of 200 mg/kg. However, the bottom and south side wall soil samples contained concentrations of TPH exceeding the cleanup level. To assess the extent of TPH contamination, four soil borings, designated HC-B1 through HC-B4, were located within and around the southern end of the former UST, as shown on Figure 2.

Soil boring HC-B1, located in the center of the former UST excavation, was designed to determine the vertical extent of TPH below the former UST. Soil borings HC-B2 through HC-B4 were located approximately 6 feet from the southern side of the former UST excavation. These three soil borings were installed to investigate the potential south, southwest, and southeast lateral migration of TPH in soil from the former UST.

No soil borings were converted to monitoring wells as there was no indication of the soil borings intercepting the local groundwater table.

Field screening results and observations made during the installation and sampling of the soil borings are discussed below.

The only water encountered during drilling was in HC-B1 at a depth of approximately 5 feet. This water-bearing layer was interpreted in the field as collected water within the former tank excavation and not a localized groundwater source.

### 2.2 Field Observations

We drilled four soil borings, HC-B1 through HC-B4, to a depth of 19.0, 16.5, 1.5, and 25.0 feet, respectively. We collected 18-inch soil samples at 2.5-foot-depth intervals from each boring. Each soil sample recovered was classified in general accordance with ASTM D 2488 as depicted on Figure A-1. Each soil sample recovered was also screened for volatile hydrocarbons using a Photovac portable photoionization detector (PID) and TPH using the Hanby field test kit. Descriptions of soil sampling methods and logs of soil borings are provided in Appendix A. The field screening results provided by both the PID and Hanby test kits are provided in the right hand column of each boring log.

In summary, the Hanby field screening tests detected TPH in soil greater than 10 mg/kg in only three samples: soil sample HC-B1-S2 at >200 mg/kg; soil sample HC-B1-S3 at 10 to 50 mg/kg; and soil sample HC-B4-S3 at >500 mg/kg. No Hanby field screening tests were performed on soil boring HC-B3 as insufficient soil was recovered during drilling.

Our field observations while drilling soil borings indicate the area south of the former UST contained 2 to 5 feet of sandy, gravelly silt, with some pea gravel. Below this, the soils are generally described as native, very stiff, clayey silt grading to silty clay. Soil boring HC-B3, which contained primarily crushed rock, was only drilled to a depth of 1.5 feet and stopped as our observations later indicated the location of HC-B3 was within a former drainage ditch for the UST excavation area. Except for soil boring HC-B4 at a depth of 5 to 10 feet where diesel-like odors were encountered, no significant organic vapors or visual signs of soils affected by petroleum hydrocarbons were observed.

### 2.3 Summary of Analytical Results

A maximum of two soil samples from each soil boring location were submitted to the Hart Crowser Chemistry Laboratory for analysis of TPH quantified as diesel by method WTPH-D and the aromatic volatile hydrocarbons benzene, toluene, ethylbenzene, and xylenes (BTEX) by EPA Method 8021A. The selection of the two soil samples per boring submitted for chemical analysis was based on the following field screening results: the soil sample with the highest TPH concentration based on the Hanby test kit; and the first soil sample (deeper than the highest TPH detection) which indicates no TPH using the Hanby test kit.

Soil sample collection and analysis derived from the four exploratory soil borings resulted in only one soil sample containing an elevated concentration of TPH (see Table 1). Soil sample HC-B4-S3, originating from the southeast boring, located approximately 5 to 7 feet below grade, contained TPH quantified as diesel at a concentration of 1,300 mg/kg, above the MTCA Method A cleanup level of 200 mg/kg. Soil sample HC-B4-S3 was non-detectable for BTEX. All other soil samples contained non-detectable concentrations of TPH quantified as diesel and BTEX. The data quality review and Hart Crowser Chemistry Laboratory Analytical Report are presented in Appendix B.

## 3.0 DRAINAGE DITCH SAMPLING

### *3.1 Soil Sample Location and Observation*

During the scheduled activities associated with soil boring drilling and sampling, we observed a 6-inch-diameter corrugated metal pipe penetrating into a drainage ditch along the roadway, buried approximately 4 feet below grade. Projecting the buried pipe to the north, the pipe apparently runs from an outlet located at the drainage ditch along an adjacent roadway to the former UST excavation (see Figure 2). The specific purpose of the pipe is not known, but it apparently acted as a drain from the area around the UST. At the direction of the Corps representative, the outlet of the pipe was exposed near the drainage ditch and one soil sample was collected near the outlet. Note that the northern end of the buried pipe entering the UST excavation was never discovered during the UST removal or this investigation.

The sample (HC-TP-1) consisted of wet gravel backfill ( -inch crushed rock) and contained a tar-like material.

### *3.2 Summary of Analytical Results*

One soil sample (HC-TP-1) collected at the outlet of the pipe was submitted and analyzed at the Hart Crowser Chemistry Laboratory. Per the Corp's contracting officer, sample HC-TP-1 was submitted to the laboratory for TPH identification by method WTPH-HCID, BTEX by EPA Method 8021A, and PCBs by EPA Method 8080. Total petroleum hydrocarbons quantified as diesel and fuel oil No. 2 were detected at a concentration of about 9,600 mg/kg, above the MTCA Method A cleanup level of 200 mg/kg. No BTEX and PCBs were detected above the laboratory detection limits (see Table 1). The data quality review and Hart Crowser Chemistry Laboratory Analytical Report are presented in Appendix B.

## 4.0 INVESTIGATION-DERIVED WASTES

### *4.1 Soil Cuttings and Excess Soil Sample Material*

As soil brings proceeded, soil cuttings and excess split-spoon sample material were collected and placed directly into four, sealed 55-gallon drums. To profile the quality of the soil cuttings, soil sample HC-SC-1 was composited from drums No. 1 and 2; soil sample HC-SC-2 was composited from drums No. 3 and 4. Each sample was submitted to the Hart Crowser Chemistry Laboratory for TPH quantified as diesel by method WTPH-D and BTEX by EPA Method 8021A. TPH and BTEX were not detected above the laboratory detection limits (see Table 1) in either sample. The Hart Crowser Chemistry Laboratory Analytical Report is presented in Appendix B.

The 55-gallon drums were appropriately labeled and stored near Building 4475. Based on the analytical results, the soil can be returned to the site, and spread near the former UST excavation area.

### *4.2 Decontamination Wastewater*

Following decontamination procedures for drilling and sampling equipment, all wash waters were immediately placed into three, sealed 55-gallon drums. To profile the quality of the wash waters, water sample HC-DW-1 was collected from drum No. 7; water sample HC-DW-2 was composited from drum Nos. 5 and 6. The samples were submitted to the Hart Crowser Chemistry Laboratory for TPH quantified as diesel by method WTPH-D. The results of analysis for HC-DW-1 and HC-DW-2 indicated a concentration of diesel in water at 14.3 and 19.0 mg/L, respectively. The Hart Crowser Chemistry Laboratory Analytical Report is presented in Appendix B.

The three 55-gallon drums were appropriately labeled and stored near Building 4475. Based on the analytical results, the wash waters should be disposed of off site at a licensed treatment facility.

### *4.3 Solid Waste*

All solid waste material, including used personal protective equipment, waste paper, and plastic generated during investigation activities were disposed of on site in solid waste storage bins.

## 5.0 PROPOSED SITE REMEDIATION APPROACH

### *5.1 Extent of PCS from Former UST*

The following discussion regarding the proposed site remediation approach is based on the analytical results of soil samples collected during the UST removal (side wall and bottom samples) and our limited subsurface investigation (soil boring samples and one ditch sample). These results indicate two areas of the site contain soil with concentrations of diesel above the MTCA Method A cleanup level of 200 mg/kg. These areas, identified as the Former UST Area and Drainage Ditch, are further described below.

#### ***5.1.1 Former UST Area***

The Former UST Area soils containing diesel above the cleanup level have been bounded to the north by UST excavation side wall sample 03, and to the south and southwest by soil borings HC-B2 and HC-B3. Noting that the soils surrounding the former UST consist primarily of low permeability very stiff silts and clays, we can predict that the potential migration of TPH in soil beyond our samples has been limited. As a result, we can estimate the quantity of PCS remaining at the site by drawing boundaries around the samples exceeding the cleanup level for diesel. The lateral boundary of PCS is extended 5 feet beyond the "hot" samples (excavation samples 01, 04, and 06; soil-boring sample HC-B4-S3). The vertical boundary is extended to 10 feet below grade, based on soil-boring sample HC-B4-S5.

The resulting bounded triangular area encompasses excavation samples 01, 04, and 06 and soil-boring sample HC-B4-S3 to a depth of 10 feet. The calculated volume for this area is approximately 40 to 50 cubic yards, which includes new, imported backfill within the former UST excavation.

#### ***5.1.2 Drainage Ditch***

Hart Crowser soil sample HC-TP-1 confirms the presence of diesel exceeding the MTCA Method A cleanup level within the drainage ditch soils. Although the extent or volume of affected soils within the ditch (and the trench of the buried pipe) is unknown, we do not recommend additional PCS investigation for this area. Given the physical nature of diesel in water, only the surficial soils within the drainage ditch are presumably impacted. The recommended remedial approach for the drainage ditch is provided in the next section.

### *5.2 Recommended Approach to Site Remediation*

The estimated volume of PCS associated with the former UST has been estimated to range between 40 to 50 cubic yards with only nominal additional volume associated with the drainage ditch.

Given the limited impact to soils surrounding the former UST, we recommend that the confirmed PCS be excavated and disposed of off site to a licensed landfill or PCS treatment facility. The PCS excavation, verification sampling and analysis, and reporting activities should be performed in accordance with Ecology's guidance documents for petroleum-contaminated sites.

## 6.0 LIMITATIONS

Work for this project was performed, and this letter report prepared, in accordance with generally accepted professional practices for the nature and conditions of the work completed in the same or similar localities, at the time the work was performed. It is intended for the exclusive use of the Corps of Engineers for specific application to the referenced property. This report is not meant to represent a legal opinion. No other warranty, express or implied, is made.

Any questions regarding our work and this report, the presentation of the information, and the interpretation of the data are welcome and should be referred to the undersigned.

We trust that this report meets your needs.

Sincerely,

**HART CROWSER, INC.**

**DAVID G. WINTER, P.E.**
Manager, Remediation Services

**ROY K. KUROIWA, P.E.**
Senior Project Engineer

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**Table 1 - Summary of Analytical Results (June 26 & 27, 1996)**
**PCS Investigation at Former UST No. 7-CMBPN**
**Camp Bonneville, Vancouver, WA**

| | | Concentration in mg/kg for soil and mg/L for water | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **SAMPLE ID** | **DESCRIPTION** | **WTPH-D** | | **Benzene** | | **Toluene** | | **Ethylbenzene** | | **Xylenes** | | **PCBs** |
| **Soil Samples** | | | | | | | | | | | | |
| HC-B1-S2 | Soil boring B1; sample S-2 (5_-7_) | 30 | U | 0.050 | U | 0.050 | U | 0.050 | U | 0.050 | U | -- |
| HC-B1-S4 | Soil boring B1; sample S-4 (17_-19_) | 32 | U | 0.050 | U | 0.050 | U | 0.050 | U | 0.050 | U | -- |
| HC-B2-S1 | Soil boring B2; sample S-1 (1_-3_) | 23 | U | 0.050 | U | 0.050 | U | 0.050 | U | 0.050 | U | -- |
| HC-B2-S3 | Soil boring B2; sample S-3 (5_-7_) | 23 | U | 0.050 | U | 0.050 | U | 0.050 | U | 0.050 | U | -- |
| HC-B4-S3 | Soil boring B4; sample S-3 (5_-7_) | [1,300] | | 0.050 | U | 0.130 | U | 0.050 | U | 0.050 | U | -- |
| HC-B4-S5 | Soil boring B4; sample S-5 (10_-12_) | 27 | U | 0.050 | U | 0.110 | U | 0.050 | U | 0.050 | U | -- |
| HC-TP-1 | Drainage ditch | [9,600(1)] | | 0.100 | U | 0.130 | U | 0.120 | | 0.100 | U | 0.500 U |
| HC-SC-1 | Soil cuttings; drums No. 1 & 2 | 44 | U | 0.050 | U | 0.096 | U | 0.40 | | 0.050 | U | -- |
| HC-SC-2 | Soil cuttings; drums No. 3 & 4 | 47 | U | 0.050 | U | 0.087 | U | 0.050 | U | 0.050 | U | -- |
| MTCA Method A | Cleanup level for soil | 200.0 | | 0.5 | | 40.0 | | 20.0 | | 20.0 | | 1.0 |
| **Water Samples** | | | | | | | | | | | | |
| HC-DW-1 | Decon water; drums No. 7 | 14.3 (2) | | -- | | -- | | -- | | -- | | -- |
| HC-DW-2 | Decon water; drums No. 5 & 6 | 19.0 | | -- | | -- | | -- | | -- | | -- |

(1) Based on Washington State Method WTPH-HCID, quantified as Diesel/Fuel Oil No. 2.
(2) Result represents sum of diesel- and oil-range petroleum hydrocarbons.
[ ] Indicates exceeds the MTCA Method A cleanup level.

# APPENDIX A
# SOIL BORING PROCEDURES AND SAMPLE COLLECTION METHODS

# APPENDIX A
# SOIL BORING PROCEDURES
# AND SAMPLE COLLECTION METHODS

Four soil borings were completed at the Camp Bonneville site on June 26 and 27, 1996. The following section describes boring and sample collection methods that were utilized.

## *Soil Borings*

Four soil borings were completed at the locations shown on Figure 2. One of the borings (HC-B1) was installed within the former UST excavation to investigate the vertical extent of TPH below the former UST. Three of the borings (HC-B2 through HC-B4) were installed outside the former UST excavation to evaluate both vertical and lateral extent of TPH migration in soil.

Soil borings were installed by McDonald Drilling to depths of 16 to 25 feet below ground surface using a hollow-stem auger drill rig. Soil boring HC-B3 was only installed to 1.5 feet at the instruction of the Corps field representative. Soil samples were collected at roughly 2.5-foot-depth intervals or intervals specified by the Corps field representative using split-spoon sampling procedures. The geology and stratigraphy of the boreholes were logged by a Hart Crowser field representative. Soils were classified using standard ASTM methods and screened in the field using visual, headspace, and Hanby test kit techniques.

The borings were advanced with a Mobile A-61 truck-mounted, 6-inch-inside-diameter, hollow-stem auger. Standard hollow-stem auger drilling techniques were used. Soil samples were collected using a modified Standard Penetration Test (SPT) procedure. The procedure involves driving a 3-inch-inside-diameter split-spoon sampler into the soil a distance of 18 inches beyond the end of the borehole. The sampler was driven by a 300-pound hammer dropping 30 inches onto the end of the drilling rod. The number of blows required to drive the sampler the final 12 inches is the Standard Penetration Resistance (SPR). This resistance provides a measure of the density of granular soils (sands and gravels) and consistency of finer grained cohesive soils (silts and clays).

## Soil Classification

The on-site field representative visually classified the soil samples recovered from the borings in general accordance with ASTM Method D 2488 (Figure A-1), prepared a log of soils encountered in the exploration, and recorded pertinent observations regarding drilling conditions, types of soils encountered, depth to water during drilling, and field screening results (see Figures A-2 through A-5). Soil descriptions included the following properties: density of sands and gravels/consistency of silts and clays (as determined from the Penetration Resistance or qualitatively estimated from drill action), moisture, color, minor constituents, and major constituents. The presence of non-soil substances (e.g., debris, NAPLs) were also noted when applicable.

### Soil Sampling

For all soil samples, the sampler was placed on a clean plastic sheet, opened, and the soil sample split longitudinally. Using a stainless steel spoon, soil within the sampler was placed in laboratory-supplied clean glass jar(s) with a teflon-lined screw cap(s), and immediately placed in a cooled ice chest. Gravel larger than ½ inch in diameter was excluded from samples retained for chemical analysis. For soil samples to be analyzed for volatile organics, soil was carefully packed into the sample jar to minimize the headspace.

## Field Screening

The remaining soil in the split-spoon sampler was transferred into a clean jar for field screening of organic vapors using a portable photoionization detector (PID) equipped with a 10.2 eV lamp. The PID is capable of providing qualitative estimates of total organic vapor concentrations in the sample jar headspace and is not affected by the presence of methane. The soil sample jars headspace were covered with aluminum foil, capped, and allowed to equilibrate for a minimum of 10 minutes. PID measurements were made by removing the cap and penetrating the aluminum foil with the tip of the PID, taking care not to allow contact between the tip of the PID and soil particles. The maximum organic vapor reading observed during the first 10 seconds was recorded on the field boring log. Field PID measurements and visual observations were used to help select samples to be sent to the laboratory for chemical analysis.

Soil from the split-spoon sampler was also screened for TPH in the field by using a Hanby field test kit. The Hanby kit is capable of providing qualitative estimates of the total volatile concentrations in the soil sample. Hanby measurements were made by weighing out five grams of soil and extracting with a solvent. The extract was poured into a test-tube, a catalyst is added, and the contents shaken. The color of the reacted sample indicated the type of compound present and the intensity was used to determine the concentration.

Two samples from each boring, with the exception of B-3 were selected for chemical analysis based on the field screening results. The two samples selected were the one that indicated the highest TPH concentration and the first deeper soil sample which indicated no TPH using the Hanby test kit. Samples were submitted under chain of custody to the Hart Crowser Chemistry Laboratory for analysis of volatile organics (EPA Method 8021A) and total petroleum hydrocarbons (WTPH-D).

### *Drainage Ditch Sampling*

During soil boring drilling activities, an old drainage pipe was discovered. Based on instructions from the Corps field representative, a sample was collected at the outlet of the pipe, within a drainage ditch. A stainless steel spoon was used to collect product-stained soil from an area slightly above the water table. The sample was well mixed in a stainless steel bowl and placed in the appropriate pre-cleaned sample jars.

The sample from the drainline pipe area was submitted for analysis under chain of custody to the Hart Crowser Chemical Laboratory for analysis of TPH (TPH-HCID), PCBs (EPA Method 8080), and volatile organics (EPA Method 8021A).

### *Quality Control Samples*

In addition to the soil samples, sample HC-B1-S10 was submitted as a blind duplicate of HC-B1-S2 for analysis of volatile organics and total petroleum hydrocarbons. Two duplicate samples from different sampling intervals (HC-B1-S2 and HC-B1-S4) and a trip blank were also submitted to the NPD laboratory in Troutdale.

Two rinse blanks were collected from water that was in direct contact with sampling equipment and submitted for analysis of volatile organics and TPH. One trip blank was also submitted for analysis of volatile organics only.

### *Equipment Decontamination*

Before drilling, the drill rig, all auger sections, steel casing, and downhole equipment were steam cleaned. Between each boring, the drilling and downhole soil sampling equipment were steam cleaned using clean water. Steam cleaning was generally conducted adjacent to the boring location.

Before each sample for chemical analysis is collected, all downhole soil and groundwater sampling equipment was decontaminated by:

- Scrubbing with detergent solution (ALCONOX);
- Rinsing with tap water; and
- Thoroughly spraying with deionized water.

### *Investigative Waste Handling and Sampling*

Soil cuttings from drilling depths above 15 feet and decontamination water were placed in 55-gallon drums labeled with the date, drum number, job name, source contract number, contact phone numbers, and a description of the contents. Solid waste, including personal protection equipment, waste paper, and plastic, was disposed of in on-site solid waste storage bins. All investigation derived wastes were left on site for handling and disposal during subsequent remediation activities.

Soil cuttings were placed in Drum Nos. 1 through 4. Cuttings samples from the drums were collected using a post-hole digger to collect a volume representative of the entire depth of the drum. The volumes collected were composited into two samples and submitted to the laboratory for disposal designation. Sample HC-SC-1 is a composite of cuttings from HC-B-1 located in Drum Nos. 1 and 2. Sample HC-SC-2 is a composite of cuttings from HC-B-2 and HC-B-4 located in Drum Nos. 3 and 4.

Decontamination water was placed in Drum Nos. 5, 6 and 7. The drums were sampled using a stainless steel bailer. Sample HC-DW-1 was collected from Drum No. 7 and HC-DW-2 was collected from Drum Nos. 5 and 6. The samples were submitted to Hart Crowser Chemistry Laboratory for disposal designation.

### *Borehole Abandonment*

Boreholes were abandoned by filling with bentonite chips as the auger was withdrawn, in accordance with Chapter 173-160 WAC "Minimum Standards for Construction and Maintenance of Wells." Boring locations were staked and surveyed.

The test pit in the ditchline was abandoned by covering the excavated slope with bentonite pellets and soil. A berm was constructed to retain petroleum-contaminated soil and water until the bentonite was hydrated.

# APPENDIX B
# SOIL AND WATER CHEMICAL DATA QUALITY REVIEW AND CHEMISTRY LABORATORY ANALYTICAL REPORT

# APPENDIX B
# SOIL AND WATER CHEMICAL DATA QUALITY REVIEW AND CHEMISTRY LABORATORY ANALYTICAL REPORT

Ten soil and five water samples were collected on June 26 and 27, 1996. The samples were submitted to Hart Crowser Chemistry Laboratory for analysis of total petroleum hydrocarbons (WTPH-D and TPH-HCID), volatile organics (EPA Method 8021A), and PCBs (EPA Method 8081). The following criteria were evaluated in the standard data quality review process for the results:

- Holding times;
- Method, trip, and rinse blanks;
- Surrogate recoveries;
- Laboratory and field duplicates;
- Laboratory Control Sample recoveries;
- Matrix spike/matrix spike duplicate recoveries; and
- Detection limit goals.

QA/QC control limits used to evaluate the data are included at the end of the laboratory data report. These values are statistically updated ranges and differ slightly from those published in the Management Plan.

## *WTPH-D*

### ***Soil Samples***

The soil samples were analyzed for the required compounds in accordance with the method. All required holding times were met. Laboratory duplicate relative percent differences (RPDs) were acceptable at 5 percent. The field duplicate RPD for HC-B1-S4 and HC-B1-S10 could not be calculated since results were all non-detects. No rinse blank contamination was present. Method blank contamination was present for diesel. Sample results less than five times the blank contamination were qualified as not detected (U). Laboratory control sample, proficiency sample, and surrogate recoveries were acceptable, with the following exceptions. Some recoveries of surrogates in the laboratory control sample, the proficiency sample, and one project sample could not be calculated because of coelution interference. No data were qualified based on surrogate recovery. Matrix spike/matrix spike recoveries were acceptable. Detection limit goals were achieved for samples, with the exception of those samples which were qualified non-detected (U) based on blank contamination.

***Water Samples***

The water samples were analyzed for the required compounds in accordance with the method. All required holding times were met. Laboratory duplicate relative percent differences (RPDs) were acceptable at 3 percent. Method blank contamination was present for diesel and oil. Sample results less than five times the blank contamination were qualified as not detected (U). Laboratory control sample, proficiency sample, and surrogate recoveries were acceptable, with the following exceptions. Recovery of one surrogates in the laboratory control sample could not be calculated because of coelution interference. No data were qualified based on surrogate recovery in the QC sample. Detection limit goals were achieved for samples, with the exception of those samples which were qualified non-detected (U) based on blank contamination.

## TPH-HCID

***Soil Samples***

One soil sample was analyzed for the required compounds in accordance with the method. All required holding times were met. Laboratory duplicate relative percent differences (RPDs) were acceptable at 14 percent. No method blank contamination was detected. Laboratory control sample and surrogate recoveries were acceptable, with the following exceptions. Two surrogate recoveries in the sample could not be calculated because of coelution interference. No data were qualified based on surrogate recovery. Detection limits goals were achieved. The data are acceptable as reported.

## Volatiles Organics

***Soil Samples***

The soil samples were analyzed for the required compounds in accordance with the method. All required holding times for volatiles were met. No trip blank contamination was present. Method blank contamination was detected for toluene. Sample results greater than five times the blank contamination was qualified as not detected (U). Laboratory duplicate RPD was acceptable at 1 percent. Field duplicate RPD for HC-B1-S2 and HC-B1-S10 could not be calculated since results were not detected. Laboratory control sample, proficiency sample, and surrogate recoveries were generally acceptable. The surrogate recovery of 1,2-bromofluorobenzene was slightly below control limits for one method blank sample. No qualifiers were assigned to the method blank. The matrix spike/matrix spike recoveries of 1,1-dichloroethene was above laboratory control limits. No qualifiers were assigned since results were all non-detects. Detection limit goals were achieved with the exception of samples that were qualified based on blank contamination.

***<u>Water Samples</u>***

The water samples were analyzed for the required compounds in accordance with the method. All required holding times for volatiles were met. No method blank contamination was detected. No laboratory duplicate data were reported. No field duplicate was collected for water samples. Laboratory control sample, proficiency sample, and surrogate recoveries were acceptable. Detection limit goals were achieved.

### *PCBs*

***<u>Soil Samples</u>***

The soil sample was analyzed for the required compounds in accordance with the method. All required holding times were met. No method blank contamination was detected. Laboratory duplicate RPD could not be calculated since results were not detected. Laboratory control sample, proficiency sample, and surrogate recoveries were acceptable. Detection limit goals were achieved.

# CHEMISTRY LABORATORY ANALYTICAL REPORT
# HART CROWSER CHEMISTRY LABORATORY

# APPENDIX C
# HART CROWSER FIELD NOTES

# APPENDIX D
# RESPONSE TO COMMENTS AND CORPS COMMENTS TO DRAFT PETROLEUM-CONTAMINATED SOIL INVESTIGATION REPORT

**RESPONSE TO COMMENTS**
**DRAFT PETROLEUM-CONTAMINATED SOIL**
**INVESTIGATION**
**FORMER TANK NO. 7-CMBPN**
**BUILDING NO. 4475**
**CAMP BONNEVILLE**
**VANCOUVER, WASHINGTON**

**Reviewer: Victor Ramos**

1. As per discussion with Dina Ginn, the Quality Assurance Report will be reviewed when available.

2. Comment accepted and discussed in the report. Soil boring HC-B3, which contained primarily crushed rock, was only drilled to a depth of 1.5 feet bgs and stopped as our observations later indicated the location of HC-B3 was within a former drainage ditch for the UST excavation area.

3. A copy of the field notes is provided in Appendix C.

4. Comment accepted and discussed in the report. All solid waste material generated during the investigation were disposed of in solid waste storage bins on the site.

5. Comment accepted and discussed in the report.

6. The control limits used to evaluate the EPA Method 8010 surrogate recoveries were included on page 31 of the laboratory data report. These control limits are slightly different from those cited in the Management plan as they have been statistically updated by the laboratory. Recoveries of 1,4-dichlorobutane and 2-bromo-1-chloropropane are acceptable.

7. The control limits used to evaluate the EPA Method 8020 surrogate recoveries were included on page 32 of the laboratory data report. These control limits are slightly different from those cited in the Management plan as they have been updated by the laboratory. Recovery of in the method blank is acceptable. It is noted that the recovery for 1,2-bromofluorobenzene is slightly below these newer control limits. Appendix B will be revised to include this information.

8. The control limits reported on page 31 of the laboratory data report represent the most current control limit ranges published by the Hart Crowser laboratory. Since these values are periodically updated based on the statistical evaluation of samples analyzed, these control limits were used instead of those published in the Management Plan. Additional text will be provided in Appendix B to clarify this change.

9. A temperature blank was not included in the coolers submitted to the Hart Crowser laboratory. The cooler was transported directly to the laboratory and stored in a refrigerator until the samples were analyzed. The temperature of the cooler was recorded on the chain of custody.

10. A copy of the sample custody record will be provided by the NPD laboratory as part of the Quality Assurance Report.

**Reviewer: Dennis Fischer**

1. The text is corrected to indicate that water encountered during soil boring drilling has been interpreted to be collected surface water within the former UST excavation.

2. All references to the drainage pipe have been modified to indicate that only the outlet to the pipe (near the roadway) was observed in the field. The location of the pipe leading to the former UST excavation is projected based on its likely layout and available information obtained in the field.

3. The proposed extent of PCS excavation has been indicated on Figure 2.

4. The text is corrected to indicate that water encountered during soil boring drilling has been interpreted to be collected surface water within the former UST excavation.

5. The text has been expanded to indicate the method of test pit abandonment. The test pit in the ditch was abandoned by covering the excavated slope with bentonite pellets and soil.

6. The text is corrected to indicate that water encountered during soil boring drilling has been interpreted to be collected surface water within the former UST excavation.

**Reviewer: Dina Ginn**

1. Figure 1 has been included in the report.

2. The statement has been corrected.

3. Figure and text have been corrected to reflect the stockpile has been removed by others.

4. The statement has been corrected to indicate the analytical report and data evaluation are presented in Appendix B.

5. Figure 1 has been included in the report.

6. The proposed extent of PCS excavation has been indicated on Figure 2.

7. The statement has been corrected.

8. The statement has been corrected to indicate that all investigation-derived wastes were left on site for handling and disposal during subsequent remediation activities.

9. Boring log B-1 has been modified to indicate that the water encountered in the former UST excavation is interpreted as collected surface water in the bottom of the former excavation.

10. Section 2.2, Field Observations during soil boring B-1 sampling at 15 feet bgs discusses the detection of TPH ranging between 10 through 50 ppm using the Hanby test kit. Further analytical testing of soil samples between 5 and 7 feet bgs and 17 to 19 feet bgs indicates no detection of TPH above the detection limits. The results are below regulatory limits, therefore, no further action is required at this location.

11. The strategy developed for soil sampling and analysis provides the selection of two soil samples per boring for laboratory testing based on the following field screening results: the soil sample with the highest TPH concentration based on the Hanby test kit; and the first soil sample (deeper than the highest TPH detection) which indicates no TPH using the Hanby test kit. Based on this rational, soil samples S3 and S5 were selected for laboratory analysis.

12. This sentence has been removed from the text.

13. A copy of the field notes is provided in Appendix C.