


Remedial Investigation Work Plan

Kosmos Mill Oil Cleanup

Kosmos Flats Area

Agreed Order No. DE 16955
Facility/Site No. 61559576

Prepared for
Tacoma Power,
Tacoma Public Utilities

December 30, 2021
19499-02

HARTCROWSER
A division of Haley & Aldrich

HARTCROWSER
A division of Haley & Aldrich

Remedial Investigation Work Plan

Kosmos Mill Oil Cleanup

Kosmos Flats Area

Prepared for

Tacoma Power,
Tacoma Public Utilities

December 30, 2021
19499-02

Prepared by

Hart Crowser, a division of Haley & Aldrich

Angie Goodwin

Angie Goodwin, LHG
Senior Associate Hydrogeologist
Angie.Goodwin@hartcrowser.com

Andrew Kaparos

Andrew S. Kaparos, PE
Associate Environmental Engineer
andrew.kaparos@hartcrowser.com

Andrew Nakahara, EIT
Senior Staff Environmental Engineer
andrew.nakahara@hartcrowser.com

3131 Elliott Avenue, Suite 600
Seattle, Washington 98121
206.324.9530

Contents

TABLES

FIGURES

APPENDIX A

Sampling Analysis Plan/Quality Assurance Project Plan

APPENDIX B

Health and Safety Plan

Remedial Investigation Work Plan

Kosmos Mill Oil Cleanup

Kosmos Flats Area

1.0 INTRODUCTION

On behalf of Tacoma Power, Hart Crowser, a division of Haley & Aldrich (Hart Crowser) has prepared this remedial investigation work plan (RI Work Plan) for the former Kosmos Mill Site (Site). The Site is located approximately 7.3 miles southeast of Morton, Washington and is accessible off State Route 12 via Kosmos Road, followed by Champion Haul Road (Figure 1).

A seep of Bunker C oil was discovered along the bank of Rainey Creek near the Site (Figure 2). Tacoma Power immediately began investigations and implemented measures to mitigate risks to human and environmental health once the seep was discovered. The Site currently includes parts of the former Kosmos Lumber Mill and the bank of Rainey Creek as shown as the area of potential effect (APE) in Figure 2. The following is a detailed summary of events at the Site:

Seep Discovery:

- April 2019 – The first seep was discovered and reported to the Washington State Department of Ecology (Ecology). On April 26, 2019, Ecology spills response staff received a report (Environmental Report Tracking System no. 688792) of "black oily liquid" coming out of the hill slope and into Rainey Creek. Ecology completed a site visit on April 27, 2019 and confirmed the presence of a black oily liquid seeping from the bank and layered in sediment along Rainey Creek, a tributary to Riffe Lake. Sampling of the seep material indicated the presence of Bunker C-range petroleum hydrocarbons (Bunker C).

- May 2019 – Ecology requested periodic visual inspections of the Site by Tacoma Power. The water levels in Riffe Lake and Rainey Creek rose above the petroleum seep elevation. A Rainey Creek surface water quality sample result showed no evidence of Bunker C oil near the seep.

Remedial Investigation Begins:

- July 2019 – Tacoma Power selected Hart Crowser as the environmental consultants to conduct a remedial investigation and feasibility study (RI/FS) for this project.

  Tacoma Power updated the Kosmos Town and Mill site form (45LE529) and requested concurrence from the Department of Archaeology and Historic Preservation (DAHP) that the Site be not be eligible for inclusion in the National Register of Historic Places. Tacoma Power received agreement from DAHP in September 2019, after the cultural resources survey was completed (see September 2019 bullet below).

- August 2019 – During a pre-investigation Site visit in August, material observed with tar-like consistency and petroleum-like odor was discovered in the upland area (labeled as "oil boils" in

Figure 2). Tacoma Power collected a sample from the northern oil boil for chemical analysis and confirmed it contained petroleum in the oil range.

- September 2019 – Tacoma Power's archeological consulting firm, Willamette Cultural Resource Associates, Ltd. (WCRA), completed an archeological survey of the proposed Site for permitting the APE. The APE was identified based on the archeological survey. Hart Crowser reviewed Tacoma Power's historical documents and completed an online records review of Ecology's documents and environmental database site assessment reports.

Sheen and Additional Seeps Discovered:

- October 2019 – Water elevations of Riffe Lake and Rainey Creek decreased, and a sheen was observed in the creek. Tacoma Power immediately deployed Best Management Practices (BMPs) within the creek and along the bank and shoreline to prevent additional petroleum-impacted material from entering the creek. BMPs included oil-adsorbing pom poms, sweeps, pads, and booms in addition to plastic sheeting covering along the bank.

  Tacoma Power collected a sample of the seep material and the results confirmed the presence of petroleum (oil and diesel) and polycyclic aromatic hydrocarbons (PAHs) in the sample.

- November 2019 – Tacoma Power declared an emergency in order to quickly implement an Independent Remedial Action (IRA) to address the exposed seeps before the water levels in Riffe Lake rose and inundated the seep areas.

  Additional petroleum-like seeps were observed along Rainey Creek's bank, south of the original seep and at a lower elevation, near the toe of the creek bank (Figure 2).

Site Investigation and Emergency Independent Remedial Action:

- November 2019 – A geophysical survey was conducted in advance of preparing the Remedial Investigation Work Plan (Hart Crowser 2019), which was completed on December 6, 2019. The geophysical survey included the use of ground penetrating radar (GPR) and a time-domain electromagnetic system (EM61).

  Anderson Environmental Contractors (AEC) mobilized their equipment on-site in preparation for the emergency IRA and cap installation activities. Since excavators were on-site, three test pit explorations were conducted prior to the work plan being finalized (Figure 3). One exploration was just north of the ravine to assess potential petroleum-impacted soil and two were towards the south APE boundary to assess soil conditions for construction dewatering purposes.

- December 2019 – The APE was expanded, a protective engineered cap was designed, the bank was excavated for the cap installation (which included excavation of impacted material), a protective cap was installed, and the Site's work plan was completed and implemented. The work plan included conducting test pits, drilling borings, collecting soil samples, and collecting grab groundwater samples from boreholes.

  - For the APE expansion, all newly proposed areas where soil would be disturbed was archaeologically surveyed. WCRA prepared a memorandum for Tacoma Power stating that the planned areas in the newly proposed APE were all within the historic Kosmos Mill Site. No new feature areas were observed and WCRA recommended Tacoma Power utilize their Inadvertent Discovery Plan and spot check sub-surface profile exposures moving forward.

  - Hart Crowser designed the protective engineered cap to be placed on the bank to help reduce the potential for petroleum to discharge to Rainey Creek.

  - After the cap design was completed, AEC, under the direction of Tacoma Power, excavated the bank and installed the cap. As part of the cap construction effort, water quality samples were collected at the request of Tacoma Power for their water quality permit with Ecology as required under their 401 Water Quality Certification for the Cowlitz Project. After the excavation for the cap area, soil samples were collected along the bank and creek bed to characterize soil that was remaining in-place (Hart Crowser 2021). All excavated petroleum-impacted soil was stockpiled on-site for future disposal, which was completed in February 2020.

  - While the creek bank was being excavated, test pit and drilling explorations were performed in general accordance with the work plan. Soil samples and grab groundwater samples were collected, selected for chemical analysis, and submitted to the laboratory. This work and analytical results are discussed in this RI Work Plan and can be found in the Data Summary Report (Hart Crowser 2021).

  - Excavation activities were completed on December 18, 2019, and Tacoma Power continued the surface water sampling and analysis from December 19, 2019 through March 3, 2020 (Hart Crowser 2021).

- January 2020 – Ecology issues a potential liable person (PLP) status letter to Tacoma Power dated January 7, 2020, pursuant to RCW 70.105D.040(2) and WAC 173-340-500. Based on this change, the RI/FS was placed on hold to follow the Agreed Order process.

- February 2020 – As part of the emergency IRA and in conformance with Tacoma Power's Water Quality Protection Plan (WQPP), approximately 186,200 gallons of dewatering discharge and rainwater that was impacted by the oil seeps during the construction of the cap was pumped into holding treatment tanks and then disposed of at City of Morton's, PRS Group's, and City of Tacoma's wastewater treatment facilities. On-site disposal of the impacted water was not possible due to lack of infiltration capability of Site soils and inability to meet water quality standards. However, heavy rains were flooding the impacted soil stockpile and project area and to keep the water level down to continue to haul the stockpile to a disposal facility, impacted water from the stockpile area was pumped to the log pond area intermittently over an 8-hour period. That water was added to standing water already in the log pond area and those waters were allowed to infiltrate. Additionally, approximately 10,956 tons of impacted soil previously excavated and stockpiled as part of the emergency IRA was disposed of off-site at the Cowlitz County Headquarters Landfill and Hillsboro Landfill. After the stockpile removal, the emergency IRA was completed as of February 7, 2020.

- March/April 2020 – In March, Tacoma Power observed sheen on ponded water where the former petroleum-impacted stockpile was located and collected ponded water samples. The sheen was likely a result of some residual material from the former stockpile. Tacoma Power conducted routine follow-up inspections, mapping new sheen locations and sizes and documenting those in the monthly reports, and observed the ponded water dissipating. The area was seeded in April 2020 to promote vegetation growth and stabilize the former soil stockpile area.

- Summer 2020 – Tacoma Power observed that the vegetation struggled to establish in the stockpile area, especially in the areas of ponded water. This water remained late into the summer. The area was monitored by Tacoma Power and the area was graded and seeded for vegetation.

- August 2020 – An Agreed Order (AO; DE 16955) with Ecology was executed on August 19, 2020 requiring preparation and submittal of a Data Summary Report and RI Work Plan, conduct an RI and Feasibility Study (FS) and prepare report(s), and prepare and submit a draft Cleanup Action Plan. The RI work is to identify the type and extent of contamination at the Site. The Ecology Facility Site identification number is 61559576.

- February 2021 – In accordance with the Agreed Order, a Data Summary Report was prepared to document and summarize the Site investigation performed to-date and to describe the emergency IRA conducted in association with the petroleum seeps. The Data Summary Report was approved by Ecology on February 24, 2021 that indicated several areas where additional data would be needed. Additional Site details and environmental investigations to-date are provided in the Data Summary Report (Hart Crowser 2021).

- April/May 2021 – A layer of solidified petroleum product (SPP) was observed as a ledge on the east bank of Rainey Creek on the north side of the ravine and as a partially exposed SPP layer in the ravine east of the SPP ledge. The SPP ledge was sampled and submitted for chemical analysis (see Section 3.1.3 for additional information).

- Summer and Fall 2021 – Tacoma Power personnel continue to note the SPP locations and collecting the SPP debris as it is discovered and disposing off-site.

- October 2021 – Tacoma Power collected and removed the visible metal debris in the ravine and graded the area by moving some soil from the edges of the ravine to fill in the lower, depressed areas to prevent exposure to surface water. Additionally, the SPP layer located north of the ravine was removed approximately 4 feet towards the east and disposed of off-site to Hillsboro Landfill. Ecology's Water Quality Program has approved the plan and oversaw construction.

This RI Work Plan is intended to develop the framework to further characterize the nature and extent of environmental impacts and address the data gaps identified in the Data Summary Report. A draft RI report and a draft FS report will be completed following this additional investigation to better understand the source and nature and extent of the contamination present at the Site, and to evaluate potential cleanup actions, as necessary.

1.1 Regulatory Framework

The RI Work Plan will be implemented in general accordance with guidance put forth in the Model Toxics Control Act (MTCA), as stipulated in Washington Administrative Code (WAC) 173-340 and AO DE16955. Under MTCA, an RI and FS are required to be developed once a Site is prioritized for remedial action (WAC 173-340-350; Ecology 2007). The purpose of the RI and FS reports are to evaluate the nature and extent of environmental contamination and remedial options and recommend a cleanup action, as described in WAC 173-340-360 through 173-340-390, based on the collection, development, and evaluation of a sufficient site-specific data set.

1.2 Purpose and Objectives

The purpose of this RI Work Plan is to document the scope, technical approach, and implementation details for completing the Site RI and FS. The purpose of the RI is to generate data of sufficient quality to characterize the nature and extent of impacts in environmental media, including soil, groundwater, Rainey Creek sediment, and surface water; to evaluate data relative to appropriate cleanup levels (CULs); and to support an evaluation of potential cleanup actions. The objective of the RI and FS process is to identify contaminants of potential concern (COPCs) at the Site and their source(s) and extent. The primary COPC appears to be Bunker C oil and other COPCs commonly found with Bunker C such as other intermediate and/or and heavy fuel oils. Additionally copper and zinc were identified as COPCs in surface water in the Data Summary Report (Hart Crowser 2021).

This RI Work Plan provides an overview of pertinent background information, an initial evaluation of existing data for the Site (including a preliminary Conceptual Site Model [CSM]), the identification of data needs to support the risk assessment and evaluation of remedial alternatives, and a scope of work designed to address the identified data needs. It also includes other components such as the Sampling and Analysis Plan (SAP) and Quality Assurance Project Plan (QAPP), which is provided in Appendix A; and site-specific Health and Safety Plan (HASP), which is provided in Appendix B.

1.3 Work Plan Organization

This RI Work Plan for the Site complies with MTCA requirements and is organized as follows:

- **Section 2.0—Background and Physical Setting:** Provides background information of the Site, including current and historical land use, surface features, and local geology and hydrogeology.
- **Section 3.0—Previous Investigations and Data Evaluation:** Details past investigations and remedial work performed at the Site and cultural and natural resources present on the Site.
- **Section 4.0—Preliminary Screening Levels:** Presents the preliminary CSM for the Site, potential sources, fate and transport of COPCs, and human and ecological exposure pathways.
- **Section 5.0—Remedial Investigation Activities:** Presents the sampling objectives and approach as well as the scope and data collection activities.

- **Section 6.0—Project Management Plan:** Identifies key project personnel and the anticipated project timeline.

2.0 BACKGROUND AND PHYSICAL SETTING

The background and physical setting information summarized below are based on Site visits and review of prior environmental data and documents.

Historically, the Site was established as a lumber mill in 1904. The former mill included railroad lines/tracks, several buildings, and a log pond (Figure 2). The City of Tacoma purchased the former Kosmos townsite and lumber mill in the 1960's and the inhabitants were relocated. The land was acquired to create the Riffe Lake reservoir for recreational use and power generation. The lumber mill facility was abandoned and demolished prior to the 1968 completion of Mossyrock Dam. Riffe Lake is currently a component of the Cowlitz River Hydroelectric Project operated by Tacoma Power. Additional Site background and description information are provided in the Data Summary Report (Hart Crowser 2021).

2.1 Site Description

The Site is located in Rainey Valley, within the Riffe Lake reservoir in an area referred to as Kosmos Flats. Rainey Creek bounds the Site to the north and west, Champion Haul Road to the east, and Riffe Lake to the south. The Site topography generally slopes to the south towards Riffe Lake, but the local topography near the petroleum seeps gradually slopes to the northwest, towards Rainey Creek.

The Kosmos Flats is a flat plateau and is referred to in this RI Work Plan as the upland area. This area was formerly the location of the Kosmos lumber mill. The building foundation, railroad rails, metal and concrete debris from the former mill can be seen in the upland area. The former mill location is on the east bank, top of an outside bend of Rainey Creek channel. Other site features include a surface-water conveyance ditch and a former log pond dike. There is approximately a 38-foot elevation difference between the top and bottom of the creek's bank and the bank ranges from 1:1 to 3:1 slope along the Site. Downstream of the protective cap, the bank is generally at a 2:1 slope. At the bank cap, the bank's slope is generally at a 3:1 slope. Upstream of the cap, the bank steepens to 1:1 with almost vertical portions for an approximate 300-foot length before the slope becomes less steep. Near the cap on the upstream side is a ravine that trends from the creek's bank to the east towards the upland area of the Site. This ravine contains metal and other debris from historical mill operation; however, most of the visible debris was removed by Tacoma Power in October 2021.

The northeastern side of the Site in the upland area is where soil was stockpiled from the emergency action excavation. A surface water diversion trench is on the eastern and northern sides of former stockpile area and discharges to Rainey Creek about 190 feet upstream of the ravine (see Figure 2). Surface water from the former stockpile area drains to the north into the diversion trench.

The highest elevation in the upland area is just south of the Site at the top of the log pond's dike that encloses the northern edge of the former pond. The lowest elevation in the upland area is the deep point of the former log pond enclosure.

Elevations discussed in this report are taken from the Tacoma City Light (TCL) datum, which is 3.96 feet below North American Vertical Datum of 1988 (NAVD 88). From September to May, reservoir water level elevations are typically at the lowest ranging between 700 and 720 feet. However, in March of 2019, the reservoir water level decreased to an approximate elevation of 670 feet. The spillway at Mossyrock Dam is at elevation 728.5 feet. Historically, spring rainfall and snowmelt flood the Site up to an elevation of 781.2 feet, which is the maximum design flood. From June to August, the water levels in the reservoir are higher and closer to full-pool levels. The reservoir's normal full-pool elevation is approximately 778.5 feet, which is the regulated Ordinary High Water Line and would submerge the upland portion of the Site. However, in recent years the reservoir's full-pool water levels have been maintained at an approximate elevation of 749 feet due to seismic safety concerns with the Mossyrock Dam spillway piers. This has allowed the Site to be exposed for extended durations and for vegetation to grow.

The Site's ground surface elevation ranges from approximately 718 feet near the petroleum seep area at the toe of Rainey Creek to approximately 758 feet in the upland area at the top of the bank near the old lumber mill foundations. Rainey Creek's bed is at an approximate elevation of 716 feet adjacent to the protective cap. During the 2019 Site investigation and protective cap construction, the creek's water level was at its lowest at approximately 719 feet. During a storm event in the winter and early spring of 2019-2020, the creek's water level rose during higher flows and then backwatered until the entire Site was inundated on February 8, 2020. After about a week, the water receded, and the upland area was visible again.

2.2 Adjacent Sites

Hart Crowser completed a search of Ecology's online databases and reviewed records for any listed sites within a 1-mile radius of the Site. The findings of the records review indicated a single adjacent site within 0.3 mile of the Site, the former Kosmos Townsite, which is described below. The former Kosmos Townsite is located north/northeast of the Site and is also situated in Rainey Valley. Most of the townsite was located between Frost Creek to the north and Rainey Creek to the south (Figure 1). The townsite was located on a flood plain and experiences similar flood events as the Site.

Between September 1992 and December 1992, five areas in the Kosmos Townsite located approximately 0.3 mile north/northeast of the Site were investigated for underground storage tanks (USTs) after the discovery of a partially exposed UST (DOWL 1993, provided in Appendix C). Ten USTs were found in four of the five areas ranging in size from 500-gallons to 2,500-gallons. Only one of the USTs in Area 3 contained petroleum product (gasoline), the remaining USTs contained water or soil. All five of the areas had contaminated soil above MTCA Method A CULs. Additionally, ten groundwater monitoring wells were installed around the contaminated sites and groundwater monitoring proceeded for two sampling periods in October 1992 and April 1993. Nine of the monitoring wells (MW-1 though MW-9) were installed at the expected maximum perimeter of the impacted plume and one well (MW-10) was installed in the expected maximum groundwater concentration (DOWL 1993). The monitoring wells were installed to a depth of approximately 14 feet below ground surface (bgs) and groundwater samples were analyzed for total petroleum hydrocarbons as gasoline and diesel (TPH-G and TPH-D, respectively), and benzene, toluene, ethylbenzene, and xylenes (BTEX). Based on the groundwater sampling DOWL concluded that the impacted groundwater was contained within areas adjacent to sources (DOWL 1993).

Approximately 15,000 cubic yards of contaminated soil was excavated from the Kosmos Townsite and remediated on-site by a mobile, low-temperature thermal desorption unit. The remediated soil was used as backfill for the excavations. Groundwater data collected by DOWL showed that contaminants did not migrate away from the UST perimeter set by the monitoring wells, but concentrations above MTCA Method A CULs were detected in the anticipated central area of the contaminated plume. The DOWL 1993 Site Characterization Report and Cleanup Action Plan for the Former Kosmos Townsite is provided in Appendix C.

2.3 Physical Setting

The general public can enter the Site by foot, and the surrounding land and water is used for recreational activities. Tacoma Power does not have any plans to redevelop the area. It will continue to be used for general public recreation access.

2.3.1 *Geology*

The Site is located along Rainey Creek in the Cowlitz River watershed. During the late Pleistocene, the Cowlitz glacier extended from its source on Mount Rainier, roughly to the town of Salkum, Washington, west of the Site. During this Epoch, the Cowlitz glacier advanced and retreated on at least four distinct occurrences. These glaciations produced three distinct outwash deposits. The earliest deposit was the Wingate Hill outwash followed by the Hayden Creek drift and most recently the Evans Creek outwash.

In the Rainey Creek valley, glacial deposits are represented as the Hayden Creek drift. The Hayden Creek drift is dominantly composed of outwash deposits expressed as poorly graded gravel deposits and localized till deposits. It is also common to find loess deposits up to 3 feet thick in the Hayden Creek formation. The entire Hayden Creek formation is heavily oxidized to depths up to 30 feet.

Soil from borings and test pits conducted by Hart Crowser during the initial Site investigation are generally consistent with expected outwash deposits of the Hayden Creek formation. Soil in the upland area generally consisted of sandy silts to silty sands with gravel in the upper 5 to 15 feet and silty gravel with sand and some cobbles to poorly graded coarse sand below 15 feet. Additionally, localized fine-grained organic deposits of silt and clay were found in low lying vegetated areas in the upper 5 feet during the 2019 Site investigation in explorations TP-7, TP-10, and TP-12. Fill was generally encountered between approximately 10 and 35 feet bgs. Fill contains concrete, wood, and metal debris up to depths of 28 feet bgs in explorations TP-2, TP-5, TP-7, TP-15, B-8, and B-10. Fill also contains TPH-like staining below 28 feet bgs to 35 feet bgs in exploration B-2. The outwash deposits were encountered below the fill. Till-like material was only observed in the bank samples taken on the west side of the Rainey Creek, opposite of the Site. Based on observations during the emergency IRA construction and from a soil sample collected from the exposed creek bed of Rainey Creek, the creek bed material generally consists of gray clayey sand with gravel and cobbles.

2.3.2 *Hydrogeology*

Groundwater in the upland area was generally encountered from 37 to 47 feet bgs (approximate elevation 710 to 721 feet) during the initial Site investigation in November and December 2019. The elevation of

Rainey Creek during the time of the initial Site investigation was approximately 719 feet. Additionally, perched groundwater was encountered 5 to 10 feet bgs in borings and test pits and observed to be discontinuous in nature.

In 1992, Site groundwater was encountered during the excavation of Site A at approximately 10 to 11 feet bgs (AIRO 1993). In 1993, at the former townsite (located to the northeast of the Site) groundwater was encountered during the assessment at approximately 6 to 11 feet bgs and flowed to the southwest, towards Riffe Lake, and that depth to groundwater varies seasonally (DOWL 1993).

Based on the historical groundwater information and groundwater conditions found at the time of the 2019 investigation, groundwater levels are inferred to be tied to the reservoir levels as we observed the lowered groundwater levels with lower lake levels and may fluctuate as water is retained and released from the Mossyrock Dam.

3.0 PREVIOUS INVESTIGATIONS AND DATA EVALUATION

3.1 Site Investigations

3.1.1 *AIRO 1993 Site Assessment*

Two USTs related to the lumber mill were discovered at the Site in 1992, which were subsequently removed by AIRO Environmental Services. The first UST was a 500-gallon steel tank, located south of the observed seeps and found partially exposed along an earthen bank of Rainey Creek, labeled Site D in Figure 2. It was filled with lake water and did not exhibit a sheen or other indicators for the presence of petroleum products. The water inside the UST was analyzed for polychlorinated biphenyls (PCBs) and total halogens, which were not detected at or above laboratory reporting limits in water samples from this tank (AIRO 1993).

The second UST, a 5,000-gallon tank, was located below ground level near the remaining mill facility foundations, labeled Site A in Figure 2. The UST contained petroleum product with the presence of halogenated hydrocarbons. Soil containing heavy oil-range petroleum (TPH-O) at concentrations exceeding MTCA Method A soil CULs surrounded the 5,000-gallon UST. The tank and the surrounding soils were subsequently removed. A total volume of 87 cubic yards of contaminated soil was removed and disposed of at the Kitsap County Landfill (AIRO 1993).

3.1.2 *2019 Site Investigations and Emergency Independent Remedial Action*

In 2019 and 2020, following the observation of the seep in April 2019, a Site investigation and IRA were conducted at the Site. In November and December 2019, twelve test pits (TP-2, TP-3, TP-5 through TP-8, and TP-10 through TP-15) were excavated to depths of 5 to 20 feet and ten sonic borings (B-1 through B-10) were advanced using a sonic drill rig to depths of 40 to 50 feet in the upland area of the Site (Figure 3). Soil samples from borings and test pits were generally collected from 2.5- and up to 5-foot intervals. Grab groundwater samples were collected from four of the borings (B-4, B-6, B-7, and B-9) with the temporary well screens set at 45 to 50 feet bgs. Two areas were also excavated by Tacoma Power's contractor AEC to the south of the investigation area in the former log pond area (Figure 2) to an approximate depth of 18 inches bgs to assess soil conditions for construction dewatering purposes. No obvious indicators (visual and olfactory) of petroleum impacts were observed by Tacoma Power staff and no soil samples were collected from these excavations.

As part of the emergency IRA, AEC excavated the creek bank and graded some creek bed material to temporarily divert the flow of Rainey Creek away from the work area. During this flow diversion, non-aqueous phase liquid (NAPL) was observed (brown, oil-like, and heavy sheen) in the creek bed directly adjacent to the location of the petroleum seeps on the bank. One soil sample was collected from the exposed creek bed (Creekbed 1) at an approximate elevation of 717 feet and three additional soil samples were collected from the bank approximately 65 feet opposite to the Site (Westbank 1, Westbank 2, and Westbank 3) at an approximate elevation of 721 to 718 feet. The samples were analyzed for TPH-D, TPH-O, TPH-G, metals, PAHs, and volatile organic compounds (VOCs). TPH-D, TPH-O, and cPAHs were detected at concentrations above MTCA Method A CULs in Creekbed 1, all other analytes were either not detected at or above laboratory reporting limits or were detected at concentrations below applicable MTCA CULs. After the excavation for the area where the cap was to be installed, six samples, identified as UB-1 through UB-3 for upper bank and LB-1 through LB-3 for lower bank, were collected at or near the bank's sloped ground surface at approximate elevation of 746 for the upper bank and 719 for the lower bank (Figure 3).

Surface water samples of Rainey Creek were collected to monitor the effectiveness of the BMPs that Tacoma Power had implemented during excavation activities, in general accordance with Tacoma Power's water quality protection plan (WQPP). Grab surface water samples were collected by Hart Crowser approximately one to two hours after excavation activities began each day. After excavation was completed in December 2019, Tacoma Power performed the surface water sampling and chemical analysis through February 4, 2020 (before the Site was inundated by the storm event). Surface water sample locations and data are provided in the Data Summary Report (Hart Crowser 2021).

From December 2019 to March 2020, Tacoma Power collected surface water samples from ponded water near and in the former stockpile area (samples COP 1 and SOP 1, respectively) and collected surface water samples from the log pond area (samples Log Pond #1 and Log Pond #2). Standing water that was sampled in the former log pond resulted from heavy rain in February 2020 and excess water pumped to the log pond from the soil stockpile area during stockpile removal. Some of the surface water sample results contained concentrations of pH, turbidity, copper, and zinc above indicator levels. One sample (SOP 1) collected in March 2020 contained elevated concentrations of TPH-D and TPH-O above indicator levels. Analytical results and water sample locations are provided in the Data Summary Report (Hart Crowser 2021).

Soil samples were analyzed for TPH-D, TPH-O, TPH-G, metals, PCBs, VOCs, and PAHs. Analytical results from the borings and test pits indicate the presence of TPH-G, TPH-D, and TPH-O and carcinogenic polycyclic aromatic hydrocarbons (cPAHs) in soil at concentrations above CULs primarily in the upper 10 to 15 feet of soil in the upland area of the Site. An isolated area near the former Site A (5,000 gallon UST) was found to contain petroleum-contaminated soil in the upper 2.5 feet bgs. Additionally, TPH-D, TPHO, and cPAHs were found in soil above CULs in the creek bed and on the creek bank underneath the protective cap (Creekbed 1 and LB-2, respectively).

Groundwater samples collected were analyzed for TPH-D, TPH-O, TPH-G, total metals, PCBs, VOCs, and total suspended solids (TSS). Two samples (B-4-W and B-6-W) were analyzed for and contained total metals (arsenic, cadmium, chromium, and lead) above CULs; however, the samples also contained high levels of turbidity and TSS (analyzed in sample B-4-W). Surface water samples collected during the earthwork activities for emergency IRA showed elevated TPH-O, TPH-D, copper, and zinc in areas adjacent to the construction area, but not downstream of the protective cap area.

More details about the initial Site investigation and the emergency independent remedial actions are described in the Hart Crowser Data Summary Report, dated February 19, 2021.

3.1.3 *Site Investigation by the Department of Ecology*

During a March 2021 site visit by Ecology's Water Quality Program, a layer of SPP was observed as a ledge on the east bank of Rainey Creek on the north side of the ravine (Figure 4). The layer is resistant to erosion as it is observed to be sand and gravel cemented in a hard petroleum matrix and was overhanging the stream bank and along the bank top (i.e. the soil beneath the SPP had been eroded). The ledge of the SPP is 16 feet long by 2 feet wide and 3 to 7 inches thick and the eastern portion is covered with alluvium.

On April 16, 2021, Ecology sampled the SPP ledge and submitted for chemical analysis of TPH-D, TPH-O, TPH-G, total metals (arsenic, cadmium, chromium, hexavalent chromium, copper, lead, nickel, zinc, and mercury), PAHs, BTEX, and extractable and volatile petroleum hydrocarbons (EPH and VPH, respectively). Laboratory report EV21040103 is provided in Appendix D. Analytical results shows concentrations exceed MTCA Method A soil CULs for TPH-D, TPH-O, and cPAHs. There were detectable concentrations for metals except for hexavalent chromium. There were no detectable concentrations in the VPH range or for BTEX compounds. There were detectable concentrations in the EPH range. Since this Site can be submerged during high reservoir levels, leach testing was performed on the SPP ledge soil sample to determine if there was a risk to surface water quality. The leaching test was completed using distilled water in a modified toxicity characteristic leaching procedure (TCLP) and the leachate (labeled as rinsate in the laboratory report) was analyzed for TPH-D, TPH-O, and metals. Results show TPH-D, TPH-O, and copper levels exceed WQPP indicator levels.

In May 2021 Tacoma Power personnel observed a partially exposed SPP layer in the ravine east of the SPP ledge (Figure 4). It is not known if this is connected to the SPP ledge. The eastern portion of this layer is also covered by alluvium.

SPP debris was found scattered on the Site's upland surface and Rainey Creek bank. Tacoma Power personnel are noting the location and collecting this debris as it is discovered and disposing off-site. On October 4 and 5, 2021, Tacoma Power collected and removed the visible metal debris in the ravine and graded the area by moving some soil from the edges of the ravine to fill in the lower, depressed areas to prevent exposure to surface water. Additionally, the SPP layer located north of the ravine was removed approximately 4 feet towards the east and disposed of off-site to Hillsboro Landfill. Ecology's Water Quality Program approved the plan and oversaw construction.

3.2 Cultural and Natural Resources

The former Kosmos Town and Mill Site has been identified, evaluated, and concurred upon by the Department of Archaeology and Historic Preservation as not a National Register-eligible archaeological site. However, remnants or historic features may still be found during the investigation that require further documentation. Pre-historic artifacts or sites are not anticipated to be impacted. If needed, Tacoma Power or their designee will observe the explorations; if any cultural resource artifacts are encountered, field staff shall follow Tacoma Power's Inadvertent Discovery Plan, which outlines the plans and procedures for dealing with unanticipated discoveries of cultural resources. The proposed explorations extend beyond the current APE boundary, and Tacoma Power is coordinating with their cultural resources staff to expand the APE as necessary before any subsurface work is performed. The proposed expanded APE boundary is presented in Figure 5.

4.0 PRELIMINARY SCREENING LEVELS

Preliminary screening levels for the Site have been proposed based on previous investigations and the preliminary CSM presented in the previous RI Work Plan (Hart Crowser 2019). The CSM and screening levels will be revaluated following additional data collected under the scope of this plan.

4.1 Proposed Screening Levels

The following MTCA CULs for each media will be used for screening purposes in the RI. Proposed CULs will be evaluated and provided in the FS.

4.1.1 *Soil*

For human health screening, soil will be screened against MTCA Method A CULs for unrestricted land use. The Method A values are for protection of human health via the direct-contact or ingestion pathways and protection of groundwater via the soil-leaching-to-groundwater pathway. For certain constituents, MTCA Method A CULs are not available and Method B CULs will be applied. Method B CULs may be used at any site. Additionally, proposed Site-specific Method B CULs for petroleum will be calculated based on the EPH and VPH analyses.

4.1.2 *Groundwater*

Groundwater will be screened to MTCA Method A CULs and applicable or relevant and appropriate requirements (ARAR) for freshwater surface water.

For certain constituents, MTCA Method A CULs are not available and Method B CULs will be applied. Additionally, proposed Site-specific Method B CULs for petroleum will be calculated based on the EPH and VPH analyses. The minimum concentration of the state and federal aquatic life and human health freshwater water quality standards will be selected as the surface water ARAR. Potable water is not provided to the Site and there are no known drinking water supply wells on the Site.

4.1.3 *Surface Water*

Surface water samples will be screened and compared to the MTCA Aquatic Life (freshwater/acute) levels for surface water (WAC 173-201A-240) per Tacoma Power's Water Quality Protection Plan (WQPP) Tables 1 and 2, revised on September 9, 2021 (see Appendix E).

4.1.4 *Sediments*

Sediment samples will be screened and compared to the Sediment Cleanup Objectives (SCOs) for freshwater sediment as presented in the Sediment Management Standards (SMS, WAC 173-204-563). For constituents not specifically listed in the SMS, a SCO will be established as described in WAC 173-204-560(3).

4.2 Proposed Points of Compliance

The soil point of compliance (POC) is the depth at which soil CULs shall be attained. The standard POC in soil for human direct contact and for ecological receptors is 15 feet bgs throughout an entire site and the standard POC is all depths throughout a site for protection of groundwater and surface water. The standard POC for protection of groundwater and surface water is preliminarily applied to soil and sediment on the Site.

Additional assessment of soil, groundwater, sediment, and surface water on the Site will inform final POCs on the Site. It is anticipated that the determination of whether soil is protective of groundwater will be assessed using a POC established for groundwater. Note that a conditional POC of up to 6 feet bgs may be established for ecological receptors, as this represents the interval that receptors are most likely to directly contact in the absence of anthropogenic or other disturbances (e.g., excavation bringing deeper soils to the surface).

For groundwater, the POC is the point or points where the groundwater CULs must be attained for a site to comply with the cleanup standards. Groundwater CULs shall be attained in all groundwater from the POC to the outer boundary of the hazardous-substance plume. In accordance with (WAC 173-340-720(8)(c)), a conditional POC may be established if it is not practicable to meet the CULs throughout the site within a reasonable restoration time frame. A conditional POC for groundwater is not proposed at this time for the Site.

4.3 Preliminary Conceptual Site Model

A CSM describes potential chemical sources, release mechanisms, environmental transport processes, exposure routes, and receptors. The primary purpose of the CSM is to describe pathways by which human and ecological receptors could be exposed to site-related chemicals. A complete exposure pathway consists of four necessary elements: (1) a source and mechanism of chemical release to the environment, (2) an environmental transport medium for a release chemical, (3) a point of potential contact with the impacted medium (referred to as the exposure point), and (4) an exposure route (e.g., soil ingestion) at the exposure point.

The preliminary CSM included herein is based on findings from previous investigations and remedial actions at the former Kosmos Mill. The historical operation of the former mill and associated USTs and associated piping likely contributed to contamination of soil at the Site. Contaminants in soil and groundwater at the Site have the potential to migrate through a number of pathways to the Rainey Creek bank, resulting in possible exposures to human and/or ecological receptors. Data generated from this RI Work Plan will be used to develop a comprehensive and updated CSM for the Site to be used during the RI and FS processes.

Upland Area. In general, the petroleum-contaminated soil was encountered in the upper 10 to 15 feet during the Site investigation in the upland area. The extent to the north of explorations TP-5 and B-6, to the south of explorations TP-15 and B-6, and to the northeast/southeast of exploration B-6 are unknown; however, the two areas excavated for dewatering purposes in the log pond area to the south did not exhibit any obvious environmental impacts. The petroleum-contaminated soil (specifically TPH-O) at exploration TP-12 was encountered in the upper 2.5 feet while in the sample collected between depths of 2.5 and 4 feet bgs petroleum-contaminated soil was not detected at or above laboratory reporting limits for TPH-D and TPH-O. Due to the proximity of the 1992 UST removal and cleanup at Site A, this may be residual petroleum encountered from the 1992 UST removal and cleanup at Site A.

Creek Bank Area. Petroleum-like odors and NAPL were observed in soil during construction of the protective bank cap to the northeast, east, and southwest of the seep area; however, the area could not be further investigated due to steep slopes and unstable soils, rising lake and creek water levels, and needing to install the protective bank cap in a timely manner. The areas to the northeast and southwest were not covered by the protective cap and will be further evaluated during the investigation. The lower bank sample (LB-2) collected from the exposed bank surface during excavation of the protective cap, had detections of TPH-D, TPH-O, and cPAHs above MTCA Method A CULs.

Sediment. The creek bed sample (Creekbed 1) collected during excavation of the protective cap, had detections of TPH-D, TPH-O, and cPAHs above MTCA Method A CULs. It is unknown how far the petroleum contamination reaches into the creek bed.

Surface Water. Surface water samples were collected during construction of the protective cap as well as after construction was completed (Figure 6). Samples collected during construction activities exceeded the indicator levels for surface water from location D-2 for TPH-D, copper, and turbidity and from location D-1 for zinc. Location D-2 was collected inside the excavation area and location D-1 was collected directly outside of the excavation work area and the sea curtain, but upstream of Boom 4.

Samples collected after construction activities that exceeded the surface water indicator levels for TPH-O and TPH-D/TPH-O combined were collected from location D-6, which is located inside the last boom (Boom 6) downstream of the cap area; and for copper and TPH-D/TPH-O combined were collected from location U-3, which is located upstream of the cap area. Turbidity was typically below the indicator level, except for two instances at locations at D-1B and U-3.

4.4 Contaminant Transport and Exposure Routes

Possible contaminant transport routes from the Site were identified in the previous RI Work Plan (Hart Crowser 2019) and the Data Summary Report (Hart Crowser 2021). The primary transport routes generally include soil to groundwater and groundwater to surface water and sediment. The transport pathways could possibly result in exposures to ecological receptors within Rainey Creek and Riffe Lake, and potential human receptors via fish consumption. The following sections focus on the possible transport pathways and exposure routes from the Site.

4.4.1 *Potential Sources and Release Mechanisms*

Possible contaminant sources for the oil seeps, SPP layers, and debris are from usage of petroleum products during the lumber mill operation from 1904 to sometime in the 1960's; unknown and known leaky USTs (LUSTs) and piping, and petroleum-impacted soil associated with the former USTs; and possible unknown sources. During the initial Site investigations and IRA protective cap excavation and construction, pipes and NAPL were discovered and appeared to be running in the direction of the seep areas. An abandoned culvert with petroleum-like odor was observed in the drainage ravine directly to the north of the cap location during the IRA. Additional SPP ledge and layer was observed north of the ravine and within the ravine, respectively. Information gathered from previous work and this RI Work Plan will be used to determine possible sources and source locations.

4.4.2 *Fate and Transport Processes*

The fate and transport processes of heavy fuel oil depends on the composition of the contaminant and the environment affected by the contaminant. In general, when heavy fuel enters the environment, the individual products comprising the fuel partition to various environmental compartments according to their own physical-chemical properties (API 2012). Data generated from the RI Work Plan will be used to better understand the fate and transport processes at the Site. The most likely contaminant transport routes/pathways are described below.

4.4.3 *Primary Transport Pathways*

The primary mechanisms likely to influence the fate and transport of chemicals at the Site include natural biodegradation of organic chemicals; sorption to soil and sediment; advection and dispersion in groundwater; volatilization of volatile chemicals from soil or groundwater to air; leaching of chemicals from soil to groundwater; and discharge of chemically impacted soil, groundwater, and sediment to surface water. The relative importance of these processes varies depending on the chemical and physical properties of the released contaminant. The properties of soil, sediment, and the dynamics of groundwater flow also affect contaminant fate and transport.

The Site is partially vegetated and mostly unpaved except for former mill structure concrete foundation slabs that are still visible. Therefore, the soil-to-groundwater migration pathway is potentially complete because of the potential for infiltration of precipitation through unpaved areas and through cracks in the former foundations into the vadose-zone soil. Leaching of near-surface soil impacts during precipitation events could result in impacts to shallow groundwater at the Site. In addition, transport parameters change dramatically when the Site is fully submerged. Lighter than water contamination will move vertically upwards towards the water's surface when soil is fully saturated.

Volatile contaminants may partition to the vapor phase in the source areas or downgradient of the source areas via groundwater transport of dissolved-phase contamination. However, there are currently no structures at the Site, so the potential vapor phase is less of a concern and considered incomplete. The Site is a gated wildlife area not accessible by vehicles. The Site is generally used for passive, outdoor recreational activities (i.e. hiking, fishing, and hunting) and Tacoma Power does not have any current plans to develop the area. After the spillway piers are modified to alleviate seismic concerns, the Site would most likely be inundated annually as in the past with a normal full-pool operational elevation of 778.5 feet.

The Site is immediately adjacent to Rainey Creek and Riffe Lake downstream. Given the close proximity to the Site, there is potential for the dissolved-phase contamination and NAPL to migrate downgradient of the source area and impact sediment and surface water. However, the lateral extent of any potential groundwater plume has not yet been fully delineated. Therefore, the pathway for discharge of chemically-impacted groundwater to surface water and sediment in Rainey Creek and Riffe Lake is considered potentially complete.

4.5 Human Health and Ecological Exposure

4.5.1 *Human Health Exposure Scenarios*

The Site is currently vacant, but accessible by the public as a recreational wildlife area. The current Site uses are expected to continue into the foreseeable future.

Rainey Creek and Riffe Lake, which are directly adjacent to the Site and approximately 1,500 feet to the southwest, respectively, as well as the land on and around the Site provide habitat that may attract recreational visitors.

Based on these uses, and that cleanup is required, human receptors may include construction workers and recreational users. The following pathways are potentially complete for human exposure:

Construction Workers—Construction workers could potentially be exposed to chemicals in environmental media on the Site by the following pathways:

- Direct skin contact with or incidental ingestion of chemically impacted soil, sediment, or groundwater during excavations on the Site.
- Inhalation of wind-borne particulates on or migrating off-site from chemically-impacted soil being handled or exposed on-site during excavations on the Site.
- Inhalation of outdoor air vapors emanating from soil, sediment, or groundwater with volatile chemical impacts on-site or migrating off-site.

Recreational Visitors—The Site and the surrounding area is currently closed with signs to recreational visitors stating “Area Closed, No Trespassing" indicating that the area is closed to the public and no trespassing is allowed with violators being subject to prosecution under RCW 9A.52.080. Site roads are gated and not readily accessible by vehicles; however, pedestrians could access the area. Riffe Lake is still accessible to the general public, who could be exposed to chemicals migrating to the water or from the subsurface soils by the following potential pathways:

- Direct skin contact with and incidental ingestion of surface water or sediment from Rainey Creek or Riffe Lake that has been chemically impacted via discharges of chemically impacted groundwater migrating off-site.
- Ingestion of chemicals bioaccumulated in the tissue of fish from chemically impacted surface water or sediment in Rainey Creek and Riffe Lake.
- Ingestion of chemicals bioaccumulated in terrestrial plants and/or animals from impacted soil at the Site.
- Direct skin contact with and incidental ingestion of chemically impacted soil near the seepage area.
- Inhalation of wind-borne particulates on or migrating off-site from chemically impacted soil.
- Inhalation of outdoor air vapors emanating from soil or groundwater with volatile chemical impacts on or migrating off the Site.

4.5.2 *Terrestrial Ecological Receptors*

The proposed soil sampling will support the effort to conduct a terrestrial ecological evaluation (TEE). The purpose of the TEE is to determine whether a release of hazardous substances to soil may pose a threat to the terrestrial environment. The investigation will support development of a site-specific TEE weight-of-evidence evaluation consistent with WAC 173-340-7493. Collected soil data will be used to evaluate soil concentrations meeting ecological screening levels (ESLs) or natural background specifically to support the TEE.

4.5.3 *Aquatic Ecological Receptors*

Aquatic ecological receptors may be exposed to chemically impacted shallow soil, surface water, sediment, and/or fish tissue at the Site by the following pathways:

- Direct contact with and ingestion of surface water or sediment in Rainey Creek and Riffe Lake that has been chemically impacted via discharges of chemically impacted groundwater migrating off-site.
- Ingestion of chemicals bioaccumulated in the tissue of fish from chemically impacted surface water or sediment in Rainey Creek and Riffe Lake.

5.0 REMEDIAL INVESTIGATION ACTIVITIES

The field investigations will be conducted in general accordance with the methods and protocol described in the SAP/QAAP (Appendix A).

Investigation activities will be performed to delineate the extent and magnitude of contamination on and near the Site. Activities will include performing an additional GPR survey to supplement the previous GPR investigation data. The GPR will be used to detect and map subsurface anomalies and known and unknown pipes left in-place. Additional activities will include completing soil borings, test pits, and potholes; installing temporary and permanent groundwater monitoring wells; collecting soil, sediment, groundwater, and surface water samples for chemical analysis; visually inspecting the Site and the banks of Rainey Creek; and inventorying areas of SPP and debris (Figure 4).

5.1 Remedial Investigation Data Gaps and Objectives

Previous investigations identified impacts to soil, sediment, surface water, and groundwater at the Site caused by a release of petroleum and an interim cleanup action was performed. However, additional assessment at the Site is needed to characterize the current nature and extent of impacts.

5.1.1 *Data Gaps*

As described in the Data Summary Report, four data gaps were identified following the initial Site investigation and IRA. These data gaps are discussed below, and additional investigation of these data gaps are required to further understand the Site and determine the extent of contamination.

Extent of Contamination in the Upland Area. Petroleum-contaminated soil was identified in the upland area and on the creek bank and bed. In the upland area, the vertical extent of the petroleum-contaminated soil appears to be within the upper 10 to 15 feet bgs and most likely follows topography towards the bank of Rainey Creek where the seeps and SPP layer were observed. The horizontal extent in the central area is not defined towards the southwest near TP-15; north and west near TP-5; east of TP-7; and south, northeast, and north of B-6. Also, in the upland area, an isolated area north of the former Site A contained petroleum-contaminated soil from 0 to 2.5 feet bgs. Additional investigations with soil sampling and analysis in these areas will further delineate the horizontal extents in the upland area including to the east and south of the former Site A cleanup area and identifying the depth and extent of the SPP layers.

Extent of Contamination along the Creek Bank. Petroleum-impacted soil was discovered during the cap excavation, in the creek bed, and along the creek bank south of the installed cap. The extents of these petroleum-impacts are unknown. Based on observations during the installation of the cap, the downstream edge of the cap was terminated at a location that had approximately four feet of clean native material adjacent to the creek edge and a vein of contaminated material appeared to continue to run parallel to the creek. This vein was in an area of approximately ten square feet. Investigating the extent of the petroleum-contaminated soil in the creek and creek bank would be extremely difficult due to the steep terrain on the bank south of the cap, the inaccessibility of reaching the opposite (west) creek bank with equipment, and the creek water levels. Routine inspections and monitoring are currently being conducted by Tacoma Power staff. Additional explorations with soil sampling and analysis to the north and south of the protective cap area will further delineate the extents of the petroleum-impacted soil along bank.

Extent of the Pipe Network. During the Site investigation and construction of the cap, multiple pipes were encountered with a couple pipes containing observable NAPL. Some of the pipes or pipe segments were removed, but the complete pipe network associated with the former mill was not fully discovered. It is also not known if the remaining pipes contain any residual petroleum product. Therefore, this is considered a potential data gap for future investigations. As shown on Figure 4, GPR surveys will be used to further evaluate the extent of the pipe network and identify other subsurface anomalies like a UST. The area of previous GPR investigation can be found in the Data Summary Report's Appendix E, Figure E-1.

Abandoned Culvert and Drainage Ravine. An abandoned culvert and petroleum-like odor was observed in the drainage ravine filled with debris and railroad ties to the north/northeast of the cap. Due to time limitations during the cap excavation and installation (with water levels anticipated to rise), the extent of petroleum impacts in the drainage ravine could not be fully delineated. To further define the extent of potential impacts, the ravine area will be investigated using potholing with a vacuum truck and extension hose due to limited accessibility along the Rainey Creek bank. The upland area on the north side of the ravine will be investigated by advancing a test pit exploration and a boring for collection of soil and grab groundwater samples (Figure 4).

In early October 2021, Tacoma Power collected and removed the visible metal debris in the ravine and graded the area to prevent exposure to surface water. Tacoma Power removed the SPP layer located north of the ravine approximately 4 feet towards the east and dispose off-site. However, it is unknown if all the debris and SPP layer were removed. Explorations in this area will assist in delineating these impacts.

Elevated Metals in Groundwater. Elevated total metals were detected in two grab groundwater samples (B-4-W and B-6-W). Since these were collected as grab groundwater samples from a temporary reconnaissance boring, there is the potential that the elevated metals are associated with the high turbidity observed in the samples and not necessarily representative of the surrounding groundwater conditions. On future grab groundwater sampling, we propose to analyze for total and dissolved metals to determine if total metals are a COPC in groundwater. Additionally, eight monitoring wells will be installed and developed prior to sampling to reduce turbidity in groundwater samples.

5.1.2 *Remedial Investigation Objectives*

The RI objectives in addressing data gaps as they relate to hazardous substances known and potentially present at the Site include the following:

- Evaluation of contaminant migration pathways.
- Determination of the nature, extent, and distribution of hazardous substances in environmental media at the Site. This analysis will focus on the vertical and horizontal extent of contamination in soil, sediment, and groundwater. Figures and cross-sections will be provided identifying the elevations and areas that are impacted.

- Assess presence and extent of SPP layers and debris at the Site.
- Identify the potential source of the oil seeps.
- Assessment of reasonably likely future human and ecological receptors identified in the preliminary CSM discussed above (Section 4). Further evaluation of potential chemical sources, contaminant migration pathways and the nature, extent, and distribution of hazardous substances in affected media.
- Through the risk screening, evaluation of the risk to human health and the environment from releases of hazardous substances.
- Generation or use of data of sufficient quality for Site characterization and risk screening.
- Development of the information necessary to conduct a preliminary evaluation and design of source control measures to address contaminant releases from the Site, if deemed necessary.

5.2 Scope Of Work

To accomplish the remedial investigation objectives listed above, the following scope of work will be performed (Figure 4):

- Perform GPR surveys in areas where pipes were encountered during the initial Site investigation and emergency creek bank excavation to assess the extents of the known buried pipes and other subsurface anomalies.
- Advance approximately 15 explorations using sonic drill methods to collect soil and grab groundwater samples.
- Install monitoring wells in 4 of the sonic borings during seasonal low water levels (deep monitoring wells) and install 4 monitoring wells during seasonal high-water levels (shallow monitoring wells).
- Conduct six groundwater monitoring events on a quarterly schedule from the newly installed shallow and deep monitoring wells. One event will be after the deep wells are installed, one event will be after the shallow wells are installed, and four additional quarterly events. The shallow and deep monitoring well sampling plan is included in Appendix A.
- Conduct monthly groundwater level monitoring and submit data to Ecology (Tacoma Power personnel will collect and submit this groundwater level data). Monthly water level readings will be conducted after the monitoring wells are installed and between quarterly monitoring events for one year.
- Excavate approximately 24 test pits to collect soil samples to depths of 10 to 15 feet bgs, with an additional 5 contingency test pits if needed to investigate environmental impacts farther to the southwest and in the central area farther to the northeast.

- Advance approximately 15 pothole explorations using a vacuum truck to collect soil samples to depths of 10 to 15 feet bgs.

- Collect 12 grab sediment samples during seasonal low water levels. Sediment sample locations are adjacent to seep areas, upstream of the protective cap, and downstream of the protective cap.

- Collect 3 surface water samples located upstream of the ravine, adjacent to the protective cap, and downstream of the cap during seasonal high and low surface water levels.

- Collect and field screen soil and sediment samples from explorations for selected chemical analyses. If field screening indicates contamination and or impacts, then those samples will be analyzed as well as samples collected below the impacted areas to confirm vertical distribution.

- Select soil boring, test pit, or pothole subsurface soil samples for chemical analysis based on field screening results and location in relationship to historical analytical results, and analyze for one or more of the following:
  - TPH-G, TPH-D, and TPH-O;
  - VPH and EPH;
  - VOCs;
  - PAHs; and
  - metals (arsenic, barium, cadmium, chromium III, chromium VI, copper, lead, mercury, nickel, selenium, silver, and zinc).

- Analyze groundwater samples for the following analyses:
  - TPH-G, TPH-D, and TPH-O;
  - VPH and EPH;
  - VOCs;
  - PAHs; and
  - total and dissolved metals (arsenic, barium, cadmium, chromium III, chromium VI, copper, lead, mercury, nickel, selenium, silver, and zinc).

- Analyze sediment samples for the following analyses:
  - TPH-G, TPH-D, and TPH-O;
  - VPH and EPH;
  - VOCs;
  - PAHs;
  - metals (arsenic, barium, cadmium, chromium III, chromium VI, copper, lead, mercury, nickel, selenium, silver, and zinc); and
  - Total organic carbon (TOC).

- Analyze surface water samples for the following analyses:
  - TPH-G, TPH-D, and TPH-O;
  - BTEX;
  - cPAHs; and

  - total and dissolved metals (arsenic, cadmium, chromium VI, copper, lead, mercury, nickel, and zinc).

- Visually inspect the Rainey Creek east and west banks near the protective bank cap area for signs of seepage or environmental impacts.

- Manage investigation-derived waste (IDW) by not storing at the Site but by hauling off-site to an appropriate disposal facility.

- Following the data collection and evaluation, a draft RI report will be prepared in accordance with Section VII.D of the Agreed Order discussing the analytical results and assessing risks to on- and off-site receptors via exposure pathways identified in the CSM.

- Prepare groundwater monitoring data tables and figures for submittal to Ecology following each quarterly groundwater monitoring event.

- Prepare a technical memorandum summarizing all quarters of groundwater monitoring data collected with tables, figures, chemical data quality review, and discussion of the results. Additional quarterly monitoring events and the monthly water level monitoring will be evaluated after the review of this report.

These activities are discussed in further detail within this RI Work Plan in the SAP/QAPP (included as Appendix A).

5.3 Field Activities

On behalf of Tacoma Power, Hart Crowser will coordinate with subcontractors, including a subsurface utility locator, driller, and analytical laboratory to complete this scope of work. A SAP/QAPP (see Appendix A) will guide environmental field sampling and laboratory analytical methods and procedures. A site-specific HASP for field activities specific to this scope of work is provided in Appendix B.

Before field activities begin, Hart Crowser will call into the Underground Utility Notification Center and boring locations will be cleared for subsurface utilities by public utility locators. During the exploration advancements a description of soil conditions and visual and olfactory observations will be recorded on boring logs by a geologist or hydrogeologist licensed in the State of Washington, or by a person working under the direct supervision of a Washington-State-licensed geologist or hydrogeologist. The soil from temporary borings will be field screened for organic vapors, using a photoionization detector. Soil and groundwater observations and sample parameters will be recorded on field sampling data sheets.

Non-dedicated sampling equipment will be decontaminated using industry-standard techniques. All downhole drilling equipment will be pressure-washed with hot, potable water before and after each use by the drilling subcontractor. Hart Crowser will coordinate IDW disposal with an approved subcontractor to transport and dispose of the IDW after proper characterization.

All sampling locations will be determined using a handheld global positioning system device with sub-meter accuracy. The proposed sampling locations are illustrated on Figure 4.

5.3.1 *GPR Survey*

Hart Crowser will coordinate with a licensed surveyor to provide GPR services. Four areas have been marked out (Figure 4) for surveying to identify the extent of piping encountered during the initial Site investigation and IRA.

5.3.2 *Drilling and Grab Soil and Groundwater Sampling*

Hart Crowser will coordinate with a licensed driller to provide sonic drilling services. Eleven borings (B-11 through B-17 and MW-1D through MW-4D on Figure 4) will be advanced during seasonal low water levels up to approximately 50 feet bgs or deeper to reach the groundwater table to a maximum of 60 feet for the collection and analysis of at least two soil samples per boring. Four of these borings will be completed as deep monitoring wells (see MW-1D through MW-4D on Figure 4). Grab groundwater (or reconnaissance) samples will be collected from the remaining 7 temporary borings. An additional 4 new borings will be drilled and completed as shallow monitoring wells (see MW-1S through MW-4S on Figure 4) during seasonal high-water levels.

Temporary borings (B-11 through B-17) will be abandoned by filling with hydrated bentonite chips or with bentonite grout to the surrounding grade, in general accordance with the Minimum Standards for Construction and Maintenance of Wells (WAC 173-160).

5.3.3 *Monitoring Well Installations and Groundwater Monitoring*

Eight groundwater monitoring wells will be installed to assess the vertical distribution of contaminants. Four monitoring wells will be installed during seasonal high water levels and four will be installed during seasonal low water levels (see Figure 4 for proposed well locations). All monitoring wells will be installed and constructed in general accordance with the Minimum Standards for Construction and Maintenance of Wells (WAC 173-160).

Construction. The monitoring wells will be constructed of 2-inch-diameter Schedule 40 PVC with 10 to 20 feet of screened casing. We anticipate that most of the shallow wells will be screened at depths ranging between 10 to 20 feet bgs and the deep wells will be screened from 40 to 60 feet bgs. However, boring depth will be determined based on soil field screening results and depth of groundwater. If field screening results indicate that contamination may be present at depth, we may continue advancing the borings and would complete the monitoring wells after we have delineated the vertical extent of contamination. The top of the screen will be placed 1 foot above observed water table. A clean silica sand pack will be placed about 1 foot above the screened section, and a minimum 3-foot bentonite seal will be placed above the sand to within about 1 foot of the ground surface. A concrete surface seal will secure a flush-mounted, traffic-rated monument. A watertight locking cap and lock will secure the wellhead, and bolts will secure the monument cover. All monuments will be permanently marked with well identification numbers. The top of the well casing will be surveyed to calculate groundwater elevations and flow direction.

Development. Following installation, monitoring wells can be developed immediately. Each well will be developed by purging up to 10 casing volumes of groundwater from the well using a stainless-steel or disposable bailer and/or a submersible pump. Development will be considered complete after water from the well becomes visibly clear, 10 well casing volumes have been removed, or the well bails dry (whichever is less). Development water will handled in accordance with Section 5.4.

Quarterly Groundwater Sampling. New monitoring wells will be sampled no sooner than 12 hours after development. Four quarterly groundwater sampling events will be conducted on each shallow and deep monitoring well set (total of six groundwater monitoring events). One after the deep wells are installed, one after the shallow wells are installed, and four additional monitoring events on a quarterly basis.

After the groundwater levels are measured, each well will be purged at a low-flow rate using a peristaltic or submersible pump connected to disposable tubing. The tubing inlet will be placed approximately at the center of the well screen or if the water table is below the top of the screened interval, then the tubing inlet will be placed at the center of the monitoring well’s water column. To assess the effectiveness of purging, field parameters including pH, dissolved oxygen (DO), oxidation reduction potential (ORP), electrical conductivity, turbidity, and temperature will be measured by means of a flow-through cell. Purging will be considered complete when three casing volumes of water have been removed, the well purges dry, or field parameters stabilize to within 10 percent (whichever is less). If the well is purged dry, it will be allowed to recover before sampling is performed.

Monthly Water Level Monitoring. Between quarterly groundwater monitoring events, Tacoma Power personnel will collect groundwater level measurements monthly and provide the information as data tables to Ecology.

5.3.4 *Test Pits*

Hart Crowser will coordinate with a licensed excavator operator to provide excavation services for the advancement of the test pits (Figure 4). Twenty-four test pits (TP-16 through TP-39) with a contingency five test pits (TPH-40 through TP-44) if impacts are still observed. Each test pit will be advanced up to approximately 10 feet bgs (or possibly up to 15 feet or the maximum depth of the excavator's reach) for the collection and analysis of at least two soil samples per test pit.

Test pits will be abandoned by backfilling with the material that was excavated during the advancement in 5-foot intervals and tamped down with the excavator bucket.

5.3.5 *Potholes*

Hart Crowser will coordinate with a licensed vacuum-truck operator to provide potholing services. Fifteen potholes (PH-1 through PH-15 on Figure 4) will be advanced up to approximately 10 feet bgs (up to a maximum depth of 15 feet) for the collection and analysis of at least two soil samples per pothole. The diameter of the pothole ranges from 8 to 12 inches depending on if needing to scale up or down on the vacuum hose based on soil type and depth. Soil samples will be collected from the pothole sidewall or bottom either using a decontaminated hand auger or other hand tools.

Potholes will be abandoned by filling with hydrated bentonite chips or with bentonite grout to the surrounding grade, in accordance with the Minimum Standards for Construction and Maintenance of Wells (WAC 173-160).

5.3.6 *Grab Sediment Sampling*

Hart Crowser will collect up to 12 grab sediment samples (SS-1 through SS-12 on Figure 4) for chemical analysis from along the creek bed in areas upstream and downstream of the cap and across from the seep areas (Figure 4). Grab sediment samples will be collected to depths of 6 to 12 inches below mudline or until refusal. The grab sediment sampling will be conducted when water levels in Rainey Creek are at the seasonally low levels. If creek water levels are higher than anticipated (i.e. over a foot while standing in the creek) or other unsafe conditions are observed, sediment sampling will not continue and next steps will be discussed with Tacoma Power and Ecology.

5.3.7 *Surface Water Sampling*

Hart Crowser will collect up to 3 grab surface water samples (SW-1 through SW-3 on Figure 4) for chemical analysis from along the creek in areas located upstream of the ravine (for background data), adjacent to the protective cap, and downstream of the protective cap. Surface water samples will be collected using laboratory-provided containers that are dipped into the stream at the water's surface. The surface water sampling will be conducted twice when water levels in Rainey Creek are at the seasonal high (near the full-pool operating elevation of 749 feet) and seasonal low (approximately below an elevation of 735 feet) water levels.

5.3.8 *Soil Screening and Sampling*

Hart Crowser field personnel will collect soil samples generally at 2.5-foot intervals from the explorations; however, some samples may be collected up to 5-foot intervals from the boring explorations depending on sample recovery. Field screening will be performed on each sample for environmental impacts using physical observation, performing sheen tests, and measuring headspace vapor using a photoionization detector (PID). Additional information for soil screening and sampling is detailed in the SAP/QAPP (Appendix A).

5.3.9 *Laboratory Analysis and Quality Assurance and Quality Control*

Laboratory analyses will be completed consistent with the protocols described in the SAP/QAPP (Appendix A). The SAP/QAPP was designed to guide aspects of laboratory and field analytical quality procedures and QA/QC requirements for analytical sampling and analysis.

Soil and groundwater samples collected by Hart Crowser will be submitted under standard chain-of-custody procedures and will be analyzed as described in the SAP/QAPP.

5.3.10 *Cultural Resource Oversight*

If explorations need to occur beyond the current APE boundary, an experienced archaeological monitor will be present during the advancement of the explorations proposed in the upland areas of the Site to assess and document the presence of any culturally significant resources.

5.3.11 *Reporting*

Upon completion of field work and data analysis, Tacoma Power will prepare and submit a draft RI report to Ecology describing the work completed in accordance with the AO. Following preparation of the draft RI report, Tacoma Power will prepare a public review draft RI report after incorporating Ecology's comments on the draft RI report. Documentation of the fieldwork, data validation and QA/QC will be provided, along with an evaluation of the analytical results, and recommendations for further assessment, if applicable.

Additionally, Tacoma Power will prepare and submit to Ecology monthly groundwater level monitoring data tables and quarterly groundwater monitoring tables and figures following each quarterly event.

A technical memorandum will be prepared summarizing all quarters of groundwater monitoring data collected with tables, figures, chemical data quality review, and discussion of the results. Additional quarterly monitoring events and monthly water level monitoring events will be evaluated after the review of this report.

5.4 IDW Management

IDW will consist of excess soil cuttings, development and purged groundwater from borings and monitoring wells, decontamination water, and personal protective equipment (PPE). There are multiple methods for IDW disposal. The remote setting and potential public access to the on-site IDW storage will require immediate coordination and removal to prevent public disturbance of the IDW. The preferred method is to use the existing profiles and agreements for the soil and water disposed of during the 2019 investigation and construction activities and haul the soil and water IDW directly to the disposal facilities immediately after the field activities.

If existing profiles are not accepted by the disposal facility and direct haul is not possible, the contingency method described below will be adopted.

The contingency method is to have the soil IDW be placed in a roll off drop box and/or in labeled, Department of Transportation (DOT)-approved, 55-gallon steel drums. Water IDW will be placed in separately labeled, DOT-approved, 55-gallon steel drums. Associated samples collected from the RI activities will be used to profile the IDW for disposal. Once the analytical results are received and submitted to a permitted disposal or treatment facility for profile generation and approval, the IDW will be appropriately disposed of at the selected facility. Copies of all disposal documentation (e.g., manifests, weight tickets) for IDW will be provided in the final report.

6.0 PROJECT MANAGEMENT PLAN

6.1 Key Project Personnel

Kevin Smith is the Project Manager for Tacoma Power and is responsible for all management for the Project. Mr. Smith is also responsible for planning, creating, and/or managing all work activities, variances, tracking, reporting, communication, performance evaluations, staffing, and internal coordination, and project/program funding as it pertains to developing the project design/construction. The Tacoma Power

Project Manager also serves as the Project Coordinator who is the designated representative of the Site and the single point of contact and liaison with the Ecology's designated project coordinator Craig Rankine.

Chris Mattson is the Project Sponsor for Tacoma Power and serves as the primary champion for this project. Mr. Mattson will manage the initial project justification and overall benefits realization. The Project Sponsor has the authority to define scope and approve schedule and work plan and will provide overall guidance to the Project Manager throughout the project. Mr. Mattson is also responsible for reviewing and approving all changes to scope, schedule, costs baselines, and project deliverable and accepting or rejecting as appropriate and upon completion of the project approving final project closeout.

Mary Henley is the Environmental Coordinator for Tacoma Power and serves as the environmental clean-up subject matter expert and advisor to the team on environmental and regulatory aspects of the project. Ms. Henley will report work with the Tacoma Power Project Manager to coordinate all activities required to meet Ecology regulatory requirements, excluding Federal Energy Regulatory Commission (FERC) environmental requirements.

Matt Peter is the Natural Resources Coordinator for Tacoma Power and serves as the subject matter expert and advisor to the team to ensure that the Kosmos Site investigation and clean-up meet the terms and conditions of the FERC license and is responsible for Ecology regulation coordination. Mr. Peter is also responsible for necessary permitting that may include State Environmental Policy Act (SEPA), Tacoma Power's Hydraulic Project Approval (HPA), U.S. Army Corp of Engineers (USACE) 404 Nationwide Permit (NW), and WQPP.

Jessica Venson provides Administrative Support for Tacoma Power and is responsible for assisting the Project Manager in developing all clerical related documents (specifications, reports, etc.) in organizationally approved formats. Ms. Venson will also be responsible for scribing duties during all project meetings and maintaining all project communication distribution lists.

Julie Wukelic is the Senior Principal Engineer for Hart Crowser. Ms. Wukelic will be kept informed of the status of the project and of project activities. She will be provided with data, reports, and other project-related documents prepared by Hart Crowser before their submittal to the Client and/or Ecology. She will be responsible for communicating with the property owner, participating in discussions with Ecology, and coordinating on-site activities with the property owner and Hart Crowser.

Angie Goodwin is the Project Manager for Hart Crowser and will coordinate with project task leaders and will communicate with Ms. Wukelic. She will be responsible for allocating the resources necessary to ensure that the objectives of the Site assessment are and for preparing the draft RI and FS reports. Ms. Goodwin will review data, reports, and other project-related documents prepared by Hart Crowser before their submittal to the Client or to Ecology. Ms. Goodwin will also assist project staff with technical issues.

Andrew Kaparos is the Environmental Engineer for Hart Crowser. Mr. Kaparos will be responsible for implementing the investigation and for communication of project status to the project manager. Mr. Kaparos will also be responsible for technical assistance to assigned staff, as appropriate; assistance with resolution of technical or logistical challenges that may be encountered during the investigation; and assistance with field activities and report writing and review and will participate in discussions with Ecology.

Andrew Nakahara provides laboratory coordination and oversight, assists with field activities, and writes and reviews reports for Hart Crowser.

Jessica Blanchette provides health and safety management and support for Hart Crowser.

Craig Rankine is the Ecology Cleanup Project Manager overseeing the implementation of the Agreed Order, including reviewing and providing comments and recommendations of plans and documents outlined in the Agreed Order.

7.0 SCHEDULE

We anticipate conducting the GPR survey first in February of 2022. The exploratory borings, deep monitoring well installation, potholes, and test pit advancements will be scheduled in March of 2022, when water levels are expected to be lower. The shallow monitoring well installation will be scheduled for June of 2022 when seasonal high-water levels are expected. The shallow and deep monitoring wells sampling plan is included in Appendix A.

A utility check with the public and private locators will be completed before field work commences. It is assumed that the advancement of the sonic borings, including soil and groundwater sampling will be completed within approximately ten field days. The test pits and pothole explorations are expected to be completed within approximately ten field days. If Site conditions require additional days for field work, we will notify Ecology immediately.

It is assumed that laboratory analytical data will be available within two weeks following sample submittal. That data will be reviewed and evaluated, and a draft RI report will be prepared within 90 days of completing the field investigation.

8.0 LIMITATIONS

Work for this project will be performed 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 will be performed. It is intended for the exclusive use of Hart Crowser and Tacoma Power for specific application to the referenced property. This RI Work Plan is not meant to represent a legal opinion. No other warranty, express or implied, is made.

9.0 REFERENCES

AIRO 1993. Site Assessment Report, Former Kosmos Mill Site, Glenoma, WA. Prepared for Tacoma Public Utilities by Airo Environmental Services Inc. March 31, 1993.

API, 2012. Heavy Fuel Oils Category Analysis and Hazard Characterization. Prepared for the US Environmental Protection Agency by The American Petroleum Institute Petroleum HPV Testing Group

DOWL 1993. Site Characterization & Cleanup Action Report, Former Kosmos Townsite, Lewis County, WA. Prepared for Tacoma Public Utilities by DOWL Engineers, June 1993.

Ecology 2015. Cleanup Levels and Risk Calculation Master Table. August 2015 revision.

Hart Crowser 2021. Data Summary Report, Kosmos Mill Oil Cleanup, Kosmos Flats Area. Prepared for Tacoma Public Utilities. February 19, 2021

Hart Crowser 2019. Remedial Investigation Work Plan, Kosmos Mill Oil Cleanup, Kosmos Flats Area. Prepared for Tacoma Public Utilities. December 6, 2019.

Hart Crowser 2020. Draft Emergency Independent Remedial Action Completion Report, Kosmos Mill Oil Cleanup, Kosmos Flats Area. Prepared for Tacoma Public Utilities. June 5, 2020.

Seattle Deposition Reporters 1995. No. C94-5056B Kosmos Site 30(b)(6) Deposition. January 23, 1995.

Washington State Department of Ecology (WSDOE). 2007. Model Toxics Control Act Regulation. Chapter 173-340 WAC. 12 October.

L:\Notebooks\1949902_Kosmos_Mill_Add_Env_Assistance\Deliverables\Reports\RI Work Plan_123021\2021-1230-HCHA-Kosmos RIWP-F.docx

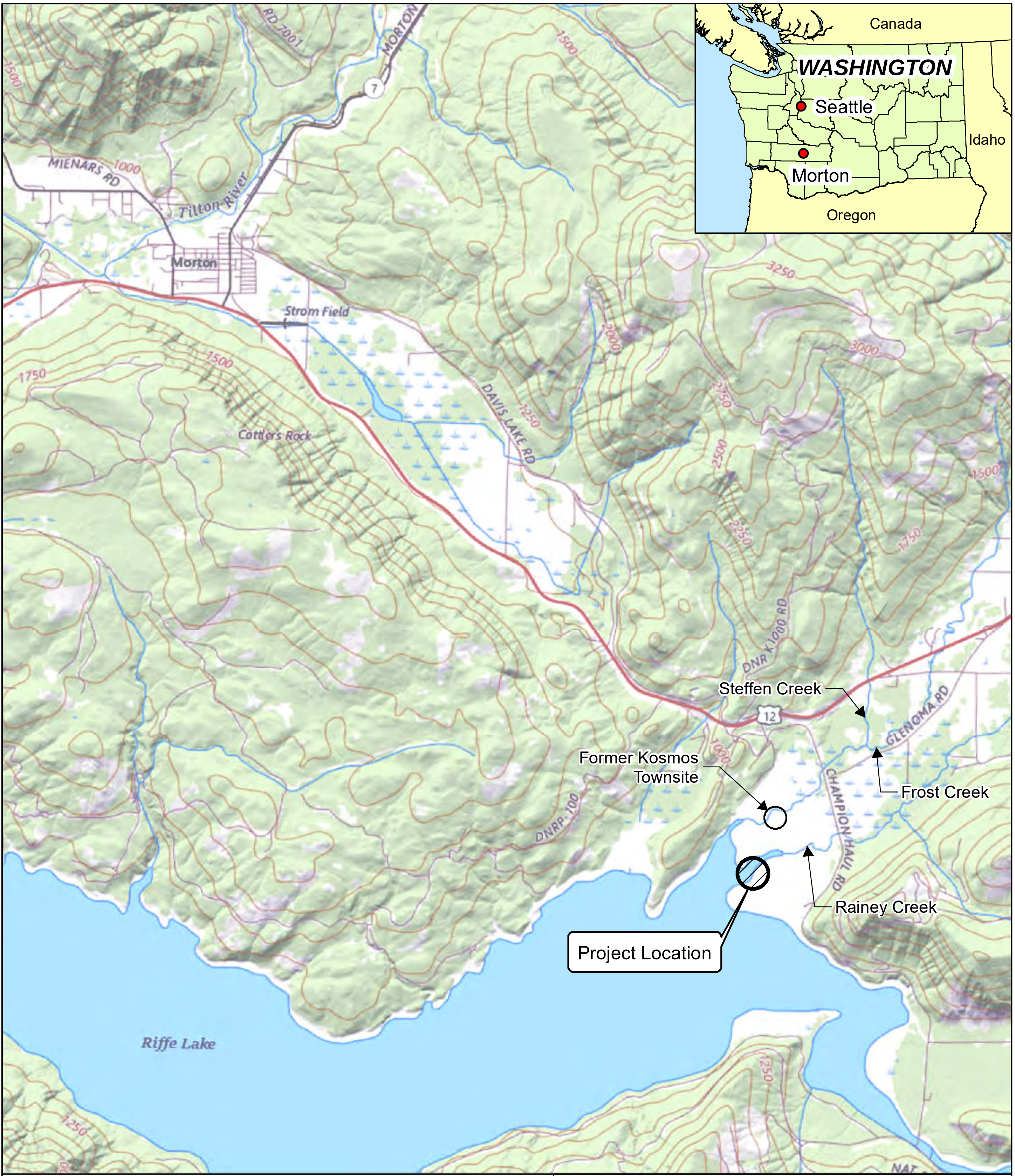
Table 1 - Remedial Investigation Exploration Locations

Exploration	Location Description	Latitude	Longitude
B-11	Ravine Area	46.49253130	-122.19118747
B-12	Upland Area South	46.49182411	-122.19072862
B-13	Upland Area West	46.49180909	-122.19193328
B-14	Upland Area Central	46.49219076	-122.19065888
B-15	Upland Area South	46.49170199	-122.19126487
B-16	Upland Area North	46.49248813	-122.19027743
B-17	Upland Area East	46.49228405	-122.18956669
MW-1D	Upland Area WesEast	46.49193465	-122.19031763
MW-1S	Upland Area WesEast	46.49196036	-122.19030223
MW-2D	Upland Area Central	46.49197774	-122.19092949
MW-2S	Upland Area Central	46.49200147	-122.19091851
MW-3D	Upland Area West	46.49217268	-122.19120685
MW-3S	Upland Area West	46.49219768	-122.19119007
MW-4D	Upland Area West	46.49196560	-122.19147553
MW-4S	Upland Area West	46.49198524	-122.19145234
TP-16	Ravine Area	46.49251372	-122.19091898
TP-17	Upland Area West	46.49206313	-122.19125445
TP-18	Upland Area West	46.49186411	-122.19155032
TP-19	Upland Area West	46.49176900	-122.19155830
TP-20	Upland Area West	46.49176271	-122.19138797
TP-21	Upland Area Central	46.49213952	-122.19083108
TP-22	Upland Area Central	46.49204380	-122.19053497
TP-23	Upland Area South	46.49179533	-122.19100852
TP-24	Upland Area Central	46.49202902	-122.19035389
TP-25	Upland Area South	46.49187917	-122.19044871
TP-26	Upland Area South	46.49187009	-122.19061580
TP-27	Upland Area South	46.49182165	-122.19029200
TP-28	Upland Area South	46.49118948	-122.19070882
TP-29	Upland Area South	46.49181809	-122.19009337
TP-30	Upland Area South	46.49112537	-122.19034140
TP-31	Upland Area East	46.49232347	-122.18969937
TP-32	Upland Area East	46.49223093	-122.18979634
TP-33	Upland Area East	46.49219817	-122.18960223
TP34	Upland Area East	46.49204443	-122.18978155
TP-35	Upland Area East	46.49186719	-122.18949495
TP-36	Upland Area East	46.49210629	-122.18925611
TP-37	Upland Area East	46.49261755	-122.18858866
TP-38	Upland Area East	46.49237466	-122.18879996
TP-39	Upland Area East	46.49234773	-122.18840901
TP-40 (a)	Upland Area Central	46.49226546	-122.19076612
TP-41 (a)	Upland Area Central	46.49180725	-122.19176579
TP-42 (a)	Upland Area South	46.49170422	-122.19171561
TP-43 (a)	Upland Area South	46.49165733	-122.19150061
TP-44 (a)	Upland Area South	46.49214999	-122.19045312

Table 1 - Remedial Investigation Exploration Locations

Exploration	Location Description	Latitude	Longitude
PH-1	Ravine Area	46.49244662	-122.19146482
PH-2	Ravine Area	46.49242952	-122.19135027
PH-3	Ravine Area	46.49234896	-122.19138946
PH-4	Ravine Area	46.49242748	-122.19114569
PH-5	Ravine Area	46.49232275	-122.19121310
PH-6	Ravine Area	46.49226165	-122.19128907
PH-7	Ravine Area	46.49242536	-122.19094653
PH-8	Ravine Area	46.49237905	-122.19103743
PH-9	Upland Area West	46.49230074	-122.19109298
PH-10	Upland Area West	46.49225530	-122.19095042
PH-11	South of Protective Cap	46.49204542	-122.19204032
PH-12	South of Protective Cap	46.49188212	-122.19203412
PH-13	South of Protective Cap	46.49210398	-122.19206537
PH-14	South of Protective Cap	46.49206022	-122.19212802
PH-15	Ravine Area	46.49254200	-122.19135800
SS-1	Upstream of Protective Cap	46.49266889	-122.19165134
SS-2	Upstream of Protective Cap	46.49264283	-122.19156262
SS-3	Upstream of Protective Cap	46.49262007	-122.19149124
SS-4	Adjacent to Protective Cap	46.49244693	-122.19191859
SS-5	Adjacent to Protective Cap	46.49241256	-122.19184184
SS-6	Adjacent to Protective Cap	46.49237710	-122.19177219
SS-7	Adjacent to Protective Cap	46.49231367	-122.19219290
SS-8	Adjacent to Protective Cap	46.49227999	-122.19213616
SS-9	Adjacent to Protective Cap	46.49223770	-122.19206202
SS-10	Downstream of Protective Cap	46.49211604	-122.19275081
SS-11	Downstream of Protective Cap	46.49203455	-122.19265974
SS-12	Downstream of Protective Cap	46.49195050	-122.19254147
SW-1	Upstream of Protective Cap and Ravine	46.49248994	-122.19149998
SW-2	Adjacent to Protective Cap	46.49227252	-122.19193919
SW-3	Downstream of Protective Cap	46.49191987	-122.19256560

B = Boring exploration.
MW = Monitoring well.
TP = Test pit exploration.
PH = Pothole exploration.
SW = Surface water sample location.
SS = Sediment sample location.
Coordinates are in North American Datum 1983 (NAD 83).
(a) Contingency test pit explorations.



0 0.5 1 2
Miles

Note: Feature locations are approximate.

N

Kosmos Mill Oil Cleanup
Morton, Washington

Vicinity Map

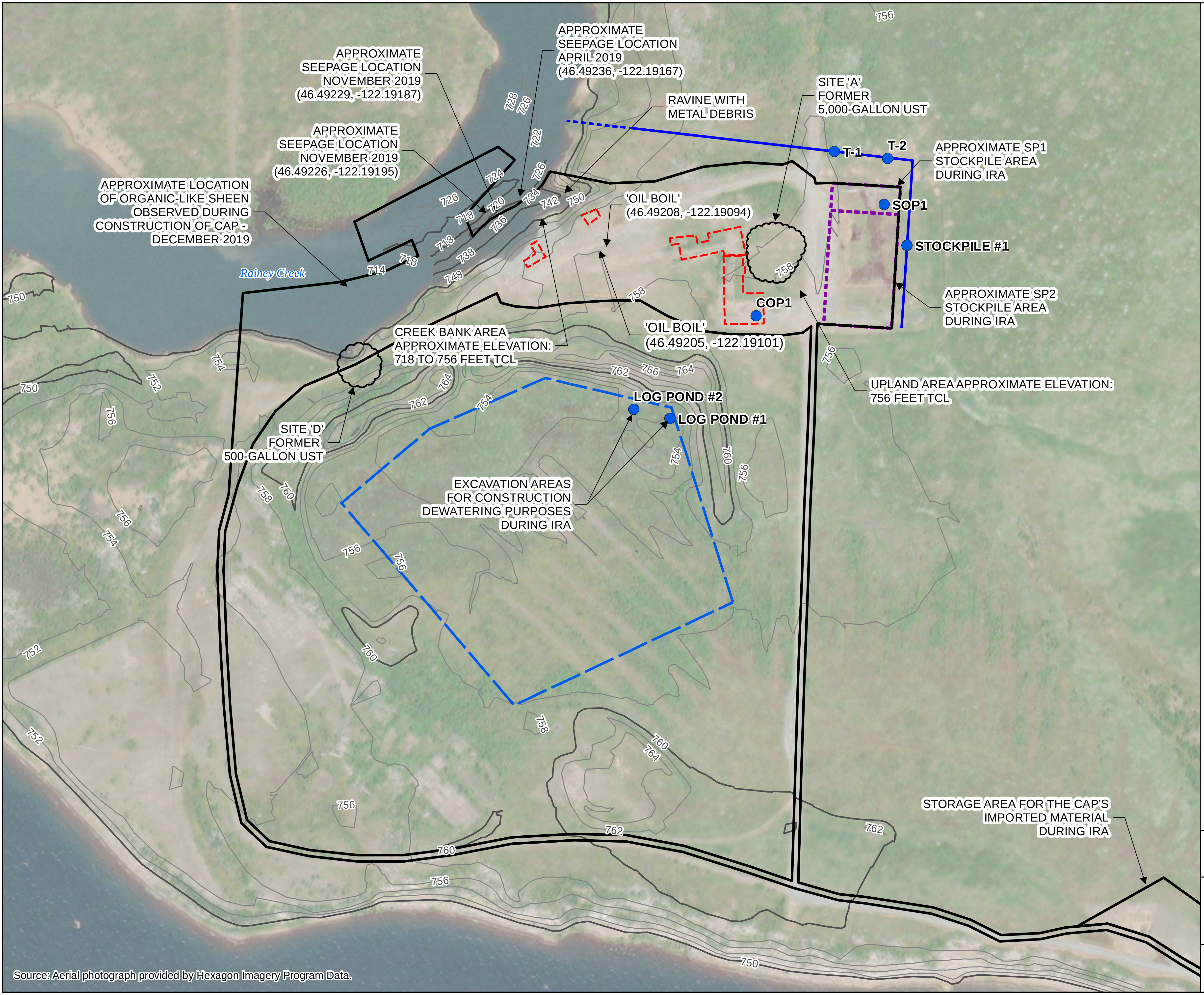
19499-02

12/21

HARTCROWSER
A division of Haley & Aldrich

Figure
1

Document Path: \\haleyaldrich.com\share\sea_projects\Notebooks\1949902_Kosmos_Mill_Add_Env_Assistance\GIS\MGIS\1949902_AA_VM.mxd Date: 12/6/2021 User Name: elindquist



Legend

- ● Ponded Water Sample (2020)
- Surface Water Diversion Trench
- ▭ 2019-2020 Area of Potential Effect
- Approximate Former Stockpile Area
- Approximate Location of Former Log Pond
- Old/Abandoned Building Concrete Slab

Notes:

1. Elevation contours, aerial photograph, and site features/locations provided by the City of Tacoma Public Utilities (TPU).
2. Contours derived from aerial 'flyover' done April 1998 when reservoir was at elevation 746.7 feet Tacoma City Light (TCL) datum. Contour interval is 2 feet.
3. Feature locations are approximate.
4. The emergency interim remedial action (IRA) began in November 2019 and was completed in February 2020.
5. Date of aerial photograph is 08/2019.
6. UST = underground storage tank.

N

0 100 200 400 Feet

Kosmos Mill
Morton, Washington

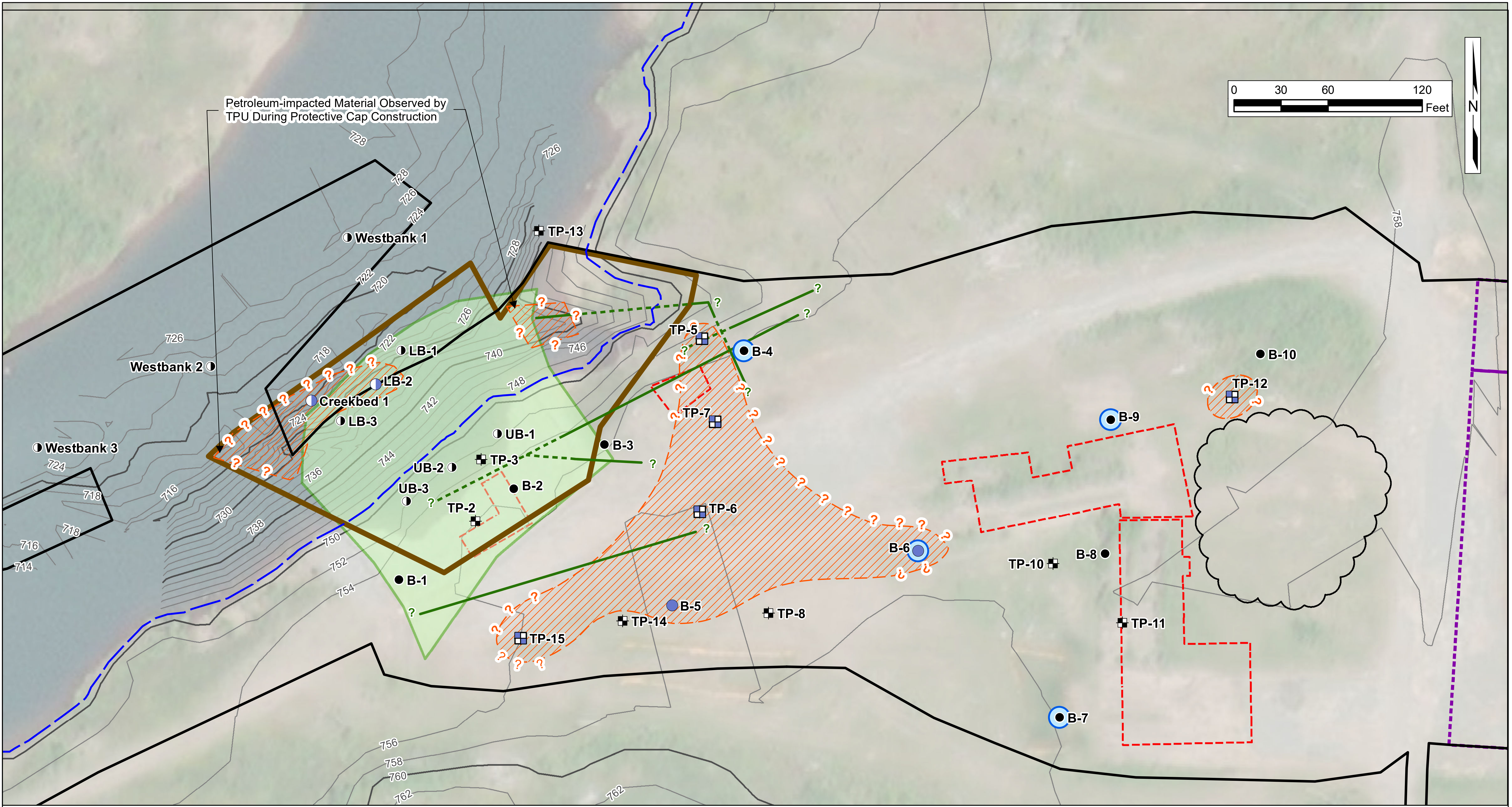
2019-2020 Site Features and Ponded Water Sample Locations

19499-02 12/21

HARTCROWSER
A division of Haley & Aldrich

Figure
2

Document Path: \\haleyaldrich.com\share\sea_projects\Notebooks\1949902_Kosmos_Mill_Add_Env_Assistance\GIS\MGIS\1949902_AD_SP-Extent.mxd Date: 12/28/2021 User Name: mschweitzer



Source: Aerial photograph provided by Hexagon Imagery Program Data.

Legend

- ● Sonic Boring (2019)
- ◑ Soil Sample (2019)
- ▣ Test Pit (2019)
- ○ Groundwater Sample (2019)
- Current Reservoir's Full-Pool Operating Elevation at 749 Feet TCL
- Pipe Encountered and Left in Place
- Pipe Encountered and Removed
- ? Unknown Pipe Extent
- 🟩 Approximate Area of Protective Cap
- Approximate Extent of IRA Excavation
- ☐ 2019-2020 Area of Potential Effect
- Approximate Former Stockpile Area
- Old/Abandoned Building Concrete Slab
- ▨ Approximate Extent of Petroleum-Contaminated Soil Remaining in Place

Notes:
1. Elevation contours, aerial photograph, and site features/locations provided by the City of Tacoma Public Utilities (TPU).
2. Contours derived from aerial 'flyover' done April 1998 when reservoir was at elevation 746.7 feet Tacoma City Light (TCL) datum. Contour interval is 2 feet.
3. Feature locations are approximate.
4. Exploration symbols shaded in blue are above Model Toxics Control Act (MTCA) Method A cleanup levels.
5. Date of aerial photograph is 08/2019.
6. UST = underground storage tank.
7. IRA = independent remedial action.

Kosmos Mill
Morton, Washington

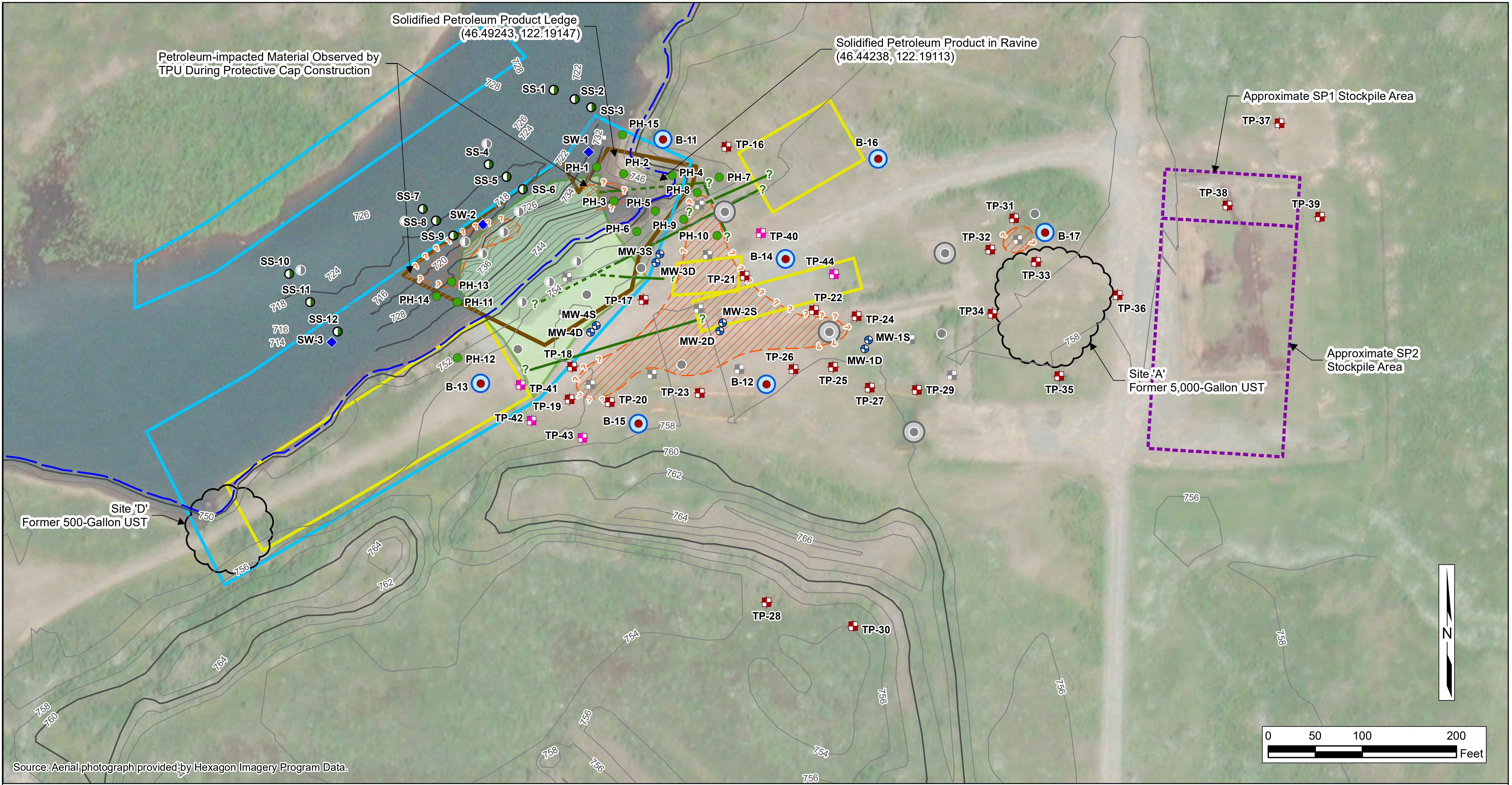
2019 Site and Exploration Plan

19499-02
12/21

HARTCROWSER
A division of Haley & Aldrich

Figure
3

Document Path: \\haleyaldrich.com\share\sea_projects\Notebooks\1949902_Kosmos_Mill_Add_Env_Assistance\GIS\MGIS\1949902_AC_SP-Extent.mxd Date: 12/28/2021 User Name: mschweitzer



Legend

- ◆ Proposed Surface Water Sample Location
- ◉ Proposed Boring with Groundwater Sample
- ⊕ Proposed Monitoring Well
- ● Proposed Vactor Truck Pothole
- ▣ Proposed Test Pit
- ◐ Proposed Grab Sediment Sample
- ▣ Proposed Contingency Test Pit
- ● Sonic Boring (2019)
- ◑ Soil Sample (2019)
- ▣ Test Pit (2019)
- ● Groundwater Sample (2019)
- — — Current Reservoir's Full-Pool Operating Elevation at 749 Feet TCL
- — Pipe Encountered and Left in Place
- - - - Pipe Encountered and Removed
- ? Unknown Pipe Extent
- ☐ Proposed GPR Area
- ☐ Proposed Visual Inspection Area
- 🟩 Approximate Area of Protective Cap
- ☐ Approximate Extent of IRA Excavation
- ☐ Approximate Former Stockpile Area
- ▨ Approximate Extent of Petroleum-Contaminated Soil Remaining in Place

Notes:
1. Elevation contours, aerial photograph, and site features/locations provided by the City of Tacoma Public Utilities (TPU).
2. Contours derived from aerial 'flyover' done April 1998 when reservoir was at elevation 746.7 feet Tacoma City Light (TCL) datum. Contour interval is 2 feet.
3. Feature locations are approximate.
4. Additional explorations may be advanced based off field observations.
5. TPU is currently working to expand the Project Area of Potential Effect (APE).
6. Date of aerial photograph is 08/2019.
7. UST = underground storage tank.
8. IRA = independent remedial action.

Kosmos Mill
Morton, Washington

Proposed Exploration Plan

19499-02
12/21

HARTCROWSER
A division of Haley & Aldrich

Figure
4

Document Path: \\haleyaldrich.com\share\sea_projects\Notebooks\1949902_Kosmos_Mill_Add_Env_Assistance\GIS\MGIS\1949902_AF_SP-Extent.mxd Date: 12/28/2021 User Name: mschweitzer

Source: Aerial photograph provided by Hexagon Imagery Program Data.

Legend

▨ Proposed Area of Potential Effect (APE) - Expanded

0 200 400 800 Feet

N

Kosmos Mill
Morton, Washington

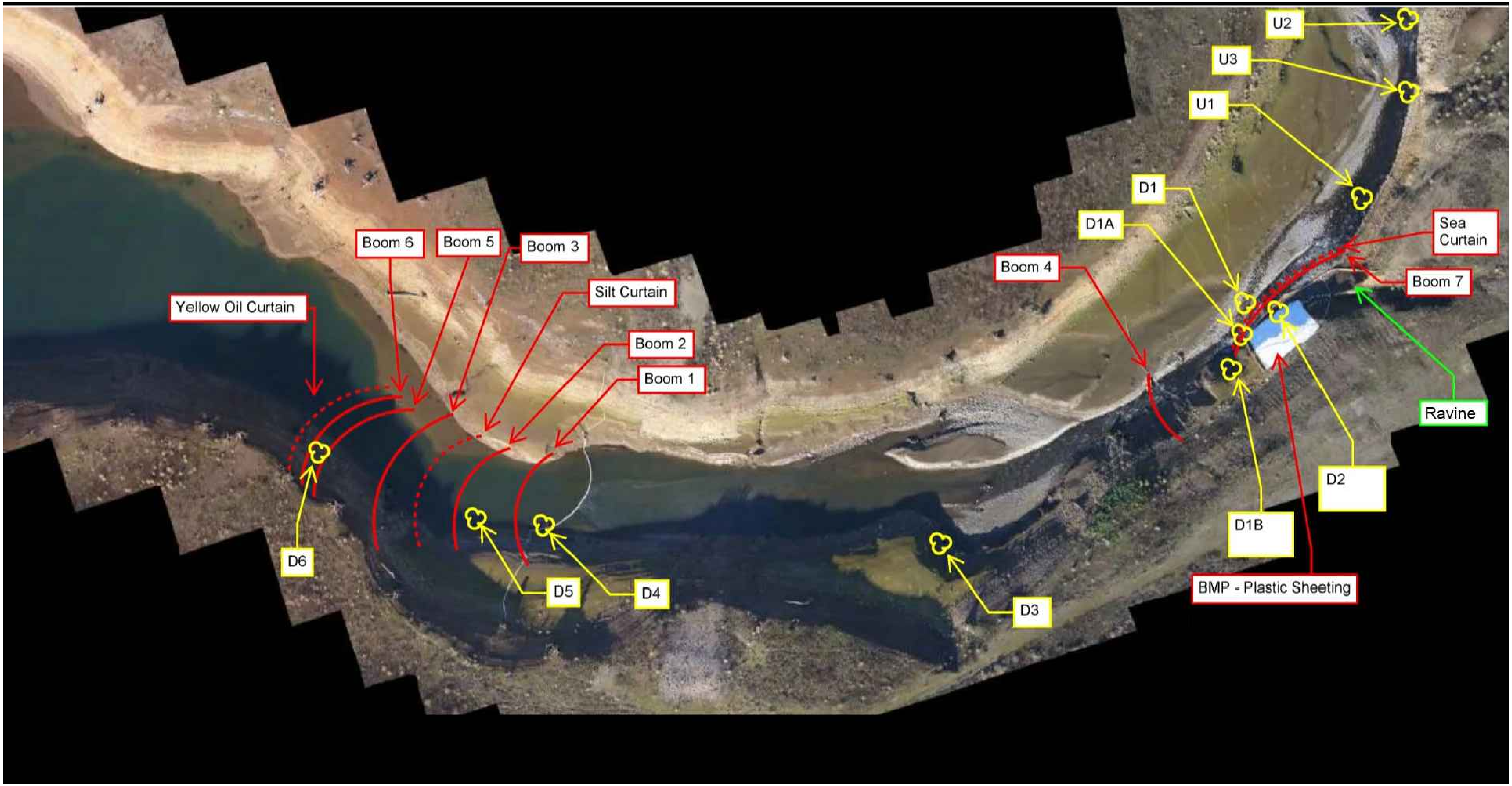
Proposed Area of Potential Effect Plan

19499-02 12/21

HARTCROWSER
A division of Haley & Aldrich

Figure
5

Document Path: \\haleyaldrich.com\share\sea_projects\Notebooks\1949902_Kosmos_Mill_Add_Env_Assistance\GIS\MGIS\1949902_AG_SP-Extent.mxd Date: 12/7/2021 User Name: elindquist



Notes:

BMP = Best Management Practice

1. Aerial for BMPs (noted in red) and creek sampling locations (noted in yellow) were provided by Tacoma Power.
2. BMPs were installed during the 2019 Independent Remedial Action (IRA).
3. BMPs were anchored to the shoreline either directly or with ropes.
4. In October 2019, plastic sheeting BMP was placed over observed petroleum seeps discovered in Spring and Fall of 2019.

Kosmos Mill
Morton, Washington

Best Management Practices and Creek Sampling Locations

19499-02
12/21

HART CROWSER
A division of Haley & Aldrich

Figure
6

File: \\haleyaldrich.com\share\sea_projects\Notebooks\1949902_Kosmos_Mill_Add_Env_Assistance\CAD\1949902_001_0001_Sampling_Locations.dwg Layout:BMPs Samp Date: 12-28-2021 Author: mschweitzer

APPENDIX A

Sampling and Analysis Plan/ Quality Assurance Project Plan

Appendix A - Sampling Analysis Plan/Quality Assurance Project Plan

Kosmos Mill Oil Cleanup

Kosmos Flats Area

A1.0 PROJECT DESCRIPTION

Hart Crowser, a division of Haley & Aldrich (Hart Crowser), has prepared this Sampling and Analysis Plan and Quality Assurance Project Plan (SAP/QAPP) consistent with the requirements of Washington Administrative Code (WAC) 173-340-820 for Tacoma Power. This document presents the organization, objectives, planned activities, and specific quality assurance/quality control (QA/QC) procedures associated with the former Kosmos Mill Site (Site) characterization data collection activities to be conducted as part of the Remedial Investigation (RI). This data collection effort is being performed as part of the Tacoma Power remedial investigation process to determine the types, sources, and extent of contamination of the oil seeps along the Rainey Creek bank and upland areas and develop cleanup levels appropriate for the media where contamination is discovered. The goal of the sampling is to obtain reliable data about physical, environmental, and chemical conditions at the Site in order to support the goals and objectives of the RI. The project goals and objectives are presented in the main text of the RI Work Plan.

The full source and extent of the oil seeps is not known. Therefore, to evaluate these potential sources and pathways, and to assist in developing the Conceptual Site Model (CSM) as part of the RI, this SAP/QAPP focuses on the proposed Site investigation to be conducted at the Site.

This SAP/QAPP provides guidance to field personnel involved in the data collection field activities to ensure that data quality is maintained. Any future changes to the data collection effort (such as changes in soil or test pit sample locations, sampling frequency, and/or chemical analyses) will be done during the Site investigation, discussed with Tacoma Power, and documented in the draft RI report.

Specific protocols for sampling, sample handling and storage, chain-of-custody, and laboratory and field analyses are described in this SAP/QAPP. Appendix B of the RI Work Plan presents the project-specific Health and Safety Plan (HASP). A copy of the SAP/QAPP and the HASP will be available in the field when completing the data collection activities.

The investigation will be performed in a phased approach, based on surface and groundwater conditions at the Site.

A2.0 FIELD SAMPLING PROCEDURES

A2.1 Site Access

Tacoma Power has granted access for Hart Crowser to conduct environmental investigation activities. Hart Crowser will coordinate activities directly with Tacoma Power and will notify the project manager before beginning work at the Site.

A2.2 Utility Location

Hart Crowser will arrange to have underground utilities located and marked prior to beginning any exploration activities. Hart Crowser will contact the Washington Utility Notification Center, who will in turn notify the various utilities in the area to mark any underground installations in the vicinity of the Site. Exploration locations will be adjusted if necessary, to avoid any underground utilities that are identified.

A2.3 Visual Inspections

Visual inspections will be performed to evaluate the condition of the cap, upland area, and creek bank. Generally, the inspections focus on:

- Identification of additional seeps, sources, or other signs of environmental impact in the upland area and along the Rainey Creek Bank.
- Verification the protective cap is performing as intended (physical isolation, soil stabilization, and chemical isolation).
    - Observations made of the surface water near the cap for the presence of floating materials, visible oil sheen, discoloration, turbidity, odor, etc. in Rainey Creek.

A2.4 GPR Survey

The purpose of the ground penetrating radar (GPR) survey is to further delineate the extent of the pipe network discovered at the Site and map subsurface anomalies. Approximately four areas will be surveyed using GPR and a time-domain electromagnetic system (EM61) or similar equipment. The final areas of the survey may be modified after work begins based on field observations and conditions at the Site. If the survey areas are modified, new locations will be chosen to better understand and characterize the extent of the pipe network and subsurface anomalies at the Site.

A2.5 Explorations and Soil and Grab Groundwater Sampling

The purpose of the test pits, potholes, and borings is to further delineate the vertical and horizontal extent of contamination. Some test pit and pothole locations will be located near potential source locations (e.g., near pipes and former building foundations) to potentially determine the source(s) of the oil seeps.

Approximately 15 borings (B-11 through B-17, MW-1S, MW-1D, MW-2S, MW-2D, MW-3S, MW-3D, MW-4S, and MW-4D) will be advanced using sonic drilling; 15 potholes (PH-1 through PH-15) will be advanced using a vacuum truck; and 24 test pits (TP-16 through TP-39) will be excavated, with a contingency 5 test pits (TP-40 through TP-44) if environmental impacts are observed in the upland central area to the southwest and northeast. The final locations (and numbers) of borings, potholes, and test pits may be modified after work begins based on field observations and conditions at the Site. If soil boring, potholes, or test pit locations are modified, new locations will be chosen near the proposed locations or at locations that will better understand and characterize the extent of contamination at the Site. There may be underground obstacles such as concrete slabs or other debris; therefore, multiple exploration attempts may be necessary. Ecology will be notified for any modifications of the exploration locations over 10 feet from proposed location.

It is expected that the shallow groundwater investigation (i.e., exploratory borings and monitoring well installations denoted with a “S” at the end of the well name) will be performed while groundwater elevations are higher (generally between the end of May and early September), while the deep groundwater investigation (i.e., exploratory borings, temporary reconnaissance wells, and monitoring well installations denoted with a “D” at the end of the well name), creek bank visual inspections, and subsurface soil investigations (i.e., potholes and test pits) will be conducted when surface and groundwater levels are lower (generally between September and early October). We anticipate that the proposed test pits and potholes will be advanced to depths of 10 to 15 feet below ground surface (bgs), shallow monitoring wells will be advanced to a depth of 20 feet bgs, the borings will be advanced to a depth of 50 feet bgs, and the deep monitoring wells will be advanced to a depth of 60 feet bgs. However, if field screening indicates that contamination may be present at greater depths in any of the explorations and/or if we do not encounter groundwater in borings, we may continue advancing the borings until we have delineated the vertical extent of contamination, until we encounter groundwater, or until we hit refusal up to a maximum depth of 60 feet bgs. The maximum depth of the test pits and potholes will be limited by the maximum reach of the equipment. Soil boring, test pit, and pothole locations will be determined using a handheld global positioning system device with sub-meter accuracy. Screening and sampling procedures during boring advancement are discussed below. If petroleum impacts are observed during field screening in the upland central area to the southwest and north east, we included up to 5 contingency test pit explorations that step-out approximately 50 to 60 feet from the potentially impacted area and to conduct another exploration. These contingency test pit explorations will be determined if needed in the field and Tacoma Power will be notified.

A2.5.1 Soil Screening

Soil obtained from explorations will be field screened for environmental impacts using physical observation, performing sheen tests, and measuring headspace vapor using a photoionization detector (PID). Visual and olfactory observations will be noted and may also be used to select samples for analysis. The effectiveness of field screening methods varies with temperature, moisture content, organic content, soil type, and age of the constituents. Soil screening tests may not be completed if limited soil volume is recovered. These techniques are discussed below.

Observation. For soil with relatively higher petroleum concentrations, there will likely be observable indicators of environmental impacts. Soil may be stained or discolored so that it is visibly noticeable compared to typical soil colors. Sheens may also cause the soil to have a shiny or glossy appearance. Odors may also be present ranging from very faint to strong and from sweet smelling to pungent. Odors are usually detected inadvertently during field activities and are usually noticeably different than typical odors in air.

Sheen Tests. A sheen test is a visual test to assess if a sheen is produced on water by the soil. A small volume of soil is placed in a pan partially filled with water and the water surface is observed for signs of sheen. Sheens are classified as described below.

Sheen Classification

Classification	Description
No sheen (NS)	No visible sheen on water surface.
Slight sheen (SS)	Light colorless film, spotty to globular; spread is irregular, not rapid, areas of no sheen remain, film dissipates rapidly.
Moderate sheen (MS)	Light to heavy film, may have some color or iridescence, globular to stringy, spread is irregular to flowing; few remaining areas of no sheen on water surface.
Heavy sheen (HS)	Heavy colorful film with iridescence; stringy, spread is rapid; sheen flows off the sample; most of the water surface may be covered with sheen.

PID Headspace Measurements. Headspace vapor screening is used to detect volatile organic vapors associated with volatile organic compounds (VOCs). The procedure includes placing a soil sample in a plastic bag and shaking the bag to expose the soil to the air trapped in the bag. PID measurements are made within 30 minutes of collection by opening the bag slightly and inserting the probe into the air space in the bag. The highest vapor reading is recorded for each sample. The PID measures concentrations in parts per million (ppm) and is calibrated to isobutylene prior to beginning the investigation. The PID can typically quantify organic vapor concentrations in the range of 0 to 1,000 ppm and is calibrated according to the manufacturer's recommendation (and at least once during or prior to the investigation).

A2.5.2 Soil Sampling

Soil samples will be collected from each exploration location. In general, soil samples will be collected for possible chemical analysis approximately every 2.5- or 5-feet. Soil samples will be collected for lithologic description, field screening, and chemical analyses, as described below. The sampling locations from within the boring may be modified in the field (based on field screening) if needed to delineate the vertical extent of impacts in soil (i.e., to bound the contamination by collecting one sample above observed impacts, one from within the impacted zone, and one from beneath the suspected impacted zone).

Soil-sampling equipment will be decontaminated before it is used at each sampling location. Where disposable (one-time use) equipment is used, it will be properly discarded after use at one sample, and a new piece will be used for the next sample. Soil samples will be obtained by hand, using a new, uncontaminated glove; or with a decontaminated stainless-steel spoon, trowel, or knife. Soil that will be analyzed for VOCs and gasoline-range organics (TPH-G) will be transferred directly from freshly exposed soil into laboratory-supplied containers using the appropriate U.S. Environmental Protection Agency (USEPA) 5035A sampling procedures. The samples will be placed in 40-milliliter vials. Depending on the soil type, 5 milligrams of soil will be added to the vials preserved with sodium bisulfate monohydrate or methanol. A soil sample will also be collected in an unpreserved glass jar for analysis of diesel- and oil-range petroleum hydrocarbons (TPH-D and TPH-O, respectively), metals, and/or polycyclic aromatic hydrocarbons (PAHs). Laboratory methods are provided in Section A4.0.

The following options are considered industry-standard sampling techniques and may be used for soil sample collection. Soil samples will be collected directly from the soil cores from the sonic borings. Samples will be collected from within the bucket of the backhoe or excavator at the test pits. The material sampled will not have been in contact with the bucket. The pothole explorations are generally 8 to 12 inches in diameter but can vary depending on soil type and depth. Samples from the potholes side walls will be collected using clean/decontaminated hand tools such as clean stainless-steel spoons or a cleaned hand auger. To prevent cross-contamination between samples, samples will be collected from soil material that has not come into contact with the backhoe, drill casings, or vactor equipment, and hand tools (and other sampling equipment) will be decontaminated between samples.

During drilling, a description of soil conditions and visual and olfactory observations will be recorded on boring logs by a geologist or hydrogeologist licensed in the State of Washington, or by a person working under the direct supervision of a Washington-State-licensed geologist or hydrogeologist in accordance with American Society for Testing and Materials (ASTM) Method D2488. Soil samples will be labeled according to the boring number and the order the sample was collected (e.g., B11-S1). The soil from temporary borings will be field screened for organic vapors using a PID and sheen testing will be performed. Soil and groundwater observations and sample parameters will be recorded on field sampling data sheets.

Sample containers will be packed in iced shipping containers (coolers) with chain-of-custody documentation and delivered or shipped to the laboratory. Generally, one duplicate soil sample will be collected for every 20 samples collected.

A2.5.3 Grab Groundwater Sampling

Grab groundwater samples will be collected from borings using conventional methods associated with the drilling method (e.g., inertia or peristaltic pump). Temporary well screens will be set in the boreholes as described below. It is assumed that grab groundwater samples will be collected from 7 temporary wells if sufficient groundwater is encountered in the sonic borings (locations shown on Figure 4 of RI Work Plan).

Prior to setting the screen and any groundwater sample collection and purging, field staff will measure and record the depth to water using an electronic water-level probe (an oil-water interface probe may be used if free product is observed in the boring).

Each temporary well will be constructed of a 2-inch-diameter Schedule 40 PVC casing with a 5-foot-long, 0.010-inch-slot capped screen and the top of the screen casing will be placed one foot above the observed water table. The well casing and screen will be lowered down the inside of the 8-inch drill casing and a clean silica sand pack (10/20 sand) will be placed between the boring wall and the PVC screen from the bottom of the well to approximately 1 to 2 feet above the screened interval. The drillers will measure the open-hole depth outside the temporary well casing before and during sand placement to confirm the sand is being placed at the correct interval. If material has sloughed at the bottom, the drillers would remove any excess material until the bottom of the boring is at the requested depth. Then the drill casing is raised to expose the sand pack and screened interval to the water formation. Each temporary well will be developed to remove suspended particulates by removing up to three casing volumes using a development pump, bailer, or similar.

The temporary wells will be sampled using low-flow groundwater sampling techniques. Purging and sampling will be conducted at a depth representing the middle of the standing water in the screen or middle of the screen if fully submerged.

Groundwater will be purged before sample collection, using new polyethylene tubing and a stainless-steel submersible pump. During purging, a water quality meter will be used to collect parameters, which will have been calibrated per the manufacturing recommendations prior to field use. The water quality parameters include dissolved oxygen; pH; redox potential; specific conductance; temperature; and turbidity. Purging will be considered complete when the equivalent of one casing volume of water have been removed, the well purges dry, or field parameters stabilize to within 10 percent for three consecutive readings (whichever is less). If the well is purged dry, it will be allowed to recover before sampling is performed.

The laboratory-supplied sample bottles will be filled directly from the polyethylene tubing at relatively low flow rates. Field filtering will be performed for the dissolved metals analysis. Groundwater samples will be labeled according to the boring number (e.g., HCB11-GW). One duplicate grab groundwater sample will be collected from one location during the sampling event. Laboratory analyses and methods are provided in Section A4.0.

To prevent cross-contamination of the wells, new disposable polyethylene tubing will be used for each groundwater sample location, and the water-level probe will be decontaminated between wells.

A2.5.4 Boring and Pothole Decommissioning

When a boring or pothole exploration is no longer needed, it will be decommissioned with hydrated bentonite chips or with bentonite grout in accordance with the WAC for Minimum Standards for Construction and Maintenance of Wells (WAC 173-160).

A2.5.5 Test Pit Spoils

Test pit soils will be excavated and placed beside the test pit excavation in an organized manner in groupings of 5-foot depth intervals. The test pit spoils will be returned to the excavation in in the order it was removed within the 5-foot intervals and tamped down by the excavator.

A2.6 Monitoring Well Construction and Development

Eight of the borings will be completed as monitoring wells after soil screening and sampling are completed. The four deep wells will be installed during the low water level season and the four shallow wells will be installed during the high-water level season. All wells will be installed and constructed in general accordance with the Minimum Standards for Construction and Maintenance of Wells (WAC 173-160).

A2.6.1 Construction

Each monitoring well will be constructed of a 2-inch-diameter Schedule 40 PVC casing with a 10- to 20-foot-long, 0.010-inch-slot screen, the top of the screen will be placed 1 foot above the observed water table. We anticipate that most of the shallow wells will be screened at depths ranging between 10 to 20 feet bgs and the deep wells will be screened from 40 to 60 feet bgs. However, boring depth will be determined based on soil field screening results and depth of groundwater.

A clean silica sand pack (10/20 sand) will be placed between the boring wall and the PVC screen from the bottom of the well to approximately 1 to 2 feet above the screened interval. A minimum 3-foot bentonite seal will be placed above the sand to within 1 or 2 feet of the ground surface. A concrete surface seal will secure a flush-mounted, traffic-rated monument. The monument cover will be secured with bolts. A unique Ecology well tag ID will be placed in each monument.

A2.6.2 Elevations

To calculate subsequent groundwater level elevations, the tops of the casings of the monitoring wells will be measured to the nearest 0.01 foot by a licensed surveyor and referenced to the Tacoma City Light (TCL) datum.

A2.6.3 Development

Following installation, monitoring wells will be developed at least 12 hours after construction. The depth to water and depth to sediment in each well will be measured using an electronic water-level probe before starting well development. Wells will be developed by surging groundwater with a stainless-steel or disposal polyethylene bailer and pumping with a submersible pump until either (a) water from the wells becomes visibly clear, (b) turbidity measurements stabilize to within 10 percent for three successive casing volumes, (c) a minimum of 10 well volumes are purged, or (d) the well bails dry. See Section A2.11 for well development water storage and disposal.

A2.6.4 Documentation

We will document our observations and development activities in our field notes and forms. Observations will include, but are not limited to, groundwater levels, development water characteristics (e.g., color, turbidity, sheens), and development purge volumes.

A2.7 Monitoring Well Sampling and Groundwater Level Monitoring

The monitoring wells will be sampled no sooner than 12 hours after development. Four quarterly groundwater monitoring events will be completed for each shallow and deep well set. One event after the installation of the deep monitoring wells, one event after the installation of the shallow monitoring wells, and four additional monitoring events on a quarterly basis. After the quarterly groundwater monitoring events have been completed, the groundwater water monitoring event schedule and analytes will be reevaluated.

A2.7.1 Measurement of Groundwater Levels

Prior to purging, groundwater levels in the wells will be measured to the nearest 0.01 foot using an electronic water-level probe.

Between groundwater sampling events, Tacoma Power will collect water level measurements and provide the data to Ecology on a monthly basis.

A2.7.2 Purging

After groundwater levels are measured, each well will be purged at a low flow rate using a peristaltic or submersible pump fitted with clean, disposable tubing. The tubing inlet will be placed approximately at the middle of the well screen or if water levels are below the top of the screen, the tubing will be placed in the middle of the water column. Tubing will be used one time and appropriately discarded. To assess the effectiveness of purging, pH, electrical conductivity, temperature, dissolved oxygen, and oxidation-reduction potential will be measured by means of a flow-through. Results of these measurements will be included in the field notes. Purging will be considered complete when three casing volumes of water have been removed, the well purges dry, or field parameters stabilize to within 10 percent for three consecutive readings (whichever is less). If the well is purged dry, it will be allowed to recover before sampling is performed.

A2.7.3 Sampling

After purging of a well is complete, a groundwater sample (labeled with the well name) will be collected using the same equipment used for purging and low-flow groundwater sampling techniques. The laboratory-supplied sample bottles will be filled directly from the polyethylene tubing. Volatile organic analysis (VOA) containers will be filled leaving no headspace. Field filtering will be performed for the dissolved metals analysis. For QA/QC purposes, one field duplicate (labeled as the well name with a “-D” at the end) will be collected.

A2.7.4 Documentation

Observations made during groundwater sampling activities will be documented in field notes. Observations will include, but are not limited to, groundwater levels, purge water characteristics (e.g., color, turbidity, sheens), purge volumes, field parameter measurements, and sampling time.

A2.7.5 Reporting

Tacoma Power will prepare and submit to Ecology monthly groundwater level monitoring data tables and quarterly groundwater monitoring data tables and figures following each quarterly event.

A technical memorandum will be prepared summarizing the quarterly groundwater monitoring data collected with tables, figures, chemical data quality review, and discussion of the results. Additional quarterly monitoring events and monthly water level monitoring events will be evaluated after the review of this report.

A2.8 Grab Sediment Sampling

Hart Crowser will collect up to 12 grab sediment samples (labeled SS-1 through SS-12) from the Rainey Creek bed in areas located upstream of the protective cap, adjacent to the seep locations, and downstream of the cap. The grab sediment sampling will be conducted during seasonal low water levels in Rainey Creek.

Samples will be collected using a hand auger or other hand tools. The samples will be collected below the mud line at 6-inch intervals until refusal is met. If creek water levels are deeper than 1 foot or conditions appear unsafe, samples will not be collected using hand tools and next steps will be discussed with Tacoma Power and Ecology.

Sediment sampling equipment will be decontaminated before it is used at each sampling location. Where disposable (one-time use) equipment is used, it will be properly discarded after use at one sample, and a new piece will be used for the next sample. Sediment samples will be obtained by hand using a new, uncontaminated glove or with a decontaminated stainless-steel spoon, trowel, or knife. Sediment that will be analyzed for VOCs and TPH-G will be transferred directly from freshly exposed sediment into laboratory-supplied containers using the appropriate U.S. Environmental Protection Agency (USEPA) 5035A sampling procedures. The samples will be placed in 40-milliliter vials. Depending on the soil type, 5 milligrams of soil will be added to the vials preserved with sodium bisulfate monohydrate or methanol. Additional sediment will also be collected in an unpreserved glass jar (provided by the laboratory) for analysis of TPH-D and TPH-O, metals, PAHs, and total organic carbon (TOC). Laboratory methods are provided in Section A4.0.

A2.9 Surface Water Sampling

Hart Crowser will collect up to 3 grab surface water samples from along the creek in areas located upstream of the ravine (sample SW-1, for background data), adjacent to the protective cap (SW-2), and downstream of the protective cap (SW-3). The surface water sampling will be conducted twice, once during high water levels and once during low water levels in Rainey Creek.

Samples will be collected using a sampler tool that holds laboratory-supplied containers attached to an extendable pole. The sample containers will be submerged at the water’s surface. Field parameters of pH and turbidity will be measured at each sample location. The field meters will be calibrated per manufacturing recommendation prior to the sampling event.

A2.10 Decontamination Procedures

Reusable field sampling equipment will be decontaminated between each sample by washing with tap water and Alconox detergent (or equivalent), rinsing with tap water, and then completing a second rinsing with distilled or deionized water.

Staff will wear disposable nitrile gloves during all sampling, decontamination, and sample handling activities. To prevent cross contamination of samples, staff will discard used gloves after completing a sample and put on a fresh pair of gloves before starting work on the next sample.

A2.11 IDW Management

During the above activities, soil drill and vacuum cuttings, development and purged groundwater, decontamination water, and other IDW will be generated and will require appropriate management. Material from the test pit explorations will be placed back into the exploration once sampling is completed.

There are multiple methods for IDW disposal. The preferred method is to use the existing profiles and agreements for the soil and water disposed of during the 2019 investigation and construction activities and haul the soil and water IDW directly to the disposal facilities. However, if existing profiles are not accepted by the disposal facility and direct haul is not possible a contingency method will be adopted. The handling and disposal of specific types of IDW are discussed below. Copies of all disposal documentation (e.g., manifests, weight tickets) for IDW will be provided in the final report.

A2.11.1 Soil

Drill soil cuttings will be placed in drums and stored on-site until after drilling is complete. A vacuum truck will collect the soil cuttings and haul directly to the disposal facility. The pothole spoils will be hauled by the vacuum truck directly to the disposal facility. As a contingency if we are not able to use the existing profile with the disposal facilities, the soil IDW (from drill and pothole spoils) will be placed in a roll off drop box and/or in labeled, 55-gallon steel drums. Associated samples collected from the RI activities will be used to profile the soil IDW for disposal. Upon receipt of the chemical analysis, the IDW will be appropriately disposed of at a permitted disposal or treatment facility.

A2.11.2 Water

Water IDW collected from development, purging, and decontamination activities will be placed in labeled, 55-gallon steel drums and stored on-site until after drilling and groundwater sampling is complete. A vacuum truck will collect the water IDW and haul directly to the disposal facility. As a contingency if we are not able to use the existing profile with the disposal facilities, the IDW will just be stored in drums on-site. Associated samples collected from the RI activities will be used to profile the water IDW for disposal. Upon receipt of the chemical analysis, the IDW will be appropriately disposed of at a permitted disposal or treatment facility.

A2.11.3 Disposable Sampling Equipment and Personal Protective Equipment (PPE)

Disposable sampling equipment (e.g., sample tubing) and PPE will be placed in plastic bags after use and disposed of as solid waste.

A3.0 SAMPLE HANDLING PROCEDURES

A3.1 Sample Preservation and Holding Times

Samples will be preserved according to the requirements of the specific analytical methods to be employed, and all samples will be extracted and analyzed within method-specified holding times. Required sample containers, preservatives, and holding times for soil, water, and sediment testing are summarized in Tables A-1 through A-3, respectively.

A3.2 Chain of Custody and Shipping Procedures

A3.2.1 Chain of Custody Procedures

Chain of custody forms will be used to document the collection, custody, and transfer of samples from their initial collection location to the laboratory. Each sample will be entered on the custody form immediately after it is collected.

Sample custody procedures will be followed to provide a record that can accompany a sample as it passes from collection through analysis. A sample is considered to be in custody if it meets at least one of the following conditions:

- It is in someone's physical possession or view;
- It is secured to prevent tampering (i.e., custody seals); and/or
- It is locked or secured in an area restricted to authorized personnel.

A chain of custody form will be completed in the field as samples are packaged. At a minimum, the information on the custody form will include the sample number, date and time of sample collection, sampler, analysis, and number of containers. A copy of the custody form will be placed in the cooler with its respective samples before the container is sealed for delivery to the laboratory. Another copy will be retained and placed in the project files after review by the project manager. Custody seals will be placed on each cooler or package containing samples so the package cannot be opened without breaking the seals.

A3.2.2 Sample Shipping/Delivery Procedures

After sample containers have been filled, they will be placed in new/clean ziplock bags and packed with ice in secured bags in coolers. The coolers will be transferred to an Ecology-accredited laboratory (Friedman & Bruya Environmental Labs) for chemical analysis. Chain of custody procedures will commence in the field and will track delivery of the sample to the analytical laboratory. Specific procedures are:

- Individual sample containers will be packed to prevent breakage;
- Custody forms will be enclosed in a plastic bag and taped to the inside lid of the cooler;

- Signed and dated custody seals will be placed on all coolers before shipping;

- Samples will be hand-delivered to the laboratory by Hart Crowser personnel or courier;

- When sample possession is transferred to the laboratory, the custody form will be signed by the persons transferring custody of the coolers; and

- Upon receipt of samples at the laboratory, the shipping container custody seal will be broken, and the sample-receiving custodian will compare samples with information on the chain of custody form and record the condition of the samples received.

A4.0 LABORATORY ANALYSES

Soil samples will be selected based on field screening results and location of the sample near previous soil sample exceedances. Selected soil samples and grab sediment samples will be analyzed for one or more of the following analyses:

- TPH-D and TPH-O by Ecology Method NWTPH-Dx;
- TPH-G by Ecology Method NWTPH-Gx;
- EPH by Ecology Method NWEPH;
- VPH by Ecology Method NWVPH;
- PAHs by EPA Method 8270E;
- VOCs by EPA Method EPA 8260D;
- Total metals (arsenic, barium, cadmium, chromium III, copper, lead, mercury, nickel, selenium, silver, and zinc) EPA Methods 6020B/1631E;
- Chromium VI by EPA 7196 or SM 3500 Cr B; and
- TOC (sediment only) by EPA 9060/SM 5310.

All groundwater samples will be analyzed for the following analyses:

- TPH-D and TPH-O by Ecology Method NWTPH-Dx;
- TPH-G by Ecology Method NWTPH-Gx;
- EPH by Ecology Method NWEPH;
- VPH by Ecology Method NWVPH;
- PAHs by EPA Method 8270E;
- VOCs by EPA Method EPA 8260D;
- Total and dissolved metals (arsenic, barium, cadmium, chromium III, copper, lead, mercury, nickel, selenium, silver, and zinc) EPA Methods 6020B/1631E;
- Chromium VI by EPA 7196 or SM 3500 Cr B; and
- Total Suspended Solids (TSS) by SM 2540D.

All grab surface water samples will be analyzed for the following analyses:

- TPH-D and TPH-O by Ecology Method NWTPH-Dx;

- TPH-G by Ecology Method NWTPH-Gx;
- cPAHs by EPA Method 8270E/625.1 Mod;
- Benzene, toluene, ethylbenzene, and xylene (BTEX) by EPA Method EPA SW 846/8260D;
- Total metals (arsenic, cadmium, copper, lead, nickel, and zinc) EPA Methods 6020B/200.8;
- Trace-level mercury by EPA Method 1631E; and
- Chromium VI by EPA SM 3500 Cr-B.

Screening levels and reporting limits for soil, groundwater, sediment, and surface water are presented in Tables A-4 through A-7, respectively.

A5.0 QUALITY ASSURANCE AND QUALITY CONTROL

The laboratory reports will be reviewed by a Hart Crowser technical specialist to ensure conformance with project standards, provide additional data qualifications as appropriate, and verify that the data are acceptable for the purposes of the project. This includes reviewing holding times, reporting limits, method blanks, surrogate recoveries, laboratory duplicate relative percent differences (RPDs), calibration criteria (as provided), spike blank/spike blank duplicate (SB/SBD) recoveries, and matrix spike/matrix spike duplicate (MS/MSD) recoveries. Tables A-8 through A-13 summarize the quality control criteria for each analyte.

A5.1 Data Quality Indicators

The overall quality assurance objectives for field sampling, field measurements, and laboratory analysis are to produce data of known and appropriate quality. The procedures and quality control checks specified herein will be used so that known and acceptable levels of accuracy and precision are maintained for each data set. This section defines the objectives for accuracy and precision for laboratory data. These goals are primarily expressed in terms of acceptance criteria for the quality control checks performed.

A5.1.1 Precision

Precision is the degree of reproducibility or agreement between independent or repeated measurements. Analytical variability will be expressed as the RPD between laboratory replicates and between MS and MSD analyses. RPD will be used to measure precision for this investigation and is defined as follows:

$$RPD = \frac{(D_1 - D_2)}{(D_1 + D_2)/2} \times 100$$

Where

D_1 = sample value
D_2 = duplicate sample value

A5.1.2 Accuracy

Accuracy is the agreement between a measured value and its true or accepted value. While it is not possible to determine absolute accuracy for environmental samples, analysis of standards and spiked samples provides an indirect assessment of accuracy.

Laboratory accuracy will be assessed as the percent recovery of MSs, MSDs, surrogate spiked compounds (for organic analyses), and laboratory control samples. Accuracy will be defined as the percentage recovery compared with the true or accepted value and is defined as follows:

$$\%\ Recovery = \frac{(SSR - SR)}{SA} \times 100$$

Where

SSR = spiked sample result
SR = sample results (not applicable for surrogate recovery)
SA = amount of spike added

A5.1.3 Representativeness

Representativeness expresses the degree to which sample data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, or an environmental condition. The sampling program will be designed carefully to see that sample locations are selected properly, sufficient numbers of samples are collected to accurately reflect conditions at the Site, and samples are representative of sample locations. A sufficient sample volume will be collected at each sampling point to minimize bias or errors associated with sample particle size and heterogeneity.

A5.1.4 Comparability

Comparability is a qualitative parameter expressing the confidence with which one data set can be compared with another. So that results are comparable, samples will be analyzed using standard EPA methods and protocols as described in Test Methods for Evaluating Solid Wastes, Physical/Chemical Methods (EPA 1986). Data will also be reviewed to verify that precision and accuracy criteria have been achieved and, if not, that data have been appropriately qualified.

Field personnel will collect samples in a consistent manner at all sampling locations so that all data collected as part of this study are comparable. Comparability is attained by careful adherence to standardized sampling and analytical procedures, based on rigorous documentation of sample locations (including depth, time, and date).

A5.1.5 Completeness

Completeness is the percentage of measurements made that are judged to be valid. Completeness will be calculated separately for each analytical group (e.g., TPHs and VOCs). For results to be considered complete, all quality control check analyses required to verify precision and accuracy must have been performed. Data qualified as estimated during the validation process will be considered complete. Results that are rejected during the validation review or samples for which no analytical results were obtained will be considered non-valid measurements. Completeness will be calculated for each analysis using the following equation:

$$Completeness = \frac{valid\ data\ points\ obtained}{total\ data\ points\ planned} \times 100$$

The target goal for completeness is a minimum of 95 percent. Completeness will be monitored on an on-going basis so that archived sample extracts can be reanalyzed, if required, without remobilization.

A5.2 Data Quality Assurance Review

Hart Crowser will independently review the quality of the chemical analytical results provided by the laboratory. The data quality report will assess the adequacy of the reported detection limits in achieving the project screening levels; the precision, accuracy, representativeness, and completeness of the data; and the usability of the analytical data for project objectives. Exceedances of analytical control limits will be summarized and evaluated.

A data evaluation review will be performed on an all results using quality control summary sheet results provided by the laboratory for each report. Data evaluation reviews are based on the quality control requirements previously described and follow the format of the EPA National Functional Guidelines for Organic Superfund Methods Data Review (EPA 2017), modified to include specific criteria of individual analytical methods. The laboratory will be contacted to obtain raw data (instrument tuning, calibrations, instrument printouts, bench sheets, and laboratory worksheets) if any problems or discrepancies are discovered during the routine evaluation.

The data evaluation review will verify:

- That sample numbers and analyses match the chain of custody request;
- Sample preservation and holding times;
- That instrument tuning, calibration, and performance criteria were achieved;
- That laboratory blanks were analyzed at the proper frequency and that no analytes were present in the blanks;
- That laboratory duplicates, MSs, surrogate compounds, and laboratory control samples were run at the proper frequency and that control limits were met; and
- That required detection limits were achieved.

Data qualifier flags, beyond any applied by the laboratory, will be added to sample results that fall outside the quality control acceptance criteria. Typical data qualifiers are:

U	The compound was analyzed for but was not detected above the reporting limit. The associated numerical value is the sample reporting limit.
J	The associated numerical value is an estimated quantity because quality control criteria were slightly exceeded.
UJ	The compound was analyzed for, but not detected. The associated numerical value is an estimated reporting limit because quality control criteria were not met.
T	The associated numerical value is an estimated quantity because reported concentrations were less than the practical quantitation limit (lowest calibration standard).
R	Data are not usable because of significant exceedance of quality control criteria. The analyte may or may not be present; resampling and/or reanalysis is necessary for verification.

A6.0 DATA ANALYSIS AND REPORTING

A6.1 Laboratory Reports

The laboratory data reports will consist of summary data packages that will include:

- Case narrative identifying the laboratory analytical batch number, matrix and number of samples included, analyses performed, and analytical methods used, and description of any problems or exceedance of quality control criteria and corrective action taken. The laboratory manager or a designee must sign the narrative.
- Copy of chain of custody forms for all samples included in the analytical batch.
- Tabulated sample analytical results with units, data qualifiers, percent solids, sample weight or volume, dilution factor, laboratory batch and sample number, Hart Crowser sample number, and dates sampled, received, extracted, and analyzed all clearly specified.
- Summary of calibration results.
- Blank summary results indicating samples associated with each blank.
- MS/MSD result summaries with calculated percent recovery and relative percent differences.
- Laboratory control sample results, when applicable, with calculated percent recovery.
- Electronically formatted data deliverable results in Ecology EIM format.

A6.2 Data Evaluation, Analysis, and Reporting

After the planned fieldwork, sample analysis, and data quality review, results will be compared with the appropriate screening levels. A draft RI report will be prepared in accordance with Section VII.D of the

Agreed Order and will summarize the sampling procedures and laboratory testing results. The report will include a map with sampling locations, figures and cross sections with areas and elevations of contamination, tabulated analytical testing data compared with MTCA cleanup levels, sample depth, chemical data quality review, and laboratory analytical reports. The report will include statements on any limitations on the data use that are the result of adverse QC exceedances, as identified in Section A5.2, Data Quality Assurance Review. A public review draft RI Report will be completed after incorporating comments from Ecology.

A7.0 REFERENCES

ASTM 2009. ASTM D2488-09a, Standard Practice for Description and Identification of Soils (Visual-Manual Procedure). American Society for Testing Materials. ASTM International, West Conshohocken, PA.

Ecology 1997. NWTPH-Gx and NWTPH-Dx Methods, in Analytical Methods for Petroleum Hydrocarbons, ECY 97-602. Washington State Department of Ecology. June 1997.

EPA 1986. Test Methods for Evaluating Solid Waste; Physical/Chemical Methods, SW-846, 3rd Update. Environmental Protection Agency.

EPA 1992. Specifications and Guidance for Contaminant-Free Sample Containers. Environmental Protection Agency. OSWER Directive 92.0-05A.

EPA 2008. US EPA Contract Laboratory Program National Functional Guidelines for Superfund Organic Methods Data Review. Environmental Protection Agency. EPA-540-R-08-01, June 2008.

Standard Methods 1989. Standard Methods for the Examination of Water and Wastewater. 17th Edition, American Water Works Association.

\\seafs\Projects\Notebooks\1949902_Kosmos_Mill_Add_Env_Assistance\Deliverables\Reports\RI Work Plan-122821\Appendix A - SAP_QAPP.docx

Table A-1 – Sample Containers, Preservation, and Holding Times for Soil

Analysis	Preservation	Holding Time[a]	Container
Gasoline-range petroleum hydrocarbons (NWTPH-Gx)	Methanol, Cool to 4 °C	14 days	6 pre-weighed 40 mL VOA vials
Volatile organic compounds (EPA 8260D)	Methanol, Cool to 4 °C	14 days	6 pre-weighed 40 mL VOA vials
Volatile petroleum hydrocarbons (NWVPH)	Methanol, Cool to 4 °C	14 days	6 pre-weighed 40 mL VOA vials
Diesel- and oil-range petroleum hydrocarbons (NWTPH-Dx)	Cool to 4 °C	14 days to extraction; 40 days to analysis	2 wide-mouth glass jar, 4 ounce
Extractable petroleum hydrocarbons (NWEPH)			
Total metals As, Ba, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Zn (EPA Methods 6020B/1631E)	Cool to 4 °C	6 months; 28 days for mercury	
Hexavalent Chromium (EPA 7196 or SM 3500 Cr B)		30 days to extraction, 7 days to analysis	
Polycyclic aromatic hydrocarbons (EPA 8270E)	Cool to 6 °C	14 days to extraction; 40 days to analysis	2 wide-mouth glass jar, 4 ounce

Notes:

a. Holding times are from date of sample collection.

b. Diesel- and oil-range hydrocarbons, metals, and total solids can be combined into one 4 or 8-ounce glass jar.

Table A-2 – Sample Containers, Preservation, and Holding Times for Water

Analysis	Preservation	Holding Time[a]	Container
Gasoline-range hydrocarbons (NWTPH-Gx)	HCl to pH < 2, cool to 4 °C	14 days	9 x 40 mL glass VOA vials
Volatile organic compounds (EPA 8260D)	HCl to pH < 2, cool to 4 °C	14 days	9 x 40 mL glass VOA vials
Volatile petroleum hydrocarbons (NWVPH)	HCl to pH < 2, cool to 4 °C	14 days	9 x 40 mL glass VOA vials
Diesel- and oil-range petroleum hydrocarbons (NWTPH-Dx)	HCl to pH < 2, cool to 4 °C	14 days to extract, 40 to analyze	500 mL amber glass bottle / 1 L for EPH
Extractable Petroleum Hydrocarbons (NWEPH)			
Total metals As, Ba, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Zn (EPA Methods 6020B/1631E)	HNO_3 to pH < 2	6 months; 28 days for mercury	250 mL poly bottle
Dissolved metals As, Ba, Cd, Cr, Cu, Pb, Hg, Se, Ag, Zn field filtered (EPA Methods 6020B/1631E)	field filtered, HNO_3 to pH < 2	6 months; 28 days for mercury	250 mL poly bottle
Hexavalent Chromium (EPA 7196 or SM 3500 Cr B)	Cool to 4 °C	24 hours	500 mL poly bottle
Total suspended solids (SM 2540D)	None	7 days	500 mL poly bottle
Polycyclic aromatic hydrocarbons (EPA 8270E)	Cool to 6 °C	7 days to extraction; 40 days to analysis	1 L amber bottle

Notes:

a. Holding times are from date of sample collection.

Table A-3 – Sample Containers, Preservation, and Holding Times for Sediment

Analysis	Preservation	Holding Time[a]	Container
Gasoline-range petroleum hydrocarbons (NWTPH-Gx)	Methanol, Cool to 4 °C	14 days	6 pre-weighed 40 mL VOA vials
Volatile organic compounds (EPA 8260D)	Methanol, Cool to 4 °C	14 days	6 pre-weighed 40 mL VOA vials
Volatile petroleum hydrocarbons (NWVPH)	Methanol, Cool to 4 °C	14 days	6 pre-weighed 40 mL VOA vials
Diesel- and oil-range petroleum hydrocarbons (NWTPH-Dx)	Cool to 4 °C	14 days to extraction; 40 days to analysis	2 wide-mouth glass jar, 4 or 8-ounce[b]
Extractable Petroleum Hydrocarbons (NWEPH)			
Total metals As, Ba, Cd, Cr, Cu, Pb, Hg, Ni, Se, Ag, Zn (EPA Methods 6020B/1631E)	Cool to 4 °C	6 months; 28 days for mercury	
Hexavalent Chromium (EPA 7196)		30 days to extraction, 7 days to analysis	
Total solids (SM 2540)	Cool to 4 °C	10 days	2 wide-mouth glass jar, 4 or 8-ounce[f]
Polycyclic aromatic hydrocarbons (EPA 8270E)	Cool to 6 °C	14 days to extraction; 40 days to analysis	2 wide-mouth glass jar, 4 or 8-ounce[f]
Total Organic Carbon (SM5310/EPA 9060)	Cool to 6 °C	28 days	2 wide-mouth glass jar, 4 or 8-ounce[f]

Notes:
a. Holding times are from date of sample collection.
b. Diesel- and oil-range hydrocarbons, metals, and total solids can be combined into one 4 or 8-ounce glass jar.

Table A-4 - Screening Levels, Method Detection Limits, and Practical Quantitation Limits for Soil

Analyte	MTCA Method A Screening Level Unrestricted Land Uses	MTCA Method B Screening Level		MDL	RL
		Non-Cancer	Cancer		
TPH (mg/kg)					
NWTPH-gasoline	100[a]/30[b]			0.36	5.0
NWTPH-diesel	2000[c]			0.82	50
NWTPH-oil	2000[c]			4.9	250
EPH/VPH					
Total Metals by Method 6020B (mg/kg)					
Arsenic	20	24	0.67	0.1	0.5
Barium		16000		0.096	1.0
Cadmium	2	2	80	6.00E-02	1.0
Chromium	2000 (Cr III) /19 (Cr VI)	120000(CrIII)/240 (CrVI)		0.25	1.0
Copper		3200		0.24	5.0
Lead	250			0.045	1.0
Mercury	2			0.066	1.0
Nickel		1600		0.057	1.0
Selenium		400		0.081	1.0
Silver		400		0.043	1.0
Zinc		24000		0.26	5.0
Mercury by Method 1631E (mg/kg)					
Mercury	2			0.000268	0.1
PAHs by EPA 625.1/8270E (mg/kg)					
1-Methylnaphthalene		5600	34	0.000082	0.002
2-Methylnaphthalene		320		0.000094	0.002
Naphthalene	5	1600		0.00012	0.002
Acenaphthylene				0.0002	0.002
Acenaphthene		4800		0.00011	0.002
Fluorene		3200		0.00011	0.002
Phenanthrene				0.00025	0.002
Anthracene		24000		0.000077	0.002
Fluoranthene		3200		0.00015	0.002
Pyrene		2400		0.00028	0.002
Benzo(a)anthracene				0.00018	0.002
Chrysene				0.00013	0.002
Benzo(b)fluoranthene				0.00012	0.002
Benzo(k)fluoranthene				0.000071	0.002
Benzo(a)pyrene	0.1	24	0.19	0.00011	0.002
Indeno(1,2,3-cd)pyrene				0.00034	0.002
Dibenzo(ah)anthracene				0.00028	0.002
Benzo(ghi)perylene				0.00038	0.004
Volatiles by Method 8260D (mg/kg)					
1,1,1,2-Tetrachloroethane		2400	38	0.0025	0.005
1,1,1-Trichloroethane	2	160000		0.0019	0.005
1,1,2,2-Tetrachloroethane		1600	5	0.0072	0.025
1,1,2-Trichloroethane		320	18	0.0015	0.005
1,1-Dichloroethane		16000	180	0.0018	0.005
1,1-Dichloroethene				0.0017	0.005
1,1-Dichloropropene				0.0023	0.005
1,2,3-Trichlorobenzene		64		0.0103	0.025
1,2,3-Trichloropropane		320	0.0063	0.0091	0.025
1,2,4-Trichlorobenzene		800	34	0.0046	0.010
1,2,4-Trimethylbenzene		800		0.0034	0.005
1,2-Dibromo-3-chloropropane		16	1.3	0.0493	0.500
1,2-Dibromoethane (EDB)	5	720	0.5	0.0014	0.005
1,2-Dichlorobenzene		7200		0.0026	0.005
1,2-Dichloroethane (EDC)		480	11	0.0022	0.010
1,2-Dichloropropane		3200	27	0.0030	0.005
1,3,5-Trimethylbenzene		800		0.0025	0.005
1,3-Dichlorobenzene				0.0020	0.005
1,3-Dichloropropane		1600		0.0046	0.025
1,4-Dichlorobenzene		5600	190	0.0035	0.005
2,2-Dichloropropane		48000		0.0035	0.001
2-Butanone (MEK)		8		0.4440	1.000
2-Chlorotoluene		1600		0.0027	0.005
2-Hexanone		400		0.0375	0.500
4-Chlorotoluene				0.0019	0.005

Table A-4 - Screening Levels, Method Detection Limits, and Practical Quantitation Limits for Soil

Analyte	MTCA Method A Screening Level Unrestricted Land Uses	MTCA Method B Screening Level		MDL	RL
		Non-Cancer	Cancer		
4-Methyl-2-pentanone		6400		0.0391	0.500
Acetone		72000		0.5046	5.000
Benzene	0.03	320	18	0.0017	0.005
Bromobenzene		640		0.0039	0.005
Bromodichloromethane		1600	16	0.0049	0.025
Bromoform		1600	130	0.0031	0.005
Bromomethane		110		0.1468	0.500
Carbon Tetrachloride		320	14	0.0030	0.005
Chlorobenzene		1600		0.0016	0.005
Chloroethane				0.0149	0.050
Chloroform		800	32	0.0026	0.010
Chloromethane				0.0129	0.050
cis-1,2-Dichloroethene		160		0.0017	0.005
cis-1,3-Dichloropropene				0.0036	0.005
Dibromochloromethane		1600	12	0.0041	0.025
Dibromomethane		800		0.0064	0.025
Dichlorodifluoromethane		16000		0.0047	0.050
Ethylbenzene	6	8000		0.0014	0.005
Hexachlorobutadiene		80	13	0.0040	0.025
Hexane		4800		0.0071	0.025
Isopropylbenzene		8000		0.0016	0.005
m,p-Xylene	9000	16000		0.0032	0.010
Methyl t-butyl ether (MTBE)	0.1		560	0.0019	0.005
Methylene chloride	0.02	480	94	0.0865	0.500
Naphthalene	5	1600		0.0031	0.005
n-Propylbenzene		8000		0.0029	0.005
o-Xylene	9000	16000		0.0018	0.005
p-Isopropyltoluene				0.0027	0.005
sec-Butylbenzene		8000		0.0026	0.005
Styrene		16000		0.0028	0.005
tert-Butylbenzene		8000		0.0018	0.005
Tetrachloroethene	50	480	480	0.0019	0.005
Toluene	7000	6400		0.0019	0.005
trans-1,2-Dichloroethene		1600		0.0019	0.005
trans-1,3-Dichloropropene				0.0038	0.005
Trichloroethene	30	40	12	0.0021	0.005
Trichlorofluoromethane				0.0036	0.050
Vinyl chloride		240	0.67	0.0017	0.005

a. No benzene detected in any samples and BTEX < 1% of total TPH-Gx.
b. Benzene detected or BTEX > 1% of total TPH-Gx.
c. Sum of diesel- and heavy-oil-range TPH cannot exceed 2000 mg/kg criterion.
MTCA = Model Toxics Control Act
MDL = Method Detection Limit
RL = Reporting Limit

Table A-5 - Screening Levels, Method Detection Limits, and Practical Quantitation Limits for Groundwater

Analyte	MTCA Method A Cleanup Level for Groundwater	MTCA Method B Screening Level		MDL	RL
		Non-Cancer	Cancer		
TPH (µg/L)					
NWTPH-gasoline	1000[a]/800[b]			10	100
NWTPH-diesel	500			5.4	50
NWTPH-oil	500			52	250
EPH/VPH					
Total Metals by Method 6020B (µg/L)					
Arsenic	5	4.80	0.06	0.049	1.0
Barium		3200.00		N/A	1.0
Cadmium	5	8.00		0.049	1.0
Chromium	50	24000 (CrIII)		0.0740	1.0
Copper		640		0.6700	2.0
Lead	15			0.0740	1.0
Mercury	2			N/A	1.0
Nickel		320		0.0460	1.0
Selenium		80		0.120	1.0
Silver		80		0.0420	1.0
Zinc		4800		0.26	2.5
Hexavalent Chromium by SM 3500 Cr B (µg/L)					
Hexavalent Chromium		48 (CrVI)		0.0079	0.02
Total Mercury by Method 1631E (µg/L)					
Mercury	2			0.00080	0.01
PAHs by EPA 8270E (µg/L)					
1-Methylnaphthalene		560.00	1.50	0.003	0.2
2-Methylnaphthalene		32.00		0.0034	0.2
Acenaphthene		960.00		0.0037	0.02
Acenaphthylene				0.0033	0.02
Anthracene		4800.00		0.0023	0.02
Benz(a)anthracene				0.007	0.02
Benzo(a)pyrene	0.1	4.80	0.02	0.0028	0.02
Benzo(b)fluoranthene				0.0021	0.02
Benzo(g,h,i)perylene				0.0057	0.04
Benzo(k)fluoranthene				0.0035	0.02
Chrysene				0.0024	0.02
Dibenzo(a,h)anthracene				0.0051	0.02
Fluoranthene		640.00		0.0029	0.02
Fluorene		640.00		0.0044	0.02
Indeno(1,2,3-cd)pyrene				0.0049	0.02
Naphthalene	160	160.00		0.005	0.2
Phenanthrene				0.0062	0.02
Pyrene		480.00		0.0054	0.02
Dissolved Metals by Method 6020B (µg/L)					
Arsenic	5	4.80	0.06	0.049	0.2
Barium		3200.00		N/A	1.0
Cadmium	5	8.00		0.049	1.0
Chromium	50	24000 (CrIII)/48 (CrVI)		0.0740	1.0
Copper		640		0.6700	2.0
Lead	15			0.0740	1.0
Mercury	2			N/A	1.0
Nickel		320		0.0460	1.0
Selenium		80		0.120	1.0
Silver		80		0.0420	1.0
Zinc		4800		0.26	2.5

Table A-5 - Screening Levels, Method Detection Limits, and Practical Quantitation Limits for Groundwater

Analyte	MTCA Method A Cleanup Level for Groundwater	MTCA Method B Screening Level		MDL	RL
		Non-Cancer	Cancer		
Dissolved Mercury by Method 1631E (µg/L)					
Mercury	2			0.00076	0.10
Volatiles by Method 8260D (µg/L)					
1,1,1,2-Tetrachloroethane				0.038	1
1,1,1-Trichloroethane	200	16000.00		0.028	1
1,1,2,2-Tetrachloroethane		160.00	0.22	0.049	0.2
1,1,2-Trichloroethane		32.00		0.043	1
1,1-Dichloroethane				0.047	1
1,1-Dichloroethene				0.08	1
1,1-Dichloropropene				0.023	1
1,2,3-Trichlorobenzene				0.034	1
1,2,3-Trichloropropane				0.04	1
1,2,4-Trichlorobenzene				0.037	1
1,2,4-Trimethylbenzene				0.017	1
1,2-Dibromo-3-chloropropane				0.1	10
1,2-Dibromoethane (EDB)				0.043	1
1,2-Dichlorobenzene				0.017	1
1,2-Dichloroethane (EDC)	5	48.00	0.48	0.051	0.2
1,2-Dichloropropane				0.047	1
1,3,5-Trimethylbenzene				0.021	1
1,3-Dichlorobenzene				0.029	1
1,3-Dichloropropane				0.046	1
1,4-Dichlorobenzene				0.038	1
2,2-Dichloropropane				0.044	1
2-Butanone (MEK)				0.26	10
2-Chlorotoluene				0.031	1
2-Hexanone				0.078	10
2-Propanol				N/A	1000
4-Chlorotoluene				0.028	1
4-Methyl-2-pentanone				0.24	10
Acetone				2.2	10
Benzene	5	32.00	0.80	0.02	0.35
Bromobenzene				0.044	1
Bromodichloromethane		160.00	0.71	0.037	0.5
Bromoform		160.00	5.50	0.057	1
Bromomethane		11.00		0.13	1
Carbon Tetrachloride		32.00	0.63	0.03	0.5
Chlorobenzene		160.00		0.027	1
Chloroethane				0.066	1
Chloroform				0.048	1
Chloromethane				0.038	10
cis-1,2-Dichloroethene		16.00		0.058	1
cis-1,3-Dichloropropene				0.041	1
Dibromochloromethane		160.00	0.52	0.03	0.5
Dibromomethane				0.057	1
Dichlorodifluoromethane				0.038	1
Diisopropyl ether (DIPE)				0.02	1
Ethanol				N/A	1000
Ethyl t-butyl ether (ETBE)				0.038	1
Ethylbenzene	700	800.00		0.032	1
Hexachlorobutadiene		8.00	0.56	0.05	0.5
Hexane				0.039	1
Isopropylbenzene				0.024	1
m,p-Xylene	1000	1600.00		0.074	2
Methyl t-butyl ether (MTBE)	20		24	0.046	1
Methylene chloride	5	48.00	5.80	1.9	5
Naphthalene	160	160.00		0.038	1
n-Propylbenzene				0.033	1

Table A-5 - Screening Levels, Method Detection Limits, and Practical Quantitation Limits for Groundwater

Analyte	MTCA Method A Cleanup Level for Groundwater	MTCA Method B Screening Level		MDL	RL
		Non-Cancer	Cancer		
o-Xylene	1000	1600.00		0.038	1
p-Isopropyltoluene				0.025	1
sec-Butylbenzene		800		0.023	1
Styrene		1600.00		0.028	1
t-Amyl methyl ether (TAME)				0.028	1
t-Butyl alcohol (TBA)				0.47	1
tert-Butylbenzene		800.00		0.014	1
Tetrachloroethene	5	48.00	21.00	0.088	1
Toluene	1000	640.00		0.033	1
trans-1,2-Dichloroethene				0.041	1
trans-1,3-Dichloropropene		240	0.44	0.049	0.2
Trichloroethene	5	4.00	0.54	0.084	1
Trichlorofluoromethane		2400		0.051	1
Vinyl chloride	0.2	24.00	0.03	0.063	0.2

a. No benzene detected.
b. Benzene detected.
MTCA = Model Toxics Control Act
MDL = Method Detection Limit
RL = Reporting Limit

Table A-6 - Screening Levels, Method Detection Limits, and Practical Quantitation Limits for Sediment

Analyte	SMS Values		MDL	RL
	Freshwater SCO	Freshwater Cleanup Screening Levels		
TPH (mg/kg)				
NWTPH-gasoline			0.36	5.0
NWTPH-diesel	340	510	0.82	50
NWTPH-oil			4.9	250
EPH/VPH			range specific	range specific
Total Metals by Method 6020B (mg/kg)				
Arsenic	14	120	0.1	1.0
Barium			0.096	1.0
Cadmium	2.1	5.4	0.06	1.0
Chromium	72	88	0.25	1.0
Copper	400	1200	0.24	5.0
Lead	360	1300	0.045	1.0
Mercury	0.66	0.8	0.066	0.5
Nickel	26	110	0.057	1.0
Selenium	11	20	0.081	1.0
Silver	0.57	1.7	0.043	1.0
Zinc	3200	4200	0.26	5.0
Mercury by Method 1631E (mg/kg)				
Mercury	0.66	0.8	0.000268	0.1
PAHs by EPA 8270E (mg/kg)				
1-Methylnaphthalene			0.000082	0.002
2-Methylnaphthalene			0.000094	0.002
Naphthalene			0.00012	0.002
Acenaphthylene			0.0002	0.002
Acenaphthene			0.00011	0.002
Fluorene			0.00011	0.002
Phenanthrene			0.00025	0.002
Anthracene			0.000077	0.002
Fluoranthene			0.00015	0.002
Pyrene			0.00028	0.002
Benzo(a)anthracene			0.00018	0.002
Chrysene			0.00013	0.002
Benzo(b)fluoranthene			0.00012	0.002
Benzo(k)fluoranthene			0.000071	0.002
Benzo(a)pyrene			0.00011	0.002
Indeno(1,2,3-cd)pyrene			0.00034	0.002
Dibenzo(ah)anthracene			0.00028	0.002
Benzo(ghi)perylene			0.00038	0.004
Total PAHs[1]	17	30		
Volatiles by Method 8260D (mg/kg)				
1,1,1,2-Tetrachloroethane			0.0025	0.005
1,1,1-Trichloroethane			0.0019	0.005
1,1,2,2-Tetrachloroethane			0.0072	0.025
1,1,2-Trichloroethane			0.0015	0.005
1,1-Dichloroethane			0.0018	0.005
1,1-Dichloroethene			0.0017	0.005
1,1-Dichloropropene			0.0023	0.005
1,2,3-Trichlorobenzene			0.0103	0.025
1,2,3-Trichloropropane			0.0091	0.025
1,2,4-Trichlorobenzene			0.0046	0.010
1,2,4-Trimethylbenzene			0.0034	0.005
1,2-Dibromo-3-chloropropane			0.0493	0.500
1,2-Dibromoethane (EDB)			0.0014	0.005
1,2-Dichlorobenzene			0.0026	0.005
1,2-Dichloroethane (EDC)			0.0022	0.010
1,2-Dichloropropane			0.0030	0.005
1,3,5-Trimethylbenzene			0.0025	0.005
1,3-Dichlorobenzene			0.0020	0.005
1,3-Dichloropropane			0.0046	0.025
1,4-Dichlorobenzene			0.0035	0.005
2,2-Dichloropropane			0.0035	0.001

Table A-6 - Screening Levels, Method Detection Limits, and Practical Quantitation Limits for Sediment

Analyte	SMS Values		MDL	RL
	Freshwater SCO	Freshwater Cleanup Screening Levels		
2-Butanone (MEK)			0.4440	1.000
2-Chlorotoluene			0.0027	0.005
2-Hexanone			0.0375	0.500
4-Chlorotoluene			0.0019	0.005
4-Methyl-2-pentanone			0.0391	0.500
Acetone			0.5046	5.000
Benzene			0.0017	0.005
Bromobenzene			0.0039	0.005
Bromodichloromethane			0.0049	0.025
Bromoform			0.0031	0.005
Bromomethane			0.1468	0.500
Carbon Tetrachloride			0.0030	0.005
Chlorobenzene			0.0016	0.005
Chloroethane			0.0149	0.050
Chloroform			0.0026	0.010
Chloromethane			0.0129	0.050
cis-1,2-Dichloroethene			0.0017	0.005
cis-1,3-Dichloropropene			0.0036	0.005
Dibromochloromethane			0.0041	0.025
Dibromomethane			0.0064	0.025
Dichlorodifluoromethane			0.0047	0.050
Ethylbenzene			0.0014	0.005
Hexachlorobutadiene			0.0040	0.025
Hexane			0.0071	0.025
Isopropylbenzene			0.0016	0.005
m,p-Xylene			0.0032	0.010
Methyl t-butyl ether (MTBE)			0.0019	0.005
Methylene chloride			0.0865	0.500
Naphthalene			0.0031	0.005
n-Propylbenzene			0.0029	0.005
o-Xylene			0.0018	0.005
p-Isopropyltoluene			0.0027	0.005
sec-Butylbenzene			0.0026	0.005
Styrene			0.0028	0.005
tert-Butylbenzene			0.0018	0.005
Tetrachloroethene			0.0019	0.005
Toluene			0.0019	0.005
trans-1,2-Dichloroethene			0.0019	0.005
trans-1,3-Dichloropropene			0.0038	0.005
Trichloroethene			0.0021	0.005
Trichlorofluoromethane			0.0036	0.050
Vinyl chloride			0.0017	0.005
Total Organic Carbon by EPA 9060/SM 5310 (mg/kg)				
Total Organic Carbon			0.15	0.050

SCO = Sediment Cleanup Objective
SMS = Sediment Management Standards
MDL = Method Detection Limit
RL = Reporting Limit

1. Total PAHs represents the sum of 1-methylnaphthalene, 2-methylnaphthalene, acenaphthene, acenaphthylene, anthracene, benz[a]anthracene, benzo[a]pyrene, benzo[g,h,i]perylene, chrysene, dibenz[a,h]anthracene, fluoranthene, fluorene, indeno[1,2,3-c,d] pyrene, naphthalene phenanthrene, pyrene, and total benzofluoranthenes [b+j+k] (WAC 173-204-563(2)(h)).

Table A-7 - Screening Levels, Method Detection Limits, and Practical Quantitation Limits for Surface Water

Analyte	Indicator Level [1]	MDL	RL
TPH (µg/L)			
NWTPH-gasoline	250	10	100
NWTPH-diesel		5.4	50
NWTPH-oil		52	200
NWTPH-oil + NWTPH-diesel	250	57.4	250
Total Metals by Method 6020B/200.8 (µg/L)			
Arsenic	360	0.049	0.5
Cadmium	1.5	0.049	0.25
Copper	7.2	0.6700	2.0
Lead	23.5	0.0740	0.5
Nickel	652	0.0460	0.5
Zinc	52.7	0.26	2.5
Hexavalent Chromium by SM3500-Cr B (µg/L)			
Hexavalent Chromium	15	0.0079	1.2
Mercury by Method 1631E/245.1 (µg/L)			
Mercury	2.1	0.00080	0.00080
PAHs by EPA 8270E/625.1 Mod (µg/L)			
Pyrene	5.7	0.0064	0.02
Benzo(a)anthracene	23.4	0.0045	0.02
Chrysene	7.5	0.0071	0.02
Benzo(b)fluoranthene	14.4	0.0072	0.02
Benzo(k)fluoranthene	7.5	0.0075	0.02
Benzo(a)pyrene	7.5	0.012	0.02
Indeno(1,2,3-cd)pyrene	11.1	0.015	0.02
BTEX by EPA SW 846/8260D (µg/L)			
Benzene		0.020	0.20
Ethylbenzene		0.032	0.20
m,p-Xylene		0.074	0.40
o-Xylene		0.038	0.20
Toluene		0.033	0.20
Benzene + Toluene + Ethylbenzene + m, o, p Xylenes	2.0	1.0	1.2

MDL = Method Detection Limit
RL = Reporting Limit

1. Indicator levels are per the Tacoma Power's Water Quality Protection Program, Table 1, revised September 9, 2021 for the riverine.

Table A-8 – Laboratory Quality Control Procedures, Criteria, and Corrective Actions for Gasoline Analysis

Laboratory Quality Control: NWTPH-Gx (GC/FID)			
Quality Control Check	**Frequency**	**Acceptance Criteria**	**Corrective Action**
Method blank	1 per batch of every 20 or fewer samples	All analytes < reporting limit	Re-extract and re-analyze or qualify associated samples unless concentrations are > 5 x blank level
Initial calibration	Minimum 5-point external calibration before sample analysis	< 20% difference from true value, correlation coefficient ≥ 0.99	Recalibrate instrument
Continuing calibration	Minimum 1 per 12 hours and at end of sequence	NWTPH-Gx ≤ 20% difference from initial calibration.	Evaluate cause, reanalyze CCV and/or recalibrate instrument and re-analyze affected samples
Surrogates	Every lab and field sample	Laboratory control chart limits	Evaluate data for usability
Laboratory duplicate	1 per batch of 20 or fewer samples if no MS/MD	RPD <20%	Evaluate data for usability
Laboratory control sample	1 per batch of 20 or fewer samples	Laboratory control chart limits	Evaluate data for usability
Laboratory control sample duplicate; if no MS/MSD or sample duplicate	1 per batch of 20 or fewer samples	Laboratory control chart limits	Evaluate data for usability
Matrix spike	1 per batch of 20 or fewer samples if sufficient sample	Laboratory control chart limits	Evaluate data for usability
Matrix spike duplicate	1 per batch of 20 or fewer samples if sufficient sample	Laboratory control chart limits	Evaluate data for usability

Note:
GC/FID = Gas Chromatograph with a Flame Ionization Detector
MS/MSD = Matrix Spike/Matrix Spike Duplicate
RPD = Relative Percent Difference

Table A-9 – Laboratory Quality Control Procedures, Criteria, and Corrective Actions for Diesel and Motor Oil Analysis

Laboratory Quality Control: NWTPH-Dx (GC/FID)			
Quality Control Check	**Frequency**	**Acceptance Criteria**	**Corrective Action**
Method blank	1 per batch of every 20 or fewer samples	All analytes < reporting limit	Re-extract and re-analyze or qualify associated samples unless concentrations are > 5 x blank level
Initial calibration	Minimum 5-point external calibration before sample analysis	< 20% difference from true value, correlation coefficient > 0.99	Recalibrate instrument
Continuing calibration	Minimum 1 per 12 hours and at end of sequence	% difference < 20% of initial calibration	Evaluate cause, reanalyze CCV and/or recalibrate instrument and re-analyze affected samples
Surrogates	Every lab and field sample	Laboratory control chart limits	Evaluate data for usability
Laboratory duplicate	1 per batch of 20 or fewer samples if no MS/MSD	RPD <20%	Evaluate data for usability
Laboratory control sample	1 per batch of 20 or fewer samples	Laboratory control chart limits	Evaluate data for usability
Laboratory control sample duplicate; if no MS/MSD or sample duplicate	1 per batch of 20 or fewer samples	Laboratory control chart limits	Evaluate data for usability
Matrix spike	1 per batch of 20 or fewer samples if sufficient sample	Laboratory control chart limits	Evaluate data for usability
Matrix spike duplicate	1 per batch of 20 or fewer samples if sufficient sample	Laboratory control chart limits	Evaluate data for usability

Note:
GC/FID = Gas Chromatograph with a Flame Ionization Detector
MS/MSD = Matrix Spike/Matrix Spike Duplicate
RPD = Relative Percent Difference

Table A-10 – Laboratory Quality Control Procedures, Criteria, and Corrective Actions for Metals Analysis

Laboratory Quality Control: Total and Dissolved Metals – EPA 200/6000/7000 Series			
Quality Control Check	**Frequency**	**Acceptance Criteria**	**Corrective Action**
Initial calibration verification	Daily or each time instrument is set up	90 to 110% of initial calibration	Recalibrate instrument
Initial calibration blank	After each instrument calibration	All analytes < reporting limit	Correct source of contamination
Continuing calibration verification	Every 10 analytical samples and at the beginning and end of each run	90 to 110% of initial calibration	Evaluate cause, if necessary correct instrument calibration, re-analyze affected samples
Continuing calibration blank	After each continuing calibration verification	All analytes < reporting limit	Correct source of contamination
Method blank	1 per batch of 20 or fewer samples	All analytes < reporting limit	Re-extract and re-analyze associated samples unless concentrations are > 3 times the blank level
Matrix spike	1 per batch of 20 or fewer samples if sufficient sample	75 to 125% recovery	Evaluate data for usability
Matrix spike duplicate	1 per batch of 20 or fewer samples if sufficient sample	75 to 125% recovery	Evaluate data for usability
Laboratory duplicate	1 per batch of 20 or fewer samples if no MS/MSD	< 20% RPD	Evaluate data for usability
Laboratory control sample	1 per batch of 20 or fewer samples	80 to 120% recovery	Evaluate data for usability
Laboratory control sample duplicate	1 per batch of 20 or fewer samples if no MS/MSD	80 to 120% recovery	Evaluate data for usability

Note:
RPD = Relative Percent Difference

Table A-11 – Laboratory Quality Control Procedures, Criteria, and Corrective Actions for Polycyclic Aromatic Hydrocarbons Analysis

Laboratory Quality Control: Polycyclic Aromatic Hydrocarbons (PAHs) – EPA 8270D			
Quality Control Check	**Frequency**	**Acceptance Criteria**	**Corrective Action**
Instrument tuning	DFTPP; Before initial calibration and every 12 hours	See EPA Method 8270	Retune and recalibrate instrument; reanalyze affected samples
Initial calibration	See EPA Method 8270	≤ 20% relative percent difference	Laboratory to recalibrate and re-analyze affected samples
Continuing calibration verification	Every 12 hours	See EPA Method 8270	Recalibrate instrument and reanalyze affected samples
		≤ 20% percent difference	
Method blank	1 per batch of 20 or fewer samples	All analytes < reporting limit	Re-extract and re-analyze or qualify associated samples unless concentrations are > 5 x blank level
Internal Standards	Every sample and calibration standard mix	Areas with -50% to +100% of initial calibration	Reanalyze affected samples
Laboratory duplicate	1 per batch of 20 or fewer samples if no MS/MSD	RPD <20%	Evaluate data for usability
Laboratory control sample	1 per batch of 20 or fewer samples	Laboratory control chart limits	Evaluate data for usability
Laboratory control sample duplicate; if no MS/MSD or sample duplicate	1 per batch of 20 or fewer samples	Laboratory control chart limits	Evaluate data for usability
Matrix spike	1 per batch of 20 or fewer samples if sufficient sample	Laboratory control chart limits	Evaluate data for usability
Matrix spike duplicate	1 per batch of 20 or fewer samples if sufficient sample	Laboratory control chart limits	Evaluate data for usability
Surrogates	Added to every lab and field sample	Laboratory control chart limits	Evaluate data for useability

Note:
EPA = Environmental Protection Agency
DFTPP = Decafluorotriphenylphosphine
MS/MSD = Matrix Spike/Matrix Spike Duplicate
RPD = Relative Percent Difference

Table A-12 – Laboratory Quality Control Procedures, Criteria, and Corrective Actions for Volatile Organic Compound Analysis

Laboratory Quality Control: Volatile Organic Compounds (VOCs) – EPA 8260D			
Quality Control Check	**Frequency**	**Acceptance Criteria**	**Corrective Action**
Instrument tuning	Before initial calibration and every 12 hours	See EPA Method 8260	Retune and recalibrate instrument
Initial calibration	See EPA Method 8260	< 20% relative percent difference	Laboratory to recalibrate and re-analyze affected samples
Continuing calibration verification	Every 12 hours	See EPA Method 8260	Laboratory to recalibrate if correlation coefficient or response factor does not meet method requirements
		< 20% percent difference	
Method blank	1 per batch of 20 or fewer samples	All analytes < reporting limit	Laboratory to eliminate or greatly reduce laboratory contamination due to glassware or reagents or analytical system; re-analyze affected samples
Laboratory duplicate	1 per batch of 20 or fewer samples if no MS/MSD	RPD <20%	Evaluate data for usability
Laboratory control sample	1 per batch of 20 or fewer samples	Laboratory control chart limits	Evaluate data for usability
Laboratory control sample duplicate; if no MS/MSD or sample duplicate	1 per batch of 20 or fewer samples	Laboratory control chart limits	Evaluate data for usability
Matrix spike	1 per batch of 20 or fewer samples if sufficient sample	Laboratory control chart limits	Evaluate data for usability
Matrix spike duplicate	1 per batch of 20 or fewer samples if sufficient sample	Laboratory control chart limits	Evaluate data for usability
Surrogates	Added to every lab and field sample	Laboratory control chart limits	Evaluate data for useability

Note:
EPA = Environmental Protection Agency
MS/MSD = Matrix Spike/Matrix Spike Duplicate
RPD = Relative Percent Difference

Table A-13 – Laboratory Quality Control Procedures, Criteria, and Corrective Actions for Total Suspended Solids Analysis

Laboratory Quality Control: Total Suspended Solids (TSS) – SM 2540D			
Quality Control Check	**Frequency**	**Acceptance Criteria**	**Corrective Action**
Method blank	1 per batch of every 10 or fewer samples	All analytes < reporting limit	Re-extract and re-analyze associated samples unless concentrations are > 5 x blank level
Laboratory duplicate	1 per 10 or fewer samples	< 20% RPD	Evaluate data for usability

Note:
RPD = Relative Percent Difference

TACOMA POWER
TACOMA PUBLIC UTILITIES

Form A-1 - Visual Survey/Inspection Report

Surveys/inspections are required to be performed weekly. Additional surveys/inspections are required if decreases in Riffe Lake Reservoir elevation approach five feet or more between subsequent monitoring events or follow-up to assess effectiveness of BMPs is needed.

PROJECT NAME: **Kosmos Mill Oil Clean-up**

DATE: ___________________ TIME: ________________

SURVEYOR(S): ___________________________ REPRESENTING: _________________________
___________________________ _________________________

LAKE ELEVATION (FT.): ________________ TEMPERATURE (°F): ________________

WEATHER CONDITIONS: ☐ CLEAR ☐ CLOUDY ☐ MIST ☐ RAIN ☐ WIND ☐ FOG

OBSERVATIONS/ACTIONS:

Inspect BMPs to assure performance/effectiveness/condition (*include stockpile staging area).

☐ BMPs functioning properly

☐ Maintenance/installation needed

Description: ____
____
____
____

☐ Maintenance/installation performed

Description: ____
____
____
____

☐ Additional follow-up needed (notify appropriate contact)

Description: ____
____
____
____

☐ Photos attached

OBSERVATIONS/ACTIONS CONTINUED:

Inspect the Rainey Creek reach (banks and waterway) from 500 feet upstream of the temporary cap downstream to the confluence with the Riffe Lake Shoreline. If additional seeps or sheen are observed call Ecology to report an **ERTS (360.407.6300)**.

☐ No new seep(s) or sheen observed

☐ Additional seep(s) or sheen observed ERTS Tracking Number: ________________

GPS location(s)

ID#: ________________ Matrix: ________________
Lat.: ________________ Long.: ________________
Description: ____

ID#: ________________ Matrix: ________________
Lat.: ________________ Long.: ________________
Description: ____

☐ Sample(s) obtained

ID#: ________________ Matrix: ________________

ID#: ________________ Matrix: ________________

☐ No dead, dying or distressed organisms observed

☐ Presence of dead, dying or distressed organisms

Species: __________________ Count: ________________
GPS location(s)
Lat.: ________________ Long.: ________________
Description: ____

Species: __________________ Count: ________________
GPS location(s)
Lat.: ________________ Long.: ________________
Description: ____

☐ Photos attached

Additional Notes (attach supplemental pages as needed): ________________________________
____
____

I attest that the above information is true and correct to the best of my knowledge.

➡ PREPARED BY SIGNATURE: ________________________ DATE: ________________

APPENDIX B
Health and Safety Plan

Health and Safety Plan

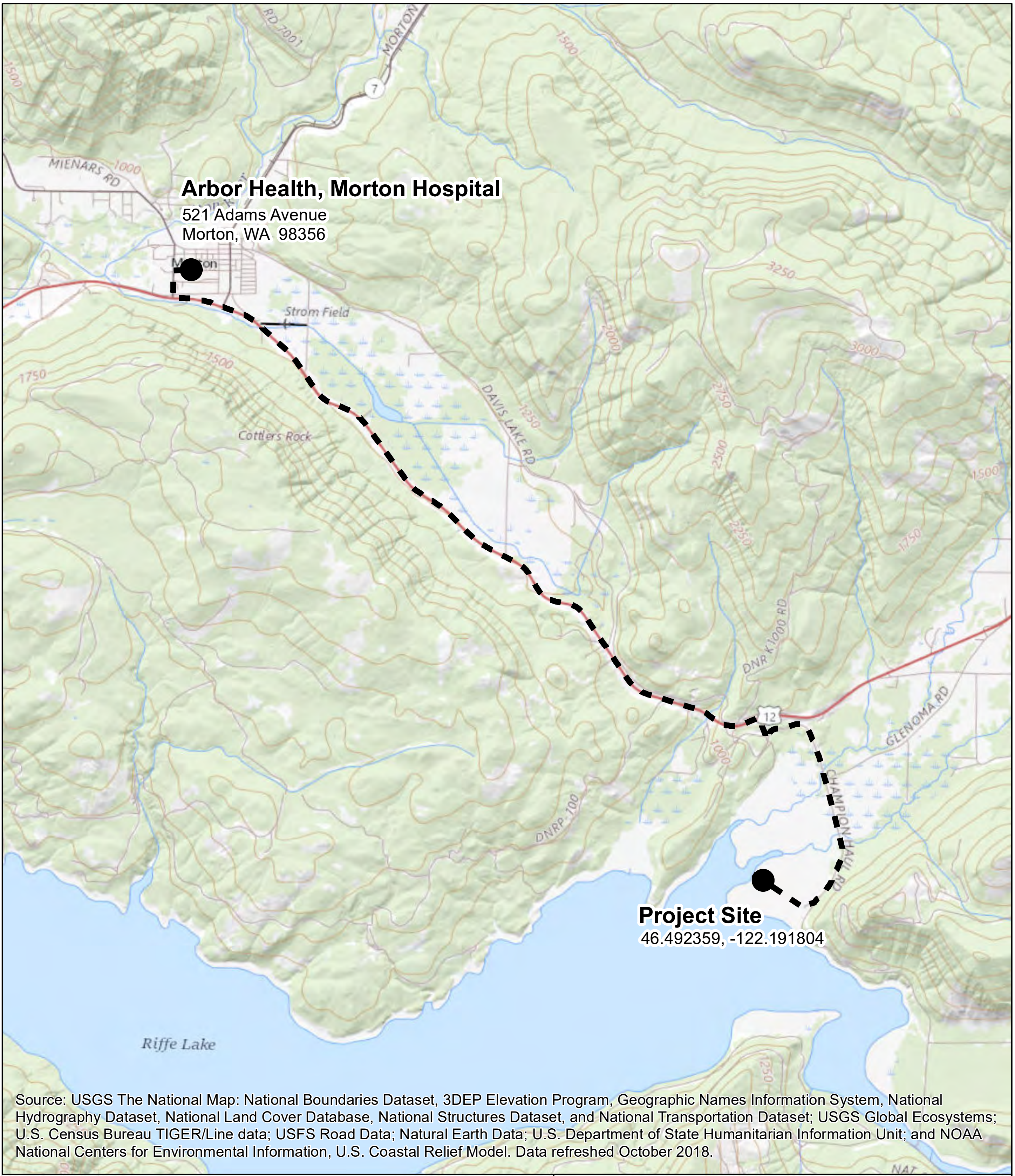
Kosmos Mill Oil Cleanup

Location coordinates: 46.492359N, -122.191804W
Glenoma, Washington
Date Prepared: November 22, 2019, December 28, 2021

EMERGENCY INFORMATION

SITE LOCATION	Kosmos Mill Site Approximately one mile south along Champion Haul Road from the intersection of Glenoma Rd and Champion Haul Road Location coordinates: 46.492841N, -122.191316W Glenoma, Washington
NEAREST HOSPITALS	Arbor Health, Morton Hospital 521 Adams Avenue Morton, WA 98356 360-496-5112 The route to the hospital is shown on Figure 1.
CONTACTS	**Hart Crowser, a division of Haley & Aldrich** Seattle Office………………………………………………….(206) 324-9530 ►Project Manager, Angie Goodwin…………………….(206) 954-2549 (C) ►Regional Health & Safety Officer, Jessica Blanchette..(360) 720-1279 (C) **Client** ►Tacoma Power, Kevin Smith………………………..….(253) 355-6762 (C) **State agency local office** **To report environmental problems or spills**………………(360) 407-6300 Poison Control Center ……………………………………(800) 222-1222
EMERGENCY RESPONDERS **Police, Fire, Ambulance**	**911**
IN EVENT OF EMERGENCY CONTACT 911 FOR HELP AS SOON AS POSSIBLE	Give the following information: ➔ **Where You Are** - address, cross streets, or landmarks ☎ **Phone Number** you are calling from ?? **What Happened** - type of injury, accident # **How many persons** need help ?? **What is being done** for the victim(s) !! **You hang up last** – let emergency dispatcher hang up first

HARTCROWSER
A division of Haley & Aldrich



Source: USGS The National Map: National Boundaries Dataset, 3DEP Elevation Program, Geographic Names Information System, National Hydrography Dataset, National Land Cover Database, National Structures Dataset, and National Transportation Dataset; USGS Global Ecosystems; U.S. Census Bureau TIGER/Line data; USFS Road Data; Natural Earth Data; U.S. Department of State Humanitarian Information Unit; and NOAA National Centers for Environmental Information, U.S. Coastal Relief Model. Data refreshed October 2018.

0 0.5 1 2 Miles

N

Note: Feature locations are approximate.

Kosmos Mill Oil Cleanup
Morton, Washington

Route to Hospital

19499-00 11/19

HARTCROWSER

Figure
1

Document Path: \\seafs\Projects\Notebooks\1949900_Kosmos_Mill_Oil_Cleanup\GIS\MGIS\1949900_AA_RouteToHosp.mxd Date: 11/20/2019 User Name: melissaschweitzer

SITE HEALTH AND SAFETY PLAN SUMMARY

Location: Kosmos Mill Site, approximately one mile south along Champion Haul Road from the intersection of Glenoma Rd and Champion Haul Rd, Glenoma, WA, location coordinates: 46.492841N, -122.191316W

Proposed dates of activities: 2022 to 2023

Proposed activities: Collect soil samples during the advancement of potholes using a vac-truck, explorations using a sonic drill rig, and test pits using an excavator. Install groundwater monitoring wells and collect groundwater samples. Collect sediment and surface water samples from Rainey Creek. Visually inspect the Rainey Creek bank for signs of seepage or environmental impact.

Type of facility: Former mill site.

Land use of area surrounding facility: Near a campground and hang-gliding landing area. Located at the mouth of Rainey Creek and near Riffe Lake.

Potential site contaminants: Total petroleum hydrocarbons as diesel (TPH-D), gasoline (TPH-G), and heavy oil (TPH-O); benzene, toluene, ethylbenzene, and xylenes (BTEX); lead; polycyclic aromatic hydrocarbons (PAHs); and polychlorinated biphenyls (PCBs).

Routes of entry: Skin contact with soil and groundwater, inhalation of volatiles, and incidental ingestion of soil and groundwater.

Other specific safety hazards: Operating motor vehicles, doing heavy lifting, cold stress, noise exposure, working around heavy equipment, biological hazards (insects, blood-borne pathogens [BBPs]), or slips, trips, and falls.

Protective measures: Safety glasses or goggles (if splash hazard exists), Class II high visibility safety vest, rubber work gloves, nitrile gloves, long pants and shirt with minimum 4-inch sleeve, rain gear, foot protection (e.g., steel-toed boots or shoes with slip-resistant soles). A half-facepiece respirator will be available if air monitoring indicates levels warranting respiratory protection.

Air monitoring equipment: MultiRAE or MiniRAE photoionization detector (PID) with a 10.6 electron volt (eV) lamp. Dust will be monitored visually and engineering controls (wetting soil) will be implemented as necessary.

1.0 INTRODUCTION

1.1 Purpose and Regulatory Compliance

This site-specific Health and Safety Plan (HASP) provides information and procedures for protecting Hart Crowser, a division of Haley & Aldrich (Hart Crowser) personnel who handle or contact hazardous substances or may be exposed to physical hazards while collecting soil and groundwater samples at the Kosmos Mill Site located in Glenoma, Washington. The HASP is to be used by Hart Crowser personnel and is written for the specific site conditions, purposes, dates, and personnel specified herein; it will be amended if conditions change.

This HASP is to be used in conjunction with Hart Crowser's Corporate Accident Prevention Program (APP), located on the Hart Crowser Intranet. Together the APP and this HASP constitute the health and safety plan for this site.

A field copy of this HASP is to be used by Hart Crowser personnel and must be available on site throughout the duration of the project. If site conditions, field activities, personnel, dates, or other conditions change over time, this HASP will be updated to address these changes as they occur. Hart Crowser personnel may make minor changes to the field copy by hand in ink (with date and initials). The signed HASP will be retained with the project files when the project is completed.

1.2 Distribution and Approval

This HASP will be made available to all Hart Crowser personnel working at the project site. Hart Crowser workers will read, sign, and return the form titled "Record of Health and Safety Communication" provided in Appendix A of this HASP to certify their agreement to comply with the minimum requirements of this HASP. The Hart Crowser project manager will route the signed Appendix A form to the project files upon completion of field activities covered under the HASP.

This HASP can be provided to subcontractors for informational purposes only and will be told clearly by the Field Health and Safety Manager that that this HASP represents minimum safety procedures for Hart Crowser workers and that subcontractors are responsible for their own safety while on the site. Nothing herein will be construed as granting rights to Hart Crowser subcontractors or any others working on this site to use or legally rely on this HASP.

This HASP has been approved by the Hart Crowser Regional Health and Safety Officer.

1.3 Chain of Command

The Hart Crowser chain of command for health and safety on this project includes the following individuals:

Regional Health and Safety Officer: Jessica Blanchette

The Hart Crowser Regional Health and Safety Officer has overall responsibility for preparation and modification of this HASP. If health and safety issues arise during site operations, the director will attempt to resolve them with the appropriate members of the project team.

Project Manager: Angie Goodwin

The Project Manager has overall responsibility for the successful outcome of the project. In consultation with the regional health and safety officer, the project manager makes final decisions about implementing this site-specific HASP. The project manager may delegate this responsibility and the accompanying authority to another project worker as needed.

Project Health and Safety Manager: Andrew Kaparos

The Project Health and Safety Manager has overall responsibility for health and safety on this project and will verify compliance with applicable requirements. This individual will communicate all relevant health and safety issues to Hart Crowser's workers.

Field Health and Safety Manager: Andrew Nakahara

The Field Health and Safety Manager is responsible for implementing this HASP in the field and for maintaining it at the project site. This individual conducts safety briefings, observes workers to verify that they are following HASP procedures, and assures that proper personal protective equipment (PPE) is available and used correctly and that employees have knowledge of the local emergency response system. The field health and safety manager will see that the field HASP is updated as needed to address changes in field conditions or procedures.

1.4 Work Activities

In April of 2019, Bunker C oil was discovered seeping out of the Rainy Creek bank in the Kosmos Flats area (the Site) and reported to the Washington State Department of Ecology (Ecology). Tacoma Power immediately began investigating the seep and implementing measures to mitigate risks to human and environmental health. Hart Crowser's work covered under this HASP includes collecting soil, groundwater, sediment, and surface water from the former mill site. Soil samples will be collected by test pit excavations, vac-truck potholing, and sonic drilling with eight borings being completed as monitoring wells. Sediment and surface water samples will be collected along Rainey Creek. Groundwater samples will be collected from temporary wells from the sonic drill borings and the newly installed monitoring wells.

The sampling will be completed in multiple mobilizations during 2022 and 2023.

1.5 Site Description

The Site is located in the Rainey Valley next to Riffe Lake. The Site is bounded by Rainey Creek to west and north, Champion Haul Road to the east, and Riffe Lake to the south. The Site topography near the oil seep gradually slopes to the northwest towards Rainy Creek. The Riffe Lake reservoir is currently a part of the power generating system operated by Tacoma Power. During the winter months the water levels in the reservoir drop. Spring rainfall and snow melt can flood the Site. The oil seep is located on the eastern side of the Rainy Creek bank, near the former Kosmos Mill site and a protective cap was installed in December 2019.

The Site was a part of the Kosmos town lumber mill which was abandoned and demolished prior to 1968. There is little readily available information regarding the lumber mill and its operations.

The Site and the surrounding area are currently closed with signs to recreational visitors stating, “Area Closed, No Trespassing," indicating that the area is closed to the public and no trespassing is allowed. Site roads are gated and not readily accessible by vehicles; however, pedestrians could access the area. Riffe Lake is still accessible to the general public.

2.0 HAZARD EVALUATION AND CONTROL MEASURES

2.1 Hazardous Substances

In April 2019, an oil seep was discovered in the Kosmos Flats area and reported to the Department of Ecology. This seep was confirmed by Ecology to be Bunker C oil on April 29, 2019. In addition, other potential hazardous substances associated with former mill sites include total petroleum hydrocarbons such as diesel (TPH-D), gasoline (TPH-G), and heavy oil (TPH-O); benzene, toluene, ethylbenzene, and xylenes (BTEX); lead; polycyclic aromatic hydrocarbons (PAHs), and polychlorinated biphenyls (PCBs).

The potential health hazards of these hazardous substances are discussed in individual fact sheets provided in Attachment A to this HASP. The fact sheets describe effects that might occur if acute (short-term) and/or chronic (occurring over a long period – more than 1 year) exposures were to happen. Inclusion of this information does not mean that these effects will occur during the work activities conducted by Hart Crowser.

In general, the hazardous substances that may be encountered during soil and groundwater sampling at the Kosmos Mill Site are not expected to be present at concentrations or in a form that could produce significant adverse health effects. The types of work activities to be conducted and the use of personal protective equipment (PPE) will limit potential exposure.

2.2 Potential Exposure Routes

Exposure to the hazardous substances listed above could occur by accidental inhalation of, direct contact with, or ingestion of potentially contaminated soil and groundwater. To prevent contact with potential contaminants, the Hart Crowser sampling team will wear the personal protective equipment (PPE) specified in Section 3.0 while sampling and while decontaminating equipment.

Inhalation

Workers could be exposed by inhaling dust when soil is moved or through volatilization of chemicals from soil. Dust will be monitored visually, and dust-control measures such as soil wetting will be implemented as needed. Air monitoring and control measures specified in this plan will minimize the possibility for inhalation of volatile organic compounds (VOCs).

Direct Contact

Workers could be exposed if contaminated soil, dust, or groundwater contacts the skin, eyes, or clothing. Wearing protective clothing and safety glasses and performing decontamination activities specified in this plan will minimize the potential for skin and eye contact with hazardous substances.

Ingestion

Workers could be exposed if they eat, drink, or perform other hand-to-mouth activities while overseeing construction or collecting soil samples. Personal hygiene measures will be implemented to prevent inadvertent ingestion of contaminants; for example, workers will remove their gloves and wash their hands and faces before eating, drinking, or using tobacco.

2.3 Air Monitoring

For activities in areas where VOCs are known or suspected to be present, air quality will be monitored using a MultiRAE, MiniRAE, or QRAEII photoionization detector (PID) to determine whether VOCs are present and to check the adequacy of PPE (specifically, respiratory protection). The monitoring results may trigger actions, as summarized in Table 1 and described in more detail below under "Action Levels."

Table 1 – Air Monitoring Action Levels

Monitoring Device	Sensor	Result	Action Required	Notes
MultiRAE or MiniRAE	VOC	<5 Units above Background	Continue Monitoring	a
		5 to 10 Units above Background	Use Half-facepiece Respirator or utilize institutional controls to reduce vapor emissions	a, b, c
		>10 Units above Background	Stop Work; Contact Project Health and Safety Manager	a, b

Notes:

a. Use appropriate lamp and calibrate unit.

b. Air-purifying respirators must be used only when use criteria are met and when appropriate cartridges are available.

c. Half-facepiece respirators generally acceptable up to 10 times the PEL.

Air quality will be monitored at the discretion of the field health and safety manager by an individual trained to use the equipment. The project manager is responsible for ascertaining that each designated operator is properly trained in the use of the monitoring equipment. **The results of all air**

monitoring will be recorded on the project "Field Health and Safety Report" form provided as Appendix B to this HASP. The results of air monitoring will be used to determine the need to upgrade personal protective equipment (PPE). The "Field Health and Safety Report" forms will be filed with the project records.

The specific piece of monitoring equipment item(s) to be used on this project will be indicated by Hart Crowser unit number on the project "Field Equipment & Supplies" form, which is included in this plan by reference. The equipment technician will calibrate, maintain, and repair each air monitoring equipment item, or arrange for these activities, which will be conducted in accordance with and at the frequency specified by the manufacturer or more frequently, as required by use conditions. The equipment technician will maintain calibration/repair records in the equipment log books.

The following sections describe the equipment and procedures that will be used to monitor VOCs.

MultiRAE or MiniRAE Photoionization Detector

Volatile Organic Compounds. A MultiRAE or MiniRAE photoionization detector (PID) will be used at locations where VOCs may be present during site activities. **This detector is non-specific**, meaning that it does not identify the chemicals present. In addition, since it is calibrated using only a single reference chemical, **the PID provides only an estimate of the actual vapor concentration present**. If chemical-specific information is necessary, other types of sampling equipment must also be used.

Monitoring Procedures. At the discretion of the field health and safety manager, air quality will be monitored using a MultiRAE or MiniRAE PID or equivalent with 10.6 eV lamp to measure organic vapor concentrations during site work activities. The 10.6 eV lamp will be specified for general hydrocarbon survey measurements for chemicals having an ionization potential of up to 10.6 eV, such as benzene (9.24 eV).

The field health and safety manager or other designated project individual is responsible for verifying that the equipment is calibrated and working properly before on-site use. For the MultiRAE or MiniRAE, this will include zeroing the instrument before work begins. Records of these activities will be maintained in the "Field Health and Safety Report" form. If there are any problems with the equipment, the item will be removed from use until repair or replacement can be coordinated with the equipment technician.

Action Levels. PID monitoring will be conducted before work begins at each individual work area where volatile chemicals may be present. Results may trigger actions, as summarized in Table 1 and described below:

- If PID measurements are less than 5 units above ambient background levels in the worker's breathing zones, work can proceed without respiratory protection, with monitoring repeated at 15- to 30-minute intervals, or more frequently if odors or signs of irritation are noted.
- If PID measurements are between 5 and 10 units above ambient background levels in the worker's breathing zones for 5 consecutive minutes, exposed workers will use air purifying

respirators as specified in Table 2, with monitoring repeated at least every 15 minutes, or more frequently if any odors or signs of irritation are noted.

- If PID measurements exceed 10 units above ambient background levels in the worker's breathing zones, work will cease, and employees will evacuate the work area pending reevaluation of the situation by the project manager and regional health and safety officer. Action will be taken, including plan modification if required, to address any situations where such results are observed.

Calibration and Maintenance. The MultiRAE or MiniRAE PID will be calibrated and maintained according to the manufacturer instructions. If there are problems with the equipment, a completed “Notice of Returned Equipment” form or other notification indicating the equipment condition will accompany the PID returned to the equipment room. The equipment technician will perform maintenance/repair as required.

2.4 Physical Hazards

Potential physical hazards associated with the project include operating motor vehicles, doing heavy lifting, cold stress, noise exposure, working around heavy equipment, biological hazards (insects, blood-borne pathogens [BBPs]), or slips, trips, and falls.

Operating Motor Vehicles

Hart Crowser personnel who operate motor vehicles are legally licensed to do so, will wear seat belts at all times when driving, and will obey all rules of the road while engaged in company business.

Hart Crowser employees will comply with all federal, state, and local regulations on use of cellular devices while driving. Only hands-free cellular devices may be used during vehicle operation. Under no circumstances is text messaging or any use of a keyboard allowed while operating a vehicle.

Heavy Lifting

Field work on this project will require some amount of heavy lifting, for instance carrying coolers containing samples and carrying equipment. Overexertion injuries to the back, shoulders, elbows, hands, or wrists can occur when a load is lifted or otherwise handled. Hands and wrists can be injured from grasping during lifting. Muscles in the forearm that are used for grasping attach to the elbow, so this joint can be injured when lifting. The shoulder can be injured by lifting any load and is especially at risk of injury from lifts done while reaching above the shoulder or away from the body. Frequent lifting and awkward lifting (i.e., above the shoulders, below the knees, at arms’ length) can also result in injuries.

The best procedures for lifting vary depending on conditions and the size and shape of the object being lifted. A general rule for avoiding injuries is to assess the object and surrounding area before lifting, and never attempt to lift an object that is poorly packaged or too heavy. Before lifting, workers should make sure their path is dry and clear of obstacles that could cause a fall.

To lift heavy objects:

- Take a deep breath and relax your muscles.
- Approach the object, and in a slow, controlled movement, bend your knees (keeping your back straight) until you are squatting.
- Grip the object securely with both hands and, when ready, push up and extend your knees until reaching a standing position, with the object at chest level. Do not lift above your shoulders or below your knees.
- Do not twist your back or bend sideways.
- Walk slowly to the destination and put down the heavy object using the same slow, controlled movements, keeping your back relatively straight and bending your knees.
- Do not lift or lower with arms extended.
- Take a break between lifting each object if necessary.
- Never attempt to move any object that seems too heavy to manage alone. Get help from a co-worker as needed.

Workers who need to lift objects should be in good physical shape. Workers not accustomed to lifting or vigorous exercise should not be assigned difficult lifting or lowering tasks.

Over-Water Safety Requirements

Working over water can pose human health and safety risks. There will be an inherent risk of falling off the boat and being immersed in water, which carries a risk of hypothermia or drowning. Additional safety hazards can include slippery surfaces on the boat, dock, or river bank, debris in the water, toxic substances, and pathogens. Our rules for over-water work are:

- All personnel on the boat and the docks will wear Coast Guard approved personal flotation devices (PFD; Type I, II, or III). The PFDs will be inspected before use, and PFDs with broken zippers or buckles or other malfunctioning components will not be used.
- Tools and equipment will be organized in a way that minimizes trip/fall hazards; they will not be left loose on the deck of the boat.
- Communications (using radios, cell phones, or other means) will be maintained between personnel on the vessel and project personnel on shore or at the office. On-shore staff will be notified of any emergency. If communication equipment fails to operate normally, sampling will be postponed until normal communications are restored.
- The vessel will remain close to shore.

- If the water is more than 5 feet deep, one or more Coast Guard-approved life rings (PFD Type IV) must be in the immediate work area and readily accessible for rescue in case a worker falls into the water. The line on the life ring must be at least 1/4 inch in diameter and at least 90 feet long and have a minimum breaking strength of 500 pounds.

Hart Crowser personnel will not jump into the water to attempt to rescue anyone who has fallen into the water. Instead, they will immediately throw the life ring to the person and call 911 if the person is unable to grasp the life ring or needs medical attention. Personnel will watch the person in the water so when rescue personnel arrive they will know where to start looking.

Heat-Related Illnesses

Weather conditions during the sampling event are expected to be in the low 70s, cloudy, and rainy. At a minimum, personnel wearing non-breathable clothing (e.g. PPE like chemical-resistant suits) at temperatures greater than 70°F should take a break every one to two hours and drink plenty of fluids. An average of one quart of fluids per hour is recommended. When temperatures are over 70°F, water will be available at the site in a sufficient quantity for each worker to drink one quart per hour. A cool or shaded rest area should be used for breaks.

The body normally cools itself by sweating. People suffer heat-related illness when the body's temperature control system is overloaded. Several factors affect the body's ability to cool itself during extremely hot weather. For instance, sweat will not evaporate as quickly when humidity is high, and clothing type and amount can affect cooling. Impermeable clothing reduces the body's ability to cool with evaporating perspiration and may lead to heat stress. Outdoor work conducted in hot weather and direct sun also increases the risk of heat-related illness in exposed workers.

Heat related illnesses and their symptoms and first-aid measures are:

- **Heat Rash**. Raised red vesicles on affected areas and decreased ability to tolerate heat; exacerbated by clothes that chafe. Maintain good personal hygiene and use drying powders or lotions.

- **Heat Cramps**. Muscle spasms and pain in the extremities and abdomen. Rest in a cool area and drink plenty of fluids. If pain persists, seek medical attention.

- **Heat Exhaustion**. Pale, cool, moist, clammy skin; profuse sweating; shallow breathing; dizziness; lassitude; and fainting. Rest in a cool area and drink plenty of fluids. Get medical attention before returning to work.

- **Heat Stroke**: Red, hot, dry skin; no perspiration; nausea; dizziness; confusion; strong rapid pulse; and coma. Cool victim immediately with cool or cold water. **Seek immediate medical attention.**

Cold Stress

Workers who are exposed to extreme cold or work outdoors in cold and wet environments may be at risk of cold stress, which can result when the core body temperature gets too low. The most common consequences of cold stress are hypothermia, frost bite, and trench foot; the latter two are not normally risks on Hart Crowser projects. Factors in cold stress include wetness, wind chill, tiredness, improper clothing, health conditions, and poor physical conditioning.

Near-freezing temperatures is a factor in cold stress. Project workers will dress appropriately for the weather conditions and pay attention to the signs and symptoms of hypothermia. When temperatures drop below normal and wind speed increases, heat can leave the body more rapidly. These weather-related conditions may lead to serious health problems.

Hypothermia

Causes. Hypothermia can result when the body loses heat faster than it can replace it, and temperature drops below 95°F. Wind chill and wetness can play a significant role in lowering core body temperature. It is important to understand that hypothermia can occur even when temperatures are not extremely cold, especially when water, wind, and/or pre-existing health conditions are involved.

Signs. Warning signs of hypothermia include shivering (only initially), confusion, loss of coordination, slurred speech, fumbling, inability to decide, disorientation, apathy, drowsiness, inability to stand or walk, dilated pupils, slowed pulse and breathing, and loss of consciousness. Confusion is a key symptom. With medium or advanced hypothermia, shivering is absent, and the person may not realize they have hypothermia. They may also be unwilling to call attention to themselves or seek help.

Treatment. Hypothermia victims should be immediately but not too rapidly re-warmed.

Rewarming involves:

- Moving the victim into a sheltered area.
- Removing any wet clothing.
- Wrapping the victim loosely with blankets or sleeping bag.
- Applying heat packs or warm containers to armpits, groin, head, neck, and chest.
- If core body temperature falls below 90°F and heated shelter is not available, using skin-to-skin contact with another individual.
- Providing warm beverages if the person is conscious.
- Getting medical help as soon as possible.

Rescue breaths and CPR for victims who are not breathing or who don’t have a pulse are not covered in this HASP.

Noise

Heavy equipment may produce noise levels that exceed 85 decibels A scale (dBA) for personnel working in or around the job site. At this level or above, hearing protection must be worn. A general guideline is if people 3 to 4 feet apart cannot converse without raising voices, the noise levels are too high and hearing protection should be worn. Ear muffs or ear plugs with a noise reduction rating (NRR) of 29 or higher (the highest NRR is 33) will be used when noise levels are too high as determined by the above guideline or by sound level measurements.

Working Around Heavy Equipment

Various heavy equipment (e.g., excavators, drill rigs) may be used at the job site. To work safely around heavy equipment, Hart Crowser on-foot workers will:

- Wear Class II high visibility vests;
- Stay out of the equipment's swing radius;
- Never position themselves in front of or behind a moving piece of equipment, or between two moving pieces of equipment;
- Maintain eye contact with the operator (never assume the operators sees an on-foot worker);
- Be aware of the back-up alarm signal associated with the equipment; use caution if wearing hearing protection; and
- Not operate heavy equipment unless the worker has the appropriate training and/or licenses.

Heavy equipment is typically powered by diesel engines which emit diesel exhaust, a mixture of gases and particulates. Short-term exposure to diesel exhaust can irritate the eyes, nose, and throat; and cause headaches and nausea. If workers experience short-term effects, they will move away from the diesel exhaust and notify the Project Health and Safety Manager or the Regional Health and Safety Officer. Exposure to diesel exhaust fumes may lead to other health problems such as lung diseases, heart diseases, asthma, lung damage and immune system problems. These problems typically occur in people with high rates of exposure and long-term exposure (e.g., heavy equipment operators, truck drivers). Existing asthma may be exacerbated by diesel exhaust.

Biological Hazards

Biological hazards include vector-borne diseases, insects, rodents and other wild or stray animals, snakes, and poisonous plants. Vector-borne diseases may be spread to workers by insects such as mosquitoes and ticks. When a mosquito or tick bites a worker, it may transfer a disease-causing agent, such as a parasite, bacteria, or virus. Examples of mosquito-borne diseases are West Nile virus and encephalitis. Lyme disease and Rocky Mountain spotted fever are tick-borne diseases. People are exposed to biological hazards through contact with insects, soil, water, bird or bat droppings, rodent droppings, or poisonous plants.

Insects

Wearing long pants, socks, and long-sleeved shirts provides protection from insects. Using insect repellents that contain DEET or picaridin also provides protection from insects. Insect bites and stings can be treated with over-the-counter products that relieve pain and prevent infection.

Stinging insects include bees, wasps, hornets, and fire ants. Personnel can avoid attracting stinging insects by wearing light-colored clothing and avoiding perfumes or colognes. If such an insect approaches, do not wave wildly and swat blindly; instead, use a gentle pushing or brushing motion to deter them.

Bee stings can produce life-threatening allergic reactions. Symptoms include pain, swelling of the throat, redness or discoloration of the wound, itching, hives, decreased consciousness, and labored or noisy breathing. Personnel who are allergic to insect stings should carry an anaphylactic shock kit prescribed by their physician.

Blood-Borne Pathogens

Workers responding to a first-aid incident could be exposed to blood-borne pathogens (BBPs), which are infectious microorganisms in blood and other body fluids that can cause disease in humans. Examples of these pathogens include hepatitis B virus, hepatitis C virus, and HIV. Workers exposed to BBPs are at risk for serious or life-threatening illnesses.

Universal precautions will be followed if BBP exposure is a concern. Universal precautions involve treating all human blood and other potentially infectious materials as a BBP and protecting oneself from exposure. The easiest way to protect oneself from blood and body fluids is to have the injured person treat their own wound if they are conscious and capable of doing so. If injured people are unable to take care of themselves, or they need help, workers should use disposable gloves and eye protection if there is a splash hazard.

If disposable gloves are not available, a plastic bag (trash, shopping, or sandwich) can be used to create a barrier. If performing CPR, always use a pocket mask equipped with a one-way valve. After removing PPE, wash hands or other affected body parts. Place PPE in a plastic bag, seal the bag, and contact the regional health and safety officer for further instructions.

If you are exposed to BBPs or other potentially infectious materials (i.e. BBPs contact your eyes, mouth, nose, open wounds/sores, abrasions, sunburned areas, or acne), follow these steps:

- Flush the area of the body that was exposed with warm water, and then wash with soap and water. Vigorously scrub all areas. It is the abrasive action of scrubbing that removes the contamination from the skin.
- If you have an open cut, squeeze it gently to make it bleed, then wash with soap and water.
- Notify your project manager or the regional health and safety officer to document the incident. Identify the source of the exposure.

- Get medical counseling (i.e., get tested for BBPs, get vaccinated if needed).

Slips, Trips, and Falls

Hart Crowser workers will be careful to prevent slips on wet walking surfaces and will look for and avoid tripping hazards such as loose rock or debris. Wear steel-toed safety boots with slip-resistant soles.

Be aware of your surroundings. Keep pathways and work areas free of debris and supplies to prevent unsafe walking and working conditions. Changes in elevation such as ruts or holes present a trip hazard and should be marked if possible. Avoid leaving tools on the ground.

Plan what you would do if you start to slip or fall. During a fall, do not try to catch yourself; try to avoid landing on your hands, elbows, or knees. Landing on the side of your body is much safer. If you are walking on a slope and know you are going to slide, lower your center of gravity by sitting down and sliding on your feet and/or bottom. If sliding while standing up, keep your weight over your feet and bend your knees; do not lean backward or forward.

Hazards requiring fall protection are not expected at this site. A written Fall Protection Work Plan is required where fall hazards of 10 feet or more exist. Fall prevention or fall protection measures is required for any walking surface of 4 feet or higher, and when working within the affected area (the distance away from the edge of an excavation equal to the depth of the excavation up to a maximum distance of 15 feet) of any excavation more than 10 feet deep. If there is a fall hazard of 4 feet or more on a hazardous slope (i.e., a slope where normal footing cannot be maintained without the use of devices because of the pitch of the surface, weather conditions, or surface material), a personal fall restraint system or positioning device system is required. Work will not be performed on slopes steeper than 75 percent or near vertical drop-offs without fall protection equipment.

2.5 Hazard Analysis and Applicable Safety Procedures by Task

Table 2 lists the tasks and associated hazards that may be anticipated during the work activities described in this HASP and associated control measures.

Table 2 – Hazard Analysis by Task

Work Task	Potential Hazards	Protective Measures
Observing and logging soil from test pits, potholes, and drilled borings	Working around heavy equipment; slips, trips and falls; heavy lifting; work near water; hot and cold stress; noise; and skin contact with contaminated media.	Level D or Level C PPE (see Section 3.0), hard hat, high-visibility safety vest or jacket, caution around moving equipment, safe lifting practices, and hearing protection.
Collecting soil, groundwater, sediment, and surface water samples	Skin contact with contaminated media; working near heavy equipment; work near water; hot and cold stress; slips, trips and falls; and heavy lifting.	Level D or Level C PPE (see Section 3.0), caution around moving equipment and traffic, hearing protection, and air monitoring (as needed).
Equipment decontamination	Skin contact with contaminated sediment and water; wet surfaces; slips, trips, and falls; heavy lifting	Level D PPE (see Section 3.0), assistance from others when moving equipment,

3.0 PERSONAL PROTECTIVE EQUIPMENT

When fieldwork is performed in contaminated areas, the primary objective is to minimize worker exposure using engineering controls such as ventilating, working up-wind or away from contaminated materials, or wetting soil to reduce dust. If engineering controls are not feasible or may not provide adequate control, and before they are fully implemented, workers will wear specified personal protective equipment (PPE) to minimize potential exposure to hazardous substances.

Contact with hazardous substances at harmful levels is not expected for this project; therefore, PPE is based on the lowest Occupational Safety and Health Administration (OSHA) requirements, Level D. Conditions requiring Level A, B, or C protection are not anticipated for this project. If they do occur, work will stop and the HASP will be amended as required before work is resumed.

Table 3 summarizes the minimum PPE requirements for Hart Crowser workers based on the potential routes of exposure and the potential hazardous substances.

Table 3 – Specific Personal Protection Level Requirements for this Site

Potential Route of Contact: Type of Contaminant	Required Protection Level	Safety Glasses	Hard Hat[b]	Steel-toed Safety Boots or shoes	Tyvek	Poly Tyvek	Nitrile Gloves	Respirator	
								Half-face piece	Full-face piece
None anticipated	Level D (a)	X	X	X					
Minor skin contact possible	Level D (a)	X	X	X	g		X		
Skin contamination possible: organics	Level C (c)	X	X	X		g	X		
Inhalation possible: organics	Level C (c)	X	X	X	g		X	d, e	f

Notes:

a. Level D protection required when atmosphere contains no known hazard and work functions preclude splashes, immersion, or the potential for unexpected inhalation of or contact with hazardous levels of any chemicals.
b. Hard hat required where risk of striking overhead objects exists.
c. Level C protection required when atmospheric contaminants, liquid splashes, or other direct contact will not adversely affect any exposed skin; this assumes that the types of air contaminants have been identified, concentrations have been measured or modeled/estimated, an appropriate respirator cartridge is available, and all air-purifying respirator criteria are met.
d. Appropriate respirator cartridges include organic vapor (MSA GMA or equivalent), combination (MSA GMC-H or equivalent), and others as required for the particular contaminants.
e. Half-facepiece respirator required when PID concentrations range from 5 to 10.
f. Full-facepiece respirators will not be used unless field representative has been properly fit-tested for a full-facepiece respirator.
g. Tyvek or protective clothing should be worn if body contact with impacted materials is likely.

3.1 Level D Activities

Level D protection will be used when the atmosphere contains no known hazards and Hart Crowser workers will not perform activities where skin contact with free-phase product or contaminated materials is likely to occur. These workers will wear regular work clothes (long pants, shirt with minimum 4-inch sleeve), eye protection (safety glasses or goggles), hand protection (nitrile or latex gloves or neoprene-coated work gloves), and foot protection (steel-toed boots or shoes).

3.2 Modified Level D Activities

Modified Level D protection will be used when the atmosphere contains no known hazards and there is a potential that Hart Crowser workers may have skin contact with hazardous substances. These workers will wear regular work clothes (long pants, shirt with minimum 4-inch sleeve), eye protection (safety glasses or goggles), hand protection (nitrile or latex gloves or neoprene-coated work gloves), and foot protection (steel-toed, boots or shoes), and will supplement this equipment with chemical resistant outer clothing (e.g. Tyvek® or rain gear) and chemical resistant gloves. Workers will make sure the protective clothing and gloves are suitable for the types of chemicals that may be encountered on site.

3.3 Level C Activities

Workers performing site activities where skin contact with free product or contaminated materials is likely will wear chemical-resistant gloves (nitrile, neoprene, or other appropriate outer gloves, and surgical inner gloves) and polyethylene-coated Tyvek® or other chemical-resistant suits or rain gear. Workers will make sure the protective clothing and gloves are suitable for the types of chemicals that may be encountered on site. Workers will use face shields or goggles as necessary to avoid splashes in the eyes or face.

When performing activities in which inhalation of chemical vapors and dusts is a concern, workers will wear half-facepiece air-purifying respirators as specified in Table 3. If respirators are used, cartridges should be changed on a daily basis, at minimum. They should be changed more frequently if chemical vapors are detected inside the respirator or other symptoms of breakthrough are noted (respiratory irritation, dizziness, or breathing difficulty).

4.0 SAFETY SUPPLIES AND EQUIPMENT LIST

The following safety supplies and equipment must be available on site:

- Fire extinguisher – 3 to 4-pound ABC
- First aid kit in a sturdy weatherproof carrying case
- Bottled sterile hand-held eyewash solution
- Mobile telephone
- Class II high visibility safety vest or jacket
- Gore-Tex (or similar) rainsuit
- Head protection – hard hat
- Hearing protection
- Half-facepiece respirator with combination cartridges (as needed)
- Foot protection – steel-toed boots with slip-resistant soles
- Hand protection – nitrile outer gloves/nitrile inner gloves or neoprene-coated work gloves
- Eye protection – safety glasses or safety goggles if a splash hazard is present
- Personal flotation device (PFD) when the chance of drowning is present
- Type IV Coast Guard Approved life ring if water exceeds 5 feet deep

All non-disposable safety gear and PPE must be cleaned after use and stored securely to avoid damage. Avoid storing gear in direct sunlight or exposed to weather conditions. Safety equipment and PPE should be checked before use and damaged or worn-out gear should be disposed of and replaced.

5.0 SITE CONTROL

Field work for this project consists primarily of low-impact sampling activities that will not result in the migration of contaminants or increased exposure to human health or the environment; therefore, formal exclusion zones, contaminant reduction zones, and support zones are not necessary for this field work.

Although a formal contaminant reduction zone is not necessary, project workers will use precautions during sampling activities. The amount of equipment and number of personnel allowed in sampling areas will be minimized and the amount of samples collected should not exceed what is needed for laboratory analysis.

6.0 DECONTAMINATION

Decontamination for this project is limited to decontaminating sampling equipment.

Hart Crowser workers will practice good hygiene by washing their hands and faces prior to taking rest breaks, drinking liquids, and so forth. They will also wash their hands and faces fully before eating, using tobacco, or as soon as possible upon leaving a work area.

7.0 SITE SECURITY

Security at the Kosmos Mill Site will be the responsibility of the field health and safety manager. Any security problems will be reported to the appropriate authorities and to the client.

8.0 SPILL CONTAINMENT

Sources of bulk chemical subject to spillage are not expected for this project. Accordingly, a spill containment plan is not required for this project.

9.0 EMERGENCY RESPONSE PLAN

This Emergency Response Plan outlines the steps necessary for appropriate response to emergency situations that could reasonably occur during Hart Crowser's work at Kosmos Mill Site. The following paragraphs summarize the key emergency responses for this project.

9.1 Plan Content and Review

The principal hazards addressed by this plan are fire, medical emergencies, and situations such as inadequate PPE for the hazards present. However, to help anticipate other potential emergency situations, field personnel will exercise caution and look for signs of potentially hazardous situations, including:

- General physical hazards (slippery or uneven surfaces, inclement weather, working around heavy equipment);

- Poisonous plants or dangerous animals;
- Underground pipelines or cables; and
- Live electrical wires or equipment.

These and other potential conditions should be anticipated, and steps should be taken to prevent problems before they occur.

This emergency response plan will be reviewed and rehearsed, as necessary, during the on-site health and safety briefing so all personnel will know what their duties are if an emergency occurs.

9.2 Plan Implementation

The field health and safety manager will evaluate the situation and act as the lead if an emergency occurs. That individual will determine the need to implement the emergency response, in concert with other resource personnel including client representatives, the project manager, and the regional health and safety officer. Other on-site field personnel will assist the field health and safety manager as needed during an emergency.

If the plan is implemented, the field health and safety manager or designee is responsible for alerting all personnel at the affected area by use of a signal device (such as a hand-held air horn) or visual or shouted instructions, as appropriate.

The field health and safety manager will identify a safe assembly area for workers to gather if it is necessary to evacuate the area and will communicate this location to workers during the on-site health and safety briefing. The “buddy” system will be employed during evacuation to facilitate safe evacuation. The field health and safety manager is responsible for roll call at the assembly area to account for all personnel. As only one Hart Crowser worker will be on-site, a buddy system will be established with other contractors or subcontractors.

9.3 Emergency Response Contacts

Emergency contact information is provided in this HASP (see Page 1). A copy of this HASP will be maintained at the project site. Emergency information includes:

- Emergency telephone numbers;
- Route to nearest hospital (Figure 1); and
- Site description (Section 1.4).

A significant environmental release of contaminants is not likely to occur from work activities subject to this HASP. If it does, the field health and safety manager will contact the project manager or regional health and safety officer to make any required notifications.

If an emergency situation occurs requiring implementation of the emergency response plan (fire, serious injury, or inadequate personal protection equipment for the hazards present, for instance), Hart Crowser staff will cease all work immediately, pending approval from the field health and safety manager to restart work. The general emergency actions described below will be followed.

9.4 Fires

Hart Crowser personnel may attempt to control only very small fires. If the fire expands, or an explosion appears likely, Hart Crowser field workers will evacuate the area immediately. If a fire occurs that cannot be controlled with a 3 to 4-pound ABC fire extinguisher, immediate intervention by the local fire department or other appropriate agency is imperative. Use these steps:

- Immediately call **911**;
- Evacuate to a safe area away from the danger to a previously agreed upon upwind location; and
- Inform the project manager or field health and safety manager of the situation.

9.5 Medical Emergencies

Hart Crowser staff will call **911** immediately if a medical emergency (such as a serious injury or an unconscious worker) occurs. If workers are unsure about the severity of an accident or exposure, they will take a conservative approach and seek medical attention. The field health and safety manager will notify the project manager of the outcome of the medical incident as soon as possible.

No Hart Crowser employees are trained to perform rescue duties or medical duties beyond basic CPR and first aid. Hart Crowser employees certified in CPR and first aid may respond to work-related incidents requiring first aid services. First aid will be treatment for such things as minor cuts and bruises as needed. When rendering first aid, Hart Crowser workers will take necessary precautions to avoid exposure to BBPs. Section 2.4, Physical Hazards, provides information on BBPs and precautions for avoiding exposure.

9.6 Uncontrolled Contaminant Release

Work activities for this project do not present the potential for an uncontrolled contaminant release as defined by:

Washington

- Chapter 296-24, Washington Administrative Code (WAC), General Safety and Health Standards.
- Chapter 296-62, WAC, General Occupational Health Standards.
- Chapter 296-155, WAC, Safety Standards for Construction Work.
- Chapter 296-800, WAC, Core Rules. Core Rules are the basic safety and health rules needed by most employers in Washington State.

Federal OSHA

- 29 Code of Federal Regulations (CFR) 1910, General Occupational Safety and Health Standards.
- 29 CFR 1926, Safety and Health Regulations for Construction.
- 29 CFR 1904, Recording and Reporting Occupational Injuries and Illnesses.

Hart Crowser staff are not trained as emergency responders as defined by federal and state regulations; therefore, they are not qualified to respond to hazardous material emergencies.

9.7 Potentially High Chemical Exposure Situations

Work activities for this project do not present the potential for high chemical exposure situations.

10.0 NOTIFICATION AND REPORTING

The project manager will be informed immediately if an emergency, accident, or injury occurs at the project location. The project manager will notify the client immediately. The field health and safety manager will notify the regional health and safety officer as soon as possible after the situation has been stabilized. The project manager or regional health and safety officer will notify the appropriate client contacts and regulatory agencies, if applicable. If an individual is injured or suffers a work-related illness, the field health and safety manager or designee will complete an injury/accident report and submit it to human resources or the regional health and safety officer within 24 hours. A blank report is provided as Appendix C.

The project manager, the field health and safety manager, and the regional health and safety officer will evaluate emergency response following the incident. The results of the evaluation will be used in follow-up training exercises to improve the emergency response plan.

11.0 MEDICAL SURVEILLANCE

Hart Crowser employees working on this project participate in a medical surveillance program as described in Section 11 of Hart Crowser's APP.

12.0 SAFETY TRAINING REQUIREMENTS

Hart Crowser employees who work at sites where there is potential for exposure to hazardous substances, health hazards, or safety hazards will have completed 40 hours of hazardous waste operations and emergency response (HAZWOPER) training and 3 days of supervised field experience. In addition, employees will have completed an 8-hour annual refresher training within the past 12 months or will possess equivalent documented training by experience. Site supervisors will have completed 8 hours of HAZWOPER supervisor training. The project manager will ensure that all employees working on this site have completed required HAZWOPER training. The Hart Crowser safety records coordinator maintains employee health and safety training records.

Employees performing some tasks will require additional safety training on performing the task safely (without injury or property damage) and in compliance with safety regulations. Examples of these tasks include entering confined spaces, wearing a respirator, operating equipment or machinery, working at heights, handling or using hazardous substances, and working in excessive outdoor heat. Safety training requirements are specified in Section 7.2 of the Hart Crowser APP. Hart Crowser personnel will complete hazard-specific safety training as needed based on the tasks to be performed.

Before each work day starts, the field health and safety manager will review applicable health and safety issues with Hart Crowser employees. At these briefings the work to be accomplished will be reviewed and there will be an opportunity for questions to be asked. The “Field Health and Safety Report” form (Appendix B) will be completed daily by the Hart Crowser field health and safety manager or designated individual.

13.0 REPORTING, REPORTS, AND DOCUMENTATION

All incidents (accidents, injuries, near-misses) that occur during field work on this project will be reported to the project manager immediately. The project manager will notify the client and the regional health and safety officer.

The field health and safety manager is responsible for maintaining records demonstrating that the provisions of this HASP are implemented throughout the course of this project.

\\seafs\Projects\Notebooks\1949902_Kosmos_Mill_Add_Env_Assistance\Health and Safety\Kosmos HASP.docx

APPENDIX A

Record of Health and Safety Communication

Record of Health and Safety Communication

PROJECT NAME: Kosmos Mill Oil Cleanup

PROJECT NUMBER: 19499-02

SITE CONTAMINANTS: Total petroleum hydrocarbons as diesel (TPH-D), gasoline (TPH-G), and heavy oil (TPH-O); benzene, toluene, ethylbenzene, and xylenes (BTEX); lead; polycyclic aromatic hydrocarbons (PAHs); and polychlorinated biphenyls (PCBs).

PPE REQUIREMENTS (check all that apply):

X	Eye protection	X	Gloves (specify)	Nitrile or neoprene-coated work gloves
X	Foot protection	X	Clothing (specify)	Long pants, shirt with minimum 4-inch sleeve
X	Head protection		Respirator (specify)	Half-face air purifying (as needed)
		X	Other (specify)	Hearing protection

The following personnel have reviewed a copy of the site-specific HASP. By signing below, these personnel indicate they have read the plan, including all referenced information, and that they understand the requirements detailed for this project.

PRINTED NAME	SIGNATURE	PROJECT DUTIES	DATE

Project manager: please route a copy of this form to the job files when completed.

Benzene - ToxFAQs™

CAS # 71-43-2

This fact sheet answers the most frequently asked health questions (FAQs) about benzene. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHTLIGHTS: Benzene is a widely used chemical formed from both natural processes and human activities. Breathing benzene can cause drowsiness, dizziness, and unconsciousness; long-term benzene exposure causes effects on the bone marrow and can cause anemia and leukemia. Benzene has been found in at least 1,000 of the 1,684 National Priority List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is benzene?

Benzene is a colorless liquid with a sweet odor. It evaporates into the air very quickly and dissolves slightly in water. It is highly flammable and is formed from both natural processes and human activities.

Benzene is widely used in the United States; it ranks in the top 20 chemicals for production volume. Some industries use benzene to make other chemicals which are used to make plastics, resins, and nylon and other synthetic fibers. Benzene is also used to make some types of rubbers, lubricants, dyes, detergents, drugs, and pesticides. Natural sources of benzene include emissions from volcanoes and forest fires. Benzene is also a natural part of crude oil, gasoline, and cigarette smoke.

What happens to benzene when it enters the environment?

- Industrial processes are the main source of benzene in the environment.
- Benzene can pass into the air from water and soil.
- It reacts with other chemicals in the air and breaks down within a few days.
- Benzene in the air can attach to rain or snow and be carried back down to the ground.
- It breaks down more slowly in water and soil, and can pass through the soil into underground water.
- Benzene does not build up in plants or animals.

How might I be exposed to benzene?

- Outdoor air contains low levels of benzene from tobacco smoke, automobile service stations, exhaust from motor vehicles, and industrial emissions.
- Vapors (or gases) from products that contain benzene, such as glues, paints, furniture wax, and detergents, can also be a source of exposure.
- Air around hazardous waste sites or gas stations will contain higher levels of benzene.
- Working in industries that make or use benzene.

How can benzene affect my health?

Breathing very high levels of benzene can result in death, while high levels can cause drowsiness, dizziness, rapid heart rate, headaches, tremors, confusion, and unconsciousness. Eating or drinking foods containing high levels of benzene can cause vomiting, irritation of the stomach, dizziness, sleepiness, convulsions, rapid heart rate, and death.

The major effect of benzene from long-term exposure is on the blood. Benzene causes harmful effects on the bone marrow and can cause a decrease in red blood cells leading to anemia. It can also cause excessive bleeding and can affect the immune system, increasing the chance for infection. Some women who breathed high levels of benzene for many months had irregular menstrual periods and a decrease in the size of their ovaries, but we do not know for certain that benzene caused the effects. It is not known whether benzene will affect fertility in men.

Benzene

CAS # 71-43-2

How likely is benzene to cause cancer?

Long-term exposure to high levels of benzene in the air can cause leukemia, particularly acute myelogenous leukemia, often referred to as AML. This is a cancer of the bloodforming organs. The Department of Health and Human Services (DHHS) has determined that benzene is a known carcinogen. The International Agency for Research on Cancer (IARC) and the EPA have determined that benzene is carcinogenic to humans.

How can benzene affect children?

Children can be affected by benzene exposure in the same ways as adults. It is not known if children are more susceptible to benzene poisoning than adults.

Benzene can pass from the mother's blood to a fetus. Animal studies have shown low birth weights, delayed bone formation, and bone marrow damage when pregnant animals breathed benzene.

How can families reduce the risks of exposure to benzene?

Benzene exposure can be reduced by limiting contact with gasoline and cigarette smoke. Families are encouraged not to smoke in their house, in enclosed environments, or near their children.

Is there a medical test to determine whether I've been exposed to benzene?

Several tests can show if you have been exposed to benzene. There is a test for measuring benzene in the breath; this test must be done shortly after exposure. Benzene can also be measured in the blood; however, since benzene disappears rapidly from the blood, this test is only useful for recent exposures.

In the body, benzene is converted to products called metabolites. Certain metabolites can be measured in the urine. The metabolite S-phenylmercapturic acid in urine is a sensitive indicator of benzene exposure. However, this test must be done shortly after exposure and is not a reliable indicator of how much benzene you have been exposed to, since the metabolites may be present in urine from other sources.

Has the federal government made recommendations to protect human health?

The EPA has set the maximum permissible level of benzene in drinking water at 5 parts benzene per billion parts of water (5 ppb).

The Occupational Safety and Health Administration (OSHA) has set limits of 1 part benzene per million parts of workplace air (1 ppm) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR) 2007. Toxicological Profile for Benzene (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Ethylbenzene- ToxFAQs™

CAS # 100-41-4

This fact sheet answers the most frequently asked health questions (FAQs) about ethylbenzene. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Ethylbenzene is a colorless liquid found in a number of products including gasoline and paints. Breathing very high levels can cause dizziness and throat and eye irritation. Breathing lower levels has resulted in hearing effects and kidney damage in animals. Ethylbenzene has been found in at least 829 of 1,699 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What is ethylbenzene?

Ethylbenzene is a colorless, flammable liquid that smells like gasoline.

It is naturally found in coal tar and petroleum and is also found in manufactured products such as inks, pesticides, and paints.

Ethylbenzene is used primarily to make another chemical, styrene. Other uses include as a solvent, in fuels, and to make other chemicals.

What happens to ethylbenzene when it enters the environment?

- Ethylbenzene moves easily into the air from water and soil.
- It takes about 3 days for ethylbenzene to be broken down in air into other chemicals.
- In surface water, ethylbenzene breaks down by reacting with other chemicals found naturally in water.
- Ethylbenzene can move through soil into groundwater.
- In soil, it is broken down by bacteria.

How might I be exposed to ethylbenzene?

- If you live in a city or near many factories or heavily traveled highways, you may be exposed to ethylbenzene in air.
- Releases of ethylbenzene into the air occur from burning oil, gas, and coal and from industries using ethylbenzene.
- Ethylbenzene is not often found in drinking water. Higher levels may be found in residential drinking water wells near landfills, waste sites, or leaking underground fuel storage tanks.
- Exposure can occur if you work in an industry where ethylbenzene is used or made.
- Exposure can occur if you use products containing it, such as gasoline, carpet glues, varnishes, and paints.

How can ethylbenzene affect my health?

Exposure to high levels of ethylbenzene in air for short periods can cause eye and throat irritation. Exposure to higher levels can result in dizziness.

Irreversible damage to the inner ear and hearing has been observed in animals exposed to relatively low concentrations of ethylbenzene for several days to weeks.

Exposure to relatively low concentrations of ethylbenzene in air for several months to years causes kidney damage in animals.

How likely is ethylbenzene to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that ethylbenzene is a possible human carcinogen.

CAS # 100-41-4

How does ethylbenzene affect children?

There are no studies evaluating the effects of ethylbenzene exposure on children or immature animals. It is likely that children would have the same health effects as adults. We do not know whether children would be more sensitive than adults to the effects of ethylbenzene.

We do not know if ethylbenzene will cause birth defects in humans. Minor birth defects and low birth weight have occurred in newborn animals whose mothers were exposed to ethylbenzene in air during pregnancy.

How can families reduce the risk of exposure to ethylbenzene?

- Use adequate ventilation to reduce exposure to ethylbenzene vapors from consumer products such as gasoline, pesticides, varnishes and paints, and newly installed carpeting.
- Sometimes older children sniff household chemicals, including ethylbenzene, in an attempt to get high. Talk with your children about the dangers of sniffing chemicals.
- Household chemicals should be stored out of reach of children to prevent accidental poisoning. Always store household chemicals in their original containers; never store them in containers that children would find attractive to eat or drink from, such as old soda bottles. Gasoline should be stored in a gasoline can with a locked cap.

Is there a medical test to show whether I've been exposed to ethylbenzene?

Ethylbenzene is found in the blood, urine, breath, and some body tissues of exposed people. The most common way to test for ethylbenzene is in the urine. This test measures substances formed by the breakdown of ethylbenzene. Because these substances leave the body very quickly, this test needs to be done within a few hours after exposure occurs.

These tests can show you were exposed to ethylbenzene, but cannot predict the kind of health effects that might occur.

Has the federal government made recommendations to protect human health?

The EPA has determined that exposure to ethylbenzene in drinking water at concentrations of 30 mg/L for 1 day or 3 mg/L for 10 days is not expected to cause any adverse effects in a child.

The EPA has determined that lifetime exposure to 0.7 mg/L ethylbenzene is not expected to cause any adverse effects.

The Occupational Health and Safety Administration (OSHA) has limited workers' exposure to an average of 100 ppm for an 8-hour workday, 40-hour workweek.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2010. Toxicological Profile for Ethylbenzene. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

FUEL OILS

CAS # 8008-20-6, 70892-10-3, 68476-30-2, 68476-34-6, 68476-31-3

Agency for Toxic Substances and Disease Registry ToxFAQs **September 1996**

This fact sheet answers the most frequently asked health questions (FAQs) about fuel oils. For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

SUMMARY: Fuel oils are liquid mixtures produced from petroleum, and their use mostly involves burning them as fuels. Drinking or breathing fuel oils may cause nausea or nervous system effects. However, exposure under normal use conditions is not likely to be harmful. Fuel oils have been found in at least 26 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are fuel oils?

(Pronounced fyo͞o′əl oilz)

Fuel oils are a variety of yellowish to light brown liquid mixtures that come from crude petroleum. Some chemicals found in fuel oils may evaporate easily, while others may more easily dissolve in water.

Fuel oils are produced by different petroleum refining processes, depending on their intended uses. Fuel oils may be used as fuel for engines, lamps, heaters, furnaces, and stoves, or as solvents.

Some commonly found fuel oils include kerosene, diesel fuel, jet fuel, range oil, and home heating oil. These fuel oils differ from one another by their hydrocarbon compositions, boiling point ranges, chemical additives, and uses.

What happens to fuel oils when they enter the environment?

- Some chemicals found in fuel oils may evaporate into the air from open containers or contaminated soil or water.
- Some chemicals found in fuel oils may dissolve in water after spills to surface waters or leaks from underground storage tanks.
- Some chemicals found in fuel oils may stick to particles in water, which will eventually cause them to settle to the bottom sediment.
- Some of the chemicals found in fuel oils may be broken down slowly in air, water, and soil by sunlight or small organisms.
- Some of the chemicals found in fuel oils may build up significantly in plants and animals.

How might I be exposed to fuel oils?

- Using a home kerosene heater or stove, or using fuel oils at work.
- Breathing air in home or building basements that has been contaminated with fuel oil vapors entering from the soil.
- Drinking or swimming in water that has been contaminated with fuel oils from a spill or a leaking underground storage tank.
- Touching soil contaminated with fuel oils.
- Using fuel oils to wash paint or grease from skin or equipment.

How can fuel oils affect my health?

Little information is available about the health effects that may be caused by fuel oils. People who use kerosene stoves for cooking do not seem to have any health problems related to their exposure.

Breathing some fuel oils for short periods may cause nausea, eye irritation, increased blood pressure, headache, lightheadedness, loss of appetite, poor coordination, and difficulty concentrating. Breathing diesel fuel vapors for long periods may cause kidney damage and lower your blood's ability to clot.

Drinking small amounts of kerosene may cause vomiting, diarrhea, coughing, stomach swelling and cramps, drowsiness, restlessness, painful breathing, irritability, and unconsciousness. Drinking large amounts of kerosene may cause convulsions, coma, or death. Skin contact with kerosene for short periods may cause itchy, red, sore, or peeling skin.

How likely are fuel oils to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that some fuel oils (heavy) may possibly cause cancer in humans, but for other fuel oils (light) there is not enough information to make a determination. IARC has also determined that occupational exposures to fuel oils during petroleum refining are probably carcinogenic in humans.

Some studies with mice have suggested that repeated contact with fuel oils may cause liver or skin cancer. However, other mouse studies have found this not to be the case. No studies are available in other animals or in people on the carcinogenic effects of fuel oils.

Is there a medical test to show whether I've been exposed to fuel oils?

There is no medical test that shows if you have been exposed to fuel oils. Tests are available to determine if some of the chemicals commonly found in fuel oils are in your blood. However, the presence of these chemicals in blood may not necessarily mean that you have been exposed to fuel oils.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) and the Air Force Office of Safety and Health (AFOSH) have set a permissible exposure level (PEL) of 400 parts of petroleum distillates per million parts of air (400 ppm) for an 8-hour workday, 40-hour workweek.

The National Institute for Occupational Safety and Health (NIOSH) recommends that average workplace air levels not exceed 350 milligrams of petroleum distillates per cubic meter of air (350 mg/m^3) for a 40-hour workweek.

The Department of Transportation (DOT) lists fuel oils as hazardous materials and, therefore, regulates their transportation.

Glossary

Carcinogenic: Able to cause cancer.

CAS: Chemical Abstracts Service.

Evaporate: To change into a vapor or a gas.

Hydrocarbon: Any compound made up of hydrogen and carbon.

Milligram (mg): One thousandth of a gram.

ppm: Parts per million.

Sediment: Mud and debris that have settled to the bottom of a body of water.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for fuel oils. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone:1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Toluene - ToxFAQs™

CAS # 108-88-3

This fact sheet answers the most frequently asked health related questions (FAQs) regarding exposure to toluene. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important that you understand this information because this substance may harm you, or your family. The health effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to toluene occurs from breathing contaminated workplace air, automobile exhaust, or by using products such as paints, paint thinners, fingernail polish, lacquers, and adhesives. Toluene affects the nervous system. Toluene has been found in at least 1,012 of the 1,699 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What is toluene?

Toluene is a clear, colorless liquid with a distinctive smell. It is a good solvent (a substance that can dissolve other substances). Toluene occurs naturally in crude oil and in the tolú tree. It is produced in the process of making gasoline and other fuels from crude oil and in making coke from coal.

Toluene is used in making paints, paint thinners, fingernail polish, lacquers, adhesives, and rubber and in some printing and leather tanning processes. Toluene is also used in the manufacture of other chemicals, nylon, and plastics. It is also added to gasoline along with benzene and xylene to improve octane ratings.

What happens to toluene when it enters the environment?

- Toluene enters the environment when you use materials that contain it. It can also enter surface water and ground water from spills of solvents and petroleum products as well as leaking underground storage tanks at gasoline stations and other facilities.
- When toluene-containing products are placed in landfills or waste disposal sites, toluene can enter the soil or water near the waste site.
- Toluene in subsurface water can be degraded by anaerobic microorganisms.
- Toluene in surface water or soil will readily evaporate to the air or be degraded by bacteria.
- Toluene does not usually stay in the environment long.

How might I be exposed to toluene?

- Breathing contaminated workplace air or automobile exhaust.
- Individuals who work with gasoline, paint, lacquer, or dyes have greater exposures to toluene, as do individuals who smoke or intentionally inhale products containing toluene for its euphoric effects or to get high.
- Living near uncontrolled hazardous waste sites containing toluene products.
- Toluene is not frequently detected in drinking water or food.

How can toluene affect my health?

Toluene may affect the nervous system. Low to moderate levels can cause tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, and loss of appetite. These symptoms usually disappear when exposure stops.

Long-term daily inhalation exposure to toluene in the workplace may cause some hearing and color vision loss. Repeatedly breathing toluene from glue or paint thinners may permanently damage the brain.

The effects of toluene in animals are similar to those seen in humans.

How likely is toluene to cause cancer?

Studies in workers and animals exposed to toluene generally indicate that toluene is not carcinogenic

The International Agency for Research on Cancer (IARC) determined that toluene is not classifiable as to its carcinogenicity in humans. The EPA determined there is inadequate information to assess the carcinogenic potential of toluene. The National Toxicology Program (NTP) has not considered the carcinogenic potential of toluene.

How can toluene affect children?

The effects of toluene on children have not been studied very much, but toluene seems to produce the same types of effects in children as it does in adults.

Some older children and adolescents who have repeatedly breathed large amounts of toluene to get high have developed loss of muscle control, loss of memory, poor balance, and decreased mental abilities. Some of these changes may last for a long time after toluene has left the body.

Some mothers who breathed large amounts of toluene during pregnancy to get high have had children with birth defects, including retardation of mental abilities and growth.

How can families reduce the risk of exposure to toluene?

- Families can reduce their risk of exposure to toluene by using consumer products containing the chemical (such as paints, glues, inks, and stain removers) in well-ventilated areas and reading the labels of the products.
- When not in use, toluene-containing products should be tightly covered to prevent evaporation into the air.
- Household chemicals should be stored out of the reach of young children to prevent accidental poisonings.
- Always store household chemicals in their original labeled containers. Never store household chemicals in containers that children would find attractive to eat or drink from, such as old soda bottles.
- Use bottled water if you have concerns about the presence of toluene in your tap water.
- Prevent children from eating or playing in the dirt if you live near a waste site that has been contaminated with toluene.
- Talk with children about the dangers of sniffing chemicals.

Is there a medical test to show whether I've been exposed to toluene?

Toluene and its breakdown products (metabolites) can be measured in blood and urine. However, the detection of toluene or its metabolites cannot predict the kind of health effects that might develop from that exposure. Because toluene and its metabolites leave the body fairly rapidly, the tests need to be conducted within days after exposure. The tests are not routinely available at the doctor's office because they require special equipment.

Has the federal government made recommendations to protect human health?

The EPA has recommended a drinking water limit of 1 mg/L for toluene.

The Occupational Safety and Health Administration (OSHA) has set a legal limit for workers of 200 ppm for toluene in air averaged over an 8 hour workday.

The National Institute for Occupational Safety and Health (NIOSH) has set a recommended limit of 100 ppm for toluene in air averaged over a 10-hour workday.

References

This ToxFAQs™ information is taken from the 2015 Toxicological Profile for Toluene (Draft for Public Comment) produced by the Agency for Toxic Substances and Disease Registry, Public Health Service, U.S. Department of Health and Human Services, Public Health Service in Atlanta, GA.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

ToxFAQs™ on the web: www.atsdr.cdc.gov/toxFAQs

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Polychlorinated Biphenyls - ToxFAQs™

This fact sheet answers the most frequently asked health questions (FAQs) about polychlorinated biphenyls. For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Polychlorinated biphenyls (PCBs) are a mixture of individual chemicals which are no longer produced in the United States, but are still found in the environment. Health effects that have been associated with exposure to PCBs include acne-like skin conditions in adults and neurobehavioral and immunological changes in children. PCBs are known to cause cancer in animals. PCBs have been found in at least 500 of the 1,598 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What are polychlorinated biphenyls?

Polychlorinated biphenyls are mixtures of up to 209 individual chlorinated compounds (known as congeners). There are no known natural sources of PCBs. PCBs are either oily liquids or solids that are colorless to light yellow. Some PCBs can exist as a vapor in air. PCBs have no known smell or taste. Many commercial PCB mixtures are known in the U.S. by the trade name Aroclor.

PCBs have been used as coolants and lubricants in transformers, capacitors, and other electrical equipment because they don't burn easily and are good insulators. The manufacture of PCBs was stopped in the U.S. in 1977 because of evidence they build up in the environment and can cause harmful health effects. Products made before 1977 that may contain PCBs include old fluorescent lighting fixtures and electrical devices containing PCB capacitors, and old microscope and hydraulic oils.

What happens to PCBs when they enter the environment?

- PCBs entered the air, water, and soil during their manufacture, use, and disposal; from accidental spills and leaks during their transport; and from leaks or fires in products containing PCBs.
- PCBs can still be released to the environment from hazardous waste sites; illegal or improper disposal of industrial wastes and consumer products; leaks from old electrical transformers containing PCBs; and burning of some wastes in incinerators.
- PCBs do not readily break down in the environment and thus may remain there for very long periods of time. PCBs can travel long distances in the air and be deposited in areas far away from where they were released. In water, a small amount of PCBs may remain dissolved, but most stick to organic particles and bottom sediments. PCBs also bind strongly to soil.
- PCBs are taken up by small organisms and fish in water. They are also taken up by other animals that eat these aquatic animals as food. PCBs accumulate in fish and marine mammals, reaching levels that may be many thousands of times higher than in water.

How might I be exposed to PCBs?

- Using old fluorescent lighting fixtures and electrical devices and appliances, such as television sets and refrigerators, that were made 30 or more years ago. These items may leak small amounts of PCBs into the air when they get hot during operation, and could be a source of skin exposure.
- Eating contaminated food. The main dietary sources of PCBs are fish (especially sportfish caught in contaminated lakes or rivers), meat, and dairy products.
- Breathing air near hazardous waste sites and drinking contaminated well water.
- In the workplace during repair and maintenance of PCB transformers; accidents, fires or spills involving transformers, fluorescent lights, and other old electrical devices; and disposal of PCB materials.

How can PCBs affect my health?

The most commonly observed health effects in people exposed to large amounts of PCBs are skin conditions such as acne and rashes. Studies in exposed workers have shown changes in blood and urine that may indicate liver damage. PCB exposures in the general population are not likely to result in skin and liver effects. Most of the studies of health effects of PCBs in the general population examined children of mothers who were exposed to PCBs.

Animals that ate food containing large amounts of PCBs for short periods of time had mild liver damage and some died. Animals that ate smaller amounts of PCBs in food over several weeks or months developed various kinds of health effects, including anemia; acne-like skin conditions; and liver, stomach, and thyroid gland injuries. Other effects of PCBs in animals include changes in the immune system, behavioral alterations, and impaired reproduction. PCBs are not known to cause birth defects.

How likely are PCBs to cause cancer?

Few studies of workers indicate that PCBs were associated with certain kinds of cancer in humans, such as cancer of the liver and biliary tract. Rats that ate food containing high levels of PCBs for two years developed liver cancer. The Department of Health and Human Services (DHHS) has concluded that PCBs may reasonably be anticipated to be carcinogens. PCBs have been classified as probably carcinogenic, and carcinogenic to humans (group 1) by the Environmental Protection Agency (EPA) and International Agency for Research on Cancer (IARC), respectively.

How can PCBs affect children?

Women who were exposed to relatively high levels of PCBs in the workplace or ate large amounts of fish contaminated with PCBs had babies that weighed slightly less than babies from women who did not have these exposures. Babies born to women who ate PCB-contaminated fish also showed abnormal responses in tests of infant behavior. Some of these behaviors, such as problems with motor skills and a decrease in short-term memory, lasted for several years. Other studies suggest that the immune system was affected in children born to and nursed by mothers exposed to increased levels of PCBs. There are no reports of structural birth defects caused by exposure to PCBs or of health effects of PCBs in older children. The most likely way infants will be exposed to PCBs is from breast milk. Transplacental transfers of PCBs were also reported In most cases, the benefits of breast-feeding outweigh any risks from exposure to PCBs in mother's milk.

How can families reduce the risks of exposure to PCBs?

- You and your children may be exposed to PCBs by eating fish or wildlife caught from contaminated locations. Certain states, Native American tribes, and U.S. territories have issued advisories to warn people about PCB-contaminated fish and fish-eating wildlife. You can reduce your family's exposure to PCBs by obeying these advisories.
- Children should be told not play with old appliances, electrical equipment, or transformers, since they may contain PCBs.
- Children should be discouraged from playing in the dirt near hazardous waste sites and in areas where there was a transformer fire. Children should also be discouraged from eating dirt and putting dirty hands, toys or other objects in their mouths, and should wash hands frequently.
- If you are exposed to PCBs in the workplace it is possible to carry them home on your clothes, body, or tools. If this is the case, you should shower and change clothing before leaving work, and your work clothes should be kept separate from other clothes and laundered separately.

Is there a medical test to show whether I've been exposed to PCBs?

Tests exist to measure levels of PCBs in your blood, body fat, and breast milk, but these are not routinely conducted. Most people normally have low levels of PCBs in their body because nearly everyone has been environmentally exposed to PCBs. The tests can show if your PCB levels are elevated, which would indicate past exposure to above-normal levels of PCBs, but cannot determine when or how long you were exposed or whether you will develop health effects.

Has the federal government made recommendations to protect human health?

The EPA has set a limit of 0.0005 milligrams of PCBs per liter of drinking water (0.0005 mg/L). Discharges, spills or accidental releases of 1 pound or more of PCBs into the environment must be reported to the EPA. The Food and Drug Administration (FDA) requires that infant foods, eggs, milk and other dairy products, fish and shellfish, poultry and red meat contain no more than 0.2-3 parts of PCBs per million parts (0.2-3 ppm) of food. Many states have established fish and wildlife consumption advisories for PCBs.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2000. Toxicological profile for polychlorinated biphenyls (PCBs). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

ToxFAQs^{TM} Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Polycyclic Aromatic Hydrocarbons (PAHs) - ToxFAQs™

This fact sheet answers the most frequently asked health questions (FAQs) about polycyclic aromatic hydrocarbons (PAHs). For more information, call the CDC Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. This information is important because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to polycyclic aromatic hydrocarbons usually occurs by breathing air contaminated by wild fires or coal tar, or by eating foods that have been grilled. PAHs have been found in at least 600 of the 1,430 National Priorities List (NPL) sites identified by the Environmental Protection Agency (EPA).

What are polycyclic aromatic hydrocarbons?

(Pronounced pŏl′ĭ-sī′klĭk ăr′ə-măt′ĭk hī′drə-kar′bənz)

Polycyclic aromatic hydrocarbons (PAHs) are a group of over 100 different chemicals that are formed during the incomplete burning of coal, oil and gas, garbage, or other organic substances like tobacco or charbroiled meat. PAHs are usually found as a mixture containing two or more of these compounds, such as soot.

Some PAHs are manufactured. These pure PAHs usually exist as colorless, white, or pale yellow-green solids. PAHs are found in coal tar, crude oil, creosote, and roofing tar, but a few are used in medicines or to make dyes, plastics, and pesticides.

What happens to PAHs when they enter the environment?

- PAHs enter the air mostly as releases from volcanoes, forest fires, burning coal, and automobile exhaust.
- PAHs can occur in air attached to dust particles.
- Some PAH particles can readily evaporate into the air from soil or surface waters.
- PAHs can break down by reacting with sunlight and other chemicals in the air, over a period of days to weeks.
- PAHs enter water through discharges from industrial and wastewater treatment plants.
- Most PAHs do not dissolve easily in water. They stick to solid particles and settle to the bottoms of lakes or rivers.
- Microorganisms can break down PAHs in soil or water after a period of weeks to months.
- In soils, PAHs are most likely to stick tightly to particles; certain PAHs move through soil to contaminate underground water.
- PAH contents of plants and animals may be much higher than PAH contents of soil or water in which they live.

How might I be exposed to PAHs?

- Breathing air containing PAHs in the workplace of coking, coal-tar, and asphalt production plants; smokehouses; and municipal trash incineration facilities.
- Breathing air containing PAHs from cigarette smoke, wood smoke, vehicle exhausts, asphalt roads, or agricultural burn smoke.
- Coming in contact with air, water, or soil near hazardous waste sites.
- Eating grilled or charred meats; contaminated cereals, flour, bread, vegetables, fruits, meats; and processed or pickled foods.
- Drinking contaminated water or cow's milk.
- Nursing infants of mothers living near hazardous waste sites may be exposed to PAHs through their mother's milk.

Agency for Toxic Substances and Disease Registry
Division of Toxicology and Human Health Sciences

Polycyclic Aromatic Hydrocarbons

How can PAHs affect my health?

Mice that were fed high levels of one PAH during pregnancy had difficulty reproducing and so did their offspring. These offspring also had higher rates of birth defects and lower body weights. It is not known whether these effects occur in people.

Animal studies have also shown that PAHs can cause harmful effects on the skin, body fluids, and ability to fight disease after both short- and long-term exposure. But these effects have not been seen in people.

How likely are PAHs to cause cancer?

The Department of Health and Human Services (DHHS) has determined that some PAHs may reasonably be expected to be carcinogens.

Some people who have breathed or touched mixtures of PAHs and other chemicals for long periods of time have developed cancer. Some PAHs have caused cancer in laboratory animals when they breathed air containing them (lung cancer), ingested them in food (stomach cancer), or had them applied to their skin (skin cancer).

Is there a medical test to show whether I've been exposed to PAHs?

In the body, PAHs are changed into chemicals that can attach to substances within the body. There are special tests that can detect PAHs attached to these substances in body tissues or blood. However, these tests cannot tell whether any health effects will occur or find out the extent or source of your exposure to the PAHs. The tests aren't usually available in your doctor's office because special equipment is needed to conduct them.

Has the federal government made recommendations to protect human health?

The Occupational Safety and Health Administration (OSHA) has set a limit of 0.2 milligrams of PAHs per cubic meter of air (0.2 mg/m^3). The OSHA Permissible Exposure Limit (PEL) for mineral oil mist that contains PAHs is 5 mg/m^3 averaged over an 8-hour exposure period.

The National Institute for Occupational Safety and Health (NIOSH) recommends that the average workplace air levels for coal tar products not exceed 0.1 mg/m^3 for a 10-hour workday, within a 40-hour workweek. There are other limits for workplace exposure for things that contain PAHs, such as coal, coal tar, and mineral oil.

Glossary

Carcinogen: A substance that can cause cancer.

Ingest: Take food or drink into your body.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1995. Toxicological profile for polycyclic aromatic hydrocarbons. Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information?

For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Human Health Sciences, 1600 Clifton Road NE, Mailstop F-57, Atlanta, GA 30329-4027.

Phone: 1-800-232-4636.

ToxFAQs™ Internet address via WWW is http://www.atsdr.cdc.gov/toxfaqs/index.asp.

ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

Lead - ToxFAQs™

What is lead?

Lead is a naturally occurring metal found in small amounts in the earth's crust. Lead can be found in all parts of our environment, including air, water and soil. Lead can exist in many different chemical forms.

Lead is used in the production of batteries, ammunition, and metal products (solder and pipes). Because of health concerns, use of lead in paints, ceramic products, caulking, and pipe solder has been dramatically reduced. The use of lead as an additive to automobile gasoline was banned in 1996 in the United States.

What happens to lead in the environment?

- Lead is an element and, therefore, it does not break down.
- When lead is released to the air, it may be transported long distances before it deposits onto the ground.
- Once deposited, lead often adheres to soil particles.
- Lead in soil can be transported into groundwater, but the amount of lead that moves into groundwater will depend on the chemical form of lead and soil type.

How can I be exposed to lead?

- Eating food or drinking water that contains lead. Water pipes in some older homes may contain lead solder which can leach into the water.
- Spending time in areas where lead-based paints have been used and are deteriorating. Deteriorating lead paint can form lead dust which can be ingested.
- Spending time in areas where the soil is contaminated with lead.
- Working in a job where lead is used or participating in certain hobbies in which lead is used, such as making stained glass.
- Using health-care products or folk remedies that contain lead.

> Lead can affect almost every organ and system in your body

How can lead affect my health?

The effects of lead are the same whether it enters the body through inhalation or ingestion. Lead can affect almost every organ and system in your body. The nervous system is the main target for lead toxicity in adults and children. Long-term exposure can result in decreased learning, memory, and attention and weakness in fingers, wrists, or ankles. Lead exposure can cause anemia and damage to kidneys. It can also cause increases in blood pressure, particularly in middle-aged and older individuals. Exposure to high lead levels can severely damage the brain and kidneys and can cause death. In pregnant women, exposure to high levels of lead may cause a miscarriage. High-level exposure in men can damage reproductive organs.

Lead

How can lead affect children?

Children are more vulnerable to lead poisoning than adults because their nervous system is still developing. Children can be exposed to lead in their environment and prior to birth from lead in their mother's body. At lower levels of exposure, lead can decrease mental development, with effects on learning, intelligence and behavior. Physical growth may also be decreased. A child who swallows large amounts of lead may develop anemia, severe stomachache, muscle weakness, and brain damage. Exposure to lead during pregnancy can result in premature births. Some effects of lead may persist into adulthood.

Can lead cause cancer?

There have been several agencies and organizations both in the United States and internationally that have reviewed studies and made an assessment about whether lead can cause cancer.

- The Department of Health and Human Services (HHS) has determined that lead and lead compounds are reasonably anticipated to be human carcinogens
- The U.S. Environmental Protection Agency (EPA) has classified lead as a probable human carcinogen.
- The International Agency for Research on Cancer (IARC) has determined that inorganic lead is probably carcinogenic to humans, and that there is insufficient information to determine whether organic lead compounds will cause cancer in humans.

Can I get a medical test to check for lead?

A blood test is available to measure the amount of lead in your blood. Blood tests are commonly used to screen children for lead poisoning. Your doctor can draw blood samples and send them to appropriate laboratories for analysis.

How can I protect my family from lead exposure?

- Avoid exposure to sources of lead.
- Do not allow children to chew or mouth surfaces that may have been painted with lead-based paint.
- If your home contains lead-based paint or you live in an area contaminated with lead, wash children's hands and faces often to remove lead dusts and soil, and regularly clean the house of dust and tracked in soil.

Want more information?

Go to ATSDR's Toxicological Profile for Lead

CDC Lead Poisoning Prevention Program https://www.cdc.gov/nceh/lead/default.htm

Environmental Protection Agency https://www.epa.gov/lead/protect-your-family-exposures-lead

Call **CDC-INFO** at 1-800-232-4636, or submit your question online at https://wwwn.cdc.gov/dcs/ContactUs/Form

Go to ATSDR's Toxic Substances Portal: http://www.atsdr.cdc.gov/substances/index.asp

If you have any more questions or concerns, you can also find & contact your ATSDR Regional Representative at http://www.atsdr.cdc.gov/DRO/dro_org.html

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

XYLENE

CAS # 1330-20-7

Division of Toxicology and Environmental Medicine ToxFAQs™ **August 2007**

This fact sheet answers the most frequently asked health questions (FAQs) about xylene. For more information, call the ATSDR Information Center at 1-800-232-4636. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It is important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: Exposure to xylene occurs in the workplace and when you use paint, gasoline, paint thinners and other products that contain it. People who breathe high levels may have dizziness, confusion, and a change in their sense of balance. Xylene has been found in at least 840 of the 1,684 National Priority List sites identified by the Environmental Protection Agency (EPA).

What is xylene?

There are three forms of xylene in which the methyl groups vary on the benzene ring: *meta*-xylene, *ortho*-xylene, and *para*-xylene (*m*-, *o*-, and *p*-xylene). These different forms are referred to as isomers.

Xylene is a colorless, sweet-smelling liquid that catches on fire easily. It occurs naturally in petroleum and coal tar. Chemical industries produce xylene from petroleum. It is one of the top 30 chemicals produced in the United States in terms of volume.

Xylene is used as a solvent and in the printing, rubber, and leather industries. It is also used as a cleaning agent, a thinner for paint, and in paints and varnishes. It is found in small amounts in airplane fuel and gasoline.

What happens to xylene when it enters the environment?

❑ Xylene evaporates quickly from the soil and surface water into the air.
❑ In the air, it is broken down by sunlight into other less harmful chemicals in a couple of days.
❑ It is broken down by microorganisms in soil and water.
❑ Only a small amount of it builds up in fish, shellfish, plants, and other animals living in xylene-contaminated water.

How might I be exposed to xylene?

❑ Using a variety of consumer products including gasoline, paint varnish, shellac, rust preventatives, and cigarette smoke. Xylene can be absorbed through the respiratory tract and through the skin.
❑ Ingesting xylene-contaminated food or water, although these levels are likely to be very low.
❑ Working in a job that involves the use of xylene such as painters, paint industry workers, biomedical laboratory workers, automobile garage workers, metal workers, and furniture refinishers.

How can xylene affect my health?

No health effects have been noted at the background levels that people are exposed to on a daily basis.

High levels of exposure for short or long periods can cause headaches, lack of muscle coordination, dizziness, confusion, and changes in one's sense of balance. Exposure of people to high levels of xylene for short periods can also cause irritation of the skin, eyes, nose, and throat; difficulty in breathing; problems with the lungs; delayed reaction time; memory difficulties; stomach discomfort; and possibly changes in the liver and kidneys. It can cause unconsciousness and even death at very high levels.

How likely is xylene to cause cancer?

Both the International Agency for Research on Cancer (IARC) and the EPA have found that there is insufficient information to determine whether or not xylene is carcinogenic.

How can xylene affect children?

The effects of xylene have not been studied in children, but it is likely that they would be similar to those seen in exposed adults. Although there is no direct evidence, children may be more sensitive to acute inhalation exposure than adults because their narrower airways would be more sensitive to swelling effects.

Studies of unborn animals indicate that high concentrations of xylene may cause increased numbers of deaths, and delayed growth and development. In many instances, these same concentrations also cause damage to the mothers. We do not know if xylene harms the unborn child if the mother is exposed to low levels of xylene during pregnancy

How can families reduce the risks of exposure to xylene?

❏ Exposure to xylene as solvents (in paints or gasoline) can be reduced if the products are used with adequate ventilation and if they are stored in tightly closed containers out of the reach of small children.
❏ Sometimes older children sniff household chemicals in attempt to get high. Talk with your children about the dangers of sniffing xylene.
❏ If products containing xylene are spilled on the skin, then the excess should be wiped off and the area cleaned with soap and water.

Is there a medical test to determine whether I've been exposed to xylene?

Laboratory tests can detect xylene or its breakdown products in exhaled air, blood, or urine. There is a high degree of agreement between the levels of exposure to xylene and the levels of xylene breakdown products in the urine. However, a urine sample must be provided very soon after exposure ends because xylene quickly leaves the body. These tests are not routinely available at your doctor's office because they require special equipment.

Has the federal government made recommendations to protect human health?

The EPA set a limit of 10 parts xylene per million parts drinking water (10 ppm).

The Occupational Safety and Health Administration (OSHA) has set limits of 100 parts xylene per million parts of workplace air (100 ppm) for 8 hour shifts and 40 hour work weeks.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 2007. Toxicological Profile for Xylene (Update). Atlanta, GA: U.S. Department of Public Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology and Environmental Medicine, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-800-232-4636, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html. ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

ATSDR
AGENCY FOR TOXIC SUBSTANCES
AND DISEASE REGISTRY

TOTAL PETROLEUM HYDROCARBONS (TPH)

Agency for Toxic Substances and Disease Registry ToxFAQs **August 1999**

This fact sheet answers the most frequently asked health questions (FAQs) about total petroleum hydrocarbons (TPH). For more information, call the ATSDR Information Center at 1-888-422-8737. This fact sheet is one in a series of summaries about hazardous substances and their health effects. It's important you understand this information because this substance may harm you. The effects of exposure to any hazardous substance depend on the dose, the duration, how you are exposed, personal traits and habits, and whether other chemicals are present.

HIGHLIGHTS: TPH is a mixture of many different compounds. Everyone is exposed to TPH from many sources, including gasoline pumps, spilled oil on pavement, and chemicals used at home or work. Some TPH compounds can affect your nervous system, causing headaches and dizziness. TPH has been found in at least 23 of the 1,467 National Priorities List sites identified by the Environmental Protection Agency (EPA).

What are total petroleum hydrocarbons?

(Pronounced tōt′l pə-trō′lē-əm hī′drə-kär′bənz)

Total petroleum hydrocarbons (TPH) is a term used to describe a large family of several hundred chemical compounds that originally come from crude oil. Crude oil is used to make petroleum products, which can contaminate the environment. Because there are so many different chemicals in crude oil and in other petroleum products, it is not practical to measure each one separately. However, it is useful to measure the total amount of TPH at a site.

TPH is a mixture of chemicals, but they are all made mainly from hydrogen and carbon, called hydrocarbons. Scientists divide TPH into groups of petroleum hydrocarbons that act alike in soil or water. These groups are called petroleum hydrocarbon fractions. Each fraction contains many individual chemicals.

Some chemicals that may be found in TPH are hexane, jet fuels, mineral oils, benzene, toluene, xylenes, naphthalene, and fluorene, as well as other petroleum products and gasoline components. However, it is likely that samples of TPH will contain only some, or a mixture, of these chemicals.

What happens to TPH when it enters the environment?

- ☐ TPH may enter the environment through accidents, from industrial releases, or as byproducts from commercial or private uses.
- ☐ TPH may be released directly into water through spills or leaks.
- ☐ Some TPH fractions will float on the water and form surface films.
- ☐ Other TPH fractions will sink to the bottom sediments.
- ☐ Bacteria and microorganisms in the water may break down some of the TPH fractions.
- ☐ Some TPH fractions will move into the soil where they may stay for a long time.

How might I be exposed to TPH?

- ☐ Everyone is exposed to TPH from many sources.
- ☐ Breathing air at gasoline stations, using chemicals at home or work, or using certain pesticides.
- ☐ Drinking water contaminated with TPH.
- ☐ Working in occupations that use petroleum products.
- ☐ Living in an area near a spill or leak of petroleum products.
- ☐ Touching soil contaminated with TPH.

How can TPH affect my health?

Some of the TPH compounds can affect your central nervous system. One compound can cause headaches and dizziness at high levels in the air. Another compound can cause a nerve disorder called "peripheral neuropathy," consisting of numbness in the feet and legs. Other TPH compounds can cause effects on the blood, immune system, lungs, skin, and eyes.

Animal studies have shown effects on the lungs, central nervous system, liver, and kidney from exposure to TPH compounds. Some TPH compounds have also been shown to affect reproduction and the developing fetus in animals.

How likely is TPH to cause cancer?

The International Agency for Research on Cancer (IARC) has determined that one TPH compound (benzene) is carcinogenic to humans. IARC has determined that other TPH compounds (benzo[a]pyrene and gasoline) are probably and possibly carcinogenic to humans. Most of the other TPH compounds are considered not to be classifiable by IARC.

Is there a medical test to show whether I've been exposed to TPH?

There is no medical test that shows if you have been exposed to TPH. However, there are methods to determine if you have been exposed to some TPH compounds. Exposure to kerosene can be determined by its smell on the breath or clothing. Benzene can be measured in exhaled air and a breakdown product of benzene can be measured in urine. Other TPH compounds can be measured in blood, urine, breath, and some body tissues.

Has the federal government made recommendations to protect human health?

There are no regulations or advisories specific to TPH. The following are recommendations for some of the TPH fractions and compounds:

The EPA requires that spills or accidental releases into the environment of 10 pounds or more of benzene be reported to the EPA.

The Occupational Safety and Health Administration has set an exposure limit of 500 parts of petroleum distillates per million parts of air (500 ppm) for an 8-hour workday, 40-hour workweek.

Glossary

Carcinogenicity: Ability to cause cancer.

CAS: Chemical Abstracts Service.

Immune system: Body organs and cells that fight disease.

Pesticides: Chemicals used to kill pests.

References

Agency for Toxic Substances and Disease Registry (ATSDR). 1999. Toxicological profile for total petroleum hydrocarbons (TPH). Atlanta, GA: U.S. Department of Health and Human Services, Public Health Service.

Where can I get more information? For more information, contact the Agency for Toxic Substances and Disease Registry, Division of Toxicology, 1600 Clifton Road NE, Mailstop F-32, Atlanta, GA 30333. Phone: 1-888-422-8737, FAX: 770-488-4178. ToxFAQs Internet address via WWW is http://www.atsdr.cdc.gov/toxfaq.html ATSDR can tell you where to find occupational and environmental health clinics. Their specialists can recognize, evaluate, and treat illnesses resulting from exposure to hazardous substances. You can also contact your community or state health or environmental quality department if you have any more questions or concerns.

APPENDIX B
Field Health & Safety Report

Kosmos Mill Site
Glenoma, Washington

Field Health & Safety Report

19499-02 December 2021

HARTCROWSER

Appendix
B

Job No. __________
Date __________
S M T W Th F S
Arrival time: __________
Departure time: __________

Job __________

Location __________

Client __________

Field representative __________ Project manager __________

Field H&S manager __________ Project H&S manager __________

Names of personnel on site __________

Site activities __________

Potential hazards __________

Hazard control used __________

Protective measures taken __________

Comments or observations __________

Sketch position of equipment relative to exploration (attach separate diagram if needed); indicate monitoring point(s) and prevailing wind direction.

Exploration No. ____________________

Air Monitoring Log

Meter Number 1, Type ____________ Calibrated ____________ Checked ____________

Meter Number 2, Type ____________ Calibrated ____________ Checked ____________

Background Reading: Meter 1 ____________________ Meter 2 ____________________

Time	**Meter 1**	**Meter 2**	**Comments**

APPENDIX C
Hart Crowser Incident/Accident Investigation Report

Hart Crowser Incident/Accident Investigation Report*

Hart Crowser Office: ______________________________________
Incident/Accident
Site Location: ____
Address: ____
State: County:

Project number: ____
Date/time of
occurrence: ___AM ___PM

Name(s) of Hart Crowser personnel involved in the incident/accident:

Name(s) and Affiliation of any other personnel involved in the incident/accident:

What happened? Describe cause and nature of incident, injury or illness.

Was the incident/accident caused by actions of another individual: __Yes __No If yes, provide name, address, phone and details:

Describe any unsafe action, equipment, conditions that contributed to the incident/accident:

Was first aid given? **__Yes __No __ Unknown**

Was person referred to medical evaluation/treatment? **___Yes ___No ___ Unknown**

If yes, indicate date, where and to whom:

Did the employee(s) receive medical treatment beyond first aid __Yes __No __ Unknown If yes, describe medical treatment given:

Will lost time be involved? **__Yes __No __N/A**

Will restricted work days be involved? **__Yes __No __N/A**

If yes to either lost time or restricted work, complete the following:

__________________ Last normal work date
__________________ Date of return to normal work
__________________ Number of days lost time involved or expected
__________________ Number of days restricted work involved or expected

What actions will be taken to prevent recurrence? Give responsibilities and expected completion dates for each action.

Witnesses (Provide name, company, address, and phone number):

Reported By:
Date:

Reviewed by:
Corporate health and safety director:
Date:
Employee(s) manager or supervisor:
Date:
Human resources:
Date:

Will the work-related injury/illness result in a Workers' Compensation claim? __Yes __No ____N/A

If yes, provide claim number and date claim filed:

*The supervisor of the employee(s) involved in the incident/accident must ensure that this form is filled out within 24 hours of the incident/or accident and forwarded to Regional Health and Safety Officer. Attach additional sheets if necessary. If the incident is a recordable work-related injury or illness, OSHA Form 301 must be completed in addition to this form.

HASP ADDENDUM

COVID-19 Field Safety

HASP ADDENDUM

COVID-19 Field Safety

This addendum has been prepared as a means to communicate updated health and safety requirements on jobsites pertaining to Coronavirus disease 2019 (COVID-19) spread and prevention. Employees will acknowledge reviewing this addendum or obtaining a briefing on the contents of this addendum by signing the Record of Health and Safety Communication in Attachment A.

Novel Coronavirus 2019

COVID-19 is a respiratory illness that can spread from person to person. The virus that causes COVID-19 is a novel coronavirus that was first identified during an investigation into an outbreak in Wuhan, China.

Symptoms

Most people infected with the COVID-19 virus will experience mild to moderate respiratory illness and recover without requiring special treatment.

The below symptoms may appear 2–14 days after exposure (based on the incubation period of MERS-CoV viruses).

- Fever
- Cough
- Shortness of breath

If you develop emergency warning signs for COVID-19, get medical attention immediately. Emergency warning signs include*:

- Trouble breathing
- Persistent pain or pressure in the chest
- New confusion or inability to arouse
- Bluish lips or face

*This list is not inclusive. Please consult your medical provider for any other symptoms that are severe or concerning.

Severe complications can include pneumonia in either or both lungs, multi-organ failure, and in some cases death.

Based upon available information to date, those at high-risk for severe illness from COVID-19 include:

- People aged 65 years and older
- People with chronic lung disease or moderate to severe asthma.
- People who have serious heart conditions.

- People who are immunocompromised. Many conditions can cause a person to be immunocompromised.
- People of any age with severe obesity (body mass index [BMI] > 40) or certain underlying medical conditions, particularly if not well controlled, such as diabetes, renal failure, or liver disease.

People who are pregnant should be monitored since they are known to be at risk for severe viral illness, however, to date data on COVID-19 has not shown increased risk.

Information regarding COVID-19 is still developing. The best way to prevent and slow down transmission is being well informed about the COVID-19 virus, the conditions it causes, and how it spreads. Protect yourself and others from infection by washing your hands or using an alcohol-based sanitizer frequently and not touching your face.

Regulatory Compliance

There is no specific OSHA standard covering COVID-19. However, some OSHA requirements may apply to preventing occupational exposure to COVID-19. Among the most relevant are:

- OSHA's Personal Protective Equipment (PPE) standards (in general industry, 29 CFR 1910 Subpart I), which require using gloves, eye and face protection, and respiratory protection.
    - When respirators are necessary to protect workers, employers must implement a comprehensive respiratory protection program in accordance with the Respiratory Protection standard (29 CFR 1910.134) (See Hart Crowser Respiratory Program).
- The General Duty Clause, Section 5(a)(1) of the Occupational Safety and Health (OSH) Act of 1970, 29 USC 654(a)(1), which requires employers to furnish to each worker “employment and a place of employment, which are free from recognized hazards that are causing or are likely to cause death or serious physical harm.”

OSHA’s Bloodborne Pathogens standard (29 CFR 1910.1030) applies to occupational exposure to human blood and other potentially infectious materials that typically do not include respiratory secretions that may transmit COVID-19. However, the provisions of the standard offer a framework that may help control some sources of the virus, including exposures to body fluids (e.g., respiratory secretions) not covered by the standard.

Pursuant to one or more Executive Orders issued by the Governors of states Hart Crowser has a primary presence in (Hawaii, Oregon, and Washington), employers are responsible for designating an employee responsible for compliance with State issued requirements. The field health and safety officer will be responsible for informing workers on Hart Crowser jobsites of all requirements specific to their state. Individual employees working on a jobsite controlled by another company will be responsible for maintaining physical distance from other workers. Employees will notify the Project Manager or Regional Health and Safety Officer immediately if workers on jobsites not controlled by Hart Crowser fail to follow any State issued requirements.

Potential Exposure Routes

Person-to-person contact

The virus is thought to spread mainly from person-to-person.

- Between people who are in close contact with one another (within about 6 feet).
- Through respiratory droplets produced when an infected person coughs or sneezes. These droplets can land in the mouths or noses of people who are nearby or possibly be inhaled into the lungs.

People are thought to be most contagious when they are most symptomatic (the sickest). Some spread might be possible before people show symptoms; there have been reports of this occurring with this new coronavirus, but this is not thought to be the main pathway the virus spreads.

It may be possible that a person can get COVID-19 by touching a surface or object that has the virus on it and then touching their own mouth, nose, or eyes, but this is not thought to be the main way the virus spreads.

How easily a virus spreads from person-to-person can vary. Some viruses are highly contagious (spread easily), like measles, while other viruses do not spread as easily. Another factor is whether the spread is sustained, spreading continually without stopping. The virus that causes COVID-19 seems to be spreading easily and sustainably in the community (“community spread”) in some geographic areas.

<u>DO NOT COME TO WORK IF YOU ARE FEELING SICK.</u>

Safety Supplies and Equipment

The following safety supplies and equipment must be available on site:

- Hand washing station or sanitizer station
- Disposable gloves (nitrile or latex)
- Sanitizing wipes

Site Control

If Hart Crowser is not the site-controlling employer, staff should be informed of what the project is doing for COVID-19 mitigation methods prior to mobilization. If Hart Crowser employees have work areas in a shared field trailer controlled by others, obtain information from the controlling employer on sanitation practices. If job trailers are not controlled by Hart Crowser, we recommend staff wear disposable gloves while accessing common spaces (ex. opening doors, copy areas, shared desks) to limit potential exposures in areas controlled by others.

Although a formal contaminant reduction zone is not necessary, project workers will use precautions during sampling activities. The amount of equipment and number of personnel allowed in sampling areas will be minimized and the amount of samples collected should not exceed what is needed for laboratory analysis. Staff will follow CDC guidelines which, at the time of this document drafting, includes maintaining 6 feet of distance between individuals to prevent potential spread or exposure (physical distancing).

Physical Distancing

The following considerations should be taken when working with other personnel on a project site or when traveling to/from a project site:

- Keep a minimum of 6 feet from other workers at all times. While this may require creative project planning or detailed communications protocols to support physical distancing, this is the most effective method to minimize transmission of COVID-19.
- If more than one employee must travel to the project site, take separate vehicles. Do not switch vehicles during the course of the work day or over the course of the field event without fully sanitizing the vehicle before handing the vehicle over.
- Use video, photographic, email, text messaging, or telephonic communication methods with other office personnel or field personnel working in different areas of the project site versus in person discussions when at all possible.
- Avoid overnight stays at lodging establishments to the extent practical. If overnight stays are required, discuss with workforce and project management prior to securing arrangement. Consider alternatives like local subcontractor arrangements for oversight or daily return to the home base point. Any extended day with travel must balance safety from COVID-19 exposure with fatigue and safe driving considerations.

Other considerations during planning for or work at a project site, include considering:

- Implementing flexible meeting and travel options (e.g., postpone non-essential meetings or events).
- Downsizing operations.
- Delivering products through curbside pick-up or delivery.

Personal Sanitation

Hart Crowser workers will practice good hygiene by washing their hands and faces prior to taking rest breaks, drinking liquids, eating food, or before and after touching shared equipment (such as the Hart Crowser vehicles) and so forth. They will also wash their hands and faces fully before eating, using tobacco, or as soon as possible upon leaving a work area. If using shared equipment, Hart Crowser workers will decontaminate equipment using a disinfecting solution or wipe.

The following considerations should be taken at all times, with particular focus on activities conducted outside the home:

- Wash your hands often with soap and water for at least 20 seconds, especially after you have been in a public place, or after blowing your nose, coughing, or sneezing. This will require our field teams to keep extra water and sufficient soap on hand at project sites for hand washing. Follow World Health Organization (WHO) guidelines for hand washing and hand rubbing with sanitizer (Attachment B). Dry hands using disposable, single-use paper towels or equivalent which must be immediately thrown into trash cans.

- If soap and water are not readily available, use a hand sanitizer that contains at least 60 percent alcohol. Cover all surfaces of your hands and rub them together until they feel dry. Hand sanitizer should be used as a backup to hand washing or where water is no longer remaining or not available. Ensure sufficient supplies of hand sanitizers are available.

- Avoid touching your eyes, nose, and mouth with unwashed hands.

- Cover your mouth and nose with a tissue when you cough or sneeze or use the inside of your elbow. Throw used tissues in the trash. Immediately wash your hands with soap and water for at least 20 seconds or use a hand sanitizer that contains at least 60 percent alcohol.

- Disinfect shared equipment. To clean, use disinfectants found on the EPA list. Disinfecting refers to products that kill germs and lowers the risk of spreading infection. Labels contain instructions for safe and effective use of the product including precautions you should take when applying the product, such as wearing gloves (Personal Protective Equipment) and making sure you have good ventilation during use of the product. Gloves should be discarded after each cleaning and disinfection. Disinfection agents include:

    - Bleach solution of at least 1/3 cup bleach per gallon of water (4 teaspoons per quart).

    - Alcohol solution of at least 70 percent.

    - EPA-registered household disinfectants. Products with EPA-approved emerging viral pathogens claims are expected to be effective against COVID-19 based on data for harder-to-kill viruses: https://www.epa.gov/pesticide-registration/list-n-disinfectants-use-against-sars-cov-2

- Wipe all potential personal contact surfaces down at the start of each workday and every time shared equipment is transferred between personnel.

- When supplies are available, use gloved hands for work activities throughout the day where hands may come into contact with common surfaces or where transfer of shared equipment between personnel is required. Donning and doffing of gloves should follow best practices to avoid touching the gloves' outer surfaces (pinch and pull glove from the outside for removal on first hand and slide ungloved fingers under inside of glove for removal on second hand).

- Do not share food or drinking glasses or bottles. Consider packing meals for work rather than picking up food while at the project site. Do not share coolers between workers.

DO NOT COME TO WORK IF YOU ARE FEELING SICK.

All information and content in this addendum is for information purposes only and is not medical advice, diagnosis, or treatment. Printed copies are not document controlled.

ATTACHMENT A

Record of Health and Safety Communication for COVID-19

Record of Health and Safety Communication for COVID-19

PROJECT NAME: Kosmos Mill Oil Cleanup	**PROJECT NUMBER:** 19499-02

The following personnel have reviewed a copy of the site-specific HASP Addendum regarding COVID-19. By signing below, these personnel indicate they have read the plan, including all referenced information, and that they understand the requirements detailed for this project.

PRINTED NAME	SIGNATURE	PROJECT DUTIES	DATE

Project manager: please route a copy of this form to the job files when completed.

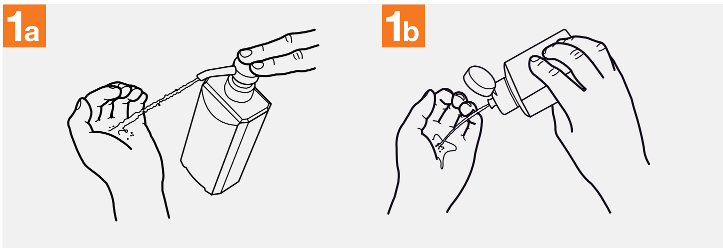
ATTACHMENT B

World Health Organization Hand Washing and Hand Rubbing Guidelines

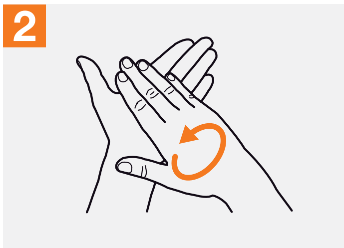
HOW TO HANDRUB?

RUB HANDS FOR HAND HYGIENE! WASH HANDS WHEN VISIBLY SOILED

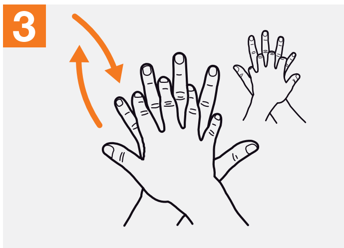
Duration of the entire procedure: 20-30 seconds



Apply a palmful of the product in a cupped hand, covering all surfaces;



Rub hands palm to palm;

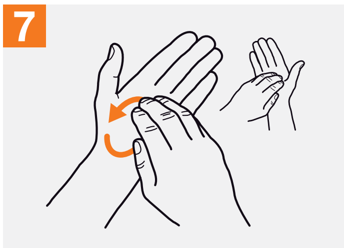


Right palm over left dorsum with interlaced fingers and vice versa;

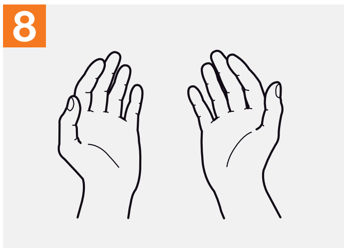
Palm to palm with fingers interlaced;

Backs of fingers to opposing palms with fingers interlocked;

Rotational rubbing of left thumb clasped in right palm and vice versa;



Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa;



Once dry, your hands are safe.

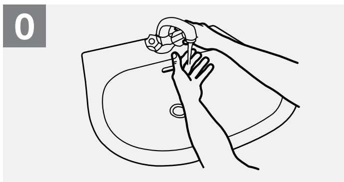
WHO acknowledges the Hôpitaux Universitaires de Genève (HUG), in particular the members of the Infection Control Programme, for their active participation in developing this material.

HOW TO HANDWASH?

WASH HANDS WHEN VISIBLY SOILED! OTHERWISE, USE HANDRUB

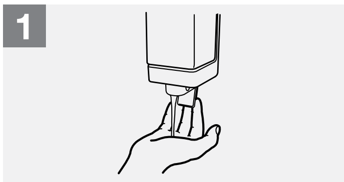
Duration of the entire procedure: 40-60 seconds

0



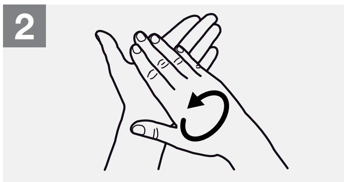
Wet hands with water;

1



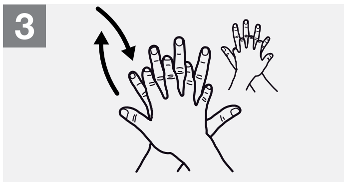
Apply enough soap to cover all hand surfaces;

2



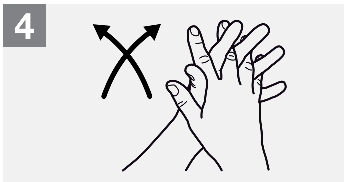
Rub hands palm to palm;

3



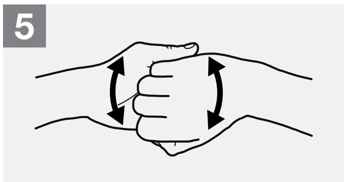
Right palm over left dorsum with interlaced fingers and vice versa;

4



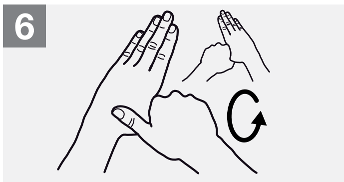
Palm to palm with fingers interlaced;

5



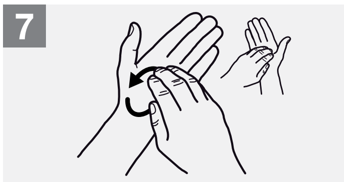
Backs of fingers to opposing palms with fingers interlocked;

6



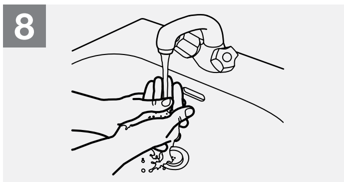
Rotational rubbing of left thumb clasped in right palm and vice versa;

7



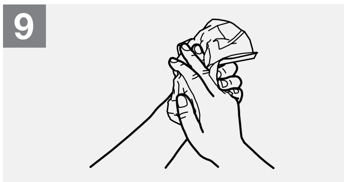
Rotational rubbing, backwards and forwards with clasped fingers of right hand in left palm and vice versa;

8



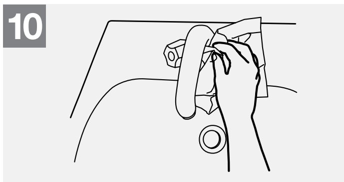
Rinse hands with water;

9



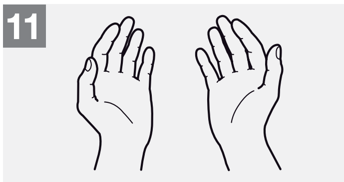
Dry hands thoroughly with a single use towel;

10



Use towel to turn off faucet;

11



Your hands are now safe.

Hand care

- Take care of your hands by regularly using a protective hand cream or lotion, at least daily.
- Do not routinely wash hands with soap and water immediately before or after using an alcohol-based handrub.
- Do not use hot water to rinse your hands.
- After handrubbing or handwashing, let your hands dry completely before putting on gloves.

Please remember

- Do not wear artificial fingernails or extenders when in direct contact with patients.
- Keep natural nails short.

WHO acknowledges the Hôpitaux Universitaires de Genève (HUG), in particular the members of the Infection Control Programme, for their active participation in developing this material.

APPENDIX C

DOWL Engineers – 1993 Site Characterization Report and Cleanup Action Plan for the Former Kosmos Townsite

DOWL
ENGINEERS
A Division of DOWL, Incorporated

August 27, 1993
W.O. S11387-09

Mr. Russell Post
Tacoma Public Utilities
3628 South 35th Street
Tacoma, Washington 98411

Subject: Site Characterization Report and Cleanup Action Plan
Former Kosmos Townsite, Lewis Co., Washington

Dear Russell:

Enclosed are the final reports summarizing the completed Kosmos investigations and soil cleanup activities. The report includes our recommendation for a groundwater "cleanup action" of (natural) containment with two groundwater monitoring episodes over the next two year period, as we discussed.

Five copies of the report are enclosed. Four sets should be sent on to DOE, to the attention of Tom Todd. I have taken the liberty of enclosing a transmittal to him if you wish to use it, or you could prepare a similar one on your letterhead as you feel appropriate.

Please note that one copy of the Nowicki report should be sent to DOE with the package. Also, I understand that you will insert the confirmation sample results for the remediated soils in a separate three ring binder. We have referred to these as "Appendix C" in the report and have included an empty binder for your use if you wish. I'm also returning your copy of the Nowicki report you provided to us for reference while the job was in progress. Thanks for letting us use it.

If you have any questions, please contact me.

Very truly yours,
DOWL ENGINEERS

Fred A Hanson

Fred A. Hanson, P.E.
Principal

Enclosures

SITE CHARACTERIZATION
&
CLEANUP ACTION REPORT

PETROLEUM LUST SITES
Former Kosmos Townsite,
Lewis County, WA

VOLUME 1

Prepared for:

TACOMA PUBLIC UTILITIES
3628 South 35th Street
Tacoma, Washington 98411

Prepared by:

DOWL ENGINEERS
8320 154th Ave N.E.
Redmond, Washington 98052

June 1993

S11387-03

FREDERICK A. HANSON
28735
Fred A. Han
EXPIRES 2\2\95

Table of Contents

Page

VOLUME 1

<u>Figures</u>

VOLUME 2

VOLUME 3

SITE CHARACTERIZATION & CLEANUP ACTION REPORT
PETROLEUM LUST SITES
FORMER KOSMOS TOWNSITE, LEWIS COUNTY, WASHINGTON

1.0 PROJECT IDENTIFICATION & LOCATION

This report was prepared by DOWL Engineers (DOWL), under contract with Tacoma Public Utilities (TPU), to document independent closure and remediation activities undertaken by TPU after the discovery of petroleum contamination in the soils and groundwater at Kosmos, Lewis County, Washington.

The former Kosmos townsite is located approximately 5 miles east of Morton, Washington. Approximately 25 years ago, the townsite area was purchased by TPU and subsequently abandoned and razed as part of the preparations for constructing the Mossyrock dam and the Riffe Lake reservoir. The location of the Kosmos site, now within the northeastern limits of the reservoir, is shown on the Vicinity Map, Figure 1. This report was prepared for submittal to the Washington Department of Ecology (DOE), Southwest Region LUST Section, Olympia, Washington in accordance with WAC Chapter 173-340-450. The Kosmos site has been identified by DOE as LUST Site #6580.

2.0 EXECUTIVE SUMMARY

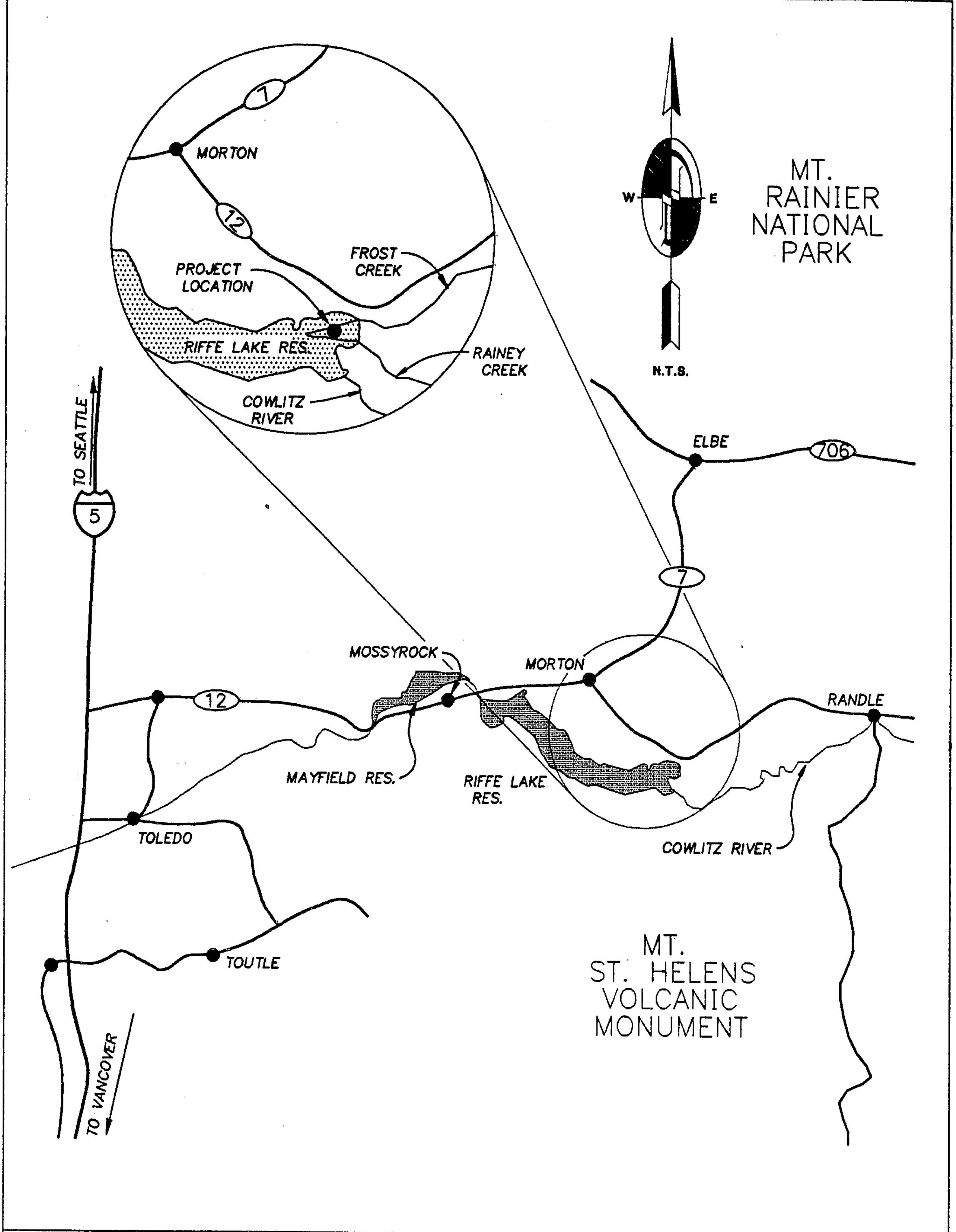
The elevation of the former Kosmos townsite is below the normal high water level of the reservoir. Although Kosmos is inundated during portions of years with normal rainfall and snow melt conditions, it is exposed during the annual low water cycle of the reservoir. Reservoir levels were unusually low last year due to a combination of drought conditions and an intentional reservoir draw-down for dam maintenance. These dry conditions provided unusually easy access and made more of the reservoir bed visable than in normal years. During this period, an old partially exposed underground storage tank (UST) was encountered and reported by someone driving through the Kosmos area.

Following this initial report, TPU researched the ownership and use of the properties within the former townsite to identify properties that were likely to have stored or used petroleum products. This research, which included personal interviews with individuals who were familiar with Kosmos, resulted in identification of five former service station locations in Kosmos. These sites are the subject of the field investigations and remediation activities reported herein. The relative geographic locations of the five Kosmos UST sites are shown on Figure 2.

TPU initiated investigation of the five sites in September 1992 and subsequently discovered and removed UST facilities from four of them. No UST facilities were discovered at the remaining site. Fuel contaminated soils were encountered at all five sites and groundwater contamination was encountered at four of them. From September 22nd through December 22nd, 1992, approximately 15,000 cubic yards of contaminated soils were excavated from the five locations and temporarily stockpiled on-site. Laboratory analytical results from soil samples collected during soils excavation indicated that total petroleum hydrocarbon concentrations in the contaminated materials ranged up to 24,000 ppm.

The Method A Cleanup Levels provided in The Model Toxics Control Act Cleanup Regulation, Chapter 173-340 WAC were used as the relevant and appropriate requirements for determining when clean conditions were obtained at the limits of site excavations and later for evaluating the completeness of on-site soil remediation.

FILENAME: D:\ACAD\S11387\S11387.DWG CREATED: OCT 08 1992 07:40:53 UPDATED: NOV 25 1992 14:15:45 PLOTTED: NOV 30 1992 08:43:43

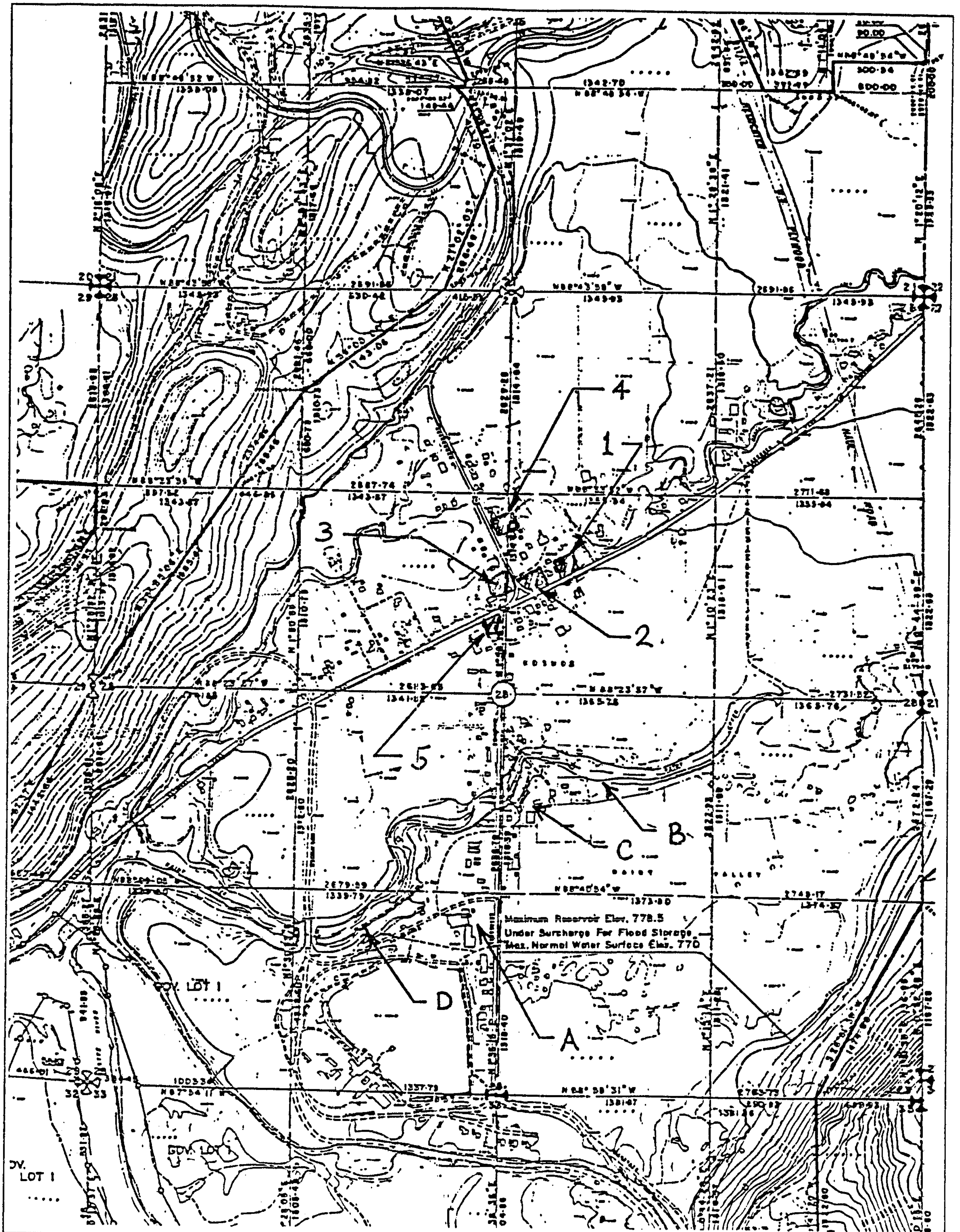


DOWL ENGINEERS
[illegible] [illegible]TH AVE NE REDMOND, WA [illegible] [illegible]

KOSMOS VICINITY MAP

FIGURE 1

FILENAME: D:\ACAD\S11387\S11387.DWG CREATED: OCT 08 1992 07:40:53 UPDATED: NOV 25 1992 14:15:45 PLOTTED: NOV 30 1992 08:43:43



DOWL ENGINEERS

FORMER KOSMOS TOWNSITE AND U.S.T. LOCATIONS

FIGURE 2

Since soil contamination was observed in excavations that extended below groundwater, groundwater monitoring wells were constructed to evaluate the extent and concentration of contamination. Laboratory analytical results from groundwater samples collected in these wells indicated that the contaminates were weathered petroleum products, probably gasoline, kerosene and diesel. TPH concentrations ranged up to 4,500 ppb and total BETX up to 713 ppb including benzene of 61 ppb. Although these releases appeared to be relatively old, the contaminated groundwater plumes had been contained by the relatively impermeable soils to small areas immediately adjacent to the former UST facilities.

The stockpiled contaminated soils were remediated on-site by a mobile, low-temperature thermal desorption unit. After laboratory analyses confirmed that the remediated soils were clean, the materials were reused for backfilling the excavations.

3.0 CONCLUSIONS & RECOMMENDATIONS

DOWL believes the information obtained from the investigation and remediation activities supports the conclusion that the five former UST facilities at Kosmos have been satisfactorily removed and closed by TPU's independent actions. All soils that had been impacted by releases from these facilities were identified, removed, successfully remediated and reused for site backfill as part of the cleanup activities.

It was clear from the review of the area's history that the UST facilities had been out of service for at least 25 years. Interpretation of sample chromatograms indicated that the releases were also probably quite old, with characteristics of weathered gasoline, diesel and kerosene products. Even though these appeared to be old releases, impacted groundwater had been naturally contained within small areas adjacent to the sources by the relatively impermeable native soils.

There will be no further contribution to groundwater contamination now that the UST facilities and the associated contaminated soils have been removed. The groundwater at the site does not have the potential to serve as a source of drinking water because of its location within the reservoir limits. The residual contamination in the groundwater is expected to dissipate over time through natural degradation without additional impacts to the environment.

DOWL recommends that the groundwater monitoring program initiated in October 1992 be continued for two additional years with one sampling episode per year. The annual monitoring episodes should be planned for late winter each year to coincide with the normal period of seasonal low water in the reservoir. If the monitoring program demonstrates that no additional contaminate migration has occurred and that contaminate concentrations are in fact diminishing, DOWL recommends that these sites be classified by DOE as satisfactorily closed with no further action required.

4.0 INVESTIGATIONS, ACTIVITIES & FINDINGS

4.1 Program Organization

This report combines data obtained by DOWL with information obtained from other participants including APS Services, Inc., Nowicki & Associates, Inc., and TPU. The participants in this program of assessment, investigation, construction and remediation activities, and their roles and services are as follows:

Property Owner: Tacoma Public Utilities (TPU)
c/o Mr. Russell Post
3628 South 35th Street
Tacoma, Washington 98411

Environmental Consultant:
DOWL Engineers, (DOWL)
c/o Mr. Fred Hanson
8320 154th Avenue NE
Redmond, Washington 98052

Excavating & UST Removal:
APS Services, Inc. (APS)
c/o Mr. Roy Thompson
3515 South 154th
Seattle, Washington 98188

Closure Assessments:
Nowicki & Associates, Inc. (Nowicki)
33516 9th Avenue South, Building 6
Federal Way, Washington 98003

Monitoring Well Construction:
Holt Drilling (Holt)
10621 Todd Road East
Puyallup, Washington 98372

Removal & Disposal of Tank Contents:
Coastal Tank Cleaning, Inc. (Coastal)
3801 7th Avenue South
Seattle, Washington

Soil Incineration:
PEMCO Soil Remediation Division (PEMCO)
c/o Earnest H. Johnson
437 N. Columbia Blvd., P.O. Box 11579
Portland, Oregon 97211

Mobile On-Site Analytical Laboratory:
Transglobal Environmental (TEG)
Geosciences Northwest, Inc.
Mr. Michael A. Korosec, Pres.
7110 38th Drive S.E.
Lacey, Washington 98503

Analytical Laboratory:
Analytical Technologies, Inc. (ATI)
560 Naches Avenue S.W., Suite 101
Renton, Washington 98055

4.2 Site Activities & Reports

4.2.1 General

APS, under contract with TPU, provided excavation services for locating and removing buried UST facilities and for excavating and stockpiling contaminated soils encountered in the excavations. APS contracted with Nowicki to provide assessment services during the excavation work and to document when excavation limits were clean. TPU arranged with TEG to provide on-site, mobile analytical laboratory services during these activities to obtain "same day" sample analytical results.

Exploration and excavation work was initiated by APS in September 1992 to search for and remove any UST facilities encountered at the Kosmos sites and to excavate and stockpile any petroleum contaminated soils (PCS) encountered. These activities were reported in detail by Nowicki in their subsequent report titled Kosmos Site Assessment, UST Removal Project, October 12, 1992. One separately bound copy of the Nowicki report is enclosed with this report. Contents discovered in the USTs, which were mostly water, were pumped out and removed from the site by Coastal.

During excavation at the five sites, exposed soils were screened by Nowicki both visually and with the use of a portable photoionization detector (PID). Soil samples were periodically collected for laboratory analysis by TEG during the work to assess contamination levels within the PCS and to provide documentation of clean limits in the excavations. Soil samples were analyzed for total petroleum hydrocarbons (TPH) in the gasoline and diesel ranges using WTPH-g and WTPH-d methods, respectively, and for benzene, ethylbenzene, toluene and xylenes (BETX) by EPA Method 8020.

Site excavation sketches, location of confirmation samples and complete sample analytical results for the excavation portion of the project are included in the Nowicki report. The location and approximate shape of the excavations are shown on Figure 3. Excavation limits were considered to be clean when the confirmation sample results indicated that contaminate concentrations were below the Method A Cleanup Levels established in WAC 173-340-740. Summary analytical results for confirmation samples used to document clean excavation limits are restated in the site comments in Section 3.2.3. Complete laboratory analytical results for the soil sampling are included in the referenced Nowicki report.

During the initial excavations at Kosmos, groundwater was typically encountered at a depth of approximately 11 to 11.5 feet below the surface, except at Site 4 where it was encountered at a depth of approximately 10 feet. Subsurface materials were not homogeneous and, therefore, the margins of the contaminated plumes were irregular. The general shape of the plumes resembled "upside-down umbrellas" with the bottoms of the contaminated lenses becoming shallower with increasing distance from the apparent sources. This observation is consistent with the water surface elevations known to exist normally in the reservoir area. No free products were observed on the standing water in any of the excavations although sheens were observed from time to time as work progressed.

All PCS were temporarily stockpiled on-site as the excavation work proceeded. Typically, from 2 to 6 feet of clean overburden was encountered above contaminated materials and these materials were removed and separately stockpiled for reuse as backfill.

4.2.2 Reports & Meetings

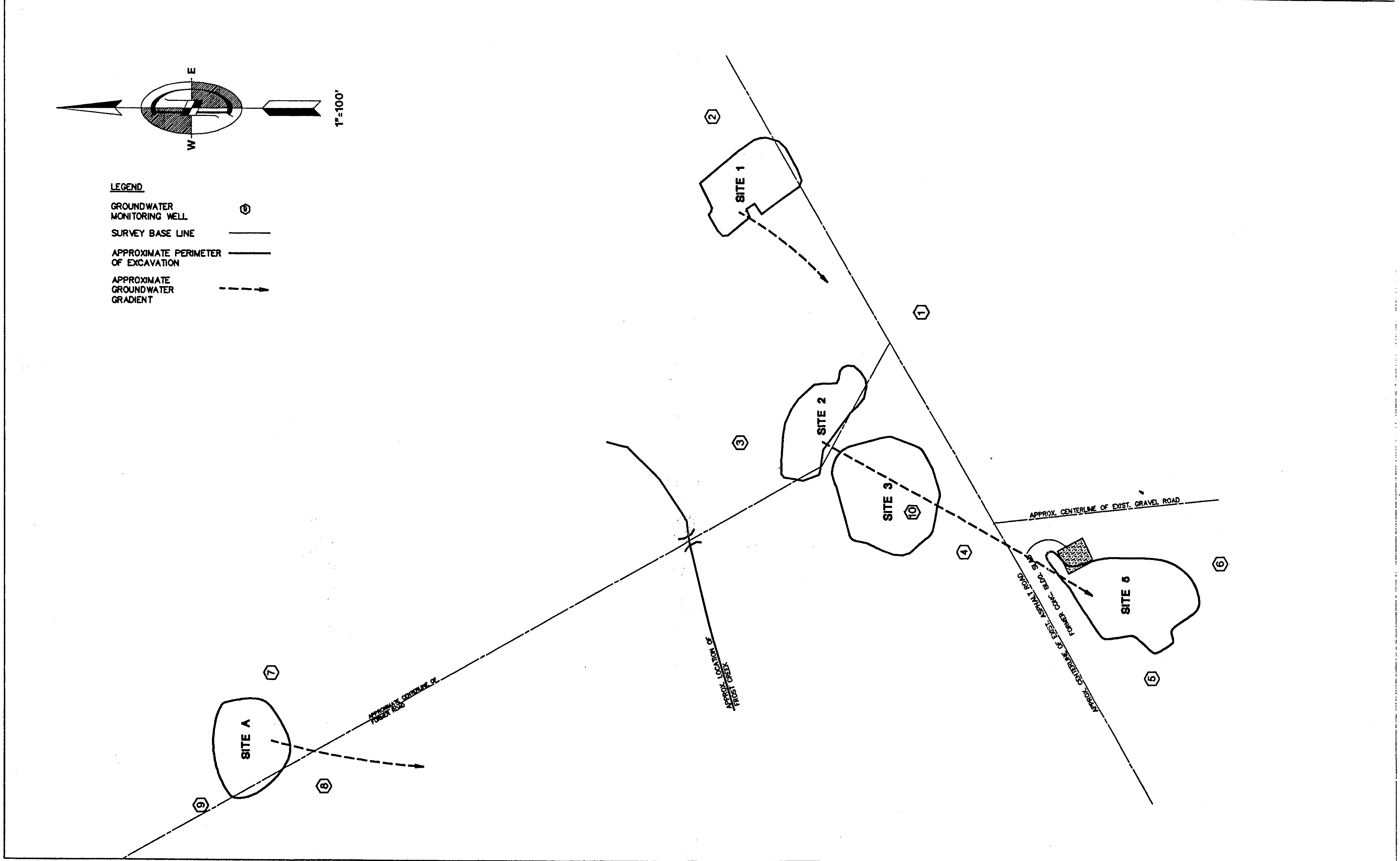
According to Nowicki, an initial telephone report advising of the confirmed releases from the Kosmos UST facilities was provided to the Southwest Region LUST Section, DOE, Olympia, on September 23, 1992. A Site Assessment report prepared by Nowicki dated September 23, 1992, including completed Site Check/Site Assessment Checklists, was also transmitted to the Southwest Region UST Section, DOE for Kosmos sites 1 through 4. Copies of these reports are included in the Nowicki report referred to in Section 4.2.1.

A meeting was held at the Southwest Region's office on October 9th to review the information obtained to date from the field investigations and the status of the site work. Participants included Mr. Tom Todd and Mr. Richard Heggen of DOE, Mr. Russell Post of TPU and Mr. Fred Hanson of DOWL.

4.2.3 Removal of UST Facilities & Petroleum Contaminated Soils

The following five Kosmos sites were all former service station locations. The identification, location and analytical results of the confirmation samples used by Nowicki to document clean conditions in the excavations are provided in the Nowicki report referred to in Section 4.2.1.

FILENAME: D:\ACAD\TEMP\S11387.DWG CREATED: OCT 08 1992 07:40:53 UPDATED: JUN 08 1993 22:10:25 PLOTTED: JUN 09 1993 06:54:34



DOWL ENGINEERS

KOSMOS U.S.T. SITES

FIGURE 3

<u>Site 1</u>. This former service station site also served as the main equipment depot and refueling station during the demolition of the old townsite. Three underground storage tanks, T1, T2 and T3, and associated underground piping were removed on September 22nd. All three tanks were full of what appeared to be water. Tank capacities for T1, T2 and T3 appeared to be approximately 2,500, 1,000 and 2,500 gallons. The tanks were corroded but no holes were observed.

Screening and laboratory sample results indicated that soils adjacent to the tanks and piping had been contaminated. TPH concentrations were reported ranging up to 12,000 ppm. The initial excavation at Site 1 began on September 22nd and then was continued with periodic interruptions from September 24th through December 22nd when it was completed.

<u>Site 2</u>. Two underground storage tanks, T1 and T2, and associated underground piping, were removed on September 22nd. Tank capacities for T1 and T2 appeared to be approximately 2,000 gallons each. Both tanks were full of water. No holes were observed in the tanks.

Screening and laboratory sample results indicated that soils adjacent to the UST facilities had been contaminated. TPH concentrations were reported ranging up to 11,000 ppm. Initial excavation at Site 2 began on September 22nd and then was continued with periodic interruptions from September 28th through December 14th when it was completed.

<u>Site 3</u>. Three underground storage tanks, T1, T2 and T3, were removed on September 22nd. Tank capacities appeared to be approximately 2,000, 500 and 1,000 gallons, respectively. Tanks T1 and T3 were full of water, Tank T2 was full of what appeared to be gasoline. No holes were observed in the tanks.

Screening and laboratory sample results indicated that the soils adjacent to these tanks had also been contaminated. TPH concentrations were reported ranging up to 24,700 ppm. Initial excavation at Site 3 began on September 22nd and then was continued with periodic interruptions through November 23rd when it was completed.

<u>Site 4</u>. On September 22nd, two steel underground fuel storage tanks, designated Tanks T1 and T2, were discovered and removed from Site 4. T2 was only half buried and was full of soil. T1 was full of water. The capacities of T1 and T2 were approximately 2,000 and 500 gallons, respectively. Both tanks were corroded but no holes were observed.

No indications of contamination were observed in the <u>T2 excavation</u>. Confirmation soil samples S4-T2B, S4-T2WNW and S4-T2ESW were collected by Nowicki from the bottom and two sidewalls, respectively, of the excavation and soil sample S4-T2SP was collected from the stockpile of excavated materials. Results from these analyses indicated that no petroleum hydrocarbon contamination had been detected.

Screening and the analysis of laboratory samples collected from in the <u>T1 excavation</u> indicated that adjacent soils had been contaminated from past petroleum releases. The laboratory results indicated TPH concentrations ranging up to 3,120 ppm. The contamination extended to a depth of approximately 11 feet below the surface; approximately 2 feet below the depth at which groundwater was encountered during the work. Initial excavation at Site 4 began on September 22nd and then was continued with periodic interruptions from October 5th through October 7th when it was completed.

<u>Site 5</u>. The former building on this site had been used for other purposes after the initial service station was closed. The concrete floor slab was still present prior to the excavation work. No UST facilities were located although an area immediately adjacent to the slab on

the north appeared to have been excavated and backfilled in the past. Materials encountered in this disturbed area were different than encountered in the remainder of the site and this was presumed to be the former UST location. Potholing, screening and sampling was performed in this area to delineate several small fuel contamination plumes that were discovered.

TPH concentrations encountered in these plumes ranged up to 15,200 ppm. Initial excavation and PCS removal began on September 29th at Site 5 during the mapping of the plumes and then was continued with periodic interruptions through October 15th when it was completed. Excavation at Site 5 extended to a depth of approximately 10 feet which was about 1 foot below the lowest point of soil contamination and approximately 2 feet above the water table encountered during the work.

4.2.4 Soil Remediation

Since water levels in the reservoir were expected to rise to normal levels by the spring and summer of 1993, limiting the time activities could continue at the site, TPU also contracted in September with PEMCO to begin PCS remediation services immediately. The PCS remediation began on October 6th, using a portable, low-temperature, thermal desorption unit supplied and operated by PEMCO. Remediation work continued with occasional interruptions until it was completed on March 17, 1993. A total of approximately 25,900 tons of PCS materials were remediated and, after confirmation sampling documented that they were clean, the materials were reused for backfilling the site excavations. Complete laboratory analytical results for the confirmation samples are included in Appendix C which is separately bound and submitted together with this report.

4.2.5 Groundwater Investigation

As reported in previous sections, soil contamination in some of the excavations extended to depths below groundwater elevations at the time of the work. Additionally, water levels under normal reservoir conditions are known to be near or above the site's surface. It was apparent that the leaking UST facilities had impacted groundwater in the area of the facilities.

Because of these findings, groundwater monitoring wells were constructed to assess the current extent and nature of groundwater contamination. During the period from October 19th through the 22nd, nine groundwater monitoring wells, MW-1 through MW-9, were constructed in locations that were expected to define the maximum perimeter of the impacted plumes. MW-10 was constructed on April 5, 1993 (after the excavations had been backfilled) in a location that was expected to be in an area of maximum groundwater contamination. Approximate groundwater gradients were calculated for three localized areas within the group of Kosmos sites. The monitoring well locations and gradients are also shown on Figure 3. Additional information about installation of the monitoring wells is provided in DOWL Engineers' Groundwater Investigation Work Plan, Old Kosmos Townsite, Lewis County, Washington, October 1992, which is included in Appendix A.

Monitoring wells were constructed to a depth of approximately 14 feet as shown on the design sketch included in the referenced work plan. Groundwater samples were subsequently collected during two sampling episodes. From October 21st through October 26th, samples were collected from the perimeter wells, except for MW-6 which was dry. The second episode, which included all ten monitoring wells, was conducted on April 5, 1993. Samples were analyzed for Total Petroleum Hydrocarbons (TPH), gasoline and diesel ranges by Washington Department of Ecology methods WTPH-g and WTPH-d, and for the volatile aromatic hydrocarbons benzene, ethylbenzene, toluene and xylene (BETX) by EPA Method 8020.

Laboratory analytical results from the samples collected during both episodes at monitoring wells MW-1, 2, 3, 5, 6, 7, 8 and 9 indicated that, except for a trace detection of toluene (0.5 ppb) in MW-5, contamination was not detected. These findings confirmed that groundwater contamination had not migrated from the former UST facilities to the perimeters defined by those wells. The results from the October sampling episode for MW-4, which was situated approximately 40 feet down-gradient from the edge of the site 3 excavation, indicated non-detection of TPH but reported 5.9 ppb total BETX including 2.6 ppb benzene. The April results from MW-4 indicated non-detection for both TPH and BETX. Results from the April sampling at MW-10, anticipated to be within the central area of the contaminated plume, indicated concentrations of 4,500 ppb TPH and 713 ppb total BETX which included 61 ppb benzene. Complete laboratory results from the groundwater sampling episodes are included in Appendix B.

4.3 QA/QC Review of Laboratory Data

A quality assurance/quality control (QA/QC) review was conducted of the analytical results for the soil and groundwater samples collected from the Kosmos monitoring wells to verify the validity of the data. Several sampling episodes were conducted between October 20, 1992 and April 6, 1993. Soil samples MW3-5, MW3-10, MW2-5, MW2-10, MW5-5, MW5-10, MW6-5, MW6-10 and monitoring well water samples MW7-1 and MW7-1A were collected on October 20 and 21, 1992. Monitoring well water samples MW8-1, MW9-1 and MW9-1A were collected on October 22, 1992. Monitoring well water samples MW1-1, MW2-1, MW2-A, MW3-1, MW4-1 and MW5-1 were collected on October 26, 1992. Soil samples MW10-10, MW10-11, MW10-15, MW10-20A and MW10-20B were collected on April 5, 1993. Monitoring well water samples MW1-2, MW2-2, MW3-2, MW4-2, MW5-2, MW6-2, MW7-2, MW8-2, MW9-2, MW10-2 and MW10-2A were collected on April 6, 1993.

All laboratory analyses were conducted by Analytical Technologies, Inc. (ATI) using the methods stated in Sections 4.2.1 and 4.2.5 above and following standard laboratory QA/QC procedures.

Extraction and analysis were conducted on the samples within the maximum allowable holding times for the analysis. Three field QA/QC water samples and one field QA/QC soil sample were collected. Sample MW7-1A was a duplicate of sample of MW7-1, MW2-A was a duplicate of sample MW2-1, MW10-20B was a duplicate of sample MW10-20A, and MW10-2A was a duplicate of MW10-2. Relative percent differences were calculated for samples with detectable concentrations of WTPH-g, benzene, toluene, ethylbenzene and total xylenes. The allowable ranges set by the laboratory for water and soil analysis by both methods are ±20%. RPD's were above the allowable limits for MW10-20A and MW10-20B for benzene (66.7%), toluene (66.7%), ethylbenzene (52.9%), total xylenes (66.7%), and gasoline range total petroleum hydrocarbons (66.7%). The RPD for ethylbenzene in MW10-2 and MW10-2A was 129.9%. ATI was contacted regarding the high RPD for samples MW10-2 and MW10-2A but no specific reason for the differences was identified.

Surrogate recovery percentages were calculated by the laboratory for every sample analyzed. Surrogate recoveries are used to determine the accuracy of the analytical results. The allowable surrogate recovery percentages ranges for water analysis are 76-120% for Method 8020 and 50-150% for WTPH-g, and the allowable ranges for soil analysis are 52-116% for Method 8020 and 50-150% for WTPH-g. Surrogate recovery percentages were out of the allowable range for water sample MW10-2 (122%) and soil samples MW10-10 (percentage not given) and MW10-11 (144%). These high percentages were attributed to matrix interferences by the laboratory and are not considered to invalidate the analytical results.

Internal laboratory quality control batches were conducted for these sets of samples. Internal samples, blank spikes, matrix spikes and matrix spike duplicates were analyzed by the laboratory. Percent recoveries of the matrix spike and matrix spike duplicates and RPDs were calculated. These results were used to determine both the accuracy and precision of the laboratory results. The tolerance ranges for percent recoveries are as outlined above for surrogate recoveries. All of the percent recoveries for the samples fall within the allowable ranges. All RPDs were within the allowable ranges mentioned previously. The quality control batches indicate that the analytical results are both precise and accurate.

Matrix blanks were analyzed using EPA Method 8020 and Method WTPH-g. Analytical results were below the method detection limit for all of the blanks analyzed. Therefore, it appears that no contamination to the samples has resulted form the laboratory glassware or reagents.

Water trip blanks were submitted to the laboratory along with the water samples collected on October 20 and 21, 1992, October 26, 1992 and April 6, 1993. Toluene was detected in the trip blank submitted with the April 6, 1993 samples. The trip blank had a 0.8 ppb detection of toluene. This detection is close to the method detection limit and is not considered to affect the sample results.

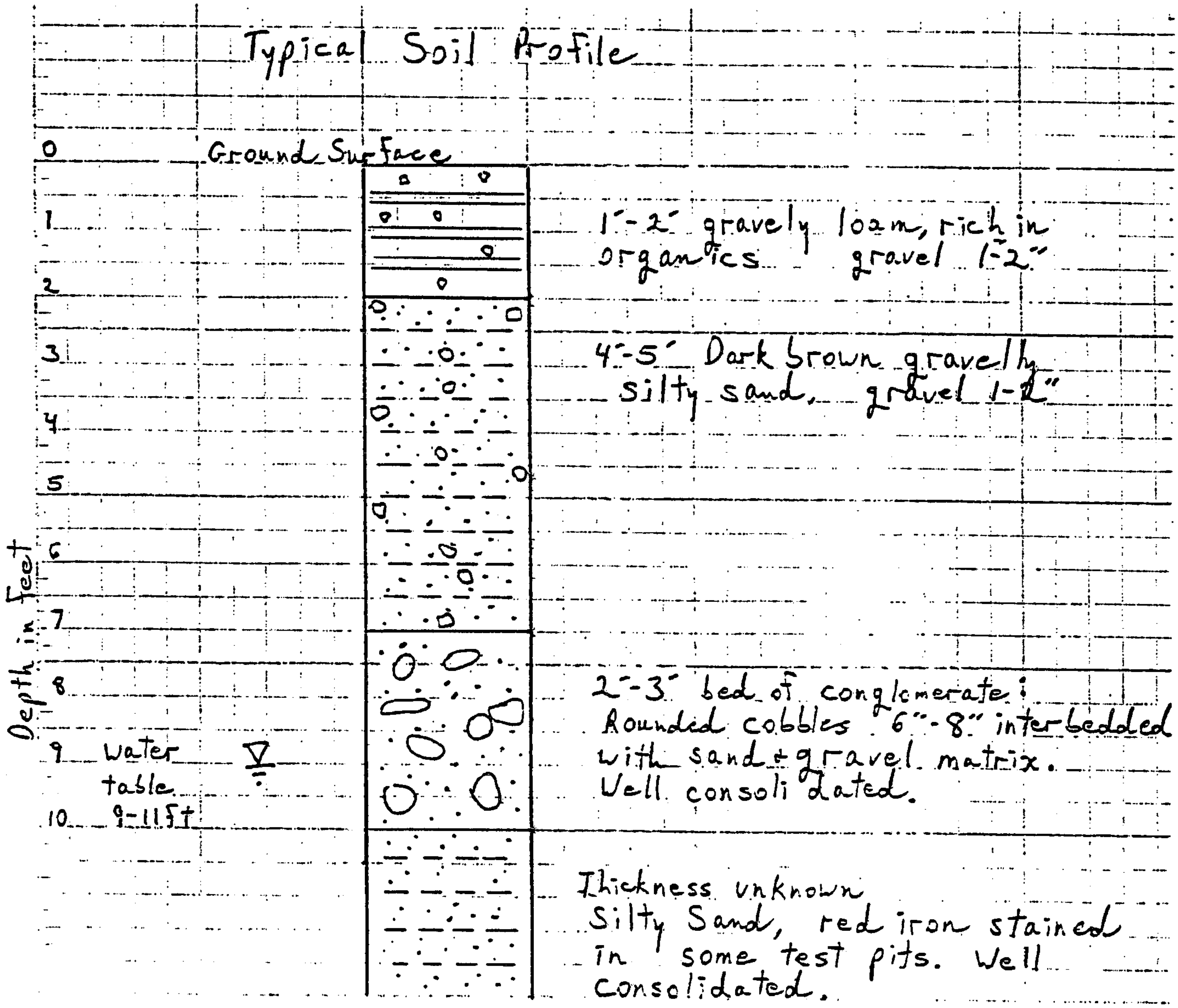
The RPDs for the field duplicate samples collected on April 5 and 6, 1993 were much higher than the allowable limits for the soil samples and for ethylbenzene in the water duplicate samples. ATI determined that MW10-2A was preserved with acid, while MW10-2 was not preserved. This could have caused analytes in sample MW10-2 to volatilize prior to analysis, thus causing the high RPD. Some of the detections in soil samples MW10-20A and MW10-20B were close to the detection limits, however, DOWL does not believe that the high RPDs can be attributed to this. It is possible that field sampling procedures were the cause of the sample result differences. The ethylbenzene results for the water samples collected on April 6, 1993 and the 8020 and WTPH-g results for the soil samples collected on April 5, 1993 are questionable. These results are not considered valid and acceptable for comparison with corrective action or cleanup levels. All other analytical results were found to be valid and acceptable for use in comparison with corrective action and/or cleanup levels.

5.0 GENERAL AREA INFORMATION

5.1 Topography, Drainage & Hydrogeological Information

The former Kosmos townsite is situated in Rainey Valley with most of the townsite lying between Frost Creek and Rainey Creek, approximately three-quarters of a mile upstream from their confluence with the Cowlitz River. The townsite lies on a flood plain which is now within the high water boundary of the Riffe Lake reservoir formed behind the Mossyrock Dam. The local surface area has a general slope of approximately two percent toward the southwest. During periods when reservoir levels are low enough to expose the surface, drainage sheet flows in these general directions toward the creeks and the reservoir water body. Ground surfaces and vegetation along the old asphalt road running east-west through the townsite exhibit evidence confirming that shorelines have been in the immediate area. Old tree stumps dot the flood plain and surround the townsite, indicating the flood plain was originally forested.

Subsurface stratigraphy was observed during the site excavations and during soil boring activities for construction of the groundwater monitoring wells. Near-surface soils generally consist of organic loams with scattered, rounded gravel to depths of approximately 5 to 8 feet, thence changing gradually to silty .sands with fractured cobbles at approximately 14 feet below the surface. Figure 4 shows a typical profile of the soil horizons encountered at the Kosmos sites.



FILENAME: D:\ALAD\TEMP\S11387.DWG CREATED: OCT 08 1992 07:40:53 UPDATED: JUN 08 1993 22:10:25 PLOTTED: JUN 09 1993 06:54:34

DOWL ENGINEERS

KOSMOS TOWNSITE
TYPICAL SOIL PROFILE

FIGURE 4

Regional groundwater flow in the Rainey Valley is generally from the northeast to the southwest toward Riffe Lake. During our field activities, the water surface of Frost Creek was approximately five feet below adjacent site surfaces. Water table elevations measured in the monitoring wells and excavations at Kosmos varied from approximately 6 to 11 feet below the surface and were generally deeper with increasing distances from the creek. It appears that during the recent dry conditions, the creek has been a local source of groundwater recharge. This condition is not unusual for mountain-fed streams that drop into wide, flat valleys. Recharge through the streambed would be anticipated to vary with soil permeability and differences between creek bed and groundwater elevations.

Calculations made from measurements of groundwater elevations during the monitoring well program indicated that the groundwater gradients, although somewhat variable within the local area, were generally to the south and southwest at the time of the investigation. The soil matrix observed at and above the groundwater depth during the work was a well consolidated, silty sand with gravel and appeared to have poor permeability. Migration of contaminants should be minimal in this matrix. Additionally, during significant portions of the years with normal rainfall and snow melt, reservoir levels will be near the surface of the site, and little horizontal groundwater movement would be anticipated.

5.2 Land Use & Occupancy

All land in the immediate Kosmos area has been within the high water reaches of the reservoir since 1967 and is uninhabited. The nearest occupied dwellings appear to be situated approximately 2,300 feet northwest and 4,500 feet northeast of the townsite.

5.3 Sanitary Sewer & Domestic Water Facilities

No currently operating sewer or water facilities exist in the Kosmos vicinity. The former Kosmos properties appear to have been served by individual, on-site sewer and water systems. Several remnants of septic tanks and drywells were observed during the excavation activities.

On November 17, 1992 a DOWL representative visited the Washington Department of Ecology Water Resource Section in Olympia and reviewed the inventory of registered domestic wells within approximately one mile of Kosmos. The inventory indicated that only two domestic water wells were within this radius, both being for residences located in the foothills more than 2,000 feet northwest of the site. The production zones of these wells are above the surface elevation of Kosmos.

5.4 Sensitive Environments

As mentioned in Section 2.0, Kosmos is within the high water reaches of the Riffe Lake reservoir and is submerged frequently. Establishment of normal littoral shelf vegetation is prevented by the seasonal water level fluctuations. As water levels periodically recede, growths of forbs and grasses are temporarily established. TPU seasonally plants winter rye and winter wheat as supplementary feed for the area's waterfowl but the area does not remain dry for sufficient periods to form bird or animal habitat. No endangered species are known to inhabit the work area.

SITE CHARACTERIZATION
&
CLEANUP ACTION REPORT

PETROLEUM LUST SITES
Former Kosmos Townsite,
Lewis County, WA

VOLUME 2

Prepared for:

TACOMA PUBLIC UTILITIES
3628 South 35th Street
Tacoma, Washington 98411

Prepared by:

DOWL ENGINEERS
8320 154th Ave N.E.
Redmond, Washington 98052

June 1993

S11387-03

Table of Contents

VOLUME 1

VOLUME 2

Appendix A

GROUNDWATER INVESTIGATION WORK PLAN

(October 1992)

GROUNDWATER INVESTIGATION
WORK PLAN
OLD KOSMOS TOWNSITE
LEWIS COUNTY, WASHINGTON

Prepared for:

TACOMA PUBLIC UTILITIES
Post Office Box 11007
Tacoma, Washington 98109

Prepared by:

DOWL ENGINEERS
8320 154th Ave N.E.
Redmond, Washington 98052

October 1992

S11387-04

TABLE OF CONTENTS

FIGURES

APPENDICES

GROUNDWATER INVESTIGATION WORK PLAN
OLD KOSMOS TOWNSITE, LEWIS COUNTY, WASHINGTON

1.0 PROJECT IDENTIFICATION

This Groundwater Investigation Work Plan, prepared on behalf of Tacoma Public Utilities (TPU) by DOWL Engineers (DOWL), covers a portion of the activities undertaken by TPU after the discovery of petroleum contamination in the soils and groundwater at the former townsite of Kosmos, Lewis County, Washington. Kosmos is located approximately 5 miles east of Morton, Washington. Approximately 25 years ago, the townsite area was purchased by TPU and subsequently abandoned and razed as part of the preparations for constructing the Mossyrock dam and the Riffe Lake reservoir. The location of Kosmos, now within the northeastern limits of the reservoir, is shown on the Vicinity Map, Figure 1. The Kosmos site has been identified by the Washington Department of Ecology (DOE) as LUST Site #6580.

2.0 BACKGROUND INFORMATION

More than twenty-five years ago, in preparation for the initial filling of the Riffe Lake reservoir, all of the existing Kosmos townsite buildings and most of the town's surface developments were demolished. The elevation of Kosmos is slightly lower than the normal high water level of the reservoir and the site is therefore inundated for portions of those years with normal rainfall and snow melt conditions. Last year's drought conditions, however, combined with an intentional draw-down of the reservoir for dam maintenance, produced unusually low reservoir and local groundwater elevations.

These dry conditions provided access and visibility to more of the reservoir bed than in normal yeas and an old partially uncovered underground storage tank was subsequently encountered and reported by someone driving through the Kosmos area. Following the initial report, TPU performed research into the individual properties within the former townsite to identify properties that were likely to have stored or used petroleum products. This research, which included personal interviews with individuals who were familiar with Kosmos, resulted in identification of five former service station locations in Kosmos. These sites are the subject of the field investigations and remediation activities reported herein. The relative locations of the five Kosmos UST sites are shown on Figure 2.

TPU initiated investigation of the five sites in September 1992 and subsequently discovered and removed UST facilities from four of them. No UST facilities were discovered at the remaining site. Fuel contaminated soils were discovered at all five sites. Excavation and stockpiling of contaminated soils began during removal of the UST facilities and continues as of this date. A mobile analytical laboratory from Transglobal Environmental Geosciences Northwest, Inc. (TEG) has also been contracted by TPU and is now located at the site to expedite analysis of soil samples collected during the excavation activities. Additionally, TPU has recently contracted with PEMCO of Portland, Oregon to provide on-site remediation of the stockpiled contaminated soils. PEMCO will use low temperature thermal destruction for remediation.

Observations made during the excavation activities indicated that contamination extended below groundwater elevations at several of the sites. Surface sheens were observed on standing water in these excavations and laboratory analyses of soil samples collected in the capillary zones in these areas confirmed that contamination is present. The contamination has been identified to consist of weathered gasoline, diesel and kerosene fuel products. DOWL was contracted by TPU to provide services to define the extent and nature of groundwater contamination and to assist TPU, as requested, with remedial investigation activities for the balance of the independent cleanup procedures at the old Kosmos townsite.

General stratigraphy, as observed during the excavation work, consisted of five to six feet of gravelly loam, underlain by loamy gravel increasing in gravel content with depth. At approximately nine feet below the surface, a bed of partially consolidated till or conglomerate with cobbles of 4 to 8 inch diameter was encountered. This lower bed does not appear to transmit water readily. Groundwater was encountered at a depth of approximately 10 feet below the surface during the work however reservoir levels, and local groundwater elevations, are anticipated to return to normal levels during the coming rainy season and spring runoff period. Groundwater will then be at or above the surface elevation of the site.

3.0 PROPOSED ACTIONS

Beginning approximately October 19th, nine 2-inch-diameter groundwater monitoring wells will be constructed around the anticipated perimeter of the contaminated groundwater plumes. The approximate locations intended for the monitoring wells are shown in Figure 3, however minor changes may be made if construction conditions require. The wells are planned to extend approximately 14 feet below the surface to obtain sufficient recharge for sample collection during periods of low groundwater. The monitoring well design also provides for maximum screening height to allow sample collection during the expected high groundwater elevations during most of a normal year. The monitoring well design sketch is shown on Figure 4. At a later date, after excavations have been backfilled, one or two additional monitoring wells will be constructed in areas where the former UST facilities have been removed and maximum contamination appeared to exist.

All monitoring well borings will be logged. One of the borings will be advanced to a depth of approximately 20 feet to assist in defining the subsurface stratigraphy. Groundwater samples will be collected for laboratory analysis from each of the completed monitoring wells. Cuttings from soil borings will be screened for the presence of petroleum hydrocarbons. Soil samples may also be collected from the borings for laboratory analysis if DOWL's site manager feels they would be useful for defining extent and concentration of contamination. The monitoring well locations shown in Figure 3 may be moved further away from the sources if screening during boring indicates groundwater at that location may be significantly contaminated.

Soil cuttings from the borings will be placed in existing stockpiles of contaminated materials on site. Water generated during monitoring well construction, development and purging shall be retained on site in sealed containers pending characterization for disposal.

3.1 Health & Safety

A separate Health and Safety Plan has been developed to provide health and safety guidelines for DOWL employees during performance of this work. DOWL's site personnel will read and sign the Health and Safety Plan prior to initiating activities. The signed copy of the plan will be retained in DOWL's project files and a copy will be available in the field for DOWL's personnel as a reference.

3.2 Goals

The goals of the activities covered by this work plan are to construct nine monitoring wells approximately at the perimeter of the contaminated groundwater plume and to document the extent of contaminate migration by collection and laboratory analysis of groundwater samples obtained from the wells. Additionally, depths-to-water table will be measured in each well for use in calculating local groundwater gradients.

3.3 Field Screening Procedures

Drill cuttings will be screened by odor and visual appearance for indications of petroleum hydrocarbon contamination. If the TEG mobile laboratory is still present during this work, soil samples may also be collected and immediately analyzed by TEG for additional guidance to final well locations.

3.4 Soil Sampling

During boring and monitoring well construction, soil samples will be collected at five-foot intervals by a split-spoon sampler, including one from the bottom of each boring. Sampling intervals may be varied by DOWL's site manager depending upon field observations. A field log will be completed for each boring. A visual analysis of the cuttings and split spoon samples will be used to provide stratigraphic column information for the field log. DOWL will carefully observe stratigraphy while drilling in an area where soil or water contamination is suspected to prevent creating a pathway through a confining layer for contaminates. If such a condition is recognized, the bore hole through the confining layer shall be immediately backfilled with bentonite.

3.5 Groundwater Sampling

One groundwater sample will be collected from each of the proposed monitoring wells. Each sample collected for chemical analysis will be collected by personnel wearing clean (analyte free) gloves by manually lowering a Teflon sample bailer into the monitoring well to retrieve the sample media. All equipment used in sample collection will be decontaminated prior to use by the methods described in Section 3.7.

3.6 Sample Analyses

Groundwater samples collected from the nine monitoring wells will be analyzed for Total Petroleum Hydrocarbons (TPH), gasoline and diesel ranges, by Washington Department of Ecology methods WTPH-g and WTPH-d, respectively, and for the volatile aromatic hydrocarbons benzene, ethylbenzene, toluene and xylene (BETX) by EPA Method 602. Soil samples will also be analyzed for TPH by WTPH-g and WTPH-d and for BETX by EPA Method 8020.

3.7 Field Sampling Equipment & Sampling Protocol

All field equipment will be new or pre-cleaned prior to mobilizing to the site. Soil samples will be collected in I-Chem, wide-mouth, clear, glass jars with Teflon-lined, polypropylene closures. A new, pre-cleaned, stainless-steel spoon will be used to transfer soil to the sample containers.

Soil samples collected for chemical analysis will be obtained using a split-spoon sampler or continuous sampling device that has been cleaned using the decontamination procedures described in this section. Split-spoon samplers will be attached to a sampling rod, lowered into the boring through the hollow stem of the auger, and driven in advance of the auger flight. Sampling rod and split-spoon samplers will be removed from the auger when driving is complete. After a split-spoon sampler is retrieved, it will be opened immediately and the sample inspected for volume of recovered material. If insufficient material is recovered in the sampler, the split-spoon will be redriven to collect another sample prior to any further advance of the auger.

Soil samples will be collected by personnel wearing clean (analyte-free) gloves using stainless steel sampling spoons. All soil sampling equipment will be decontaminated prior to each use as described in this section. Samples will be collected in the following manner:

> Rapidly collect enough material with the sampling spoon to fill the sample container approximately one-third full;
>
> Use the spoon to compact the sample material in the container and minimize pore spaces. Large aggregate and debris should be removed from the sample medium;
>
> Use the spoon to continue filling the sample container in thirds using the above procedures;
>
> After completely filling the container to minimize head space, wipe the outer rim of the container to provide a clean sealing surface and securely fasten the lid;
>
> Filled sample containers shall be immediately placed in a cooler chilled to a temperature of near 4°C;
>
> A clean sampling spoon and pair of gloves shall be used for each sample collected and shall be properly disposed of after the sample is collected.

Groundwater samples will be obtained for chemical analysis by manually lowering a Teflon sample bailer into a monitoring well to retrieve the sample. All water samples will be collected using equipment which has been decontaminated prior to use by the methods described below. Any instruments or equipment that come into contact with the sampled matrix, including those introduced into monitoring wells, will be similarly decontaminated prior to use. Groundwater sampling equipment, techniques, and procedures will be operated and implemented as outlined in Section 8.5, Groundwater Monitoring, of the U. S. Environmental Protection Agency's A Compendium of Superfund Field Operations Methods.

The protocol for handling and storing samples once they are collected is intended to maintain sample integrity from the field to the laboratory. Every precaution must be taken to assure the integrity of the sample prior to its laboratory analysis. Sample handlers shall invoke clean handling techniques while collecting sample material. A fresh change of gloves shall be used for the collection of each sample. Minimal contact between the material and the sampler's hands is preferred, so an efficient, organized routine is necessary while collecting sample material. Sample spoons and gloves shall be used for a single sample only and then shall be discarded

Sample containers for volatile organic analyses shall be completely filled to minimize head space and shall then be immediately sealed. Sample containers shall be labeled immediately following collection of the sample material with a self-adhesive label completed in indelible ink with the following information: sample identification number; date and time the sample was collected; sample media identification or sample type; analysis to be conducted on the sample; and initials of the person collecting the sample. Each sample container shall also be sealed with evidence tape that has been initialed and dated by the sampler. Evidence tape placed on sample containers at the time of collection shall be inspected upon delivery to the laboratory to insure sample integrity.

Decontamination of personnel, sampling equipment, and containers after sampling is required to ensure collection of representative samples and to prevent potential spread of contamination. Decontamination of personnel prevents ingestion and absorption of contaminants and is most readily accomplished by using a soap and water wash, and a water rinse. The rinse should be with deionized water.

All sampling equipment that is not disposed of should be properly decontaminated by a thorough scrubbing with a stiff brush in a solution of water and laboratory detergent (Alconox). The wash should be followed with a thorough rinse with deionized water. The equipment should then be rinsed again with deionized water and sealed in plastic bags. Exteriors of sample containers should be cleaned after samples are collected and container lids are tightly sealed.

Samples shall be kept out of direct sunlight and shall be stored in a cooler with Insul-Ice (or a similar reusable coolant material), near 4 degrees C, for handling and transporting to the analytical laboratory. Delivery of the samples to the laboratory shall be prompt to ensure that holding times can be met and that the analyses can be performed within the required time period after sample collection.

A Chain of Custody form shall accompany all samples from the field to the laboratory. The chain-of-custody shall include all the information contained on each sample label, shall be signed, and shall include the time and date samples are delivered to the laboratory. The original chain-of-custody shall be retained with the samples at the laboratory, copy 1 shall be retained by the consultant, and copy 2 shall be transmitted to the site owner.

All information and observations made during sampling shall be recorded in a bound field book and shall be summarized on a DOWL Daily Sampling Log for future reporting. Information should include soil types encountered, groundwater levels if observed, PID readings, location and time each sample is collected, and any other information pertinent to the sampling. Copies of DOWL's forms for Chain-of-Custody and Daily Sampling Logs are included in Appendix A.

4.0 ANALYTICAL PROGRAM

4.1 QA/QC Program

To insure that the analytical information obtained from this sampling program represents the true conditions of the sampled media, quality assurance/quality control (QA/QC) samples shall also be collected. The QA/QC effort shall be conducted in accordance with Section 7.0, Quality Assurance and Quality Control Requirements of the State of Washington Department of Ecology Guidance for Site Checks and Site Assessments for Underground Storage Tanks.

For each sample matrix, as a minimum, one QA/QC sample shall be prepared and analyzed for every ten field samples. The types and manner of collecting QA/QC sample(s) shall be as follows:

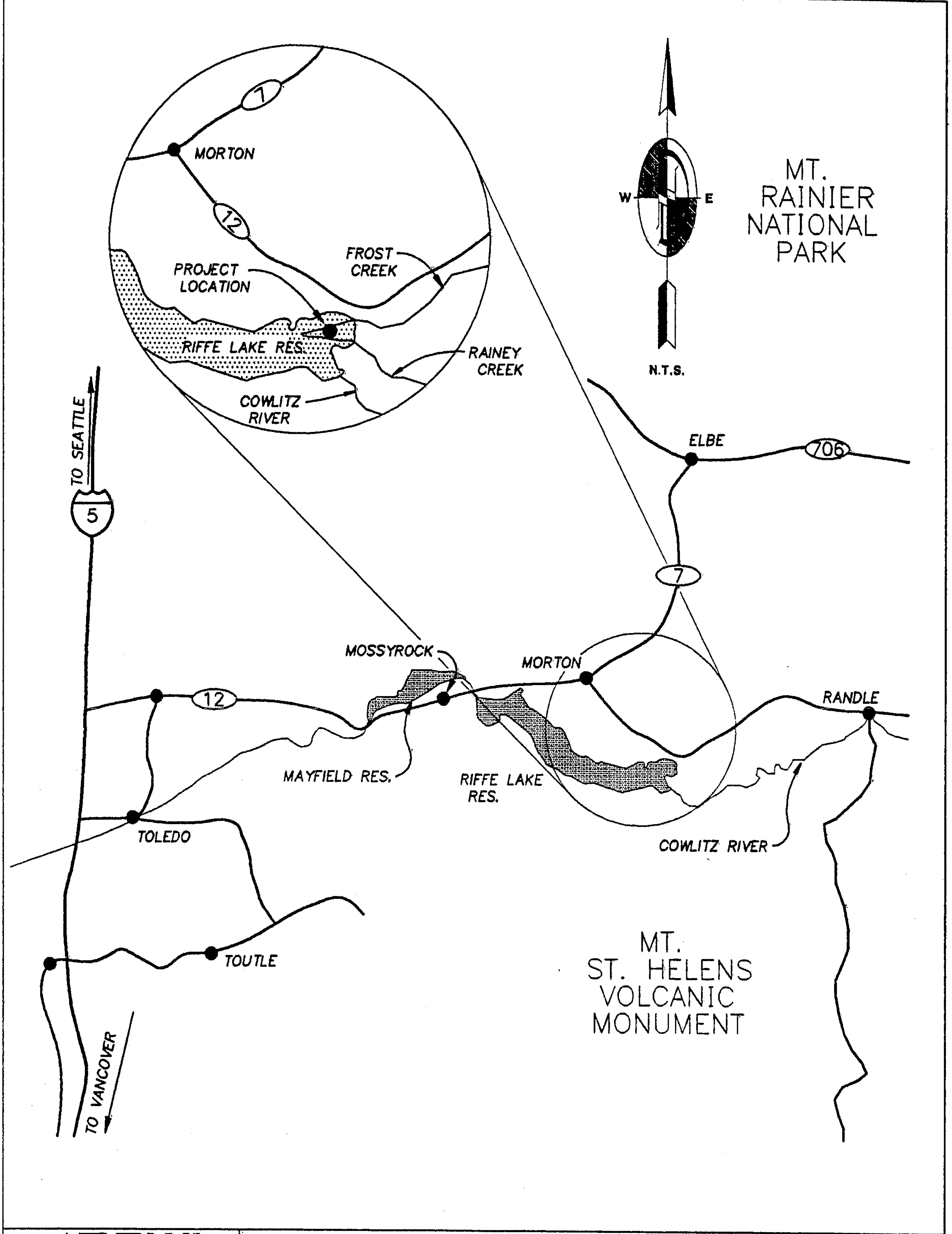
> Duplicate soil samples shall be collected in the same manner and from the same location as one of the field samples. Duplicate water samples shall be collected by repeating the sampling activity at the primary sample location. When a bailer is used for collection of a groundwater sample, the bailer shall be lowered into the well a second time to collect the duplicate sample. Duplicate samples provide the means to evaluate the consistency and quality of the field sampling procedures and operations.
>
> Trip blanks shall be used for volatile organics in water. Two 40-milliliter VOA sample vials shall be filled with analyte free water. These blanks shall accompany the sample vials to the field and shall then be exposed to all environments the sample bottles come in contact with. Trip blanks will be used to determine if analytes are picked up as contaminates during the sampling and shipping process.

4.2 Analytical Laboratory.

Analytical Technologies Inc. (ATI) in Renton, Washington will be providing analytical services for this investigation. Documents confirming that Analytical Technologies Inc. has accreditation by the State of Washington Department of Ecology is provided in Appendix B.

5.0 PROPOSED SCHEDULE

The field portion of this work is scheduled to begin on October 19, 1992 and is anticipated to be completed by October 28th.

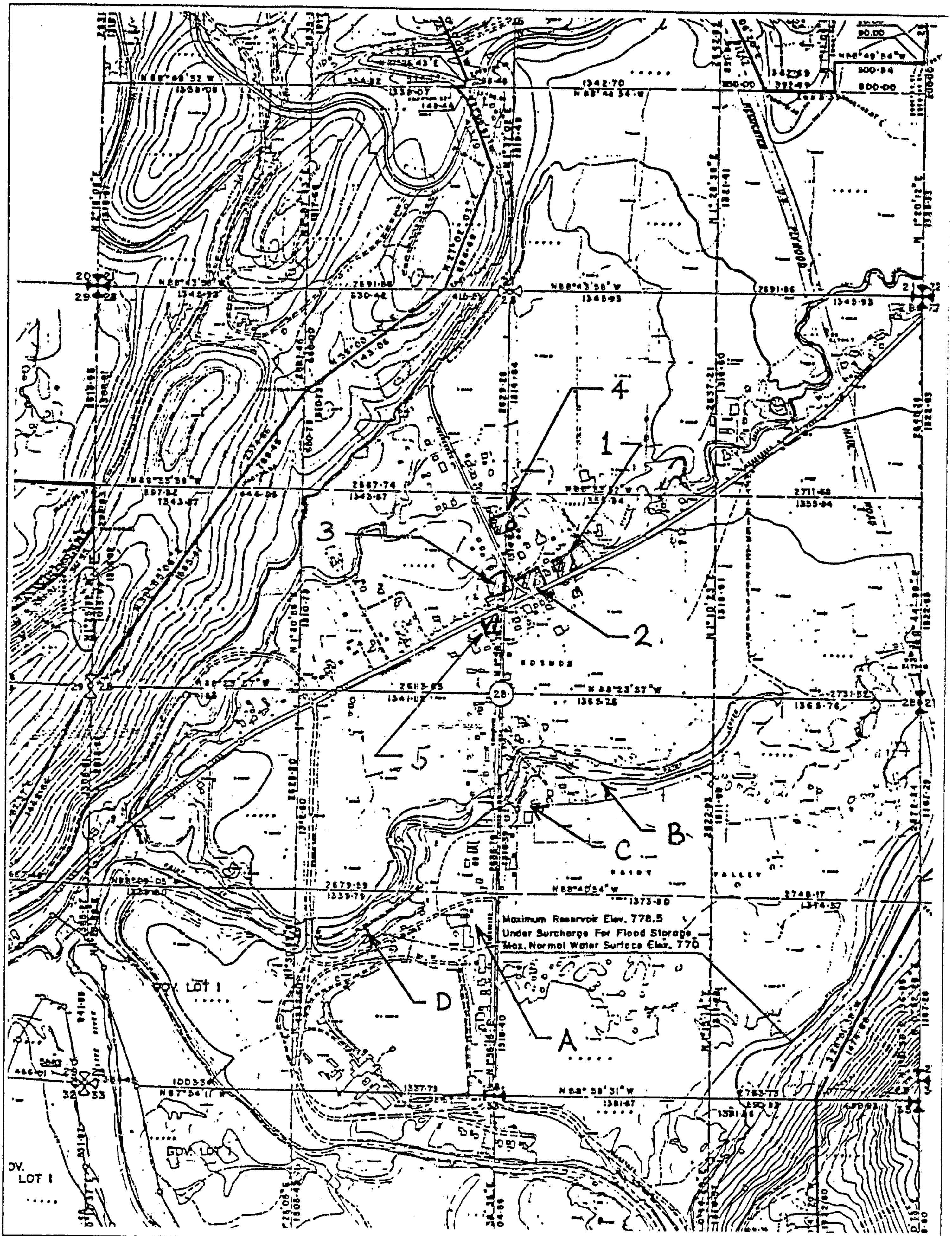


DOWL ENGINEERS
[illegible] AVE NE REDMOND, WA [illegible]

KOSMOS VICINITY MAP

FIGURE 1

FILENAME: D:\ACAD\S11387\S11387.DWG CREATED: OCT 08 1992 07:40:53 UPDATED: NOV 25 1992 14:15:45 PLOTTED: NOV 30 1992 08:43:43



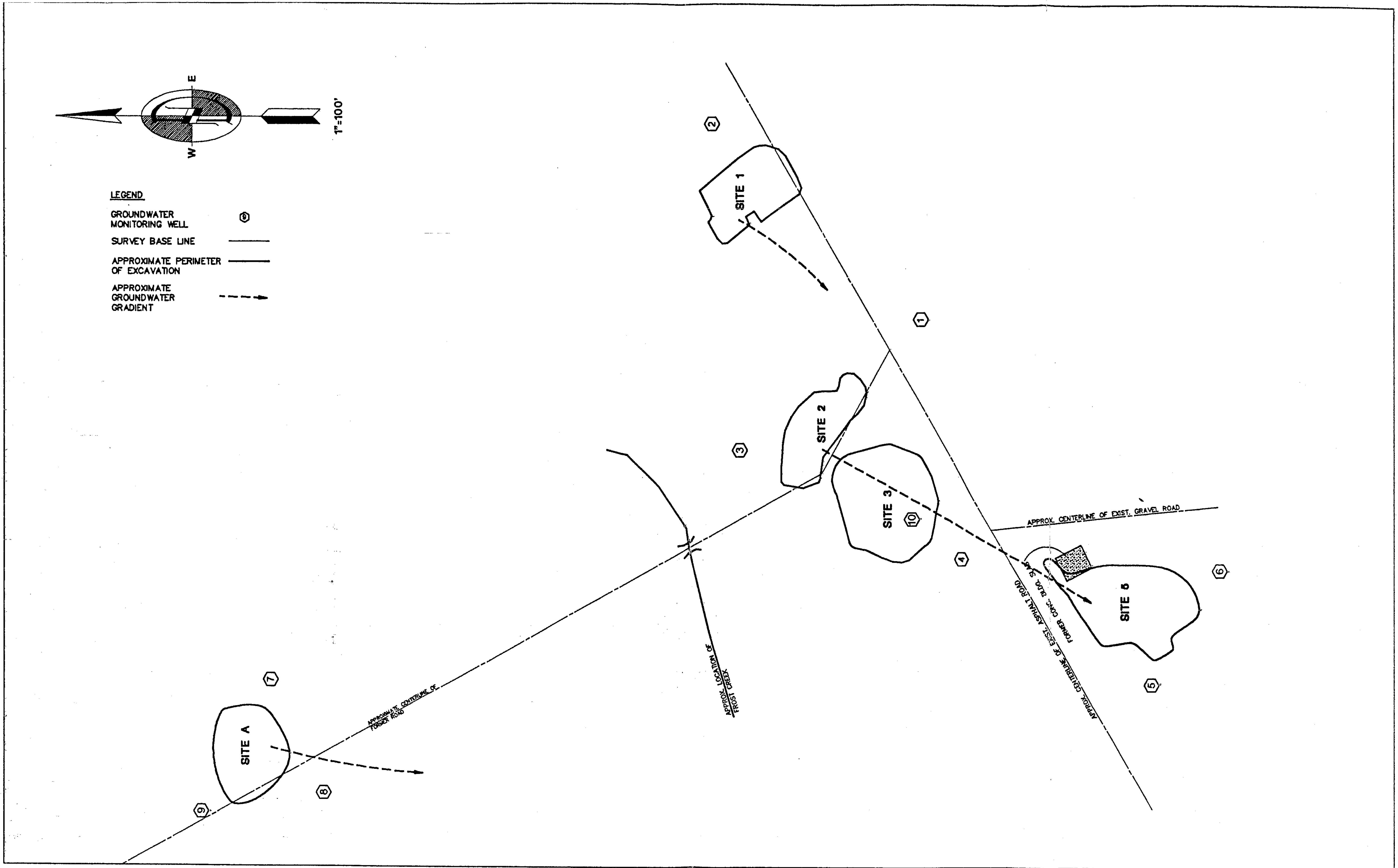
DOWL
ENGINEERS
[illegible] REDMOND, WA [illegible]

FORMER KOSMOS TOWNSITE AND U.S.T. LOCATIONS

FIGURE 2

FILENAME: D:\ACAD\S11387\S11387.DWG CREATED: OCT 08 1992 07:40:53 UPDATED: NOV 25 1992 14:15:45 PLOTTED: NOV 30 1992 08:43:43

FILENAME: D:\ACAD\TEMP\S11387.DWG CREATED: OCT 08 1992 07:40:53 UPDATED: JUN 08 1993 22:10:25 PLOTTED: JUN 09 1993 06:54:34



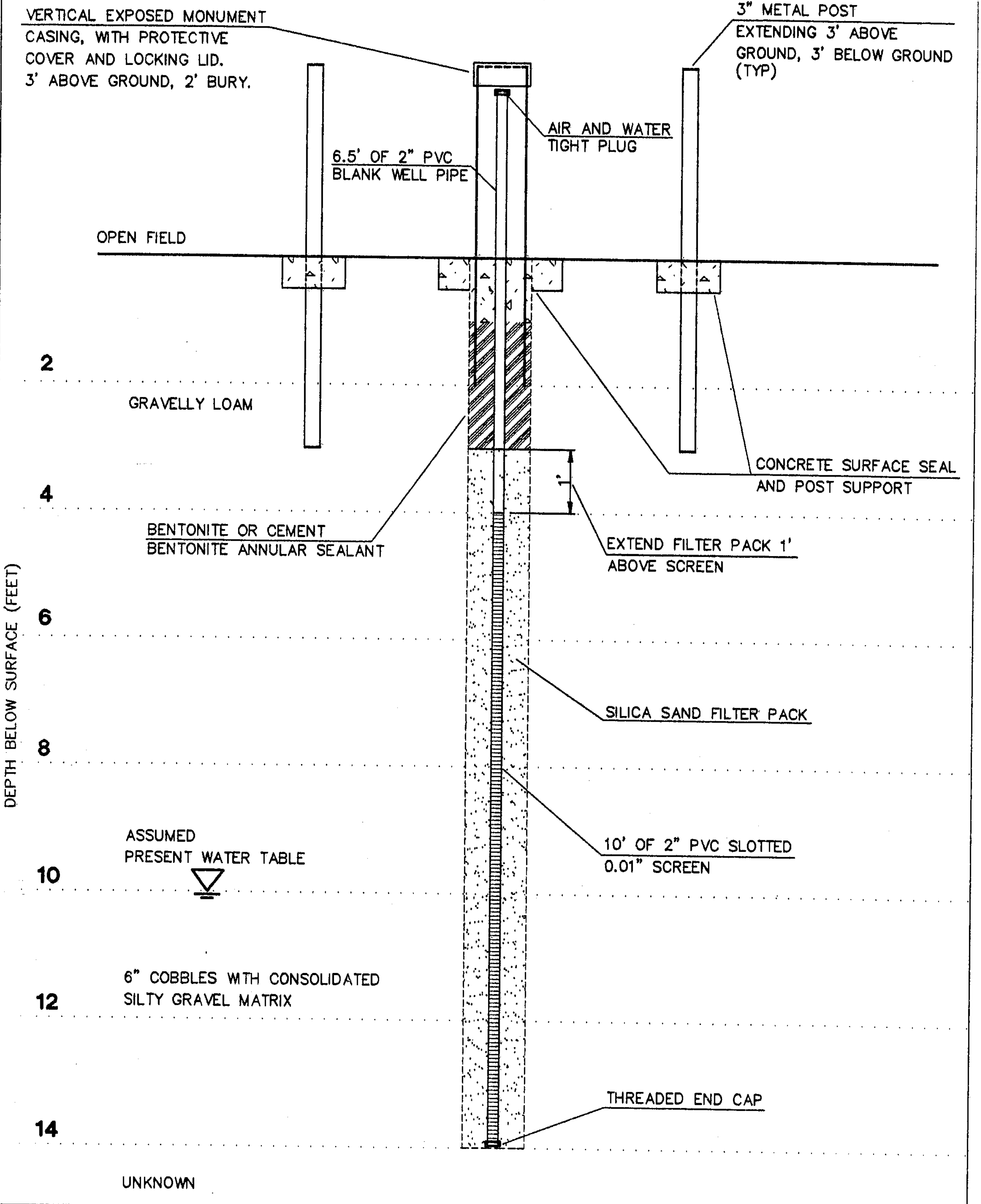
DOWL ENGINEERS

KOSMOS U.S.T. SITES

FIGURE 3

MONITORING WELL CROSS SECTION

(TYPICAL)



FILENAME: D:\ACAD\S11387\S11387.DWG CREATED: OCT 08 1992 07:40:53 UPDATED: NOV 25 1992 12:00:33 PLOTTED: NOV 25 1992 12:05:35

DOWL ENGINEERS
[illegible] 154TH AVE NE REDMOND, WA [illegible]

KOSMOS TOWNSITE
MONITORING WELL DESIGN SKETCH

FIGURE 4

ORIGINAL REPORT CONTAINED THE FOLLOWING APPENDICES:

APPENDIX A - FORMS: CHAIN-OF-CUSTODY & DAILY SAMPLING LOG

APPENDIX B - ANALYTICAL LABORATORY ACCREDITATION

Appendix B

LABORATORY ANALYSES

AnalyticalTechnologies,Inc.

560 Naches Avenue, S.W., Suite 101, Renton, WA 98055 (206) 228-8335
John H. Taylor, Jr., Laboratory Manager
Frederick W. Grothkopp, Technical Director

ATI I.D. # 9210-171

November 6, 1992

Dowl Engineers
8320 154th Avenue N.E.
Redmond, WA 98052-3523

Attention : Geoffrey Dendy

Project Number : S11387

Project Name : TPU Kosmos

On October 22, 1992, Analytical Technologies, Inc., received 12 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 quality control data are enclosed.

Tamara B. Jerome
Tamara B. Jerome
Project Manager

TBJ/hal/ff

ATI I.D. # 9210-171

SAMPLE CROSS REFERENCE SHEET

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9210-171-1	MW3-5	10/21/92	SOIL
9210-171-2	MW3-10	10/21/92	SOIL
9210-171-3	MW2-5	10/21/92	SOIL
9210-171-4	MW2-10	10/21/92	SOIL
9210-171-5	MW5-5	10/21/92	SOIL
9210-171-6	MW5-10	10/21/92	SOIL
9210-171-7	MW6-5	10/20/92	SOIL
9210-171-8	MW6-10	10/20/92	SOIL
9210-171-9	MW7-1	10/21/92	WATER
9210-171-10	MW7-1A	10/21/92	WATER
9210-171-11	MW8-1X	10/21/92	WATER*
9210-171-12	TRIP BLANK	N/A	WATER

* Analyses cancelled per Geoff Dendy.

----- TOTALS -----

MATRIX	# SAMPLES
SOIL	8
WATER	4

ATI STANDARD DISPOSAL PRACTICE

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

ATI I.D. # 9210-171

ANALYTICAL SCHEDULE

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS

ANALYSIS	TECHNIQUE	REFERENCE	LAB
BETX	GC/PID	EPA 8020	R
TOTAL PETROLEUM HYDROCARBONS	GC/FID	WA DOE WTPH-G	R
MOISTURE	GRAVIMETRIC	CLP SOW ILM01.0	R

R = ATI - Renton
SD = ATI - San Diego
PHX = ATI - Phoenix
PNR = ATI - Pensacola
FC = ATI - Fort Collins
SUB = Subcontract

ATI I.D. # 9210-171

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
CLIENT I.D. : REAGENT BLANK
SAMPLE MATRIX : WATER
EPA METHOD : 8020 (BETX)

DATE SAMPLED : N/A
DATE RECEIVED : N/A
DATE EXTRACTED : N/A
DATE ANALYZED : 10/23/92
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUND	RESULT
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	97	76 - 120

ATI I.D. # 9210-171-9

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
CLIENT I.D. : MW7-1
SAMPLE MATRIX : WATER
EPA METHOD : 8020 (BETX)

DATE SAMPLED : 10/21/92
DATE RECEIVED : 10/22/92
DATE EXTRACTED : N/A
DATE ANALYZED : 10/23/92
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUND	RESULT
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	93	76 - 120

ATI I.D. # 9210-171-12

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
CLIENT I.D. : TRIP BLANK
SAMPLE MATRIX : WATER
EPA METHOD : 8020 (BETX)

DATE SAMPLED : N/A
DATE RECEIVED : 10/22/92
DATE EXTRACTED : N/A
DATE ANALYZED : 10/24/92
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUND	RESULT
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	95	76 - 120

ATI I.D. # 9210-171

VOLATILE ORGANIC ANALYSIS
QUALITY CONTROL DATA

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
EPA METHOD : 8020 (BETX)
SAMPLE MATRIX : WATER

SAMPLE I.D. # : 9210-148-1
DATE EXTRACTED : N/A
DATE ANALYZED : 10/23/92
UNITS : ug/L

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	<0.5	20.0	17.6	88	18.4	92	4
TOLUENE	<0.5	20.0	17.4	87	18.7	94	7
TOTAL XYLENES	<0.5	40.0	33.5	84	36.2	91	8

CONTROL LIMITS	% REC.	RPD
BENZENE	77 - 112	20
TOLUENE	72 - 113	20
TOTAL XYLENES	80 - 110	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	97	95	76 - 120

ATI I.D. # 9210-171

VOLATILE ORGANIC ANALYSIS
QUALITY CONTROL DATA

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
EPA METHOD : 8020 (BETX)
SAMPLE MATRIX : WATER

SAMPLE I.D. # : BLANK SPIKE
DATE EXTRACTED : N/A
DATE ANALYZED : 10/23/92
UNITS : ug/L

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	<0.5	20.0	19.4	97	18.1	91	7
TOLUENE	<0.5	20.0	19.8	99	18.1	91	9
TOTAL XYLENES	<0.5	40.0	38.4	96	35.2	88	9

CONTROL LIMITS	% REC.	RPD
BENZENE	80 - 111	20
TOLUENE	78 - 111	20
TOTAL XYLENES	80 - 114	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	101	97	76 - 120

ATI I.D. # 9210-171

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
CLIENT I.D. : REAGENT BLANK
SAMPLE MATRIX : SOIL
EPA METHOD : 8020 (BETX)
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : N/A
DATE RECEIVED : N/A
DATE EXTRACTED : 10/23/92
DATE ANALYZED : 10/31/92
UNITS : mg/Kg
DILUTION FACTOR : 1

COMPOUND	RESULT
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025

SURROGATE PERCENT RECOVERY

		LIMITS
BROMOFLUOROBENZENE	94	52 - 116

ATI I.D. # 9210-171-1

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
CLIENT I.D. : MW3-5
SAMPLE MATRIX : SOIL
EPA METHOD : 8020 (BETX)
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : 10/21/92
DATE RECEIVED : 10/22/92
DATE EXTRACTED : 10/23/92
DATE ANALYZED : 10/29/92
UNITS : mg/Kg
DILUTION FACTOR : 1

COMPOUND	RESULT
BENZENE	<0.038
ETHYLBENZENE	<0.038
TOLUENE	<0.038
TOTAL XYLENES	<0.038

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	82	52 - 116

ATI I.D. # 9210-171-2

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
CLIENT I.D. : MW3-10
SAMPLE MATRIX : SOIL
EPA METHOD : 8020 (BETX)
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : 10/21/92
DATE RECEIVED : 10/22/92
DATE EXTRACTED : 10/23/92
DATE ANALYZED : 10/31/92
UNITS : mg/Kg
DILUTION FACTOR : 1

COMPOUND	RESULT
BENZENE	<0.039
ETHYLBENZENE	<0.039
TOLUENE	<0.039
TOTAL XYLENES	<0.039

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	72	52 - 116

ATI I.D. # 9210-171-3

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
CLIENT I.D. : MW2-5
SAMPLE MATRIX : SOIL
EPA METHOD : 8020 (BETX)
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : 10/21/92
DATE RECEIVED : 10/22/92
DATE EXTRACTED : 10/23/92
DATE ANALYZED : 10/31/92
UNITS : mg/Kg
DILUTION FACTOR : 1

COMPOUND	RESULT
BENZENE	<0.032
ETHYLBENZENE	<0.032
TOLUENE	<0.032
TOTAL XYLENES	<0.032

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	86	52 - 116

ATI I.D. # 9210-171-4

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: DOWL ENGINEERS	DATE SAMPLED	: 10/21/92
PROJECT #	: S11387	DATE RECEIVED	: 10/22/92
PROJECT NAME	: TPU KOSMOS	DATE EXTRACTED	: 10/23/92
CLIENT I.D.	: MW2-10	DATE ANALYZED	: 10/31/92
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS ARE CORRECTED FOR MOISTURE CONTENT

COMPOUND	RESULT
BENZENE	<0.032
ETHYLBENZENE	<0.032
TOLUENE	<0.032
TOTAL XYLENES	<0.032

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	81	52 - 116

ATI I.D. # 9210-171-5

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: DOWL ENGINEERS	DATE SAMPLED	: 10/21/92
PROJECT #	: S11387	DATE RECEIVED	: 10/22/92
PROJECT NAME	: TPU KOSMOS	DATE EXTRACTED	: 10/23/92
CLIENT I.D.	: MW5-5	DATE ANALYZED	: 10/30/92
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

RESULTS ARE CORRECTED FOR MOISTURE CONTENT

COMPOUND	RESULT
BENZENE	<0.029
ETHYLBENZENE	<0.029
TOLUENE	<0.029
TOTAL XYLENES	<0.029

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	80	52 - 116

ATI I.D. # 9210-171-6

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
CLIENT I.D. : MW5-10
SAMPLE MATRIX : SOIL
EPA METHOD : 8020 (BETX)
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : 10/21/92
DATE RECEIVED : 10/22/92
DATE EXTRACTED : 10/23/92
DATE ANALYZED : 10/31/92
UNITS : mg/Kg
DILUTION FACTOR : 1

COMPOUND	RESULT
BENZENE	<0.029
ETHYLBENZENE	<0.029
TOLUENE	<0.029
TOTAL XYLENES	<0.029

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	86	52 - 116

ATI I.D. # 9210-171-7

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
CLIENT I.D. : MW6-5
SAMPLE MATRIX : SOIL
EPA METHOD : 8020 (BETX)
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : 10/20/92
DATE RECEIVED : 10/22/92
DATE EXTRACTED : 10/23/92
DATE ANALYZED : 10/31/92
UNITS : mg/Kg
DILUTION FACTOR : 1

COMPOUND	RESULT
BENZENE	<0.031
ETHYLBENZENE	<0.031
TOLUENE	<0.031
TOTAL XYLENES	<0.031

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	84	52 - 116

ATI I.D. # 9210-171-8

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
CLIENT I.D. : MW6-10
SAMPLE MATRIX : SOIL
EPA METHOD : 8020 (BETX)
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : 10/20/92
DATE RECEIVED : 10/22/92
DATE EXTRACTED : 10/23/92
DATE ANALYZED : 10/31/92
UNITS : mg/Kg
DILUTION FACTOR : 1

COMPOUND	RESULT
BENZENE	<0.029
ETHYLBENZENE	<0.029
TOLUENE	<0.029
TOTAL XYLENES	<0.029

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	87	52 - 116

ATI I.D. # 9210-171

VOLATILE ORGANIC ANALYSIS
QUALITY CONTROL DATA

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
EPA METHOD : 8020 (BETX)
SAMPLE MATRIX : SOIL

SAMPLE I.D. # : 9210-171-3
DATE EXTRACTED : 10/23/92
DATE ANALYZED : 10/30/92
UNITS : mg/Kg

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	<0.025	1.00	0.769	77	0.845	85	9
TOLUENE	<0.025	1.00	0.817	82	0.878	88	7
TOTAL XYLENES	<0.025	2.00	1.63	82	1.75	88	7

CONTROL LIMITS	% REC.	RPD
BENZENE	35 - 113	20
TOLUENE	43 - 107	20
TOTAL XYLENES	46 - 114	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	83	86	52 - 116

ATI I.D. # 9210-171

VOLATILE ORGANIC ANALYSIS
QUALITY CONTROL DATA

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
EPA METHOD : 8020 (BETX)
SAMPLE MATRIX : SOIL

SAMPLE I.D. # : BLANK SPIKE
DATE EXTRACTED : 10/23/92
DATE ANALYZED : 10/31/92
UNITS : mg/Kg

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	<0.025	1.00	0.972	97	0.970	97	0
TOLUENE	<0.025	1.00	1.00	100	1.00	100	0
TOTAL XYLENES	<0.025	2.00	1.92	96	1.93	97	1

CONTROL LIMITS	% REC.	RPD
BENZENE	63 - 115	20
TOLUENE	75 - 110	20
TOTAL XYLENES	79 - 109	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	92	93	52 - 116

ATI I.D. # 9210-171

TOTAL PETROLEUM HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
CLIENT I.D. : REAGENT BLANK
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G

DATE SAMPLED : N/A
DATE RECEIVED : N/A
DATE EXTRACTED : N/A
DATE ANALYZED : 10/23/92
UNITS : mg/L
DILUTION FACTOR : 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<0.1
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
TRIFLUOROTOLUENE	93	50 - 150

ATI I.D. # 9210-171-9

TOTAL PETROLEUM HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
CLIENT I.D. : MW7-1
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G

DATE SAMPLED : 10/21/92
DATE RECEIVED : 10/22/92
DATE EXTRACTED : N/A
DATE ANALYZED : 10/23/92
UNITS : mg/L
DILUTION FACTOR : 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<0.1
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
TRIFLUOROTOLUENE	100	50 - 150

AnalyticalTechnologies,Inc.

ATI I.D. # 9210-171-10

TOTAL PETROLEUM HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
CLIENT I.D. : MW7-1A
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G

DATE SAMPLED : 10/21/92
DATE RECEIVED : 10/22/92
DATE EXTRACTED : N/A
DATE ANALYZED : 10/23/92
UNITS : mg/L
DILUTION FACTOR : 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<0.1
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
TRIFLUOROTOLUENE	96	50 - 150

ATI I.D. # 9210-171

TOTAL PETROLEUM HYDROCARBON ANALYSIS
QUALITY CONTROL DATA

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
METHOD : WA DOE WTPH-G
SAMPLE MATRIX : WATER

SAMPLE I.D. # : 9210-171-9
DATE EXTRACTED : N/A
DATE ANALYZED : 10/23/92
UNITS : mg/L

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
PETROLEUM HYDROCARBONS (GASOLINE)	<0.1	<0.1	NC	2.00	2.13	107	2.10	105	1

CONTROL LIMITS	% REC.	RPD
GASOLINE	58 - 127	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
TRIFLUOROTOLUENE	92	93	50 - 150

NC = Not Calculable.

ATI I.D. # 9210-171

TOTAL PETROLEUM HYDROCARBON ANALYSIS
QUALITY CONTROL DATA

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
METHOD : WA DOE WTPH-G
SAMPLE MATRIX : WATER

SAMPLE I.D. # : BLANK SPIKE
DATE EXTRACTED : N/A
DATE ANALYZED : 10/23/92
UNITS : mg/L

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
PETROLEUM HYDROCARBONS (GASOLINE)	<0.1	2.00	2.17	109	2.06	103	5

CONTROL LIMITS	% REC.	RPD
GASOLINE	75 - 120	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
TRIFLUOROTOLUENE	104	91	50 - 150

ATI I.D. # 9210-171

TOTAL PETROLEUM HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
CLIENT I.D. : REAGENT BLANK
SAMPLE MATRIX : SOIL
METHOD : WA DOE WTPH-G
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : N/A
DATE RECEIVED : N/A
DATE EXTRACTED : 10/23/92
DATE ANALYZED : 10/31/92
UNITS : mg/Kg
DILUTION FACTOR : 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
TRIFLUOROTOLUENE	94	50 - 150

AnalyticalTechnologies,Inc.

ATI I.D. # 9210-171-1

TOTAL PETROLEUM HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
CLIENT I.D. : MW3-5
SAMPLE MATRIX : SOIL
METHOD : WA DOE WTPH-G
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : 10/21/92
DATE RECEIVED : 10/22/92
DATE EXTRACTED : 10/23/92
DATE ANALYZED : 10/29/92
UNITS : mg/Kg
DILUTION FACTOR : 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<8
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
TRIFLUOROTOLUENE	79	50 - 150

ATI I.D. # 9210-171-2

TOTAL PETROLEUM HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
CLIENT I.D. : MW3-10
SAMPLE MATRIX : SOIL
METHOD : WA DOE WTPH-G
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : 10/21/92
DATE RECEIVED : 10/22/92
DATE EXTRACTED : 10/23/92
DATE ANALYZED : 10/29/92
UNITS : mg/Kg
DILUTION FACTOR : 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<8
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
TRIFLUOROTOLUENE	70	50 - 150

ATI I.D. # 9210-171-3

TOTAL PETROLEUM HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: DOWL ENGINEERS	DATE SAMPLED	: 10/21/92
PROJECT #	: S11387	DATE RECEIVED	: 10/22/92
PROJECT NAME	: TPU KOSMOS	DATE EXTRACTED	: 10/23/92
CLIENT I.D.	: MW2-5	DATE ANALYZED	: 10/30/92
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-G	DILUTION FACTOR	: 1

RESULTS ARE CORRECTED FOR MOISTURE CONTENT

COMPOUND	RESULT
FUEL HYDROCARBONS	<6
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
TRIFLUOROTOLUENE	79	50 - 150

ATI I.D. # 9210-171-5

TOTAL PETROLEUM HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
CLIENT I.D. : MW5-5
SAMPLE MATRIX : SOIL
METHOD : WA DOE WTPH-G
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : 10/21/92
DATE RECEIVED : 10/22/92
DATE EXTRACTED : 10/23/92
DATE ANALYZED : 10/30/92
UNITS : mg/Kg
DILUTION FACTOR : 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<6
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
TRIFLUOROTOLUENE	77	50 - 150

ATI I.D. # 9210-171-6

TOTAL PETROLEUM HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
CLIENT I.D. : MW5-10
SAMPLE MATRIX : SOIL
METHOD : WA DOE WTPH-G
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : 10/21/92
DATE RECEIVED : 10/22/92
DATE EXTRACTED : 10/23/92
DATE ANALYZED : 10/30/92
UNITS : mg/Kg
DILUTION FACTOR : 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<6
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
TRIFLUOROTOLUENE	77	50 - 150

ATI I.D. # 9210-171-7

TOTAL PETROLEUM HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: DOWL ENGINEERS	DATE SAMPLED	: 10/20/92
PROJECT #	: S11387	DATE RECEIVED	: 10/22/92
PROJECT NAME	: TPU KOSMOS	DATE EXTRACTED	: 10/23/92
CLIENT I.D.	: MW6-5	DATE ANALYZED	: 10/30/92
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-G	DILUTION FACTOR	: 1

RESULTS ARE CORRECTED FOR MOISTURE CONTENT

COMPOUND	RESULT
FUEL HYDROCARBONS	<6
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
TRIFLUOROTOLUENE	79	50 - 150

ATI I.D. # 9210-171-8

TOTAL PETROLEUM HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: DOWL ENGINEERS	DATE SAMPLED	: 10/20/92
PROJECT #	: S11387	DATE RECEIVED	: 10/22/92
PROJECT NAME	: TPU KOSMOS	DATE EXTRACTED	: 10/23/92
CLIENT I.D.	: MW6-10	DATE ANALYZED	: 10/30/92
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-G	DILUTION FACTOR	: 1

RESULTS ARE CORRECTED FOR MOISTURE CONTENT

COMPOUND	RESULT
FUEL HYDROCARBONS	<6
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
TRIFLUOROTOLUENE	72	50 - 150

ATI I.D. # 9210-171

TOTAL PETROLEUM HYDROCARBON ANALYSIS
QUALITY CONTROL DATA

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS
METHOD : WA DOE WTPH-G
SAMPLE MATRIX : SOIL

SAMPLE I.D. # : 9210-171-3
DATE EXTRACTED : 10/23/92
DATE ANALYZED : 10/30/92
UNITS : mg/Kg

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
PETROLEUM HYDROCARBONS (GASOLINE)	<5	<5	NC	100	87.2	87	84.4	84	3

CONTROL LIMITS	% REC.	RPD
GASOLINE	50 - 112	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
TRIFLUOROTOLUENE	81	80	50 - 150

NC = Not Calculable.

ATI I.D. # 9210-171

TOTAL PETROLEUM HYDROCARBON ANALYSIS
QUALITY CONTROL DATA

: DOWL ENGINEERS
\# : S11387
AME : TPU KOSMOS
: WA DOE WTPH-G
ATRIX : SOIL

SAMPLE I.D. # : BLANK SPIKE
DATE EXTRACTED : 10/23/92
DATE ANALYZED : 10/31/92
UNITS : mg/Kg

	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
HYDROCARBONS							
E.	<5	100	101	101	100	100	1
TROL LIMITS				% REC.			RPD
				80 - 119			20

ROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
TOLUENE	97	97	50 - 150

ATI I.D. # 9210-171

GENERAL CHEMISTRY ANALYSIS

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS

MATRIX : SOIL

PARAMETER	DATE ANALYZED
MOISTURE	10/23/92

ATI I.D. # 9210-171

GENERAL CHEMISTRY ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS

MATRIX : SOIL

UNITS : %

ATI I.D. #	CLIENT I.D.	MOISTURE
9210-171-1	MW3-5	35
9210-171-2	MW3-10	36
9210-171-3	MW2-5	23
9210-171-4	MW2-10	21
9210-171-5	MW5-5	13
9210-171-6	MW5-10	15
9210-171-7	MW6-5	20
9210-171-8	MW6-10	13

ATI I.D. # 9210-171

GENERAL CHEMISTRY ANALYSIS
QUALITY CONTROL DATA

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU KOSMOS

MATRIX : SOIL

UNITS : %

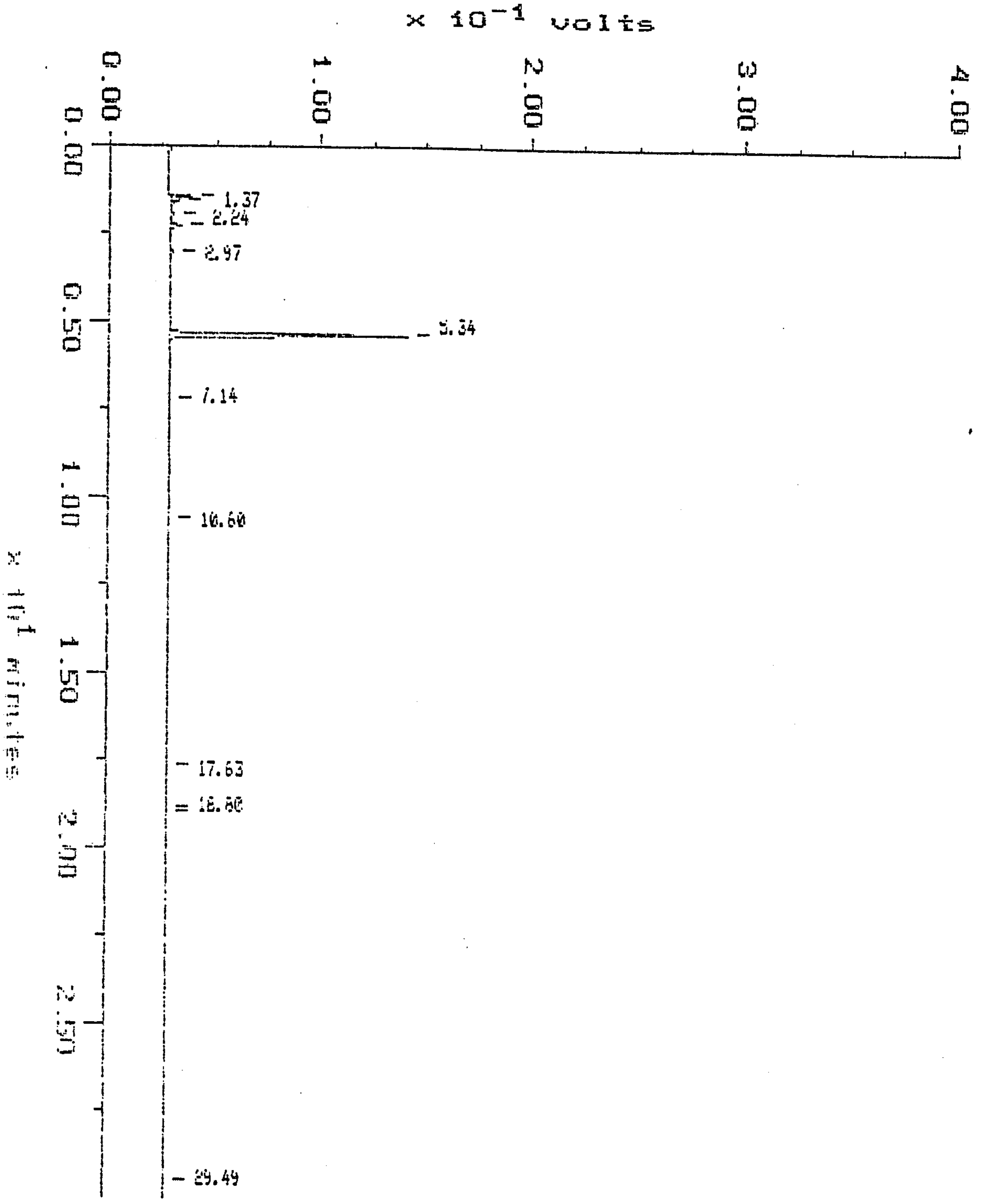
PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
MOISTURE	9210-171-3	23	22	4	N/A	N/A	N/A

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

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

WA DOE WTPH-G Blank

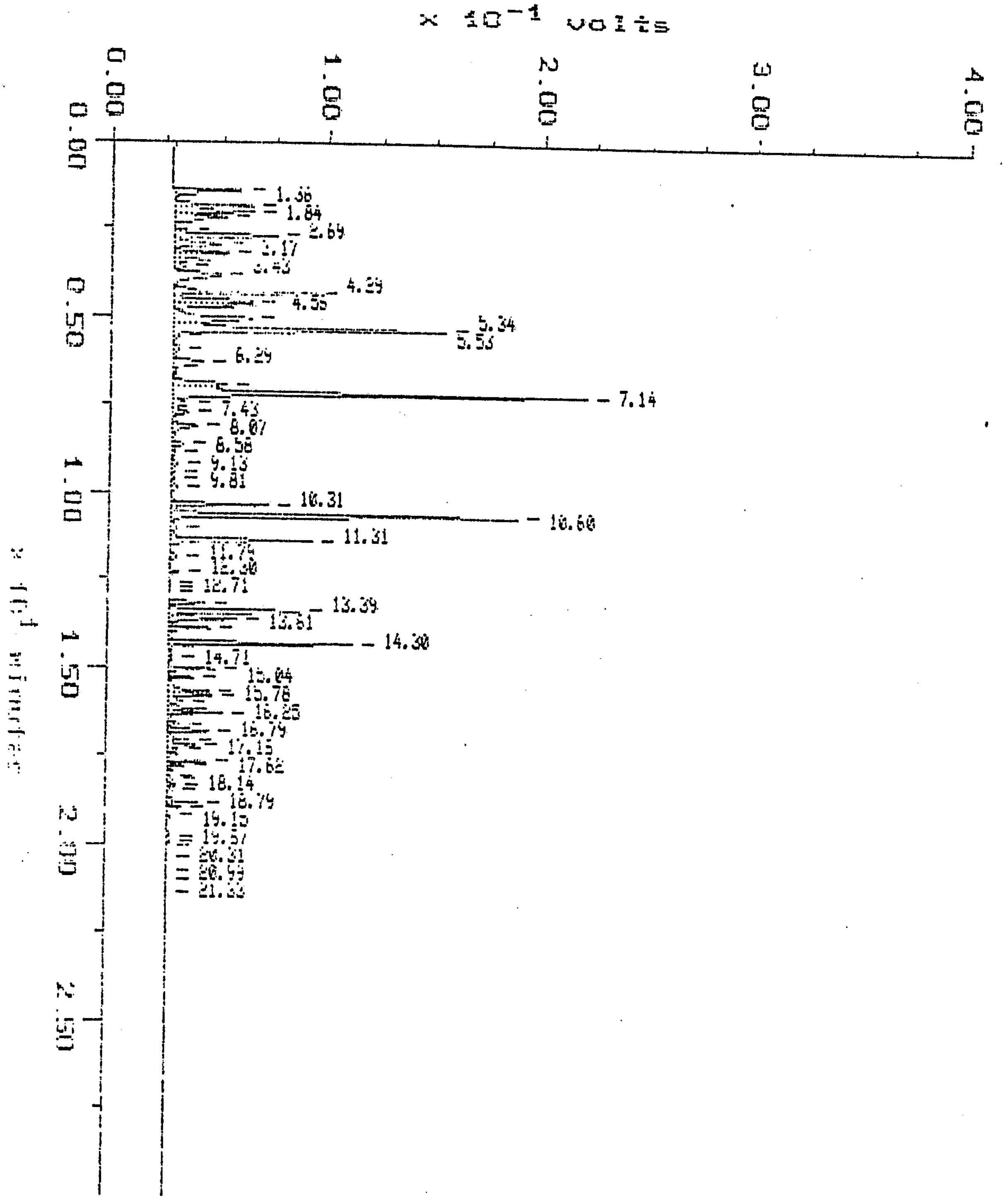
Sample: WRB 10/23 **Channel:** PRISCILLA **Filename:** 1023EP02
Acquired: 23-OCT-92 11:12 **Method:** H:\BRU2\MAXDATA\ELVIS-P\102392EP **Operator:** ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



WA DOE WTPH-G

Continuing Calibration

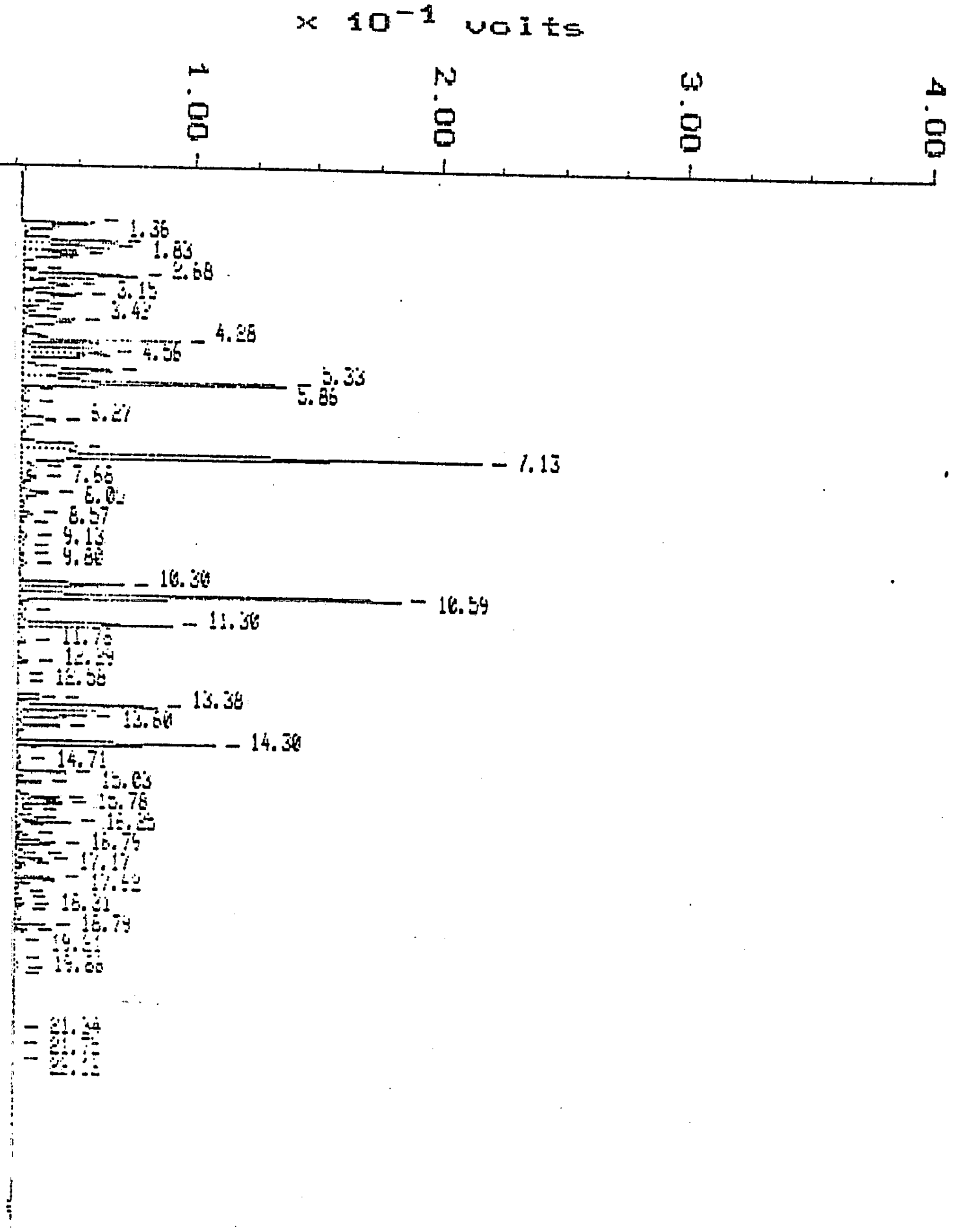
Sample: WMS 10/23　Channel: PRISCILLA
Acquired: 23-OCT-92 10:36　Method: H:\BRO2\MAXDATA\ELVIS-P\102392EP　Filename: 1023EP01
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.　Operator: ATI



WA DOE WTPH-G Continuing Calibration

Sample: WMSD 10/23 Channel: PRISCILLA
cquired: 23-OCT-92 20:46 Method: H:\BRU2\MAXDATA\ELVIS-P\102392EP
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.

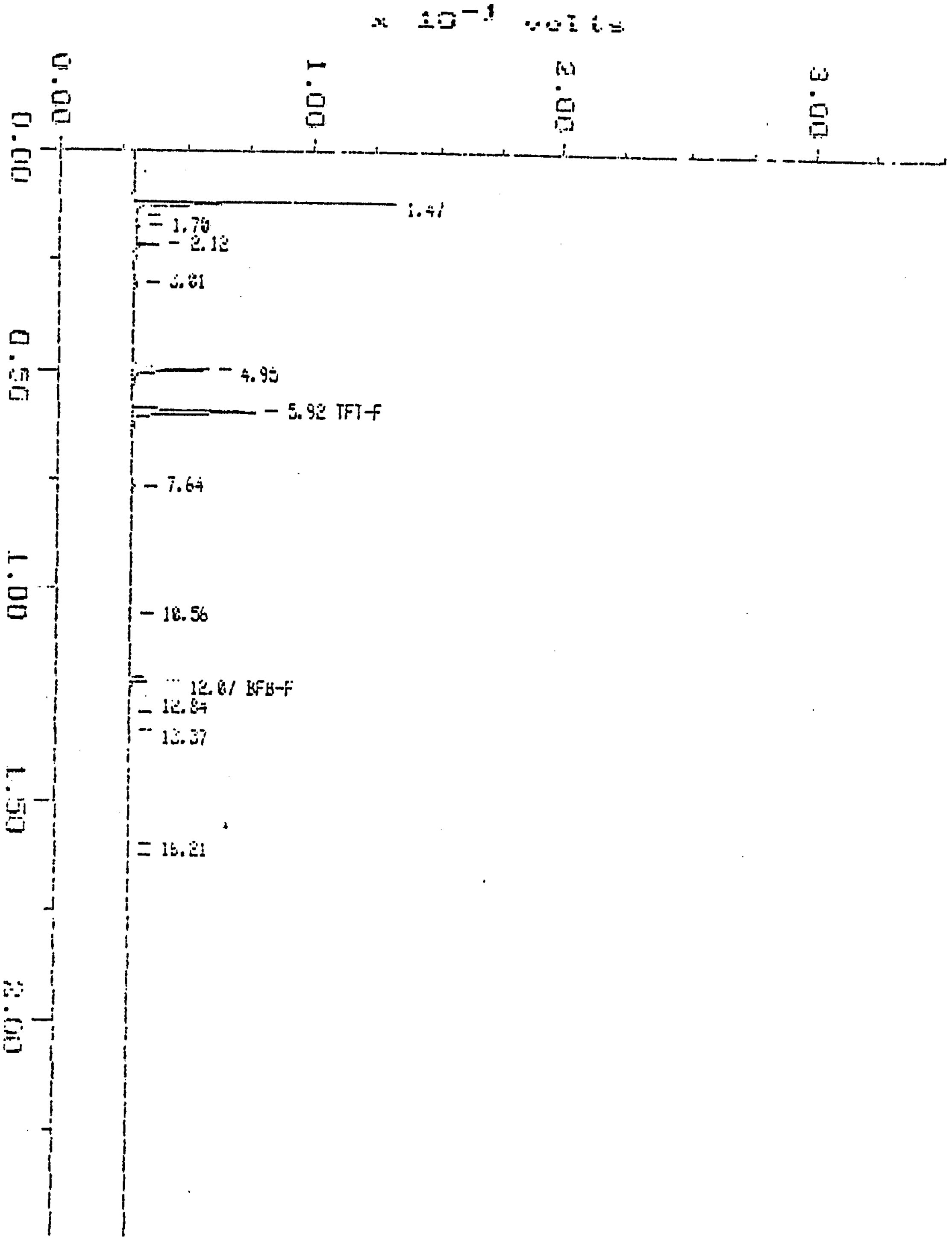
Filename: 1023EP15
Operator: ATI



WA DOE WTPH-G

Blank

Sample: BETX Channel: FID Filename: 1030B225
Acquired: 31-OCT-92 2:50 Method: H:\BRC2\MAXDATA\BALZAC\1030B292 Operator: HII
Comments: ATI : A COMMITMENT TO QUALITY



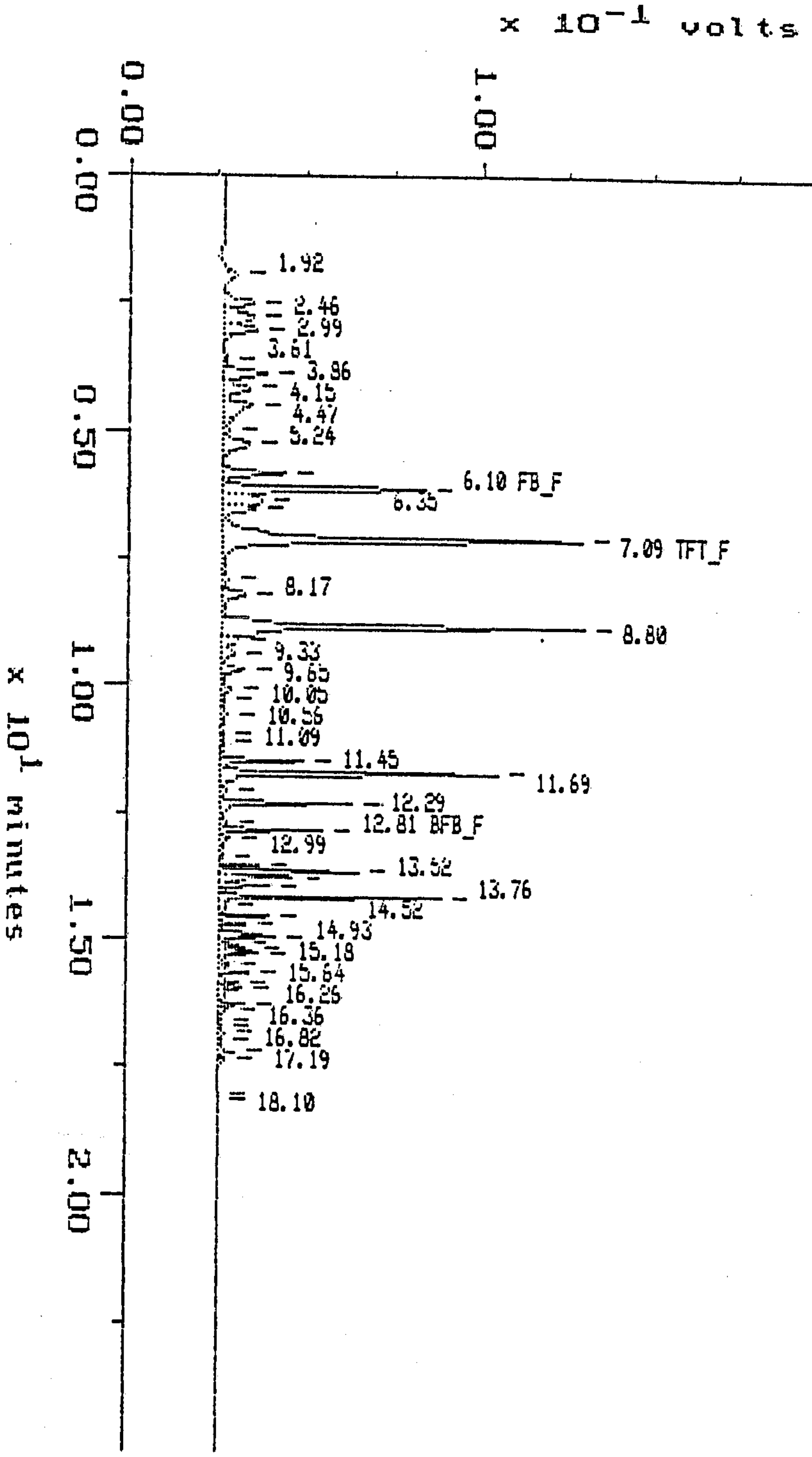
Continuing Calibration

WA DOE WTPH-G

Sample: STD-C GAS
Acquired: 29-OCT-92 18:06

Channel: JEROME-FID
Method: H:\BRU2\MAXDATA\JEROME\JR102992

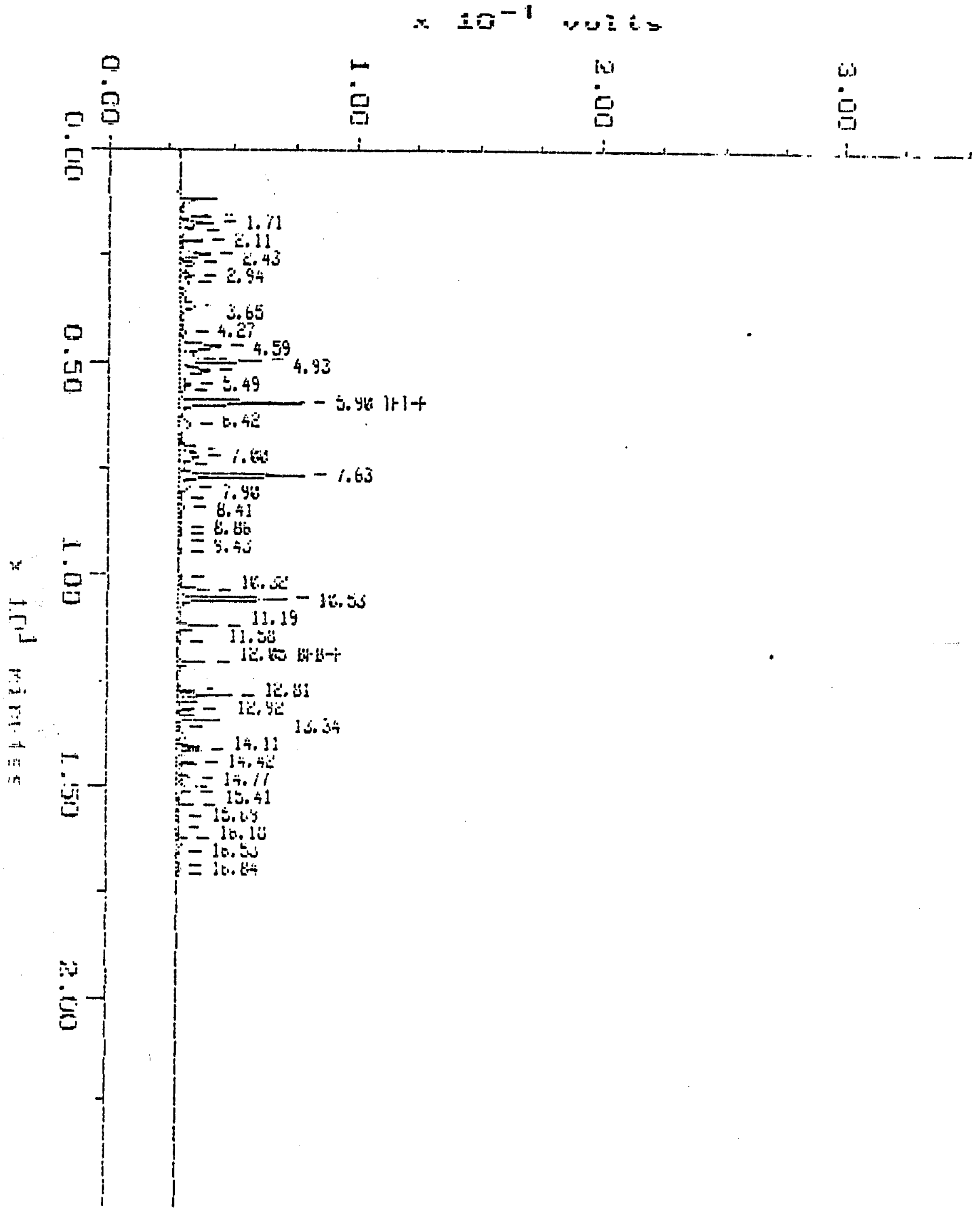
Filename: 1029JR07
Operator:



WA DOE WTPH-G

Continuing Calibration

Sample: STD-C　　Channel: FID　　Filename: 10300202
Acquired: 30-OCT-92 15:04　　Method: H:\BROZ\MAXDATA\BALZAC\10300202　　Operator: AII
Comments: AII : A COMMITMENT TO QUALITY



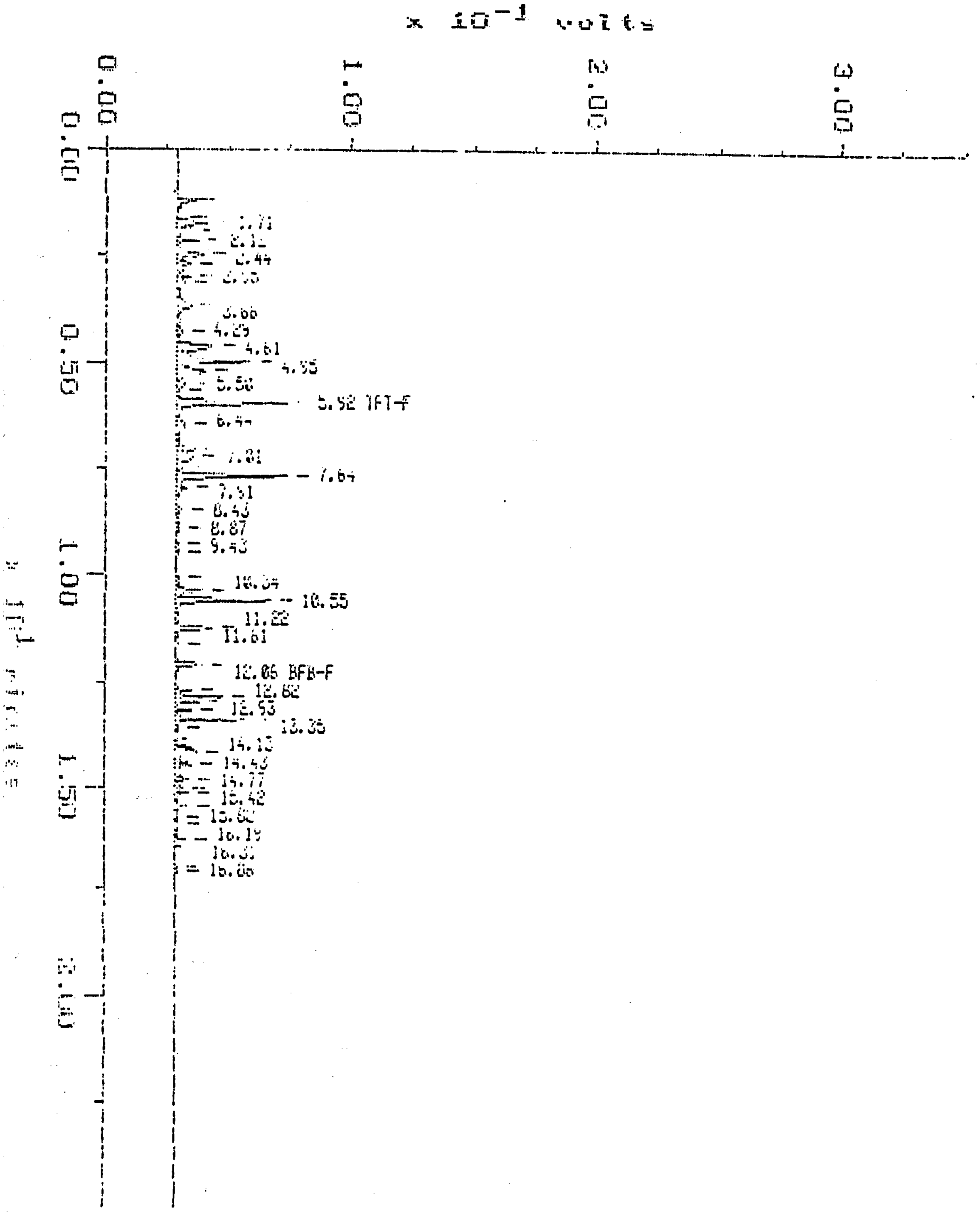
.WA DOE WTPH-G

Continuing Calibration

Sample: STD-C
Acquired: 31-OCT-92 3:54
Comments: ATI : A COMMITMENT TO QUALITY

Channel: FID
Method: H:\BRO2\MAXDATA\BALZAC\10308292

Filename: 10308227
Operator: ATI



SAMPLE RECEIPT FORM

Proj. No. S11387

Project Name TPU Kosmos

Samplers *(Signature)* Geoffrey Dendy

Analyses Requested

	Sample No.	Date	Time	Comp.	Grab	Station Location	No. Of Containers	WTPH-G	BETX							Remarks
-1	MW3-5	21 oct	1120		✓		1	✓	✓							Soil 4oz jar
-2	MW3-10	21 oct	1130		✓		1	✓	✓							Soil 4oz Jar
-3	MW2-5	21 oct	1400		✓		1	✓	✓							Soil 4oz Jar
-4	MW2-10	21 oct	1410		✓		1	✓	✓							Soil 4oz Jar
-5	MW5-5	21 oct	0835		✓		1	✓	✓							Soil 4oz Jar
-6	MW5-10	21 oct	0845		✓		1	✓	✓							Soil 4oz Jar.
-7	MW6-5	20 oct	1700		✓		1	✓	✓							Soil 4oz Jar
-8	MW6-10	20 oct	1715		✓		1	✓	✓							Soil 4oz Jar

Relinquished by: *(Signature)* Geoffrey Dendy	**Date/Time** Noon 22 oct 92	**Received by:** *(Signature)* Dave Burgess	**Relinquished by:** *(Signature)*	**Date/Time**	**Received by:** *(Signature)*
Relinquished by: *(Signature)*	**Date/Time**	**Received for Laboratory by:** *(Signature)* Roger N. Fuller	**Date/Time** 10/22/92 1400	**Remarks:**	

WHITE = ORIGINAL CANARY = COPY 1 PINK = COPY 2

DOWL ENGINEERS
A Division of DOWL, Incorporated
8320 154TH AVENUE NE REDMOND, WA 98052-3523
PH: (206) 869-2670 FAX: (206) 869-2679

CHAIN OF CUSTODY SAMPLE RECEIPT FORM

9210-171

Proj. No. S11387

Project Name TPU KOSMOS

Samplers (Signature) Geoffrey Dendy

	Sample No.	Date	Time	Comp.	Grab	Station Location	No. Of Containers	TPH-G	BETX								Remarks
-9	MW 7-1	21oct	1150		✓	Monitoring Well 7	3	✓	✓								40ml vials
-10	MW 7-1A	21oct	1150		✓	Monitoring Well 7	3	✓	✓								"
-11	~~MW 8-1X~~	~~21 oct~~	~~1420~~		~~✓~~	~~Monitoring Well 8~~	~~3~~	~~✓~~	~~✓~~								Cancel per Geoff Dendy TPJ 10/22/92
-12	Trip Blank	15oct				Lab Prepared	2		✓								40ml vials

Relinquished by: (Signature) Geoffrey Dendy	**Date/Time** 22oct92 Noon	**Received by: (Signature)** Dave Burgess	**Relinquished by: (Signature)**	**Date/Time**	**Received by: (Signature)**
Relinquished by: (Signature)	**Date/Time**	**Received for Laboratory by: (Signature)** Roger	**Date/Time** 10/22/92 1400	**Remarks:**	

WHITE = ORIGINAL CANARY = COPY 1 PINK = COPY 2

DOWL DAILY SAMPLING LOG

Page 1 of ____

SITE TPU Kosmos DATE Oct 21, 92 DOWL W.O. NO. S11387

LOCATION

FIELD TEAM Steve Sires Jeff Dendy Fred Hanson

SITE CONTACTS Russell Post + Sam Rupert of TPU

SITE CONDITIONS ~~[illegible]~~ Deep mud poor mobility

SITE WEATHER 50's drizzle - overcast

MONITORING EQUIP. None SAFETY/P.P.E. LEVEL 1)

EQUIPMENT (OTHER)

SAMPLE NUMBER	DESCRIPTION AND OBSERVATIONS	DATE	TIME	SAMPLE MATRIX	SAMPLE CONTAINER	ANALYSIS	COOLER NO.
MW7-1		21oct	1150	Water	(3) 40ml	TPH-g BETX	
MW7-1A		21oct	1150	Water	"	"	"
MW8-1x	*	21oct	1420	Water	"	"	"
Trip Blank		15 oct		Water	(2) 40ml	BETX	
MW3-5		21oct	1120	Soil	4oz Jar	TPHg BETX	
MW3-10		21oct	1130	Soil	4oz Jar	TPHg BETX	
MW2-5		21oct	1400	"	"	"	
MW2-10		21oct	1410	"	"	"	
MW5-5		21oct	0835	"	"	"	
MW5-10		21oct	0845	"	"	"	
MW6-5		20oct	1700	"	"	"	
MW6-10		20oct	1715	"	"	"	

COMMENTS * NOT ANALYZED - REPLACED w/ SAMPLE MW-8-1 OF 10/22/92

Steve Sires
Jeff Dendy Fred Hanson
PRINTED NAME OF SAMPLER

SIGNATURE

22 Oct 92
DATE

AnalyticalTechnologies,Inc.

560 Naches Avenue, S.W., Suite 101, Renton, WA 98055 (206) 228-8335
John H. Taylor, Jr., Laboratory Manager
Frederick W. Grothkopp, Technical Director

ATI I.D. # 9210-185

November 6, 1992

Dowl Engineers
8320 154th Avenue N.E.
Redmond, WA 98052-3523

Attention : Geoff Dendy

Project Number : S11387

Project Name : TPU - Kosmos

On October 23, 1992, Analytical Technologies, Inc., received three 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 quality control data are enclosed.

Tamara B. Jerome

Tamara B. Jerome
Project Manager

TBJ/hal/ff

Analytical**Technologies,**Inc.

ATI I.D. # 9210-185

SAMPLE CROSS REFERENCE SHEET

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU - KOSMOS

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9210-185-1	MW-8-1	10/22/92	WATER
9210-185-2	MW-9-1	10/22/92	WATER
9210-185-3	MW-9-1A	10/22/92	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 the report. If an extended storage period is required, please contact our sample control department before the scheduled disposal date.

ATI I.D. # 9210-185

ANALYTICAL SCHEDULE

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU - KOSMOS

ANALYSIS	TECHNIQUE	REFERENCE	LAB
BETX	GC/PID	EPA 8020	R
TOTAL PETROLEUM HYDROCARBONS	GC/FID	WA DOE WTPH-G	R

R = ATI - Renton
SD = ATI - San Diego
PHX = ATI - Phoenix
PNR = ATI - Pensacola
FC = ATI - Fort Collins
SUB = Subcontract

ATI I.D. # 9210-185

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT	: DOWL ENGINEERS	DATE SAMPLED	: N/A
PROJECT #	: S11387	DATE RECEIVED	: N/A
PROJECT NAME	: TPU - KOSMOS	DATE EXTRACTED	: N/A
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 10/27/92
SAMPLE MATRIX	: WATER	UNITS	: ug/L
EPA METHOD	: 8020 (BETX)	DILUTION FACTOR	: 1

COMPOUND	RESULT
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	93	76 - 120

ATI I.D. # 9210-185-1

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU - KOSMOS
CLIENT I.D. : MW-8-1
SAMPLE MATRIX : WATER
EPA METHOD : 8020 (BETX)

DATE SAMPLED : 10/22/92
DATE RECEIVED : 10/23/92
DATE EXTRACTED : N/A
DATE ANALYZED : 10/28/92
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUND	RESULT
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	93	76 - 120

ATI I.D. # 9210-185-2

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU - KOSMOS
CLIENT I.D. : MW-9-1
SAMPLE MATRIX : WATER
EPA METHOD : 8020 (BETX)

DATE SAMPLED : 10/22/92
DATE RECEIVED : 10/23/92
DATE EXTRACTED : N/A
DATE ANALYZED : 10/28/92
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUND	RESULT
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	87	76 - 120

ATI I.D. # 9210-185-3

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU - KOSMOS
CLIENT I.D. : MW-9-1A
SAMPLE MATRIX : WATER
EPA METHOD : 8020 (BETX)

DATE SAMPLED : 10/22/92
DATE RECEIVED : 10/23/92
DATE EXTRACTED : N/A
DATE ANALYZED : 10/28/92
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUND	RESULT
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	94	76 - 120

ATI I.D. # 9210-185

VOLATILE ORGANIC ANALYSIS
QUALITY CONTROL DATA

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU - KOSMOS
EPA METHOD : 8020 (BETX)
SAMPLE MATRIX : WATER

SAMPLE I.D. # : 9210-153-8
DATE EXTRACTED : N/A
DATE ANALYZED : 10/27/92
UNITS : ug/L

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	<0.5	20.0	19.1	96	18.7	94	2
TOLUENE	<0.5	20.0	18.5	93	18.4	92	1
TOTAL XYLENES	<0.5	40.0	35.0	88	35.5	89	1

CONTROL LIMITS	% REC.	RPD
BENZENE	77 - 112	20
TOLUENE	72 - 113	20
TOTAL XYLENES	80 - 110	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	98	92	76 - 120

ATI I.D. # 9210-185

VOLATILE ORGANIC ANALYSIS QUALITY CONTROL DATA

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU - KOSMOS
EPA METHOD : 8020 (BETX)
SAMPLE MATRIX : WATER

SAMPLE I.D. # : BLANK SPIKE
DATE EXTRACTED : N/A
DATE ANALYZED : 10/27/92
UNITS : ug/L

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	<0.5	20.0	18.6	93	19.5	98	5
TOLUENE	<0.5	20.0	18.6	93	18.9	95	2
TOTAL XYLENES	<0.5	40.0	35.8	90	36.2	91	1

CONTROL LIMITS	% REC.	RPD
BENZENE	80 - 111	20
TOLUENE	78 - 111	20
TOTAL XYLENES	80 - 114	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	98	96	76 - 120

ATI I.D. # 9210-185

TOTAL PETROLEUM HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU - KOSMOS
CLIENT I.D. : REAGENT BLANK
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G

DATE SAMPLED : N/A
DATE RECEIVED : N/A
DATE EXTRACTED : N/A
DATE ANALYZED : 10/27/92
UNITS : mg/L
DILUTION FACTOR : 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<0.1
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
TRIFLUOROTOLUENE	95	50 - 150

ATI I.D. # 9210-185-1

TOTAL PETROLEUM HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU - KOSMOS
CLIENT I.D. : MW-8-1
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G

DATE SAMPLED : 10/22/92
DATE RECEIVED : 10/23/92
DATE EXTRACTED : N/A
DATE ANALYZED : 10/28/92
UNITS : mg/L
DILUTION FACTOR : 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<0.1
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
TRIFLUOROTOLUENE	95	50 - 150

ATI I.D. # 9210-185-2

TOTAL PETROLEUM HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: DOWL ENGINEERS	DATE SAMPLED	: 10/22/92
PROJECT #	: S11387	DATE RECEIVED	: 10/23/92
PROJECT NAME	: TPU - KOSMOS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW-9-1	DATE ANALYZED	: 10/28/92
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-G	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<0.1
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
TRIFLUOROTOLUENE	93	50 - 150

ATI I.D. # 9210-185-3

TOTAL PETROLEUM HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU - KOSMOS
CLIENT I.D. : MW-9-1A
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G

DATE SAMPLED : 10/22/92
DATE RECEIVED : 10/23/92
DATE EXTRACTED : N/A
DATE ANALYZED : 10/28/92
UNITS : mg/L
DILUTION FACTOR : 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<0.1
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
TRIFLUOROTOLUENE	99	50 - 150

ATI I.D. # 9210-185

TOTAL PETROLEUM HYDROCARBON ANALYSIS
QUALITY CONTROL DATA

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : TPU - KOSMOS
METHOD : WA DOE WTPH-G
SAMPLE MATRIX : WATER

SAMPLE I.D. # : 9210-160-5
DATE EXTRACTED : N/A
DATE ANALYZED : 10/27/92
UNITS : mg/L

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
PETROLEUM HYDROCARBONS (GASOLINE)	<0.1	<0.1	NC	2.00	1.98	99	2.08	104	5

CONTROL LIMITS	% REC.	RPD
GASOLINE	58 - 127	20

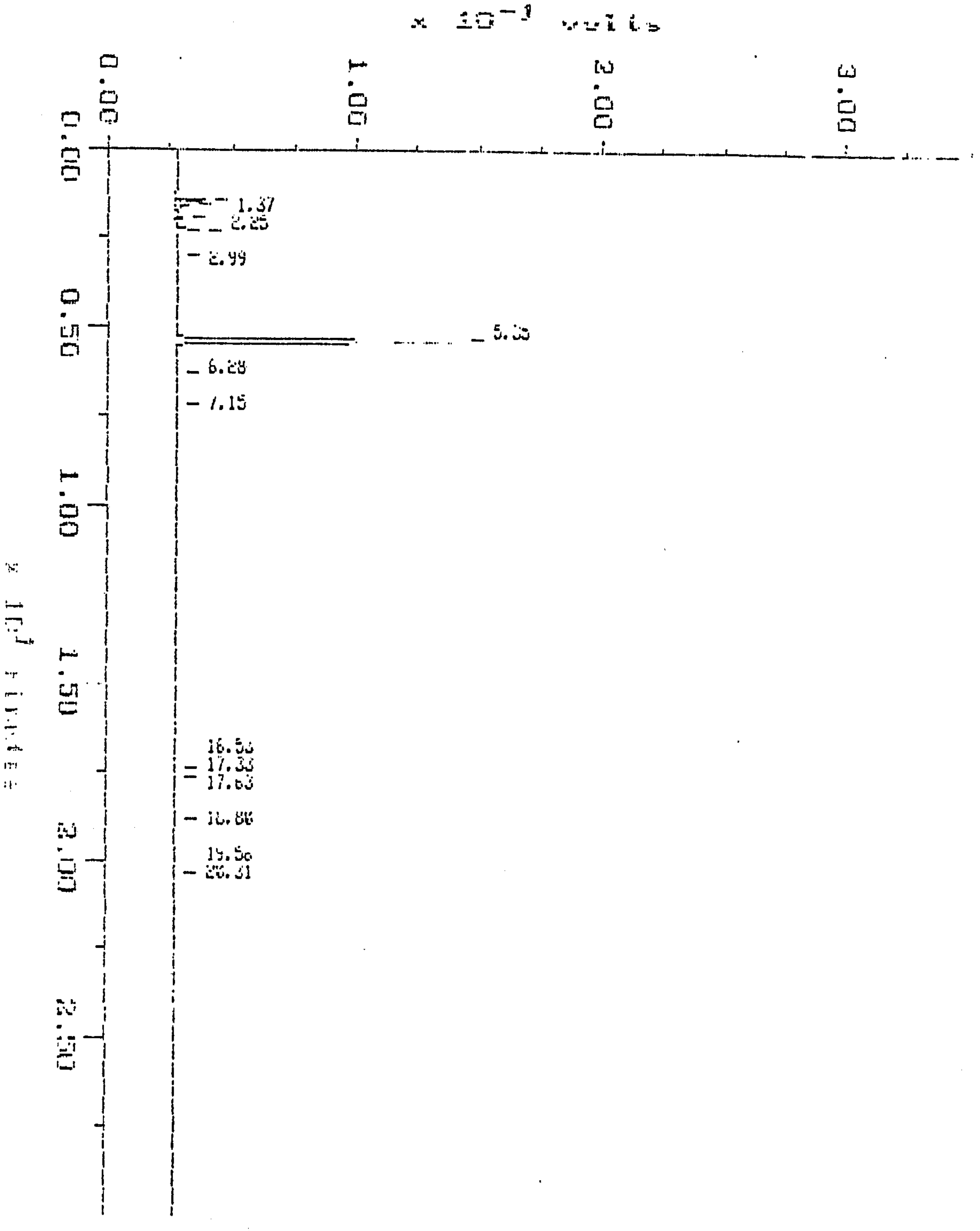
SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
TRIFLUOROTOLUENE	102	102	50 - 150

NC = Not Calculable.

WA DOE WTPH-G

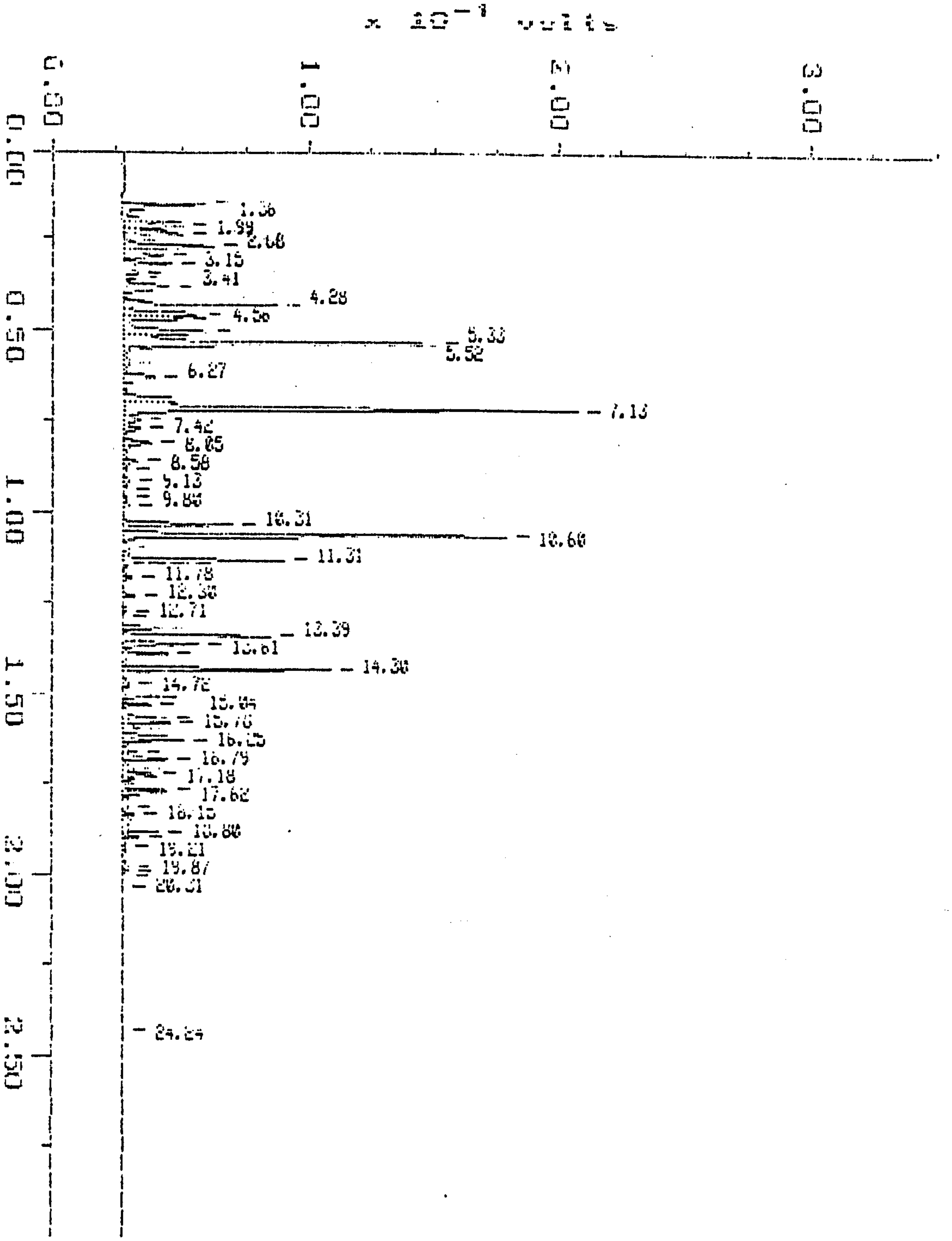
Blank

```
  Sample: WRB 10/27          Channel: PRISCILLA                                 Filename: 1027EP02
Acquired: 27-OCT-92  15:41    Method: H:\BR02\MAXDATA\ELVIS-P\102792EP          Operator: ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.
```



WA DOE WTPH-G Continuing Calibration

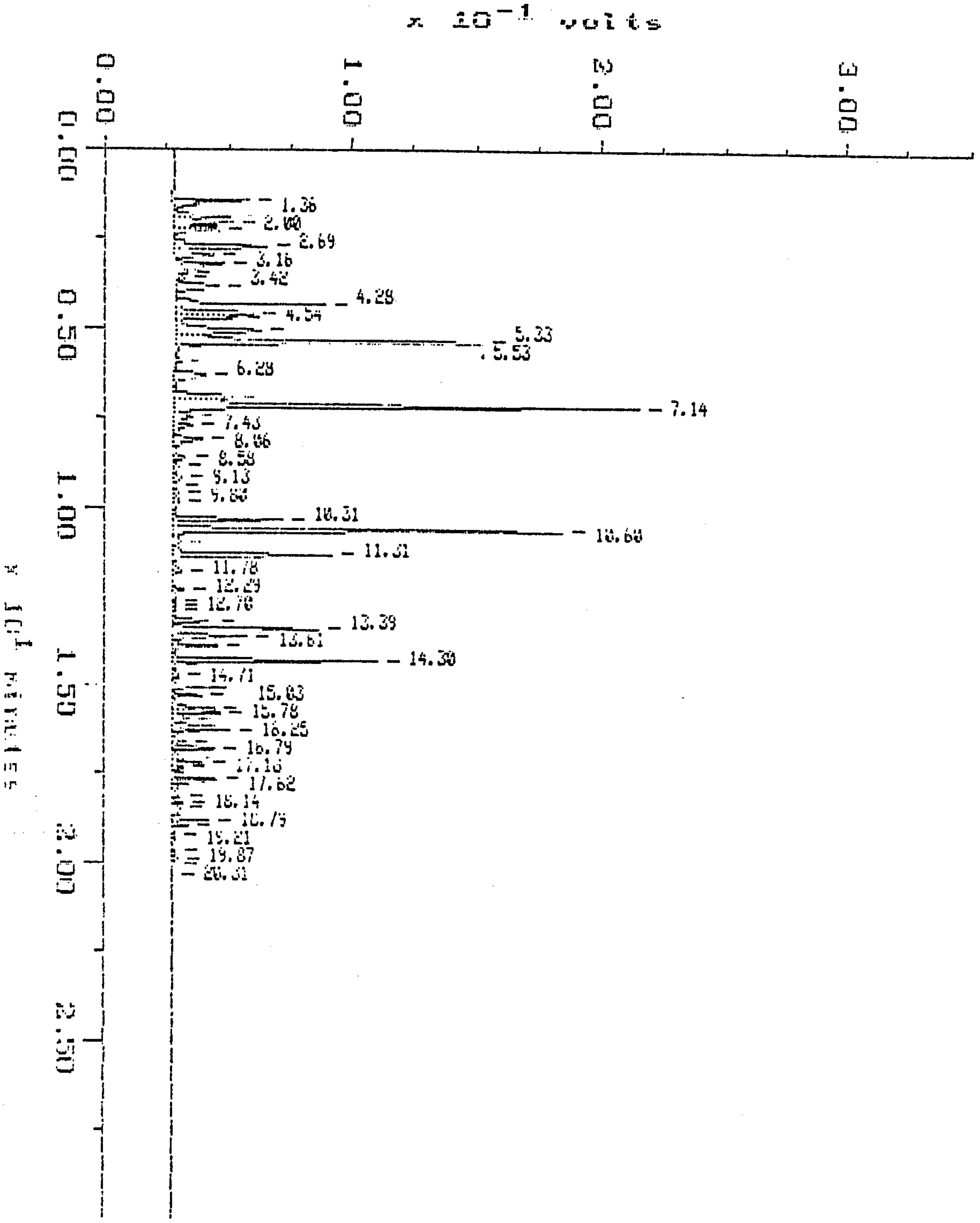
Sample: WMG 10/27 Channel: PRISCILLA Filename: 1027LF01
Acquired: 27-OCT-92 15:06 Method: H:\ARGE\MAXDATA\ELVIS-F\1027SEF Operator: ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



WA DOE WTPH-G

Continuing Calibration

Sample: WMSD 10/27 Channel: PRISCILLA Filename: 1027EP20
Acquired: 28-OCT-92 4:10 Method: R:\BRO2\MAXDATA\ELVIS-P\102792EP Operator: ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



DOWL ENGINEERS
A Division of DOWL, Incorporated
8320 154TH AVENUE NE REDMOND, WA 98052-3523
PH: (206) 869-2670 FAX: (206) 869-2879

CHAIN OF CUSTODY SAMPLE RECEIPT FORM

9210-185

Proj. No. S11387
Project Name TPU/KOSMOS
Samplers (Signature) Fred A [illegible]

Sample No.	Date	Time	Comp.	Grab	Station Location	No. Of Containers	WTPH-G	BETX	Remarks
-1 MW-8-1	10/22/92	0755		✓	WATER SAMPLE	3	✓	✓	40 ml
-2 MW-9-1	"	1050		✓	"	"	✓	✓	"
-3 MW-9-1A	"	1050		✓	"	"	✓	✓	"

Relinquished by: (Signature)	Date/Time		Received by: (Signature)	Relinquished by: (Signature)	Date/Time		Received by: (Signature)
Fred [illegible]	10/23/92	9:10	Paul [illegible] 348	Paul [illegible] 348	10/23/92	10:12	

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time		Remarks:
		[illegible]	10/23/92	1516	

WHITE = ORIGINAL CANARY = COPY 1 PINK = COPY 2

DOWL DAILY SAMPLING LOG

Page____ of ____

SITE TPU/KOSMOS TOWNSITE DATE 10/22/92 DOWL W.O. NO. 511387

LOCATION LEWIS CO, WA.

FIELD TEAM F.A. HANSON

SITE CONTACTS

SITE CONDITIONS PTLY CLOUDY / ± 55° F @ 8 AM

SITE WEATHER

MONITORING EQUIP.

SAFETY/P.P.E. LEVEL D

EQUIPMENT (OTHER)

SAMPLE NUMBER	DESCRIPTION AND OBSERVATIONS	DATE	TIME	SAMPLE MATRIX	SAMPLE CONTAINER	ANALYSIS	COOLER NO.
MW-8-1	LT GR CLOUDY / NO ODOR	10/22	0955	WATER	3. 40 ml VOA	TPHG & D BETX	
MW-9-1		"	1050	"	"	"	
MW-9-1A*		"	1050	"	"	"	

COMMENTS * MW-9-1A IS QA/QC FROM SAME MEDIA AS MW-9-1

FRED A. HANSON
PRINTED NAME OF SAMPLER

Fred A Hanson
SIGNATURE

10/22/92
DATE

AnalyticalTechnologies,Inc.
560 Naches Avenue, S.W., Suite 101, Renton, WA 98055 (206) 228-8335
John H. Taylor, Jr., Laboratory Manager
Frederick W. Grothkopp, Technical Director

ATI I.D. # 9210-223

November 9, 1992

Dowl Engineers
8320 154th Avenue N.E.
Redmond, WA 98052-3523

Attention : Geoffrey Dendy

Project Number : S11382

Project Name : TPU - Kosmos

On October 27, 1992, Analytical Technologies, Inc., received seven 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 quality control data are enclosed.

Tamara B Jerome
Tamara B. Jerome
Project Manager

TBJ/hal/elf

ATI I.D. # 9210-223

SAMPLE CROSS REFERENCE SHEET

CLIENT : DOWL ENGINEERS
PROJECT # : S11382
PROJECT NAME : TPU - KOSMOS

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9210-223-1	TRIP BLANK	N/A	WATER
9210-223-2	MW #1-1	10/26/92	WATER
9210-223-3	MW #2-1	10/26/92	WATER
9210-223-4	MW #2-A	10/26/92	WATER
9210-223-5	MW #3-1	10/26/92	WATER
9210-223-6	MW #4-1	10/26/92	WATER
9210-223-7	MW #5-1	10/26/92	WATER

----- TOTALS -----

MATRIX	# SAMPLES
WATER	7

ATI STANDARD DISPOSAL PRACTICE

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

ATI I.D. # 9210-223

ANALYTICAL SCHEDULE

CLIENT : DOWL ENGINEERS
PROJECT # : S11382
PROJECT NAME : TPU - KOSMOS

ANALYSIS	TECHNIQUE	REFERENCE	LAB
BETX	GC/PID	EPA 8020	R
TOTAL PETROLEUM HYDROCARBONS	GC/FID	WA DOE WTPH-G	R

R = ATI - Renton
SD = ATI - San Diego
PHX = ATI - Phoenix
PNR = ATI - Pensacola
FC = ATI - Fort Collins
SUB = Subcontract

ATI I.D. # 9210-223

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11382
PROJECT NAME : TPU - KOSMOS
CLIENT I.D. : REAGENT BLANK
SAMPLE MATRIX : WATER
EPA METHOD : 8020 (BETX)

DATE SAMPLED : N/A
DATE RECEIVED : N/A
DATE EXTRACTED : N/A
DATE ANALYZED : 10/30/92
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUND	RESULT
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	97	76 - 120

ATI I.D. # 9210-223-2

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11382
PROJECT NAME : TPU - KOSMOS
CLIENT I.D. : MW #1-1
SAMPLE MATRIX : WATER
EPA METHOD : 8020 (BETX)

DATE SAMPLED : 10/26/92
DATE RECEIVED : 10/27/92
DATE EXTRACTED : N/A
DATE ANALYZED : 10/31/92
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUND	RESULT
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	94	76 - 120

ATI I.D. # 9210-223-3

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11382
PROJECT NAME : TPU - KOSMOS
CLIENT I.D. : MW #2-1
SAMPLE MATRIX : WATER
EPA METHOD : 8020 (BETX)

DATE SAMPLED : 10/26/92
DATE RECEIVED : 10/27/92
DATE EXTRACTED : N/A
DATE ANALYZED : 10/31/92
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUND	RESULT
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	97	76 - 120

ATI I.D. # 9210-223-4

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11382
PROJECT NAME : TPU - KOSMOS
CLIENT I.D. : MW #2-A
SAMPLE MATRIX : WATER
EPA METHOD : 8020 (BETX)

DATE SAMPLED : 10/26/92
DATE RECEIVED : 10/27/92
DATE EXTRACTED : N/A
DATE ANALYZED : 10/31/92
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUND	RESULT
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	100	76 - 120

ATI I.D. # 9210-223-5

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11382
PROJECT NAME : TPU - KOSMOS
CLIENT I.D. : MW #3-1
SAMPLE MATRIX : WATER
EPA METHOD : 8020 (BETX)

DATE SAMPLED : 10/26/92
DATE RECEIVED : 10/27/92
DATE EXTRACTED : N/A
DATE ANALYZED : 11/01/92
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUND	RESULT
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	99	76 - 120

AnalyticalTechnologies, Inc.

ATI I.D. # 9210-223-6

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11382
PROJECT NAME : TPU - KOSMOS
CLIENT I.D. : MW #4-1
SAMPLE MATRIX : WATER
EPA METHOD : 8020 (BETX)

DATE SAMPLED : 10/26/92
DATE RECEIVED : 10/27/92
DATE EXTRACTED : N/A
DATE ANALYZED : 10/31/92
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUND	RESULT
BENZENE	2.6
ETHYLBENZENE	0.8
TOLUENE	1.5
TOTAL XYLENES	1.0

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	98	76 - 120

Below MTCA
method A levels for
Groundwater

ATI I.D. # 9210-223-7

VOLATILE ORGANIC ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11382
PROJECT NAME : TPU - KOSMOS
CLIENT I.D. : MW #5-1
SAMPLE MATRIX : WATER
EPA METHOD : 8020 (BETX)

DATE SAMPLED : 10/26/92
DATE RECEIVED : 10/27/92
DATE EXTRACTED : N/A
DATE ANALYZED : 10/31/92
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUND	RESULT
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	0.5
TOTAL XYLENES	<0.5

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	98	76 - 120

ATI I.D. # 9210-223

VOLATILE ORGANIC ANALYSIS
QUALITY CONTROL DATA

CLIENT : DOWL ENGINEERS
PROJECT # : S11382
PROJECT NAME : TPU - KOSMOS
EPA METHOD : 8020 (BETX)
SAMPLE MATRIX : WATER

SAMPLE I.D. # : 9210-232-1
DATE EXTRACTED : N/A
DATE ANALYZED : 10/30/92
UNITS : ug/L

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	<0.5	20.0	19.2	96	19.7	99	3
TOLUENE	<0.5	20.0	19.3	97	18.6	93	4
TOTAL XYLENES	<0.5	40.0	37.4	94	34.9	87	7

CONTROL LIMITS	% REC.	RPD
BENZENE	77 - 112	20
TOLUENE	72 - 113	20
TOTAL XYLENES	80 - 110	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	99	90	76 - 120

ATI I.D. # 9210-223

VOLATILE ORGANIC ANALYSIS
QUALITY CONTROL DATA

CLIENT : DOWL ENGINEERS
PROJECT # : S11382
PROJECT NAME : TPU - KOSMOS
EPA METHOD : 8020 (BETX)
SAMPLE MATRIX : WATER

SAMPLE I.D. # : 9210-220-1
DATE EXTRACTED : N/A
DATE ANALYZED : 10/31/92
UNITS : ug/L

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	<0.5	20.0	18.9	95	19.5	98	3
TOLUENE	<0.5	20.0	19.1	96	18.9	95	1
TOTAL XYLENES	<0.5	40.0	35.7	89	37.0	93	4

CONTROL LIMITS	% REC.	RPD
BENZENE	77 - 112	20
TOLUENE	72 - 113	20
TOTAL XYLENES	80 - 110	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	98	102	76 - 120

ATI I.D. # 9210-223

VOLATILE ORGANIC ANALYSIS
QUALITY CONTROL DATA

CLIENT : DOWL ENGINEERS
PROJECT # : S11382
PROJECT NAME : TPU - KOSMOS
EPA METHOD : 8020 (BETX)
SAMPLE MATRIX : WATER

SAMPLE I.D. # : BLANK SPIKE
DATE EXTRACTED : N/A
DATE ANALYZED : 10/30/92
UNITS : ug/L

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	<0.5	20.0	19.4	97	19.9	100	3
TOLUENE	<0.5	20.0	19.4	97	20.1	101	4
TOTAL XYLENES	<0.5	40.0	37.6	94	38.0	95	1

CONTROL LIMITS	% REC.	RPD
BENZENE	80 - 111	20
TOLUENE	78 - 111	20
TOTAL XYLENES	80 - 114	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	98	101	76 - 120

ATI I.D. # 9210-223

TOTAL PETROLEUM HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT	: DOWL ENGINEERS	DATE SAMPLED	: N/A
PROJECT #	: S11382	DATE RECEIVED	: N/A
PROJECT NAME	: TPU - KOSMOS	DATE EXTRACTED	: N/A
CLIENT I.D.	: REAGENT BLANK	DATE ANALYZED	: 10/29/92
SAMPLE MATRIX	: WATER	UNITS	: mg/L
METHOD	: WA DOE WTPH-G	DILUTION FACTOR	: 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<0.1
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
TRIFLUOROTOLUENE	99	50 - 150

ATI I.D. # 9210-223-2

TOTAL PETROLEUM HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11382
PROJECT NAME : TPU - KOSMOS
CLIENT I.D. : MW #1-1
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G

DATE SAMPLED : 10/26/92
DATE RECEIVED : 10/27/92
DATE EXTRACTED : N/A
DATE ANALYZED : 10/29/92
UNITS : mg/L
DILUTION FACTOR : 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<0.1
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
TRIFLUOROTOLUENE	106	50 - 150

ATI I.D. # 9210-223-3

TOTAL PETROLEUM HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11382
PROJECT NAME : TPU - KOSMOS
CLIENT I.D. : MW #2-1
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G

DATE SAMPLED : 10/26/92
DATE RECEIVED : 10/27/92
DATE EXTRACTED : N/A
DATE ANALYZED : 10/29/92
UNITS : mg/L
DILUTION FACTOR : 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<0.1
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
TRIFLUOROTOLUENE	101	50 - 150

Analytica Technologies, Inc

ATI I.D. # 9210-223-4

TOTAL PETROLEUM HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11382
PROJECT NAME : TPU - KOSMOS
CLIENT I.D. : MW #2-A
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G

DATE SAMPLED : 10/26/92
DATE RECEIVED : 10/27/92
DATE EXTRACTED : N/A
DATE ANALYZED : 10/29/92
UNITS : mg/L
DILUTION FACTOR : 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<0.1
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
TRIFLUOROTOLUENE	103	50 - 150

ATI I.D. # 9210-223-7

TOTAL PETROLEUM HYDROCARBON ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11382
PROJECT NAME : TPU - KOSMOS
CLIENT I.D. : MW #5-1
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G

DATE SAMPLED : 10/26/92
DATE RECEIVED : 10/27/92
DATE EXTRACTED : N/A
DATE ANALYZED : 10/29/92
UNITS : mg/L
DILUTION FACTOR : 1

COMPOUND	RESULT
FUEL HYDROCARBONS	<0.1
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
TRIFLUOROTOLUENE	103	50 - 150

ATI I.D. # 9210-223

TOTAL PETROLEUM HYDROCARBON ANALYSIS
QUALITY CONTROL DATA

CLIENT : DOWL ENGINEERS
PROJECT # : S11382
PROJECT NAME : TPU - KOSMOS
METHOD : WA DOE WTPH-G
SAMPLE MATRIX : WATER

SAMPLE I.D. # : 9210-223-2
DATE EXTRACTED : N/A
DATE ANALYZED : 10/29/92
UNITS : mg/L

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
PETROLEUM HYDROCARBONS (GASOLINE)	<0.1	<0.1	NC	2.00	2.28	114	2.09	105	9

CONTROL LIMITS	% REC.	RPD
GASOLINE	58 - 127	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
TRIFLUOROTOLUENE	105	108	50 - 150

NC = Not Calculable.

ATI I.D. # 9210-223

TOTAL PETROLEUM HYDROCARBON ANALYSIS
QUALITY CONTROL DATA

CLIENT : DOWL ENGINEERS
PROJECT # : S11382
PROJECT NAME : TPU - KOSMOS
METHOD : WA DOE WTPH-G
SAMPLE MATRIX : WATER

SAMPLE I.D. # : BLANK SPIKE
DATE EXTRACTED : N/A
DATE ANALYZED : 10/29/92
UNITS : mg/L

COMPOUND	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
PETROLEUM HYDROCARBONS (GASOLINE)	<0.1	2.00	2.13	107	1.94	97	9

CONTROL LIMITS	% REC.	RPD
GASOLINE	75 - 120	20

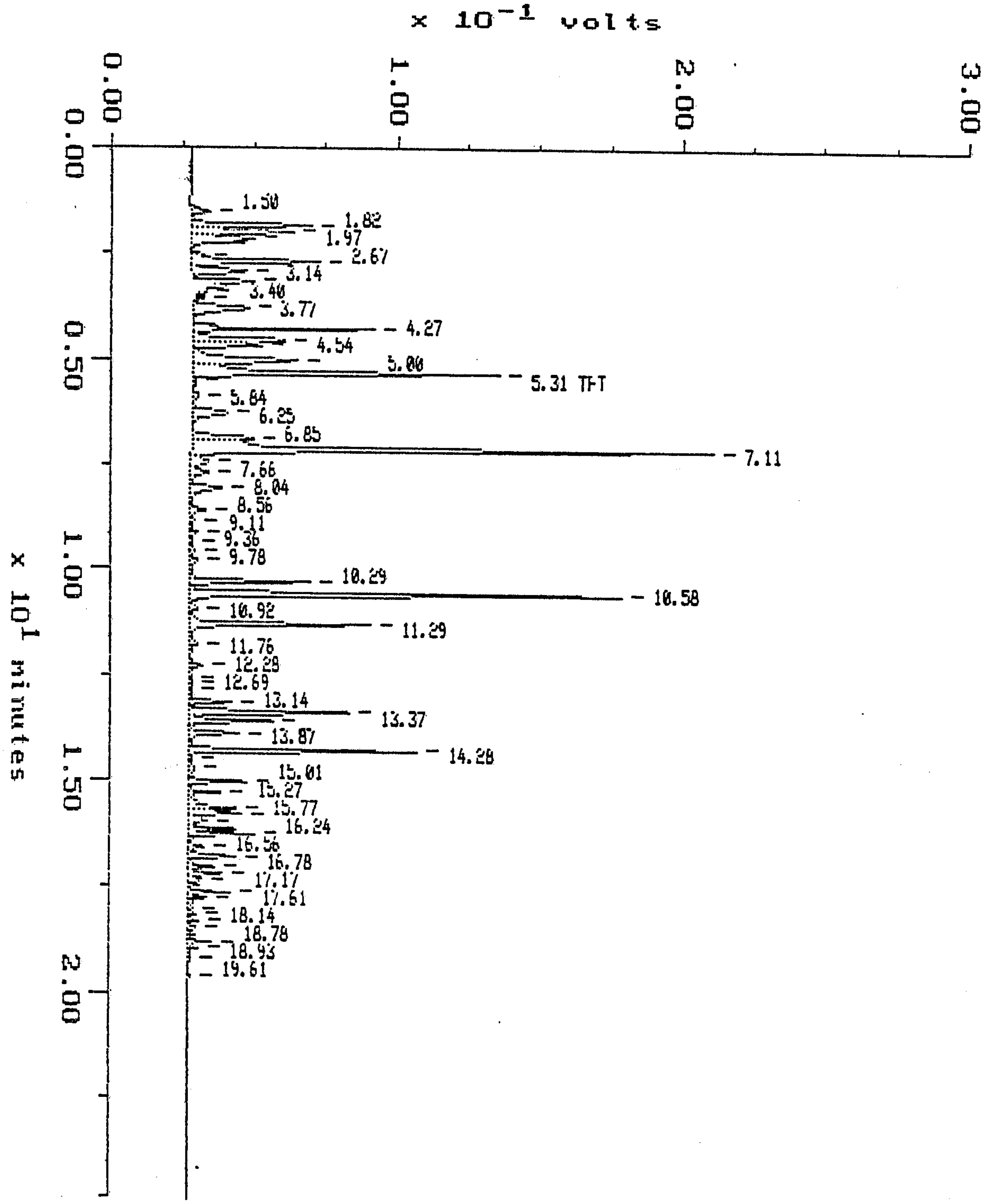
SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
TRIFLUOROTOLUENE	107	89	50 - 150

WA DOE WTPH-G

Continuing Calibration

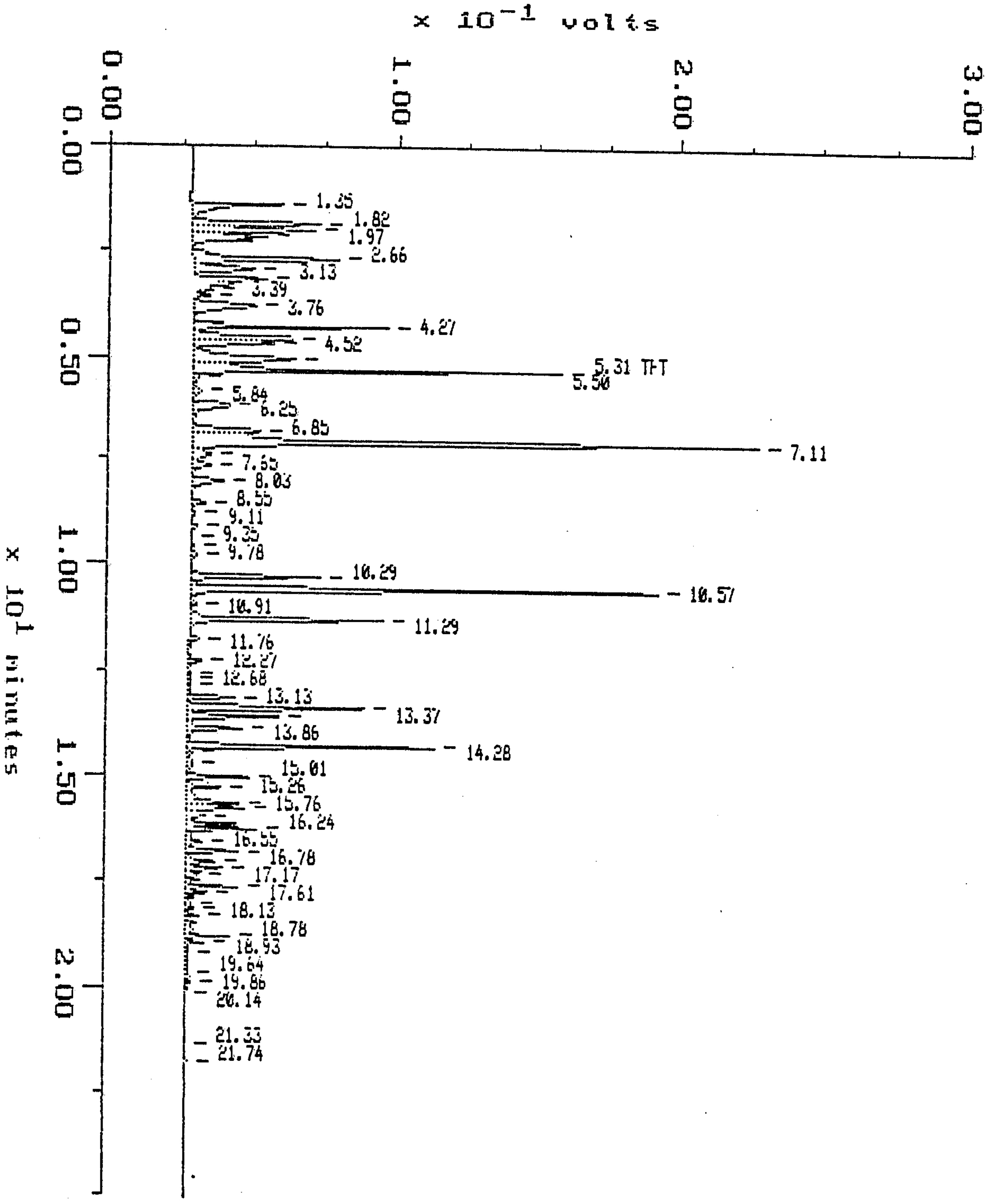
Sample: WMSD 10/29 Channel: PRISCILLA
Acquired: 29-OCT-92 23:55 Method: H:\BRO2\MAXDATA\ELVIS-P\102992EP
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.

Filename: 1029EP13
Operator: ATI



WA DOE WTPH-G Continuing Calibration

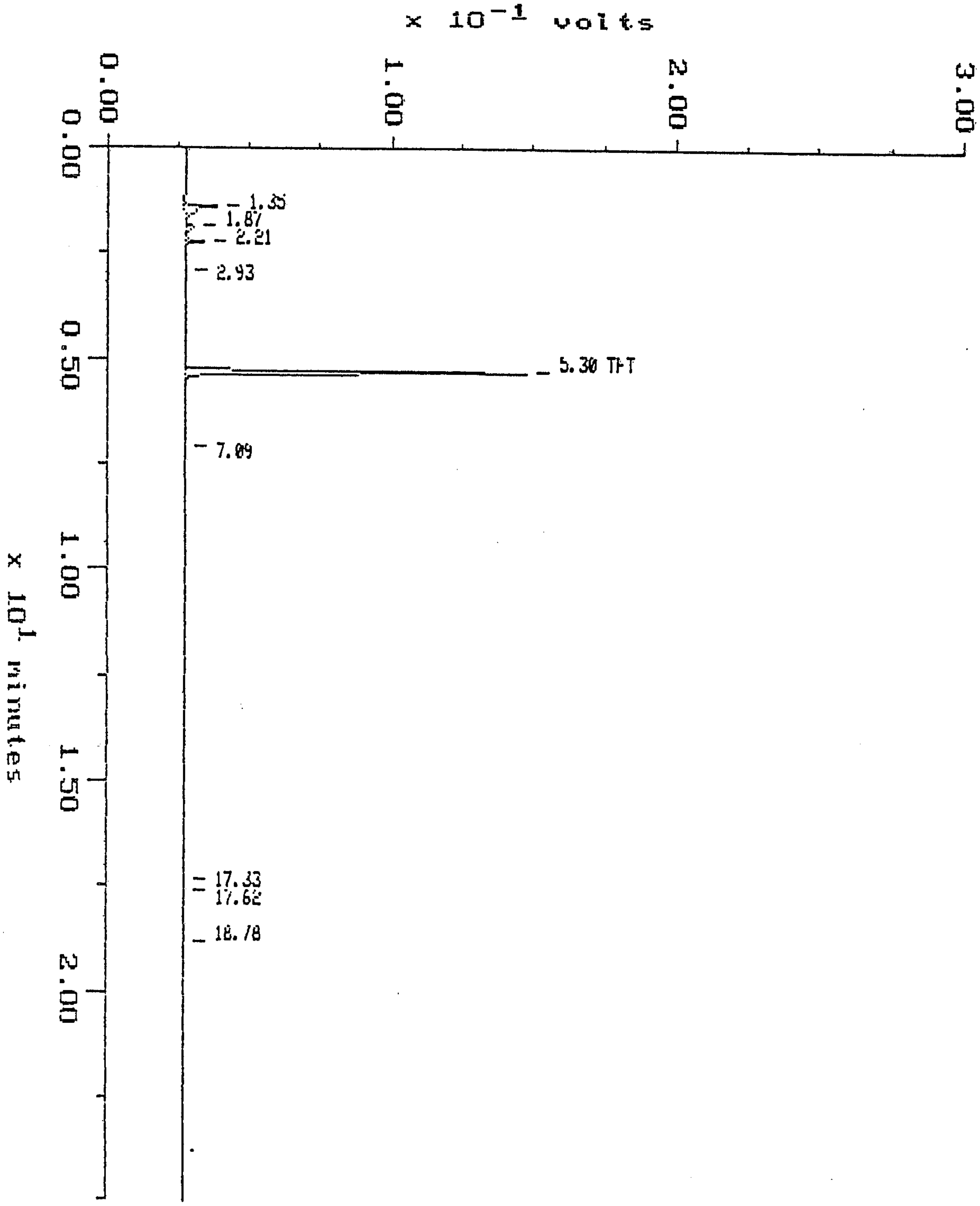
Sample: WMS 10/29 **Channel:** PRISCILLA **Filename:** 1029EP01
Acquired: 29-OCT-92 17:03 **Method:** H:\BRO2\MAXDATA\ELVIS-P\102992EP **Operator:** AII
Comments: AII FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



Blank

WA DOE WTPH-G

Sample: WRB 10/29 **Channel:** PRISCILLA **Filename:** 1029EP02
Acquired: 29-OCT-92 17:37 **Method:** H:\BRU2\MAXDATA\ELVIS-P\102992EP **Operator:** ATI
Comments: ATI FUELS: A MISSION OF EXCELLENCE IN ANALYTICAL CHROMATOGRAPHY.



DOWL ENGINEERS
A Division of DOWL, Incorporated
8320 154TH AVENUE NE REDMOND, WA 98052-3523
PH. (206) 889-2870 FAX: (206) 869-2879

CHAIN OF CUSTODY SAMPLE RECEIPT FORM

9210 - 223

Proj. No.: S11382

Project Name: TPU - KOSMOS

Samplers (Signature): Geoffrey Dendy

	Sample No.	Date	Time	Comp.	Grab	Station Location	No. Of Containers	BETX	TPH-G	Remarks
-1	TRIP BLANK	10-23-92	1430		X		2	X		40 ML VIALS
-2	MW#1-1	10-26-92	1145		X	MONITOR WELL #1	3	X	X	
-3	MW#2-1	10-26-92	1405		X	MONITOR WELL #2	3	X	X	
-4	MW#2-A	10-26-92	1410		X	MONITOR WELL #2	3	X	X	
-5	MW#3-1	10-26-92	1200		X	MONITOR WELL #3	3	X	X	
-6	MW#4-1	10-26-92	1400		X	MONITOR WELL #4	2	X	X	1 FULL SAMPLE 1 SAMPLE 1/2 FULL
-7	MW#5-1	10-26-92	1115		X	MONITOR WELL #5	3	X	X	

Relinquished by: (Signature)	Date/Time	Received by: (Signature)	Relinquished by: (Signature)	Date/Time	Received by: (Signature)
Geoffrey Dendy	850 27 oct 92	Paul Kroin 348			

Relinquished by: (Signature)	Date/Time	Received for Laboratory by: (Signature)	Date/Time	Remarks:
Paul Kroin 348	10/27/92 10:28		10/27/92 10:28	

WHITE = ORIGINAL CANARY = COPY 1 PINK = COPY 2

FAH

DOWL DAILY SAMPLING LOG

Page 1 of 1

SITE TPU Kosmos

DATE 26 Oct 92

DOWL W.O. NO. S11387

LOCATION

FIELD TEAM Steve Sires Jeff Dendy

SITE CONTACTS Sam

SITE CONDITIONS Cloudy, drying up

SITE WEATHER

MONITORING EQUIP. None

SAFETY/P.P.E. LEVEL D

EQUIPMENT (OTHER)

SAMPLE NUMBER	DESCRIPTION AND OBSERVATIONS	DATE	TIME	SAMPLE MATRIX	SAMPLE CONTAINER	ANALYSIS	COOLER NO.
Trip Blank		23 Oct	1430	water	BETX	40ml (2)	
MW #1-1		26 Oct	1145		40ml	BETX TPH-g	
MW #2-1			1405				
MW #3-1			1200				
MW #4-1			1400				
MW #5-1			1115				
MW ~~#2A~~	MW-2-1A FAH		1410				

COMMENTS Sample for MW-4 only had 1 full 40ml vial and one half of a second vial.

Geoffrey Dendy
PRINTED NAME OF SAMPLER

Geoffrey Dendy
SIGNATURE

26 Oct 92
DATE

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

ATI I.D. # 9304-069

April 21, 1993

Dowl Engineers
8320 154th Avenue N.E.
Redmond WA 98052-3523

Attention : Geoff Dendy

Project Number : S11387

Project Name : Kosmos

Dear Mr. Dendy:

On April 8, 1993, Analytical Technologies, Inc. (ATI), received 17 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 quality control data are enclosed.

Sincerely,

Tamara B. Jerome
Project Manager

TBJ/hal/ff

Enclosure

AnalyticalTechnologies,Inc.

ATI I.D. # 9304-069

SAMPLE CROSS REFERENCE SHEET

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : KOSMOS

ATI #	CLIENT DESCRIPTION	DATE SAMPLED	MATRIX
9304-069-1	MW1-2	04/06/93	WATER
9304-069-2	MW2-2	04/06/93	WATER
9304-069-3	MW3-2	04/06/93	WATER
9304-069-4	MW4-2	04/06/93	WATER
9304-069-5	MW5-2	04/06/93	WATER
9304-069-6	MW6-2	04/06/93	WATER
9304-069-7	MW7-2	04/06/93	WATER
9304-069-8	MW8-2	04/06/93	WATER
9304-069-9	MW9-2	04/06/93	WATER
9304-069-10	MW10-2	04/06/93	WATER
9304-069-11	MW10-2A	04/06/93	WATER
9304-069-12	TRIP BLANK	N/A	WATER
9304-069-13	MW10-10	04/05/93	SOIL
9304-069-14	MW10-11	04/05/93	SOIL
9304-069-15	MW10-15	04/05/93	SOIL
9304-069-16	MW10-20A	04/05/93	SOIL
9304-069-17	MW10-20B	04/05/93	SOIL

----- TOTALS -----

MATRIX	# SAMPLES
SOIL	5
WATER	12

ATI STANDARD DISPOSAL PRACTICE

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

ATI I.D. # 9304-069

ANALYTICAL SCHEDULE

CLIENT	:	DOWL ENGINEERS
PROJECT #	:	S11387
PROJECT NAME	:	KOSMOS

ANALYSIS	TECHNIQUE	REFERENCE	LAB
BETX	GC/PID	EPA 8020	R
TOTAL PETROLEUM HYDROCARBONS	GC/FID	WA DOE WTPH-G	R
MOISTURE	GRAVIMETRIC	CLP SOW ILM01.0	R

R = ATI - Renton
SD = ATI - San Diego
PHX = ATI - Phoenix
PNR = ATI - Pensacola
FC = ATI - Fort Collins
SUB = Subcontract

ATI I.D. # 9304-069

BETX - GASOLINE
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : KOSMOS
CLIENT I.D. : METHOD BLANK
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G - 8020(BETX)

DATE SAMPLED : N/A
DATE RECEIVED : N/A
DATE EXTRACTED : N/A
DATE ANALYZED : 04/09/93
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	96	76 - 120
TRIFLUOROTOLUENE	95	50 - 150

ATI I.D. # 9304-069

BETX - GASOLINE
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : KOSMOS
CLIENT I.D. : METHOD BLANK
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G - 8020(BETX)

DATE SAMPLED : N/A
DATE RECEIVED : N/A
DATE EXTRACTED : N/A
DATE ANALYZED : 04/12/93
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	84	76 - 120
TRIFLUOROTOLUENE	93	50 - 150

AnalyticalTechnologies,Inc.

ATI I.D. # 9304-069-1

BETX - GASOLINE
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : KOSMOS
CLIENT I.D. : MW1-2
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G - 8020(BETX)

DATE SAMPLED : 04/06/93
DATE RECEIVED : 04/08/93
DATE EXTRACTED : N/A
DATE ANALYZED : 04/09/93
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	90	76 - 120
TRIFLUOROTOLUENE	92	50 - 150

DOWL ENGINEERS
A Division of DOWL, Incorporated
8320 154TH AVENUE NE, REDMOND, WA 98052
TEL: (206) 869-2670 FAX: (206) 869-2679

SAMPLING INFORMATION SHEET

PROJECT: KOSMOS
CLIENT: TPU
SAMPLING TEAM: SIRES, HANSON

W.O. NO.: 511387
DATE: 4/6/93
WEATHER: CLOUDY, 45°
RAINY

SAMPLE DESIGNATION: MW-1-2
QA/QC FOR SAMPLE:
SAMPLE COLLECTION TIME: 1030
SAMPLE MATRIX:
- SOIL
- WATER ✓

SAMPLER: SIRES
SAMPLE CONTAINER:
- 3 – 40 ml ✓
- 8 oz.
- 1 l

TYPE:

SAMPLE MATRIX OBTAINED BY:
- DIRECT AQUISITION
- BACKHOE BUCKET
- H.S. AUGER
- BAILER ✓
- OTHER

COMMENTS:
NO ODOR

SAMPLE MATRIX DESCRIPTION:

TEMP. °F: 46/46/ /
CONDUCTIVITY: 03/03/ /
pH: / / /
OTHER:

PID BACKGROUND:
PID PLASTIC BAG:

ANALYSIS: WTPHg / BETX

ATI I.D. # 9304-069-2

BETX - GASOLINE
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : KOSMOS
CLIENT I.D. : MW2-2
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G - 8020(BETX)

DATE SAMPLED : 04/06/93
DATE RECEIVED : 04/08/93
DATE EXTRACTED : N/A
DATE ANALYZED : 04/09/93
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	91	76 - 120
TRIFLUOROTOLUENE	98	50 - 150

DOWL
ENGINEERS
A Division of DOWL, Incorporated
8320 154TH AVENUE NE, REDMOND, WA 98052
TEL: (206) 869-2670 FAX: (206) 869-2579

SAMPLING INFORMATION SHEET

PROJECT: KOSMOS
CLIENT: TPU
SAMPLING TEAM: SIRES, HANSON

W.O. NO.: S11387
DATE: 4/6/93
WEATHER: ± 45 CLDY
SOME RAIN

SAMPLE DESIGNATION: MW-2-2
QA/QC FOR SAMPLE:
SAMPLE COLLECTION TIME: 1010
SAMPLE MATRIX:
SOIL
WATER ✓

SAMPLER: SIRES
SAMPLE CONTAINER:
3 – 40 ml ✓
8 oz.
1 l
TYPE:

SAMPLE MATRIX OBTAINED BY:
DIRECT AQUISITION
BACKHOE BUCKET
H.S. AUGER
BAILER ✓
OTHER

COMMENTS:
NO ODOR

SAMPLE MATRIX DESCRIPTION:

TEMP. °F: 47/47/ /
CONDUCTIVITY: 02/02/ /
pH: ~~/ / /~~ *
OTHER:

PID BACKGROUND: /
PID PLASTIC BAG: /

* METER NOT WORKING

ANALYSIS: WTPHG / BETX

DOWL ENGINEERS
A Division of DOWL, Incorporated
8320 154TH AVENUE NE, REDMOND, WA 98052
TEL: (206) 869-2670 FAX: (206) 869-2679

SAMPLING INFORMATION SHEET

PROJECT: KOSMOS
W.O. NO.: 511387
CLIENT: TPU
DATE: 4/6/93
SAMPLING TEAM: Same
WEATHER: Same

SAMPLE DESIGNATION: MW-3-2
SAMPLER: SAME
QA/QC FOR SAMPLE:
SAMPLE CONTAINER:
SAMPLE COLLECTION TIME: 1245

3 - 40 ml	✓
8 oz.	
1 l	

SAMPLE MATRIX:

SOIL	
WATER	✓

TYPE:

SAMPLE MATRIX OBTAINED BY:

DIRECT AQUISITION	
BACKHOE BUCKET	
H.S. AUGER	
BAILER	✓
OTHER	

COMMENTS:
NO ODOR

SAMPLE MATRIX DESCRIPTION:

TEMP. °F: /46/46/
CONDUCTIVITY: /04/04/
pH: ~~/ / /~~
OTHER:
PID BACKGROUND:
PID PLASTIC BAG:

ANALYSIS: WTPHg / BETX

ATI I.D. # 9304-069-4

BETX - GASOLINE
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : KOSMOS
CLIENT I.D. : MW4-2
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G - 8020(BETX)

DATE SAMPLED : 04/06/93
DATE RECEIVED : 04/08/93
DATE EXTRACTED : N/A
DATE ANALYZED : 04/09/93
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	94	76 - 120
TRIFLUOROTOLUENE	94	50 - 150

DOWL ENGINEERS
A Division of DOWL, Incorporated
8320 154TH AVENUE NE, REDMOND, WA 98052
TEL: (206) 869-2670 FAX: (206) 869-2679

SAMPLING INFORMATION SHEET

PROJECT: KOSMOS
CLIENT: TPU
SAMPLING TEAM: SAME

W.O. NO.: 511387
DATE: 4/6/93
WEATHER: RAIN, 45°

SAMPLE DESIGNATION: MW-4-2
QA/QC FOR SAMPLE:
SAMPLE COLLECTION TIME: 1320
SAMPLE MATRIX:
- SOIL
- WATER ✓

SAMPLER: SAME
SAMPLE CONTAINER:
- 3 - 40 ml ✓
- 8 oz.
- 1 l

TYPE:

SAMPLE MATRIX OBTAINED BY:
- DIRECT AQUISITION
- BACKHOE BUCKET
- H.S. AUGER
- BAILER ✓
- OTHER

COMMENTS: NO ODOR

SAMPLE MATRIX DESCRIPTION:

TEMP. °F: / 48 / 48 /
CONDUCTIVITY: / 03 / 03 /
pH: / / /
OTHER:

PID BACKGROUND:
PID PLASTIC BAG:

ANALYSIS: WTPHg / BETX

ATI I.D. # 9304-069-5

BETX - GASOLINE
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : KOSMOS
CLIENT I.D. : MW5-2
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G - 8020(BETX)

DATE SAMPLED : 04/06/93
DATE RECEIVED : 04/08/93
DATE EXTRACTED : N/A
DATE ANALYZED : 04/09/93
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	94	76 - 120
TRIFLUOROTOLUENE	88	50 - 150

DOWL
ENGINEERS
A Division of DOWL, Incorporated
8320 154TH AVENUE NE, REDMOND, WA 98052
TEL: (206) 869-2670 FAX: (206) 869-2679

SAMPLING INFORMATION SHEET

PROJECT: Kosmos
CLIENT:
SAMPLING TEAM: Sim
[illegible]

W.O. NO.: 511387
DATE: 4/6/93
WEATHER: SAME

SAMPLE DESIGNATION: MW 5-2
QA/QC FOR SAMPLE:
SAMPLE COLLECTION TIME: 1120
SAMPLE MATRIX:
SOIL
[✓ WATER]

SAMPLER: Sim
SAMPLE CONTAINER:
[✓ 40 ml] 3
8 oz.
1 l
TYPE:

SAMPLE MATRIX OBTAINED BY:
DIRECT AQUISITION
BACKHOE BUCKET
H.S. AUGER
[✓ BAILER]
OTHER

COMMENTS:
START @ 1110
Purge 5 GALS
LT TAN NO ODOR
Sample @ 11:20

SAMPLE MATRIX DESCRIPTION:

TEMP. °F: 47/47/ /
CONDUCTIVITY: 04/04/ /
pH: / / /
OTHER:

PID BACKGROUND:
PID PLASTIC BAG:

ANALYSIS: WTPHg / BETX

AnalyticalTechnologies,Inc.

ATI I.D. # 9304-069-6

BETX - GASOLINE
DATA SUMMARY

CLIENT	: DOWL ENGINEERS	DATE SAMPLED	: 04/06/93
PROJECT #	: S11387	DATE RECEIVED	: 04/08/93
PROJECT NAME	: KOSMOS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW6-2	DATE ANALYZED	: 04/09/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G - 8020(BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	93	76 - 120
TRIFLUOROTOLUENE	96	50 - 150

DOWL ENGINEERS
A Division of DOWL, Incorporated
8320 154TH AVENUE NE, REDMOND, WA 98052
TEL: (206) 869-2670 FAX: (206) 869-2679

SAMPLING INFORMATION SHEET

PROJECT: KOSMOS
CLIENT: TPU
SAMPLING TEAM: SAME

W.O. NO.: 511387
DATE: 4/6/93
WEATHER: CLOUDY
± 50°
(RAIN STOPPED)

SAMPLE DESIGNATION: MW-6-2
QA/QC FOR SAMPLE:
SAMPLE COLLECTION TIME: 1105
SAMPLE MATRIX:
SOIL
WATER ✓

SAMPLER: SIRES
SAMPLE CONTAINER:
3 - 40 ml ✓
8 oz.
1 l

TYPE:

SAMPLE MATRIX OBTAINED BY:
DIRECT AQUISITION
BACKHOE BUCKET
H.S. AUGER
BAILER ✓
OTHER

COMMENTS:

SAMPLE MATRIX DESCRIPTION:

TEMP. °F: 41/6 / 46
CONDUCTIVITY: 051/051/ /
pH: / / /
OTHER:

PID BACKGROUND:
PID PLASTIC BAG:

ANALYSIS: WTPH g / BETX

ATI I.D. # 9304-069-7

BETX - GASOLINE
DATA SUMMARY

CLIENT	: DOWL ENGINEERS	DATE SAMPLED	: 04/06/93
PROJECT #	: S11387	DATE RECEIVED	: 04/08/93
PROJECT NAME	: KOSMOS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW7-2	DATE ANALYZED	: 04/10/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G - 8020(BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	85	76 - 120
TRIFLUOROTOLUENE	90	50 - 150

DOWL ENGINEERS
A Division of DOWL, Incorporated
8320 154TH AVENUE NE, REDMOND, WA 98052
TEL: (206) 869-2670 FAX: (206) 869-2679

SAMPLING INFORMATION SHEET

PROJECT: TPU / Kosmos
CLIENT: TPU
SAMPLING TEAM: Same
W.O. NO.: 511387
DATE: 4/6/93
WEATHER: Same

SAMPLE DESIGNATION: MW-7-2
QA/QC FOR SAMPLE:
SAMPLE COLLECTION TIME: 1220
SAMPLE MATRIX:
- SOIL ____
- WATER ✓

SAMPLER:
SAMPLE CONTAINER:
- 5 - 40 ml ✓
- 8 oz. ____
- 1 l ____

TYPE:

SAMPLE MATRIX OBTAINED BY:
- DIRECT AQUISITION ____
- BACKHOE BUCKET ____
- H.S. AUGER ____
- BAILER ✓
- OTHER ____

COMMENTS:
No Odor

SAMPLE MATRIX DESCRIPTION:

TEMP. °F: / 46/ 46/
CONDUCTIVITY: / 03/ 03/
pH: / / /
OTHER:

PID BACKGROUND: /
PID PLASTIC BAG: /

ANALYSIS: WTPHg / BETX

ATI I.D. # 9304-069-8

BETX - GASOLINE
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : KOSMOS
CLIENT I.D. : MW8-2
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G - 8020(BETX)

DATE SAMPLED : 04/06/93
DATE RECEIVED : 04/08/93
DATE EXTRACTED : N/A
DATE ANALYZED : 04/10/93
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	<0.5
TOTAL XYLENES	<0.5
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	88	76 - 120
TRIFLUOROTOLUENE	95	50 - 150

DOWL ENGINEERS
A Division of DOWL, Incorporated
8320 154TH AVENUE NE, REDMOND, WA 98052
TEL: (206) 869-2670 FAX: (206) 869-2679

SAMPLING INFORMATION SHEET

PROJECT:
CLIENT: TPU
SAMPLING TEAM: Same

W.O. NO.: 511387
DATE: 4/6/93
WEATHER: Rainy
45°

SAMPLE DESIGNATION: MW-8-2
QA/QC FOR SAMPLE:
SAMPLE COLLECTION TIME: 1145
SAMPLE MATRIX:
SOIL
WATER ✓

SAMPLER:
SAMPLE CONTAINER:
3 - 40 ml ✓
8 oz.
1 l
TYPE:

SAMPLE MATRIX OBTAINED BY:
DIRECT AQUISITION
BACKHOE BUCKET
H.S. AUGER
BAILER ✓
OTHER

COMMENTS:
NO ODOR

SAMPLE MATRIX DESCRIPTION:

TEMP. °F: /47/47
CONDUCTIVITY: /104/104
pH: / / 7
OTHER:

PID BACKGROUND: /
PID PLASTIC BAG: /

ANALYSIS: WTPHg / BETX

ATI I.D. # 9304-069-9

BETX - GASOLINE
DATA SUMMARY

CLIENT	: DOWL ENGINEERS	DATE SAMPLED	: 04/06/93
PROJECT #	: S11387	DATE RECEIVED	: 04/08/93
PROJECT NAME	: KOSMOS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW9-2	DATE ANALYZED	: 04/10/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G - 8020(BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS	
BENZENE	<0.5	
ETHYLBENZENE	<0.5	
TOLUENE	<0.5	
TOTAL XYLENES	<0.5	
FUEL HYDROCARBONS	<100	
HYDROCARBON RANGE	TOLUENE TO DODECANE	
HYDROCARBON QUANTITATION USING	GASOLINE	
SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	96	76 - 120
TRIFLUOROTOLUENE	96	50 - 150

DOWL
ENGINEERS
A Division of DOWL, Incorporated
8320 154TH AVENUE NE, REDMOND, WA 98052
TEL: (206) 869-2670 FAX: (206) 869-2679

SAMPLING INFORMATION SHEET

PROJECT: KOSMOS
CLIENT: TPU
SAMPLING TEAM: SAME

W.O. NO.: S11387
DATE: 4/6/93
WEATHER: 45° ±
RAIN

SAMPLE DESIGNATION: MW 9-2
QA/QC FOR SAMPLE:
SAMPLE COLLECTION TIME:
SAMPLE MATRIX:
SOIL
WATER ✓

SAMPLER: SIRES
SAMPLE CONTAINER:
40 ml 3
8 oz.
1 l

TYPE:

SAMPLE MATRIX OBTAINED BY:
DIRECT AQUISITION
BACKHOE BUCKET
H.S. AUGER
[✓ BAILER]
OTHER

COMMENTS:
Start @ 11:50
[illegible] 5gal. 5+
End @

SAMPLE MATRIX DESCRIPTION:

TEMP. °F: 46/ 46/ /
CONDUCTIVITY: 60/ 60/ /
pH: / / /
OTHER:

PID BACKGROUND:
PID PLASTIC BAG:

ANALYSIS: WTPHg / BETX

Analytical**Technologie**

Sample collected
1 Day after well
Construction

NE
Y

ATI I.D. # 9304-069-10

CLIENT	: DOWL E	DATE SAMPLED	: 04/06/93
PROJECT #	: S11387	DATE RECEIVED	: 04/08/93
PROJECT NAME	: KOSMOS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW10-2	DATE ANALYZED	: 04/10/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G - 8020(BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS	
BENZENE	59	
ETHYLBENZENE	34	D4
TOLUENE	78	
TOTAL XYLENES	370	D4
FUEL HYDROCARBONS	3,800	D4
HYDROCARBON RANGE	TOLUENE TO DODECANE	
HYDROCARBON QUANTITATION USING	GASOLINE	

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	122 F	76 - 120
TRIFLUOROTOLUENE	89 D4	50 - 150

D4 = Value from a ten fold diluted analysis.
F = Out of limits due to matrix interference.

ATI I.D. # 9304-069-11

BETX - GASOLINE
DATA SUMMARY

CLIENT	: DOWL ENGINEERS	DATE SAMPLED	: 04/06/93
PROJECT #	: S11387	DATE RECEIVED	: 04/08/93
PROJECT NAME	: KOSMOS	DATE EXTRACTED	: N/A
CLIENT I.D.	: MW10-2A	DATE ANALYZED	: 04/10/93
SAMPLE MATRIX	: WATER	UNITS	: ug/L
METHOD	: WA DOE WTPH-G - 8020(BETX)	DILUTION FACTOR	: 1

COMPOUNDS	RESULTS	
BENZENE	61	
ETHYLBENZENE	160	D4
TOLUENE	82	
TOTAL XYLENES	410	D4
FUEL HYDROCARBONS	4,500	D4
HYDROCARBON RANGE	TOLUENE TO DODECANE	
HYDROCARBON QUANTITATION USING	GASOLINE	

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	119	76 - 120
TRIFLUOROTOLUENE	94 D4	50 - 150

D4 = Value from a ten fold diluted analysis.

DOWL ENGINEERS
A Division of DOWL, Incorporated
8320 154TH AVENUE NE, REDMOND, WA 98052
TEL: (206) 869-2670 FAX: (206) 869-2679

SAMPLING INFORMATION SHEET

PROJECT: KOSMOS
CLIENT: TPU
SAMPLING TEAM: SAME

W.O. NO.: S11387
DATE: 4/6/93
WEATHER: RAIN
45°

SAMPLE DESIGNATION: MW-10-2
QA/QC FOR SAMPLE:
SAMPLE COLLECTION TIME: 1305
SAMPLE MATRIX:
- SOIL
- WATER ✓

SAMPLER:
SAMPLE CONTAINER:
- 3 - 40 ml ✓
- 8 oz.
- 1 l

TYPE:

SAMPLE MATRIX OBTAINED BY:
- DIRECT AQUISITION
- BACKHOE BUCKET
- H.S. AUGER
- BAILER ✓
- OTHER

COMMENTS:
GASOLINE ODOR

SAMPLE MATRIX DESCRIPTION:

TEMP. °F: /48/48/
CONDUCTIVITY: /15/15/
pH: / / /
OTHER:

PID BACKGROUND:
PID PLASTIC BAG:

ANALYSIS: WTPHg / BETX

ATI I.D. # 9304-069-12

BETX - GASOLINE
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : KOSMOS
CLIENT I.D. : TRIP BLANK
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G - 8020(BETX)

DATE SAMPLED : N/A
DATE RECEIVED : 04/08/93
DATE EXTRACTED : N/A
DATE ANALYZED : 04/09/93
UNITS : ug/L
DILUTION FACTOR : 1

COMPOUNDS	RESULTS
BENZENE	<0.5
ETHYLBENZENE	<0.5
TOLUENE	0.8
TOTAL XYLENES	<0.5
FUEL HYDROCARBONS	<100
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	96	76 - 120
TRIFLUOROTOLUENE	72	50 - 150

ATI I.D. # 9304-069

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : KOSMOS
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G - 8020(BETX)

SAMPLE I.D. # : 9304-069-1
DATE EXTRACTED : N/A
DATE ANALYZED : 04/09/93
UNITS : ug/L

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	<0.500	N/A	N/A	20.0	18.6	93	19.6	98	5
TOLUENE	<0.500	N/A	N/A	20.0	19.0	95	19.7	99	4
TOTAL XYLENES	<0.500	N/A	N/A	40.0	37.8	95	39.2	98	4
GASOLINE	<100	<100	NC	1,000	963	96	1,020	102	6

CONTROL LIMITS	% REC.	RPD
BENZENE	77 - 112	20
TOLUENE	72 - 113	20
TOTAL XYLENES	80 - 110	20
GASOLINE	58 - 127	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	99	98	76 - 120
TRIFLUOROTOLUENE	96	97	50 - 150

NC = Not Calculable.

ATI I.D. # 9304-069

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : KOSMOS
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G - 8020(BETX)

SAMPLE I.D. # : BLANK SPIKE
DATE EXTRACTED : N/A
DATE ANALYZED : 04/09/93
UNITS : ug/L

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.500	20.0	19.4	97	N/A	N/A	N/A
TOLUENE	<0.500	20.0	19.1	96	N/A	N/A	N/A
TOTAL XYLENES	<0.500	40.0	38.1	95	N/A	N/A	N/A
GASOLINE	<100	1,000	1,020	102	N/A	N/A	N/A

CONTROL LIMITS	% REC.	RPD
BENZENE	80 - 111	20
TOLUENE	78 - 111	20
TOTAL XYLENES	80 - 114	20
GASOLINE	75 - 120	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	95	N/A	76 - 120
TRIFLUOROTOLUENE	98	N/A	50 - 150

ATI I.D. # 9304-069

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : KOSMOS
SAMPLE MATRIX : WATER
METHOD : WA DOE WTPH-G - 8020(BETX)

SAMPLE I.D. # : BLANK SPIKE
DATE EXTRACTED : N/A
DATE ANALYZED : 04/12/93
UNITS : ug/L

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.500	20.0	19.1	96	N/A	N/A	N/A
TOLUENE	<0.500	20.0	19.4	97	N/A	N/A	N/A
TOTAL XYLENES	<0.500	40.0	37.8	95	N/A	N/A	N/A
GASOLINE	<100	1,000	874	87	N/A	N/A	N/A

CONTROL LIMITS	% REC.	RPD
BENZENE	80 - 111	20
TOLUENE	78 - 111	20
TOTAL XYLENES	80 - 114	20
GASOLINE	75 - 120	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	91	N/A	76 - 120
TRIFLUOROTOLUENE	91	N/A	50 - 150

ATI I.D. # 9304-069

BETX - GASOLINE
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : KOSMOS
CLIENT I.D. : METHOD BLANK
SAMPLE MATRIX : SOIL
METHOD : WA DOE WTPH-G - 8020(BETX)
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : N/A
DATE RECEIVED : N/A
DATE EXTRACTED : 04/08/93
DATE ANALYZED : 04/08/93
UNITS : mg/Kg
DILUTION FACTOR : 1

COMPOUNDS	RESULTS
BENZENE	<0.025
ETHYLBENZENE	<0.025
TOLUENE	<0.025
TOTAL XYLENES	<0.025
FUEL HYDROCARBONS	<5
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	63	52 - 116
TRIFLUOROTOLUENE	71	50 - 150

ATI I.D. # 9304-069-13

BETX - GASOLINE
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : KOSMOS
CLIENT I.D. : MW10-10
SAMPLE MATRIX : SOIL
METHOD : WA DOE WTPH-G - 8020(BETX)
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : 04/05/93
DATE RECEIVED : 04/08/93
DATE EXTRACTED : 04/08/93
DATE ANALYZED : 04/09/93
UNITS : mg/Kg
DILUTION FACTOR : 50

COMPOUNDS	RESULTS
BENZENE	15
ETHYLBENZENE	43
TOLUENE	17
TOTAL XYLENES	160
FUEL HYDROCARBONS	5,600
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	F	52 - 116
TRIFLUOROTOLUENE	F	50 - 150

F = Out of limits due to matrix interference.

ATI I.D. # 9304-069-14

BETX - GASOLINE
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : KOSMOS
CLIENT I.D. : MW10-11
SAMPLE MATRIX : SOIL
METHOD : WA DOE WTPH-G - 8020(BETX)
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : 04/05/93
DATE RECEIVED : 04/08/93
DATE EXTRACTED : 04/08/93
DATE ANALYZED : 04/09/93
UNITS : mg/Kg
DILUTION FACTOR : 10

COMPOUNDS	RESULTS
BENZENE	1.6
ETHYLBENZENE	4.6
TOLUENE	1.9
TOTAL XYLENES	18
FUEL HYDROCARBONS	780
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	144 F	52 - 116
TRIFLUOROTOLUENE	103	50 - 150

F = Out of limits due to matrix interference.

ATI I.D. # 9304-069-15

BETX - GASOLINE
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : KOSMOS
CLIENT I.D. : MW10-15
SAMPLE MATRIX : SOIL
METHOD : WA DOE WTPH-G - 8020(BETX)
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : 04/05/93
DATE RECEIVED : 04/08/93
DATE EXTRACTED : 04/08/93
DATE ANALYZED : 04/09/93
UNITS : mg/Kg
DILUTION FACTOR : 1

COMPOUNDS	RESULTS
BENZENE	0.055
ETHYLBENZENE	0.24
TOLUENE	0.16
TOTAL XYLENES	0.77
FUEL HYDROCARBONS	66
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	90	52 - 116
TRIFLUOROTOLUENE	76	50 - 150

Analytica Technologies, Inc.

ATI I.D. # 9304-069-16

BETX - GASOLINE
DATA SUMMARY

CLIENT	: DOWL ENGINEERS	DATE SAMPLED	: 04/05/93
PROJECT #	: S11387	DATE RECEIVED	: 04/08/93
PROJECT NAME	: KOSMOS	DATE EXTRACTED	: 04/08/93
CLIENT I.D.	: MW10-20A	DATE ANALYZED	: 04/09/93
SAMPLE MATRIX	: SOIL	UNITS	: mg/Kg
METHOD	: WA DOE WTPH-G - 8020(BETX)	DILUTION FACTOR	: 1

RESULTS ARE CORRECTED FOR MOISTURE CONTENT

COMPOUNDS	RESULTS
BENZENE	0.048
ETHYLBENZENE	0.11
TOLUENE	0.064
TOTAL XYLENES	0.38
FUEL HYDROCARBONS	17
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	89	52 - 116
TRIFLUOROTOLUENE	75	50 - 150

AnalyticalTechnologies,Inc.

ATI I.D. # 9304-069-17

BETX - GASOLINE
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : KOSMOS
CLIENT I.D. : MW10-20B
SAMPLE MATRIX : SOIL
METHOD : WA DOE WTPH-G - 8020(BETX)
RESULTS ARE CORRECTED FOR MOISTURE CONTENT

DATE SAMPLED : 04/05/93
DATE RECEIVED : 04/08/93
DATE EXTRACTED : 04/08/93
DATE ANALYZED : 04/09/93
UNITS : mg/Kg
DILUTION FACTOR : 1

COMPOUNDS	RESULTS
BENZENE	0.096
ETHYLBENZENE	0.22
TOLUENE	0.11
TOTAL XYLENES	0.78
FUEL HYDROCARBONS	34
HYDROCARBON RANGE	TOLUENE TO DODECANE
HYDROCARBON QUANTITATION USING	GASOLINE

SURROGATE PERCENT RECOVERY		LIMITS
BROMOFLUOROBENZENE	89	52 - 116
TRIFLUOROTOLUENE	71	50 - 150

ATI I.D. # 9304-069

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT	:	DOWL ENGINEERS	SAMPLE I.D. #	:	9304-068-6
PROJECT #	:	S11387	DATE EXTRACTED	:	04/08/93
PROJECT NAME	:	KOSMOS	DATE ANALYZED	:	04/09/93
SAMPLE MATRIX	:	SOIL	UNITS	:	mg/Kg
METHOD	:	WA DOE WTPH-G - 8020(BETX)			

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
GASOLINE	<5.00	<5.00	NC	N/A	N/A	N/A	N/A	N/A	N/A

CONTROL LIMITS	% REC.	RPD
GASOLINE	N/A	20

SURROGATE RECOVERIES	SAMPLE	SAMPLE DUP.	LIMITS
TRIFLUOROTOLUENE	88	70	50 - 150

NC = Not Calculable.

ATI I.D. # 9304-069

BETX - GASOLINE
QUALITY CONTROL DATA

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : KOSMOS
SAMPLE MATRIX : SOIL
METHOD : WA DOE WTPH-G - 8020(BETX)

SAMPLE I.D. # : 9304-068-7
DATE EXTRACTED : 04/08/93
DATE ANALYZED : 04/08/93
UNITS : mg/Kg

COMPOUND	SAMPLE RESULT	SAMPLE DUP. RESULT	RPD	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED RESULT	DUP. % REC.	RPD
BENZENE	<0.0250	N/A	N/A	1.00	0.864	86	0.878	88	2
TOLUENE	<0.0250	N/A	N/A	1.00	0.874	87	0.894	89	2
TOTAL XYLENES	<0.0250	N/A	N/A	2.00	1.78	89	1.80	90	1
GASOLINE	<5.00	<5.00	NC	50.0	47.2	94	46.4	93	2

CONTROL LIMITS	% REC.	RPD
BENZENE	35 - 113	20
TOLUENE	43 - 107	20
TOTAL XYLENES	46 - 114	20
GASOLINE	50 - 112	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	N/A	N/A	52 - 116
TRIFLUOROTOLUENE	N/A	N/A	50 - 150

NC = Not Calculable.

ATI I.D. # 9304-069

BETX -- GASOLINE
QUALITY CONTROL DATA

CLIENT	: DOWL ENGINEERS		SAMPLE I.D. #	: BLANK SPIKE
PROJECT #	: S11387		DATE EXTRACTED	: 04/08/93
PROJECT NAME	: KOSMOS		DATE ANALYZED	: 04/08/93
SAMPLE MATRIX	: SOIL		UNITS	: mg/Kg
METHOD	: WA DOE WTPH-G - 8020(BETX)			

COMPOUNDS	SAMPLE RESULT	SPIKE ADDED	SPIKED RESULT	% REC.	DUP. SPIKED SAMPLE	DUP. % REC.	RPD
BENZENE	<0.0250	1.00	0.889	89	N/A	N/A	N/A
TOLUENE	<0.0250	1.00	0.857	86	N/A	N/A	N/A
TOTAL XYLENES	<0.0250	2.00	1.64	82	N/A	N/A	N/A
GASOLINE	<5.00	50.0	49.7	99	N/A	N/A	N/A

CONTROL LIMITS	% REC.	RPD
BENZENE	63 - 115	20
TOLUENE	75 - 110	20
TOTAL XYLENES	79 - 109	20
GASOLINE	80 - 119	20

SURROGATE RECOVERIES	SPIKE	DUP. SPIKE	LIMITS
BROMOFLUOROBENZENE	79	N/A	52 - 116
TRIFLUOROTOLUENE	91	N/A	50 - 150

ATI I.D. # 9304-069

GENERAL CHEMISTRY ANALYSIS

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : KOSMOS

MATRIX : SOIL

PARAMETER	DATE ANALYZED
MOISTURE	04/08/93

ATI I.D. # 9304-069

GENERAL CHEMISTRY ANALYSIS
DATA SUMMARY

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : KOSMOS

MATRIX : SOIL

UNITS : %

ATI I.D. #	CLIENT I.D.	MOISTURE
9304-069-13	MW10-10	24
9304-069-14	MW10-11	12
9304-069-15	MW10-15	11
9304-069-16	MW10-20A	18
9304-069-17	MW10-20B	21

ATI I.D. # 9304-069

GENERAL CHEMISTRY ANALYSIS
QUALITY CONTROL DATA

CLIENT : DOWL ENGINEERS
PROJECT # : S11387
PROJECT NAME : KOSMOS

MATRIX : SOIL

UNITS : %

PARAMETER	ATI I.D.	SAMPLE RESULT	DUP RESULT	RPD	SPIKED RESULT	SPIKE ADDED	% REC
MOISTURE	9304-069-15	11	11	0	N/A	N/A	N/A

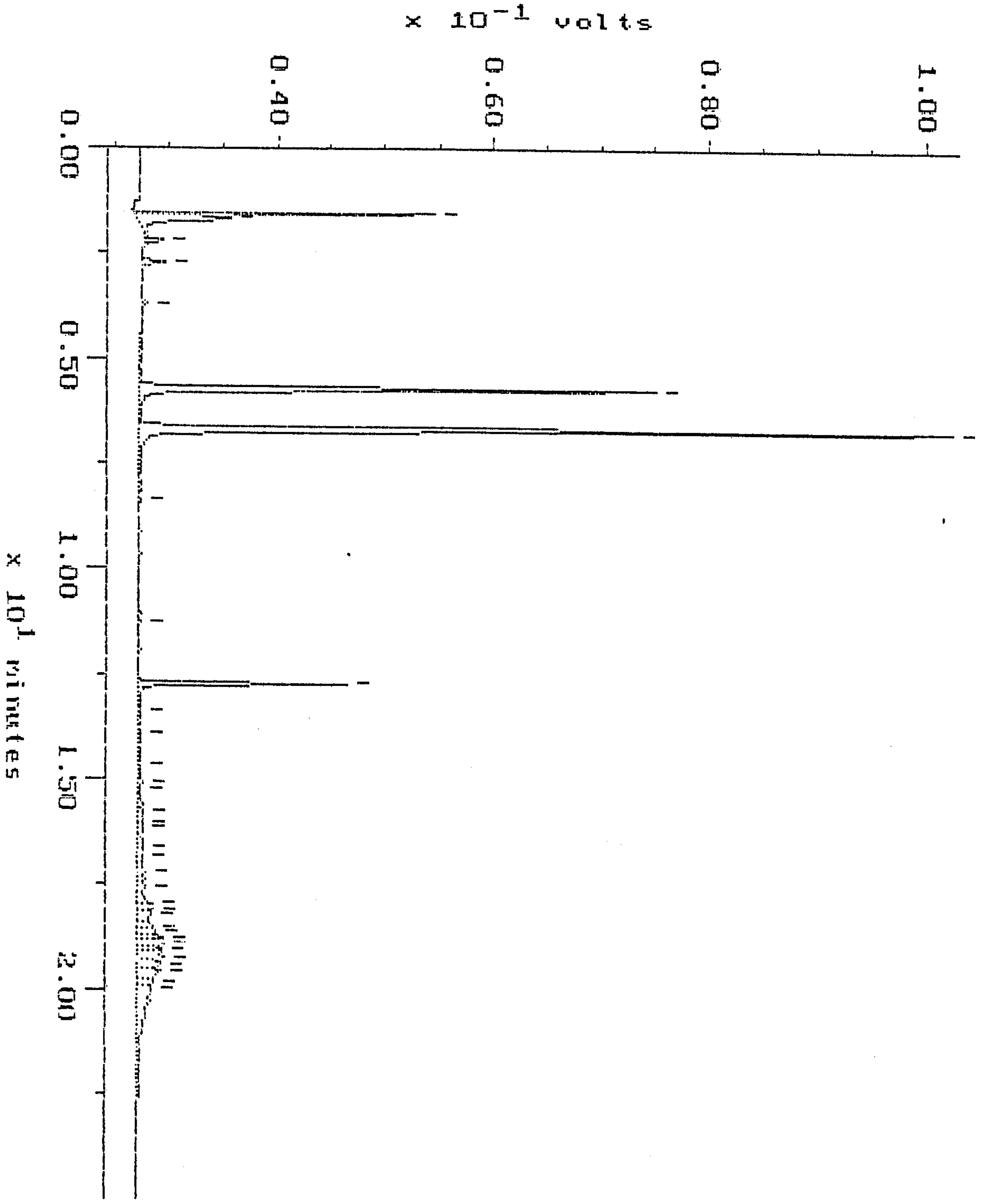
$$\% \text{ Recovery} = \frac{(\text{Spike Sample Result} - \text{Sample Result})}{\text{Spike Concentration}} \times 100$$

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

WA DOE WTPH-G

Blank

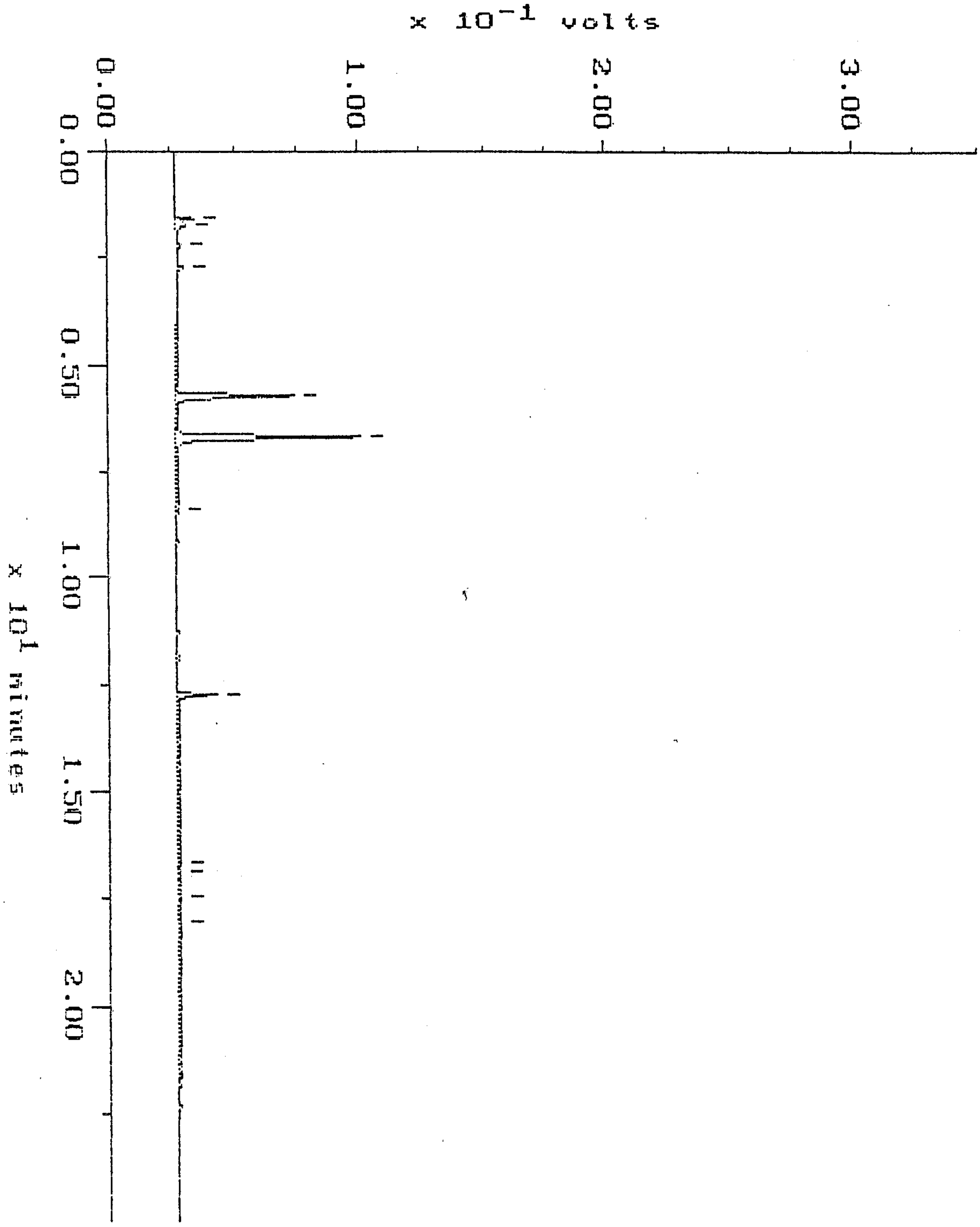
Sample: WRB 4/9
Channel: FID
Acquired: 09-APR-93 12:26
Method: F:\BR02\MAXDATA\GLAD\040993GS
Comments: ATI : A COMMITMENT TO QUALITY
Filename: R4099G05
Operator: ATI



WA DOE WTPH-G

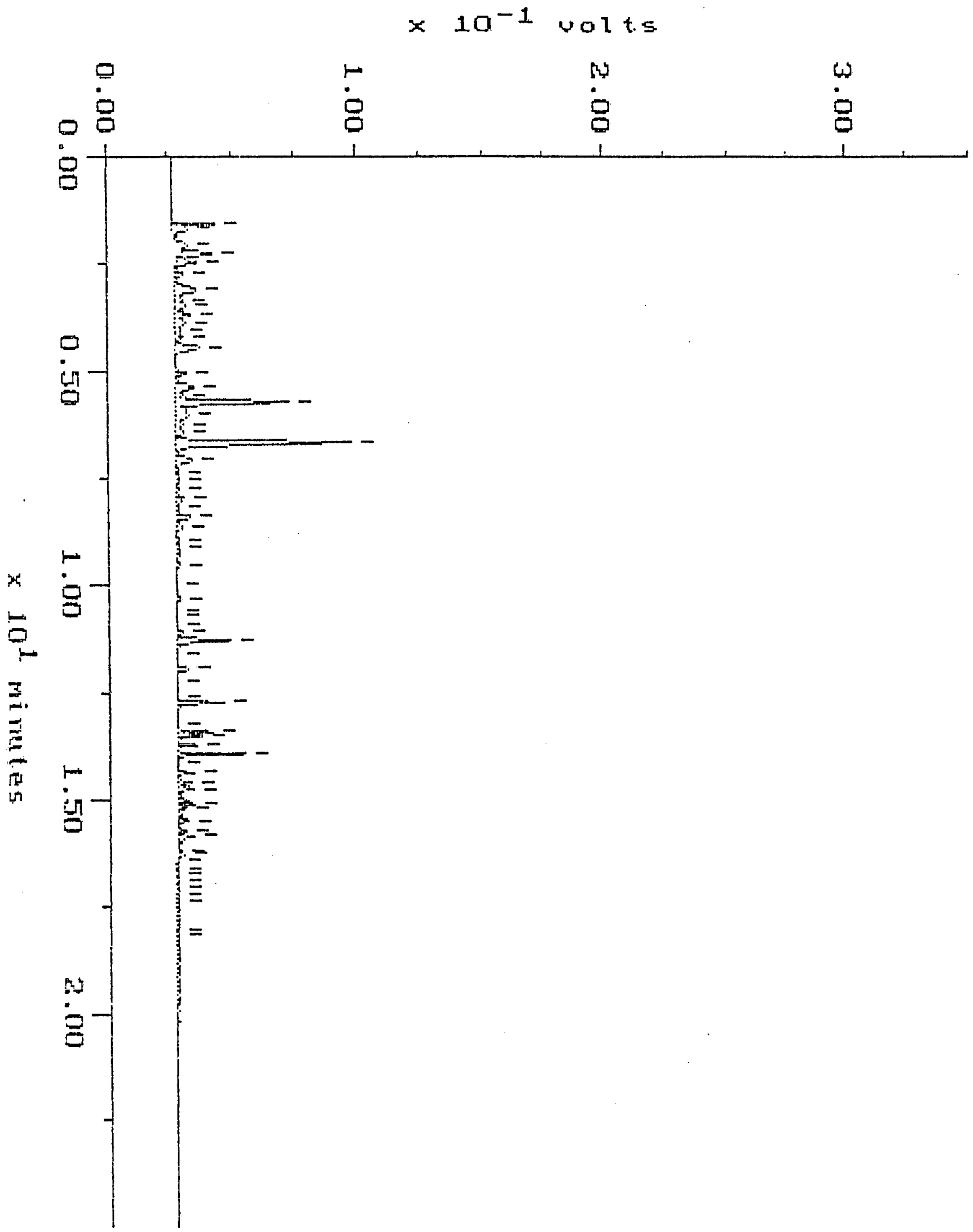
Blank

Sample: WRB 4-12
Channel: FID
Filename: R4129G03
Acquired: 12-APR-93 11:28
Method: F:\BRO2\MAXDATA\GLAD\041293GS
Operator: ATI
Comments: ATI : A COMMITMENT TO QUALITY



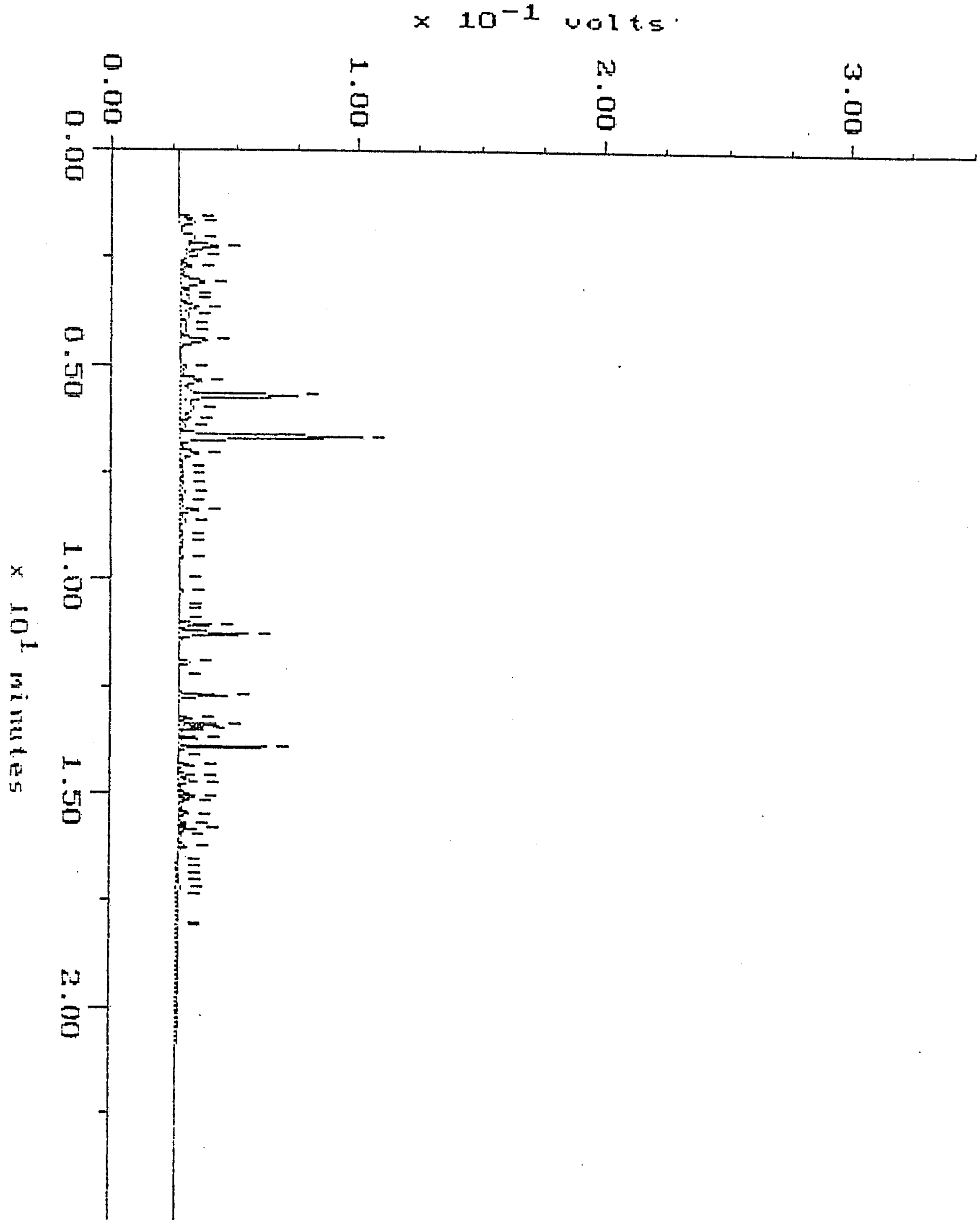
WA DOE WTPH-G

Sample: 9304-069-10DIL Channel: FID Filename: R4129G08
Acquired: 12-APR-93 17:55 Method: F:\BRO2\MAXDATA\GLAD\041293GS Operator: ATI
Dilution: 1 : 10.000
Comments: ATI : A COMMITMENT TO QUALITY



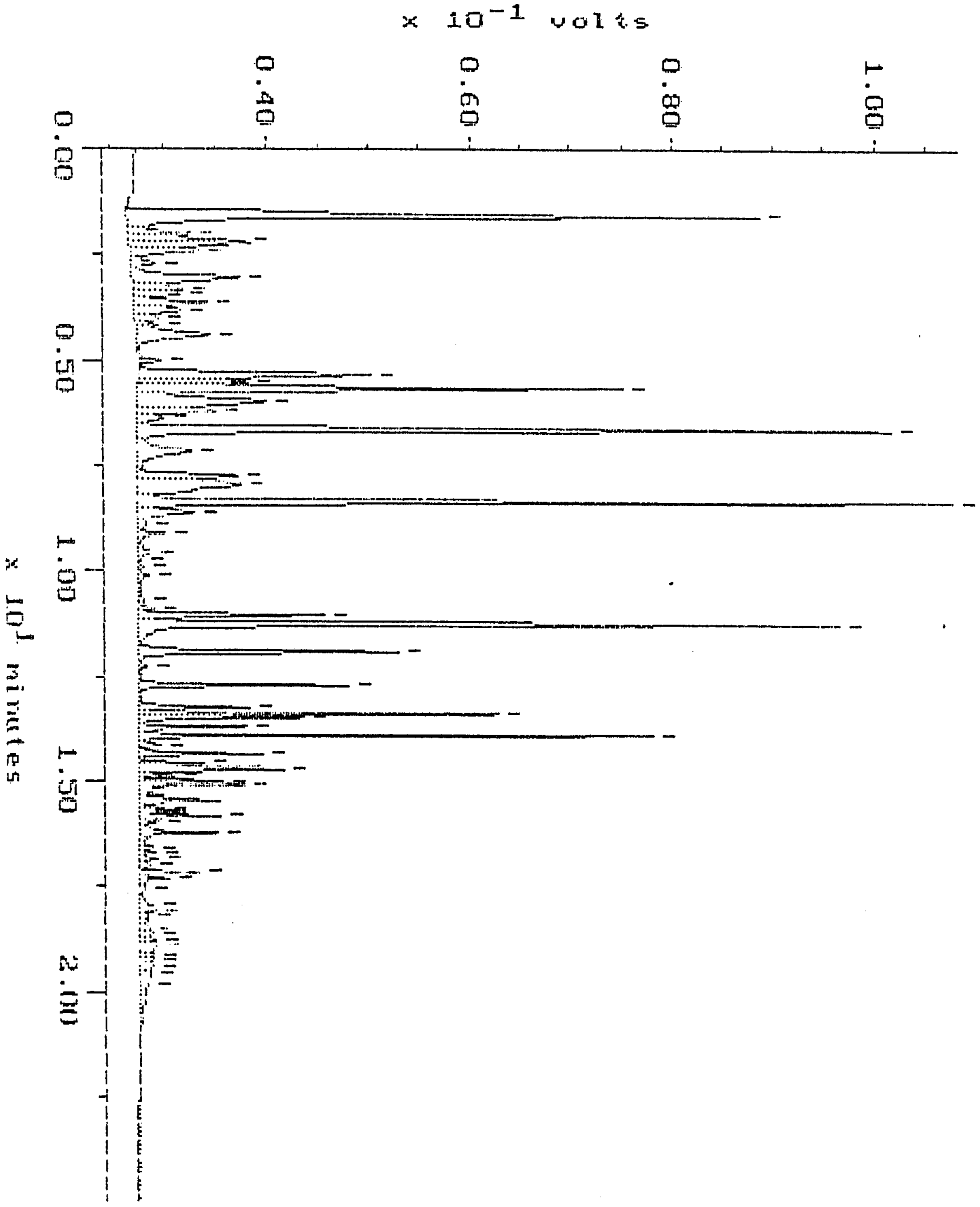
WA DOE WTPH-G

Sample: 9304-069-11DIL Channel: FID Filename: R4129G09
Acquired: 12-APR-93 18:24 Method: F:\BRO2\MAXDATA\GLAD\041293GS Operator: ATI
Dilution: 1 : 10.000
Comments: ATI : A COMMITMENT TO QUALITY



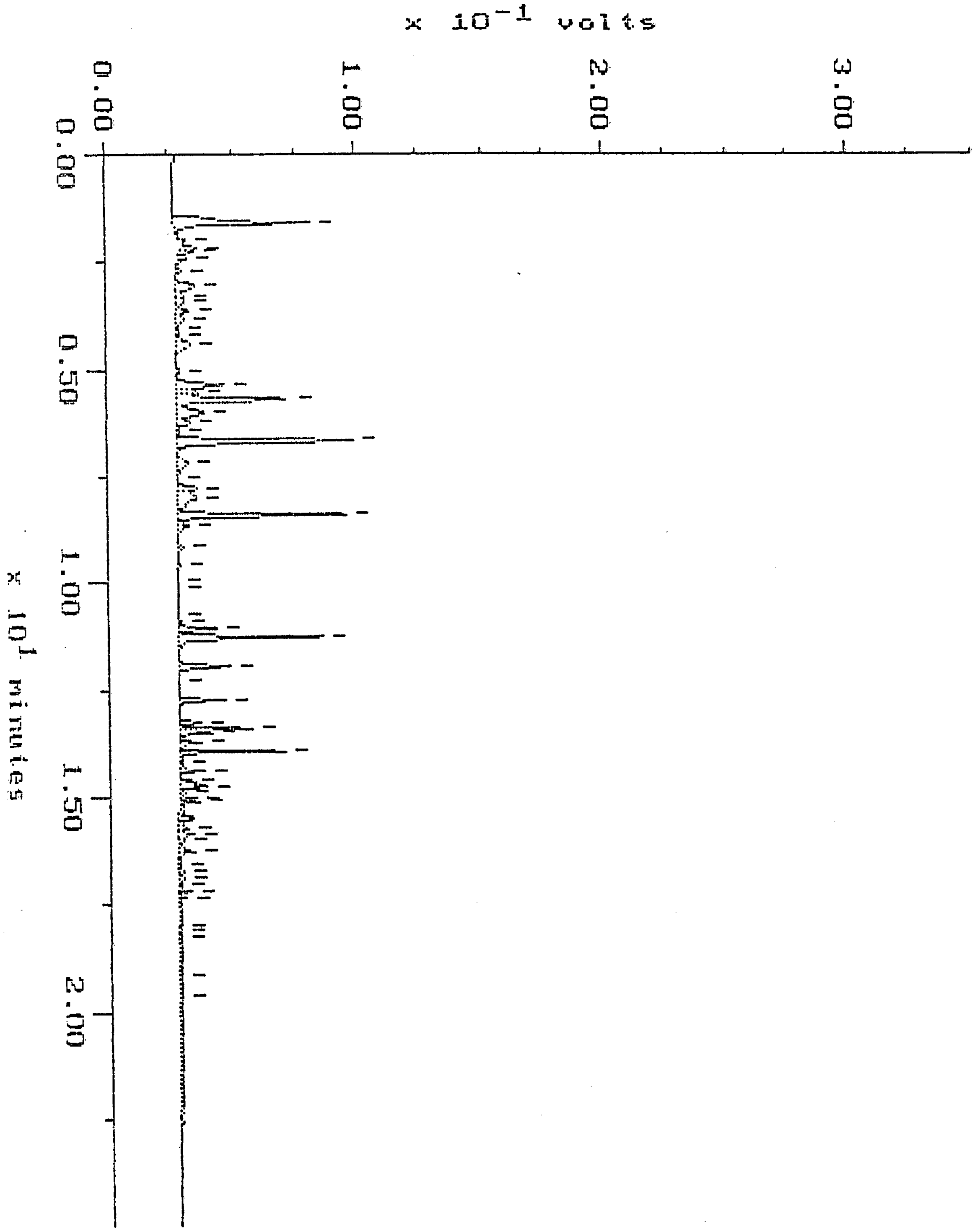
Continuing Calibration

Sample: STD-C G Channel: FID Filename: R4099G01
Acquired: 09-APR-93 8:37 Method: F:\BRU2\MAXDATA\GLAD\040993GS Operator: ATI
Comments: ATI : A COMMITMENT TO QUALITY



Continuing Calibration

Sample: STD-C 6   **Channel:** FID   **Filename:** R4129G01
Acquired: 12-APR-93 10:31   **Method:** F:\BRO2\MAXDATA\GLAD\041293GS   **Operator:** ATI
Comments: ATI : A COMMITMENT TO QUALITY

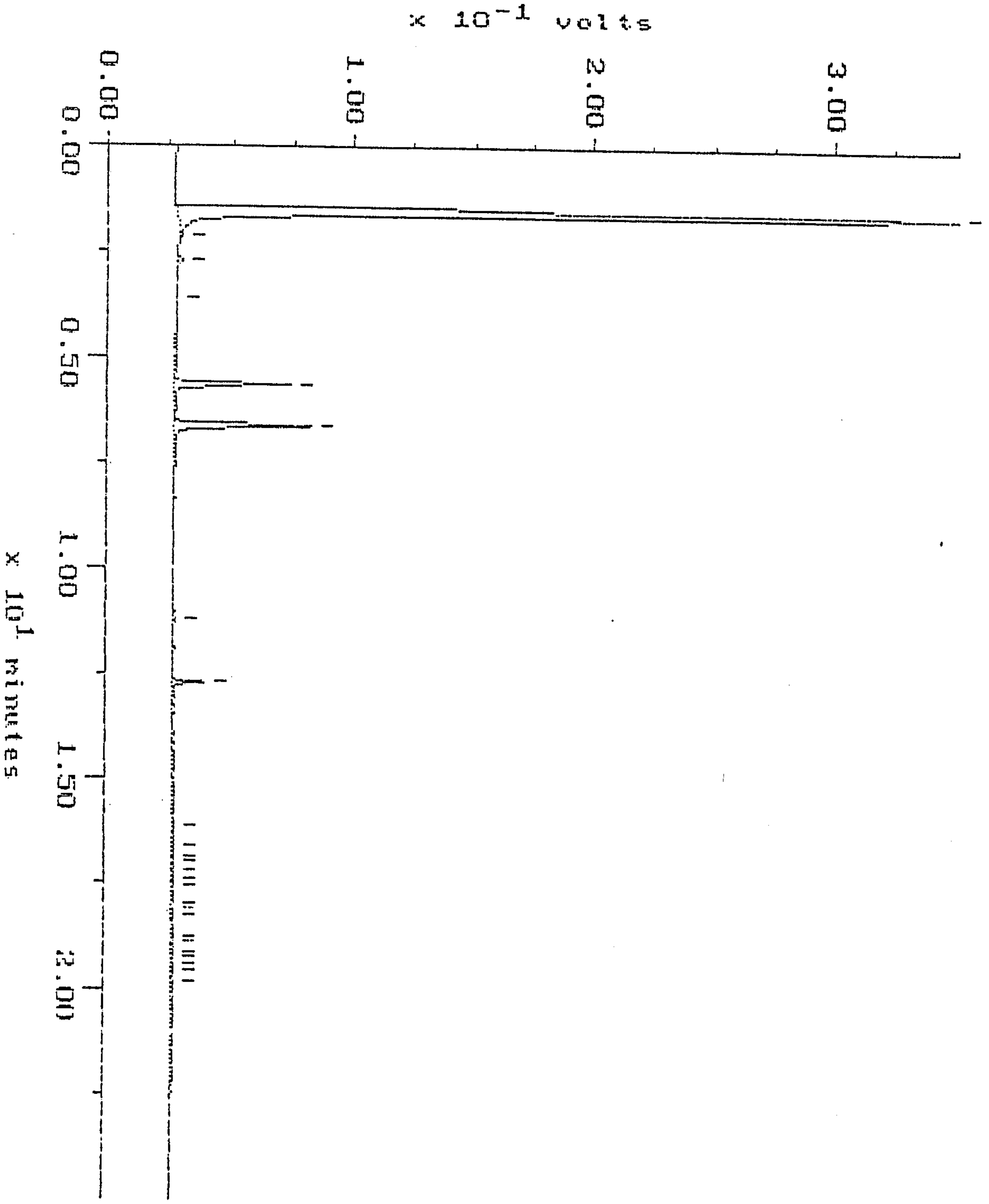


WA DOE WTPH-G

Blank

Sample: SRB 4-8
Channel: FID
Acquired: 08-APR-93 18:13
Method: F:\BRU2\MAXDATA\GLAD\040893GS
Comments: ATI : A COMMITMENT TO QUALITY

Filename: R4089G10
Operator: ATI

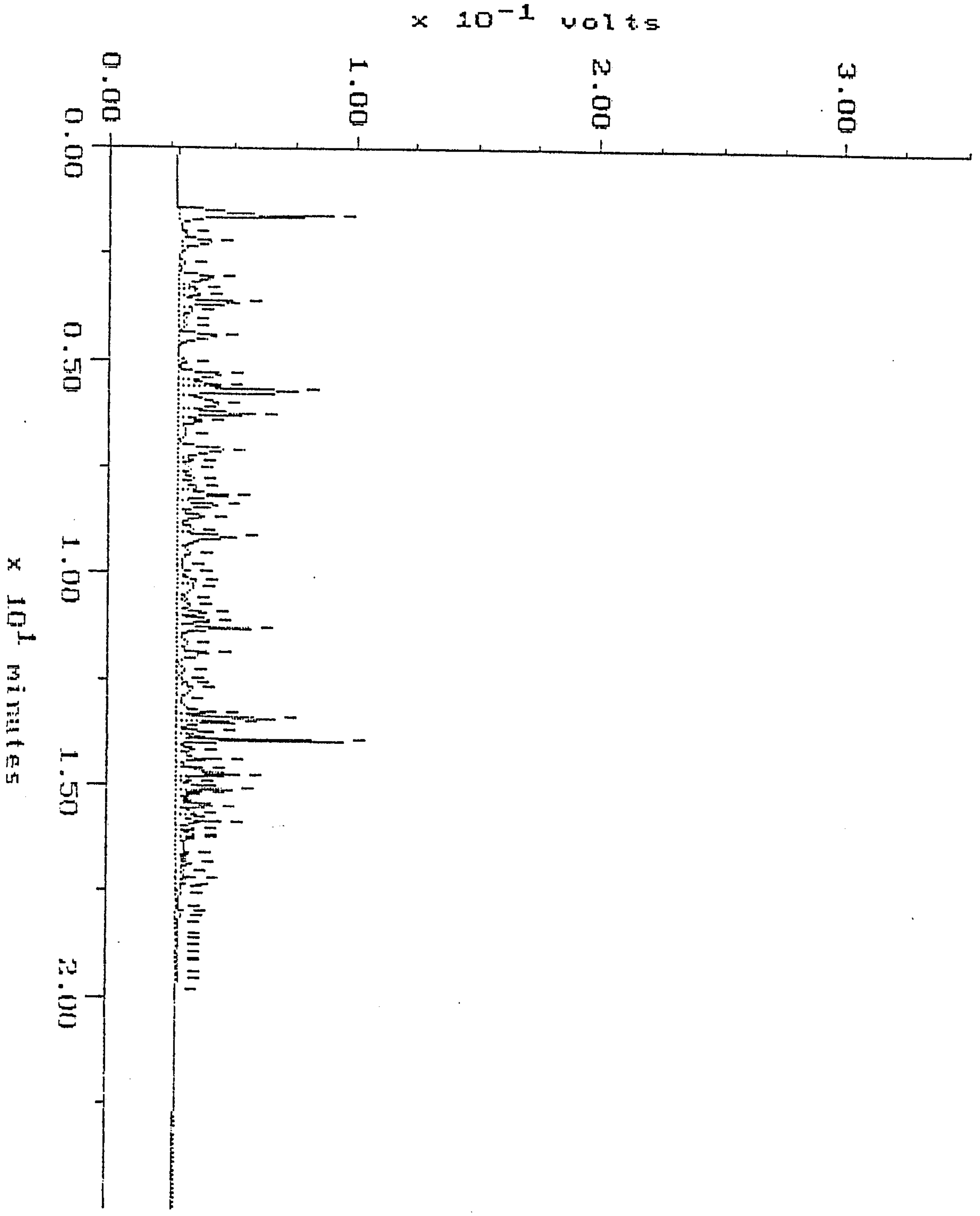


WA DOE WTPH-G

Sample: 9304-069-13DIL
Acquired: 09-APR-93 15:22
Dilution: 1 : 50.000
Comments: ATI : A COMMITMENT TO QUALITY

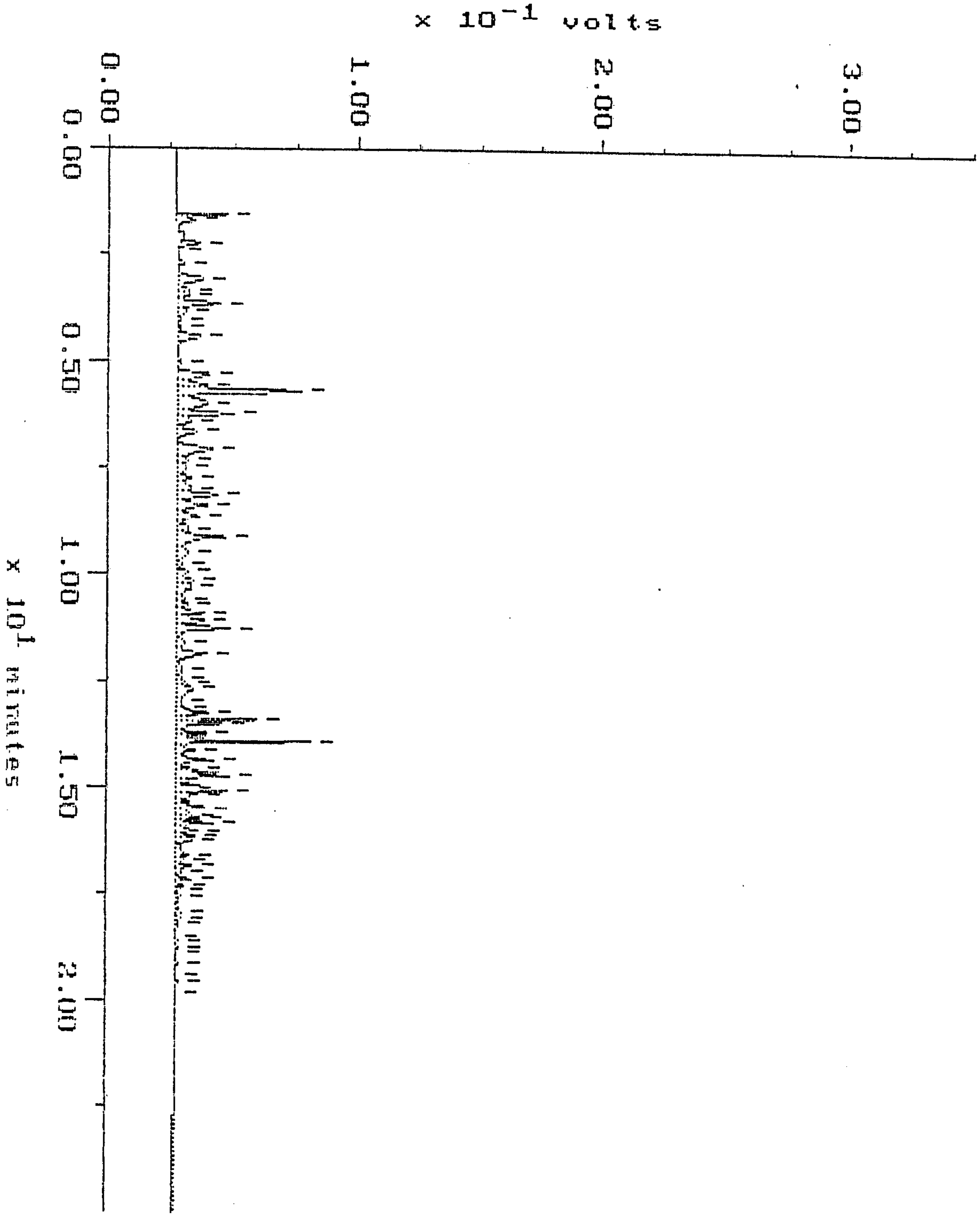
Channel: FID
Method: F:\BRO2\MAXDATA\GLAD\040993GS

Filename: R4099G09
Operator: ATI



WA DOE WTPH-G

Sample: 9304-069-14DIL
Channel: FID
Filename: R4099G10
Acquired: 09-APR-93 16:37
Method: F:\BRO2\MAXDATA\GLAD\040993GS
Operator: ATI
Dilution: 1 : 10.000
Comments: ATI : A COMMITMENT TO QUALITY

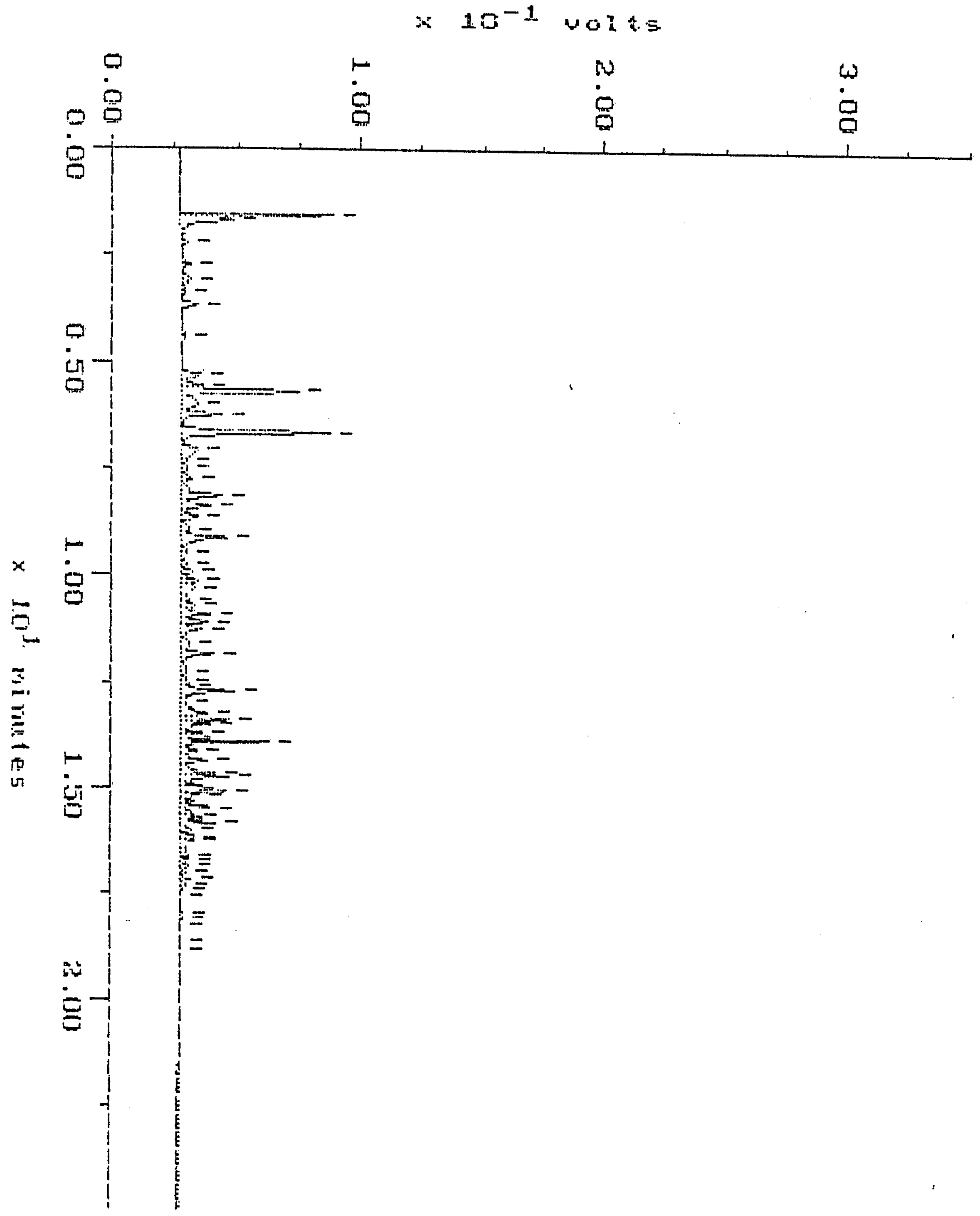


WA DOE WTPH-G

Sample: 9304-069-15 Channel: FID
Acquired: 09-APR-93 3:49 Method: F:\BRO2\MAXDATA\GLAD\04089365

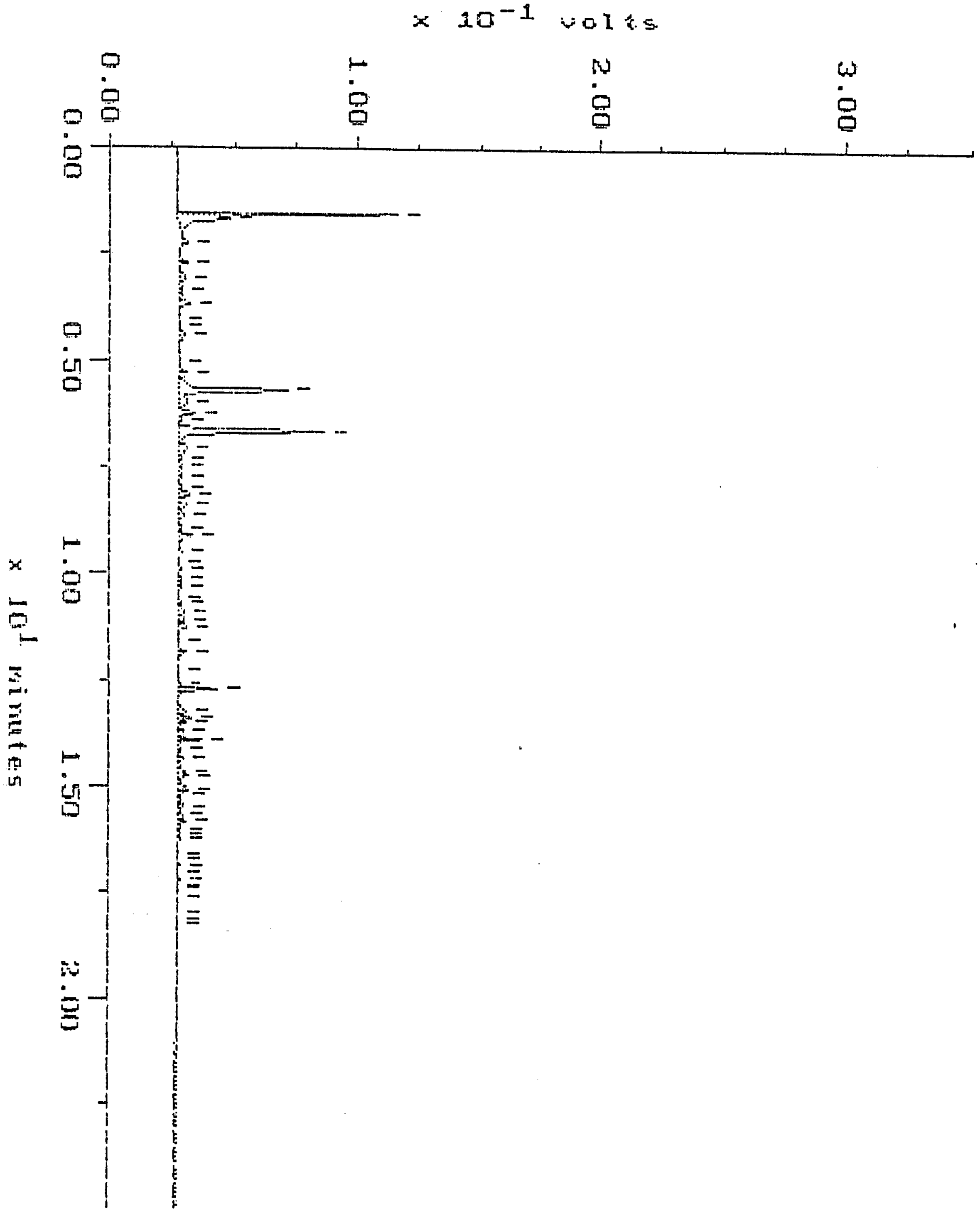
Comments: ATI : A COMMITMENT TO QUALITY

Filename: R4089G30
Operator: ATI



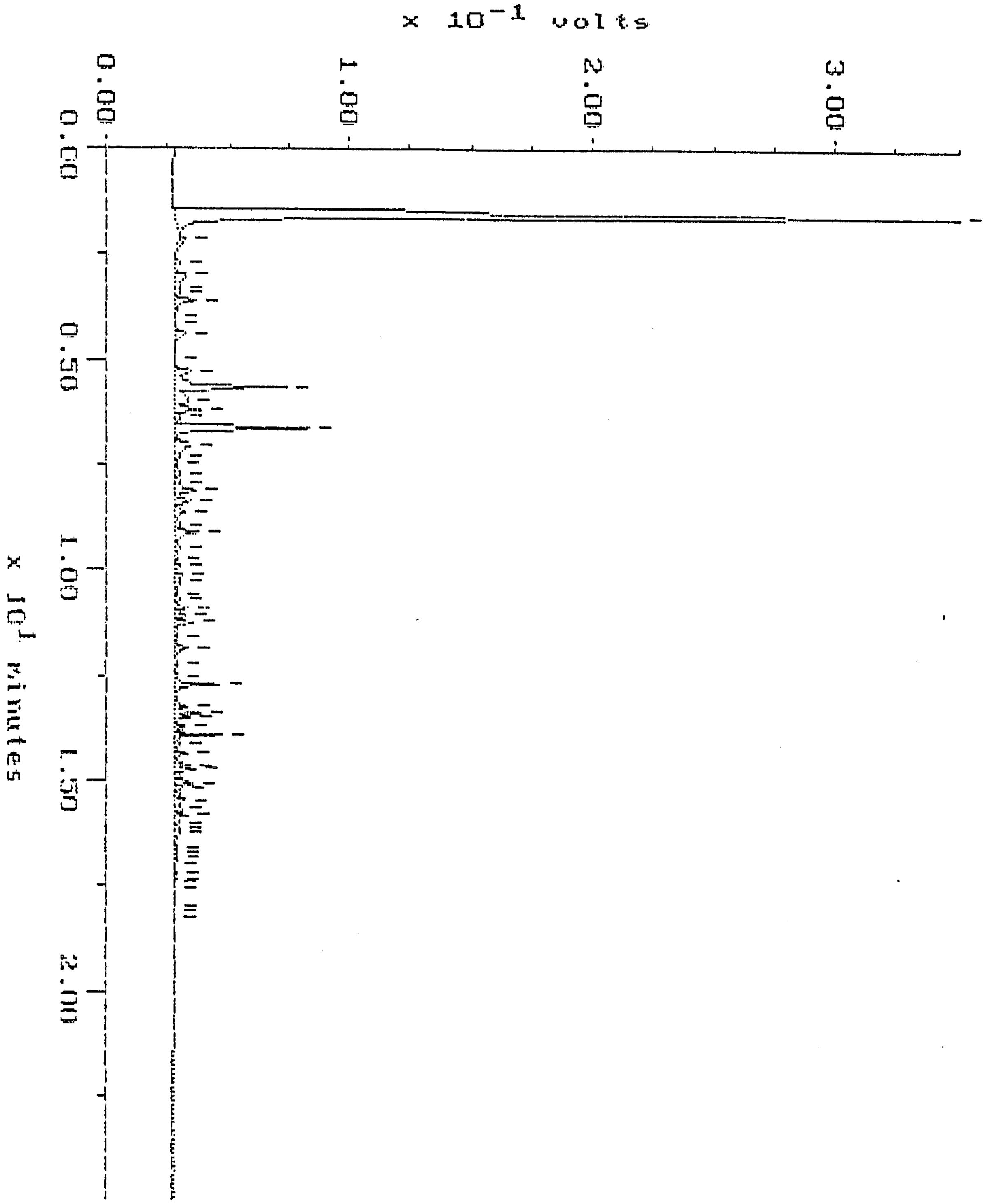
WA DOE WTPH-G

Sample: 9304-069-16 Channel: FID Filename: R4089G31
Acquired: 09-APR-93 4:18 Method: F:\BR02\MAXDATA\GLAD\04089 3GS Operator: ATI
Comments: ATI : A COMMITMENT TO QUALITY



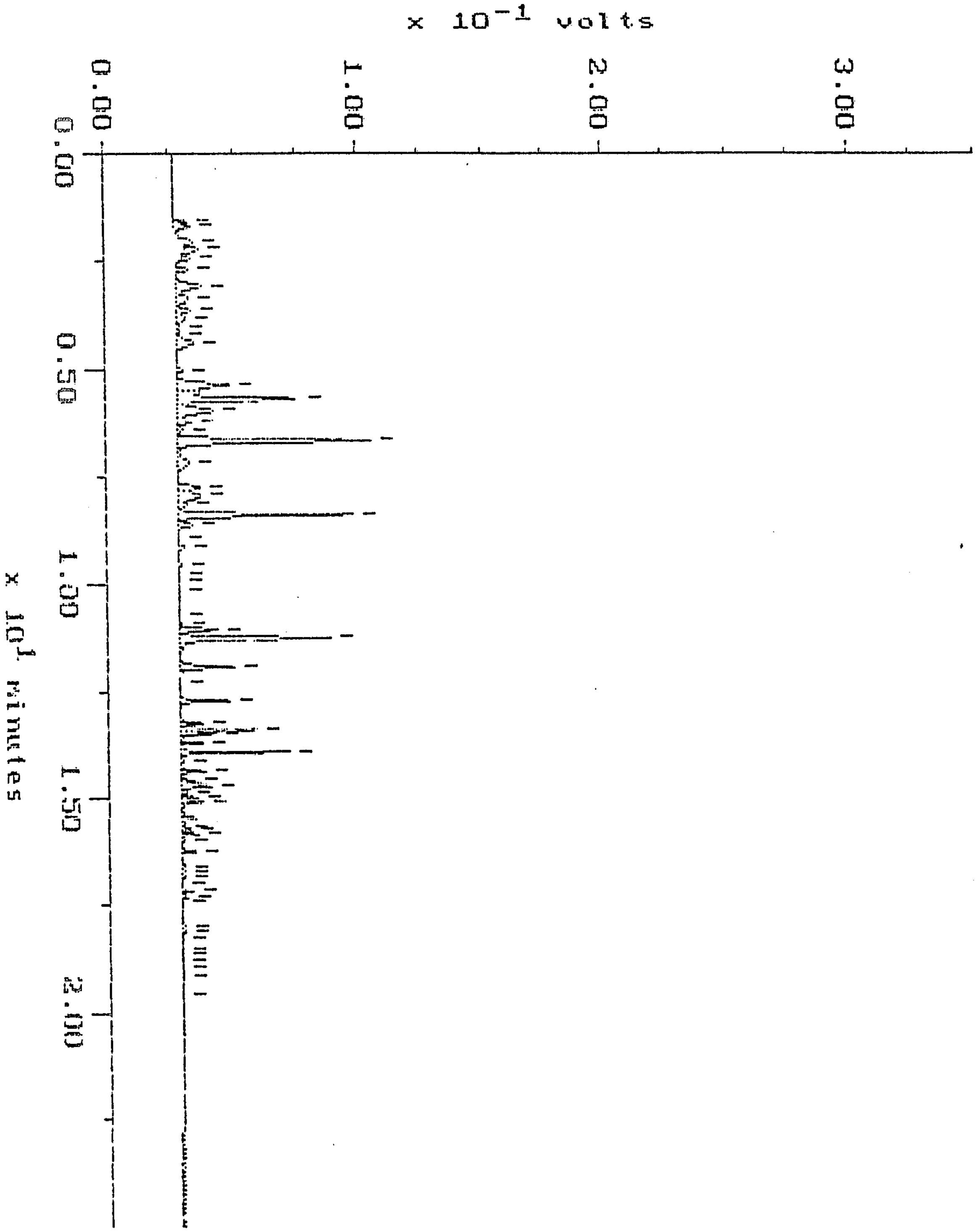
WA DOE WTPH-G

Sample: 9304-069-17 Channel: FID Filename: R4089632
Acquired: 09-APR-93 4:47 Method: F:\BR02\MAXDATA\GLAD\040893GS Operator: ATI
Comments: ATI : A COMMITMENT TO QUALITY



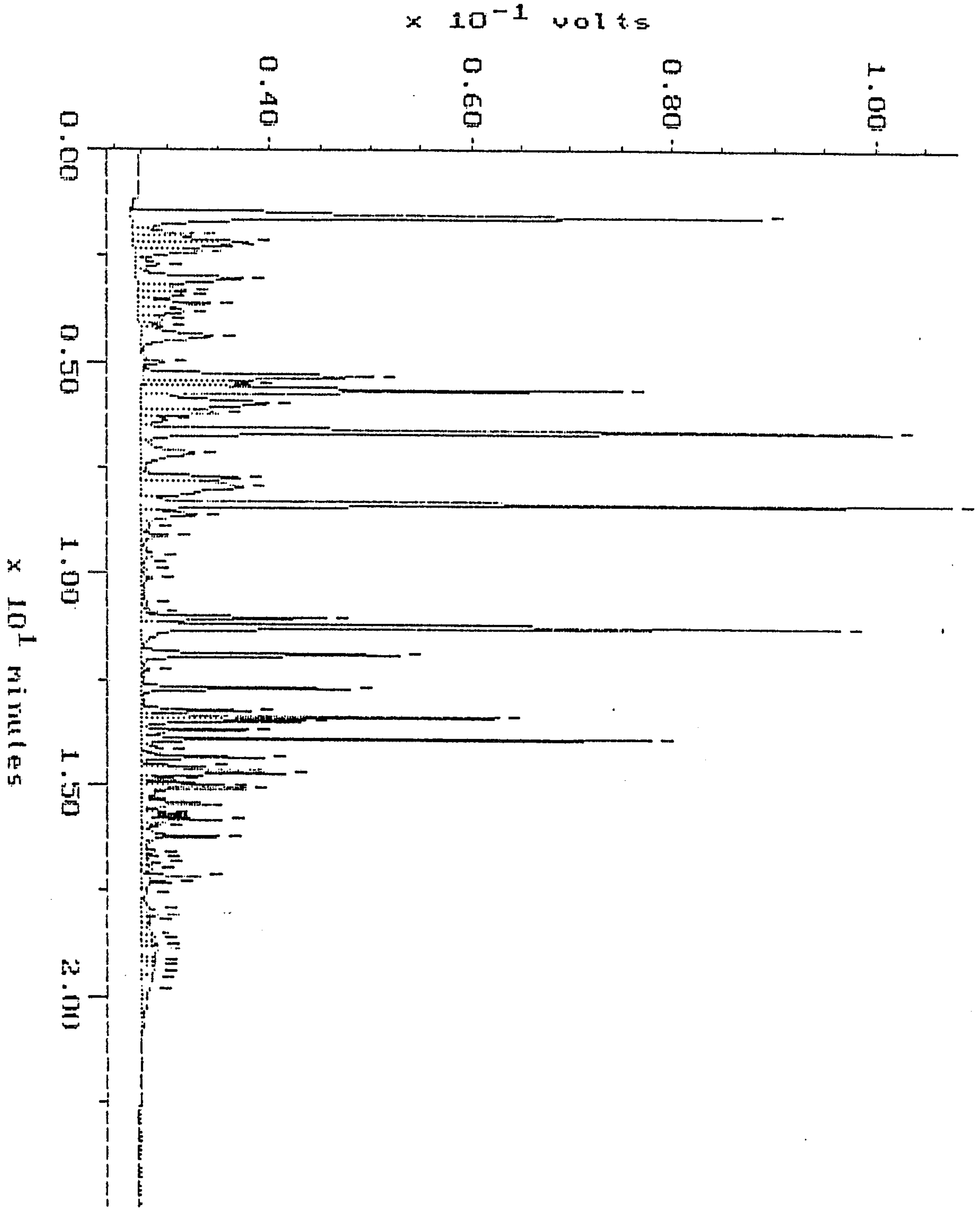
Continuing Calibration

Sample: STD-C G   Channel: FID   Filename: R4089G01
Acquired: 08-APR-93 10:46   Method: F:\BRU2\MAXDATA\GLAD\040893GS   Operator: ATI
Comments: ATI : A COMMITMENT TO QUALITY



Continuing Calibration

Sample: STD-C G Channel: FID Filename: R4099G01
Acquired: 09-APR-93 8:37 Method: F:\BRO2\MAXDATA\GLAD\040993GS Operator: ATI
Comments: ATI : A COMMITMENT TO QUALITY



DOWL ENGINEERS
A Division of DOWL, Incorporated
8320 154TH AVENUE NE REDMOND, WA 98052-3523
PH: (206) 869-2670 FAX: (206) 869-2679

CHAIN OF CUSTODY
SAMPLE RECEIPT FORM

9304-069 1 of 3

Proj. No.	Project Name
511387	Kosmos

Samplers (Signature) Steven R Sint

	Sample No.	Date	Time *	Comp.	Grab	Station Location	No. Of Containers	WTPH G	BETX								Remarks
1	MW1-2	6-6-93	1030				3/40ml	✓	✓								
2	MW2-2	↓	1010			* Date Incorrect -	↓	✓	✓								
3	MW3-2		1245			Should be 4/6/93.		✓	✓								
4	MW4-2		1320			RH		✓	✓								
5	MW5-2		1120					✓	✓								
6	MW6-2		1105					✓	✓								
7	MW7-2		1220					✓	✓								
8	MW8-2		1145					✓	✓								
9	MW9-2		1205					✓	✓								
10	MW10-2	↓	1305				↓	✓	✓								

Relinquished by: (Signature)	Date/Time		Received by: (Signature)	Relinquished by: (Signature)	Date/Time		Received by: (Signature)
Steven R. Sint	4/09/93	0810	Linda French	Linda French	4/8/93	8:40	Paul Kovis 348

Relinquished by: (Signature)	Date/Time		Received for Laboratory by: (Signature)	Date/Time		Remarks:
Paul Kovis	4/8/93	10:10		4/8/93	1000	

WHITE = ORIGINAL CANARY = COPY 1 PINK = COPY 2

DOWL ENGINEERS
A Division of DOWL, Incorporated
8320 154TH AVENUE NE REDMOND, WA 98052-3523
PH: (206) 869-2670 FAX: (206) 869-2679

CHAIN OF CUSTODY SAMPLE RECEIPT FORM

9304-069 243

Proj. No. S1B87	Project Name Kosmos
Samplers (Signature) Steve R. Siris	

	Sample No.	Date	Time	Comp.	Grab	Station Location	No. Of Containers	WTPH G	Betx								Remarks
11	MW 10-2A	6-6-93	1305				3/40ml	✓	✓								3
12	TRIPBLANK						3/40ml	✓	✓								

Relinquished by: (Signature) Steve R. Siris	Date/Time 4-8-93 0810	Received by: (Signature) Linda French	Relinquished by: (Signature) Linda French	Date/Time 4/8/93 8:40	Received by: (Signature) Paul Kosin 348
Relinquished by: (Signature) Paul Kosin	Date/Time 4/8/93 10:40	Received for Laboratory by: (Signature)	Date/Time 4/8/93 1000	Remarks:	

WHITE = ORIGINAL CANARY = COPY 1 PINK = COPY 2

DOWL ENGINEERS
A Division of DOWL, Incorporated
8320 154TH AVENUE NE REDMOND, WA 98052-3523
PH: (206) 869-2670 FAX: (206) 869-2679

CHAIN OF CUSTODY SAMPLE RECEIPT FORM

9304-069 393

Proj. No. S11387

Project Name TPU Kosmos

Samplers (Signature) Geoffrey Hendy

Analyses Requested

	Sample No.	Date	Time	Comp.	Grab	Station Location	No. Of Containers	WTPH-G	BETX							Remarks
13	MW10-10	5Apr93	1015		✓		1	✓	✓							
14	MW10-11	↓	1030		✓		1	✓	✓							
15	MW10-15		1100		✓		1	✓	✓							
16	MW10-20A		1115		✓		1	✓	✓							
17	MW10-20B	↓	1115		✓		1	✓	✓							

Relinquished by: (Signature)	Date/Time 0530 8 Apr 93	Received by: (Signature) Linda French	Relinquished by: (Signature) Linda French	Date/Time 4/8/93 8:40	Received by: (Signature) Paul Kovin 348
Relinquished by: (Signature) Paul Kovin	Date/Time 4/8/93 10:00	Received for Laboratory by: (Signature)	Date/Time 4/8/93 1200	Remarks:	

WHITE = ORIGINAL CANARY = COPY 1 PINK = COPY 2

DOWL DAILY SAMPLING LOG

Page 1 of 1

SITE Kosmos / DATE 4-7-93 * DOWL W.O. NO. 51387

LOCATION MOSSY ROCK KOSMOS TOWN Site

FIELD TEAM FRED HANSON - STEVE SIRES

SITE CONTACTS NONE

SITE CONDITIONS MUDDY - STANDING WATER

SITE WEATHER RAINY - COOL 45°F

MONITORING EQUIP. NONE SAFETY/P.P.E. LEVEL

EQUIPMENT (OTHER)

SAMPLE NUMBER	DESCRIPTION AND OBSERVATIONS	DATE *	TIME	SAMPLE MATRIX	SAMPLE CONTAINER	ANALYSIS	COOLER NO.
MW-1-2	LT TAN - NO ODOR	4-6-93	1030	Water	40ML Vial	WTPHG/BETX	
MW 2-2	LT TAN - NO ODOR		1010				
MW 3-2	" "		1245				
MW 4-2	" "		1320				
MW 5-2	" "		1120				
MW 6-2	" "		1105				
MW 7-2	" "		1220				
MW 8-2	" "		1145				
MW 9-2	" "		1205				
MW 10-2	GAS - ODOR - GRAY		1305				
MW 10-2A	" "		1305				

COMMENTS * Correct date is 4/6/93. FR Hanson

STEVEN R SIRES
PRINTED NAME OF SAMPLER

Steven R Sires
SIGNATURE

4-7-93 *
DATE

DOWL DAILY SAMPLING LOG

Page 1 of 1

SITE TPU Kosmos DATE 5 April 93 DOWL W.O. NO. 511387

LOCATION MW-10

FIELD TEAM Jeff Dendy

SITE CONTACTS Clyde of Holt Drilling

SITE CONDITIONS severe mud & frequent deep puddles

SITE WEATHER Brief rain, partly cloudy

MONITORING EQUIP. None SAFETY/P.P.E. LEVEL 1

EQUIPMENT (OTHER) water level indicator

SAMPLE NUMBER	DESCRIPTION AND OBSERVATIONS	DATE	TIME	SAMPLE MATRIX	SAMPLE CONTAINER	ANALYSIS	COOLER NO.
MW10-10	Monitoring Well 10 10ft	4-5-93	1015	soil	8 oz jar	WTPH-g BETX	
MW10-11	11ft	↓	1030	↓	↓	↓	
MW10-15	15ft		1100				
MW10-20A	20ft		1115				
MW10-20B	20ft		1115				

COMMENTS Gasoline smell encountered @ 10ft level, not so strong @ 11ft.
Water table ± 7.5 ft.

Submitted to ATI 8 April 93

Geoffrey Dendy
PRINTED NAME OF SAMPLER

Geoffrey Dendy
SIGNATURE

5 April 93
DATE

APPENDIX D
Laboratory Report for Department of Ecology Sample

May 5, 2021

Mr. Craig Rankine
WA State Department of Ecology
12121 NE 99th St, Suite 2100
Vancouver, WA 98682

Dear Mr. Rankine,

On April 20th, 1 sample was received by our laboratory and assigned our laboratory project number EV21040103. The project was identified as your Ecology Kosmos - MIC J264C 00. The sample identification and requested analyses are outlined on the attached chain of custody record.

No abnormalities or nonconformances were observed during the analyses of the project samples.

Please do not hesitate to call me if you have any questions or if I can be of further assistance.

Sincerely,

ALS Laboratory Group

Glen Perry

Glen Perry
Laboratory Director

CERTIFICATE OF ANALYSIS

CLIENT:	WA State Department of Ecology 12121 NE 99th St, Suite 2100 Vancouver, WA 98682	DATE: ALS JOB#: ALS SAMPLE#:	5/5/2021 EV21040103 EV21040103-01
CLIENT CONTACT:	Craig Rankine	DATE RECEIVED:	04/20/2021
CLIENT PROJECT:	Ecology Kosmos - MIC J264C 00	COLLECTION DATE:	4/16/2021 11:45:00 AM
CLIENT SAMPLE ID	Kosmos 4162021NW	WDOE ACCREDITATION:	C601

SAMPLE DATA RESULTS

ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
TPH-Volatile Range	NWTPH-GX	U	3.0	1	MG/KG	04/22/2021	KLS
Benzene	EPA-8021	U	0.030	1	MG/KG	04/22/2021	KLS
Toluene	EPA-8021	U	0.050	1	MG/KG	04/22/2021	KLS
Ethylbenzene	EPA-8021	U	0.050	1	MG/KG	04/22/2021	KLS
Xylenes	EPA-8021	U	0.20	1	MG/KG	04/22/2021	KLS
C5-C6 Aliphatics	NWVPH	U	5.0	1	MG/KG	04/28/2021	KLS
>C6-C8 Aliphatics	NWVPH	U	5.0	1	MG/KG	04/28/2021	KLS
>C8-C10 Aliphatics	NWVPH	U	5.0	1	MG/KG	04/28/2021	KLS
>C8-C10 Aromatics	NWVPH	U	5.0	1	MG/KG	04/28/2021	KLS
Hexane	NWVPH	U	0.20	1	MG/KG	04/28/2021	KLS
TPH-Diesel Range	NWTPH-DX	**22000**	5000	200	MG/KG	04/22/2021	JNF
TPH-Oil Range	NWTPH-DX	**41000**	10000	200	MG/KG	04/22/2021	JNF
TPH-Diesel Range (Rinsate)	NWTPH-DX/1311MOD	**5200**	240	1	UG/L	05/05/2021	JNF
TPH-Oil Range (Rinsate)	NWTPH-DX/1311MOD	**1800**	250	1	UG/L	05/05/2021	JNF
>C10-C12 Aliphatics	NWEPH	U	270	1	MG/KG	04/29/2021	EBS
>C12-C16 Aliphatics	NWEPH	**2100**	270	1	MG/KG	04/29/2021	EBS
>C16-C21 Aliphatics	NWEPH	**2700**	270	1	MG/KG	04/29/2021	EBS
>C21-C34 Aliphatics	NWEPH	**9300**	270	1	MG/KG	04/29/2021	EBS
>C10-C12 Aromatics	NWEPH	U	270	1	MG/KG	04/29/2021	EBS
>C12-C16 Aromatics	NWEPH	**770**	270	1	MG/KG	04/29/2021	EBS
>C16-C21 Aromatics	NWEPH	**5400**	270	1	MG/KG	04/29/2021	EBS
>C21-C34 Aromatics	NWEPH	**18000**	270	1	MG/KG	04/29/2021	EBS
Naphthalene	EPA-8270 SIM	U	20	1	UG/KG	04/28/2021	JMK
2-Methylnaphthalene	EPA-8270 SIM	**1100**	20	1	UG/KG	04/28/2021	JMK
1-Methylnaphthalene	EPA-8270 SIM	**1900**	20	1	UG/KG	04/28/2021	JMK
Acenaphthylene	EPA-8270 SIM	U	20	1	UG/KG	04/28/2021	JMK
Acenaphthene	EPA-8270 SIM	U	20	1	UG/KG	04/28/2021	JMK
Fluorene	EPA-8270 SIM	U	20	1	UG/KG	04/28/2021	JMK
Phenanthrene	EPA-8270 SIM	**1900**	21	1	UG/KG	04/28/2021	JMK
Anthracene	EPA-8270 SIM	U	20	1	UG/KG	04/28/2021	JMK
Fluoranthene	EPA-8270 SIM	U	20	1	UG/KG	04/28/2021	JMK
Pyrene	EPA-8270 SIM	**14000**	600	30	UG/KG	04/28/2021	JMK
Benzo[A]Anthracene	EPA-8270 SIM	**2400**	20	1	UG/KG	04/28/2021	JMK
Chrysene	EPA-8270 SIM	**5900**	20	1	UG/KG	04/28/2021	JMK
Benzo[B]Fluoranthene	EPA-8270 SIM	**620**	20	1	UG/KG	04/28/2021	JMK
Benzo[K]Fluoranthene	EPA-8270 SIM	**790**	20	1	UG/KG	04/28/2021	JMK
Benzo[A]Pyrene	EPA-8270 SIM	**6500**	20	1	UG/KG	04/28/2021	JMK
Indeno[1,2,3-Cd]Pyrene	EPA-8270 SIM	**1100**	20	1	UG/KG	04/28/2021	JMK

CERTIFICATE OF ANALYSIS

CLIENT:	WA State Department of Ecology 12121 NE 99th St, Suite 2100 Vancouver, WA 98682	DATE: ALS JOB#: ALS SAMPLE#:	5/5/2021 EV21040103 EV21040103-01
CLIENT CONTACT:	Craig Rankine	DATE RECEIVED:	04/20/2021
CLIENT PROJECT:	Ecology Kosmos - MIC J264C 00	COLLECTION DATE:	4/16/2021 11:45:00 AM
CLIENT SAMPLE ID	Kosmos 4162021NW	WDOE ACCREDITATION:	C601

SAMPLE DATA RESULTS

ANALYTE	METHOD	RESULTS	REPORTING LIMITS	DILUTION FACTOR	UNITS	ANALYSIS DATE	ANALYSIS BY
Dibenz[A,H]Anthracene	EPA-8270 SIM	U	21	1	UG/KG	04/28/2021	JMK
Benzo[G,H,I]Perylene	EPA-8270 SIM	**2300**	23	1	UG/KG	04/28/2021	JMK
Chromium (VI)	EPA-7196	U	5.0	1	MG/KG	04/26/2021	EBS
Mercury	EPA-7471	**0.027**	0.020	1	MG/KG	04/21/2021	RAL
Mercury (Rinsate)	EPA-7470/1311MOD	U	0.00020	1	MG/L	04/30/2021	RAL
Arsenic	EPA-6020	**2.0**	0.20	1	MG/KG	04/21/2021	RAL
Cadmium	EPA-6020	**0.13**	0.10	1	MG/KG	04/21/2021	RAL
Chromium	EPA-6020	**12**	0.10	1	MG/KG	04/21/2021	RAL
Copper	EPA-6020	**44**	0.10	1	MG/KG	04/21/2021	RAL
Lead	EPA-6020	**37**	0.10	1	MG/KG	04/21/2021	RAL
Nickel	EPA-6020	**28**	0.10	1	MG/KG	04/21/2021	RAL
Zinc	EPA-6020	**69**	0.50	1	MG/KG	04/21/2021	RAL
Arsenic (Rinsate)	EPA-6020/1311MOD	U	0.031	6.25	MG/L	04/30/2021	RAL
Cadmium (Rinsate)	EPA-6020/1311MOD	U	0.031	6.25	MG/L	04/30/2021	RAL
Chromium (Rinsate)	EPA-6020/1311MOD	U	0.031	6.25	MG/L	04/30/2021	RAL
Copper (Rinsate)	EPA-6020/1311MOD	**0.060**	0.031	6.25	MG/L	04/30/2021	RAL
Lead (Rinsate)	EPA-6020/1311MOD	U	0.031	6.25	MG/L	04/30/2021	RAL
Nickel (Rinsate)	EPA-6020/1311MOD	U	0.031	6.25	MG/L	04/30/2021	RAL
Zinc (Rinsate)	EPA-6020/1311MOD	U	0.031	6.25	MG/L	04/30/2021	RAL

SURROGATE	METHOD	%REC	ANALYSIS DATE	ANALYSIS BY
TFT	NWTPH-GX	**83.7**	04/22/2021	KLS
TFT	EPA-8021	**84.6**	04/22/2021	KLS
TFT - Aliphatic	NWVPH	**84.8**	04/28/2021	KLS
TFT - Aromatic	NWVPH	**90.4**	04/28/2021	KLS
TFT - Hexane	NWVPH	**83.5**	04/28/2021	KLS
C25 200X Dilution	NWTPH-DX	U, SUR07	04/22/2021	JNF
C25	NWTPH-DX/1311MOD	**90.6**	05/05/2021	JNF
C25	NWEPH	**74.7**	04/29/2021	EBS
p-Terphenyl	NWEPH	**104**	04/29/2021	EBS
Terphenyl-d14 30X Dilution	EPA-8270 SIM	**162 SUR12**	04/28/2021	JMK
Terphenyl-d14	EPA-8270 SIM	**162 SUR12**	04/28/2021	JMK

U - Analyte analyzed for but not detected at level above reporting limit.
SUR12 -Surrogate recoveries were outside of the control limits due to matrix interference.
SUR07 -The surrogate recovery could not be determined due to dilution below the calibration range.
Chromatogram indicates that it is likely that sample contains an unidentified diesel range product and an unidentified oil range product.

Diesel range product results biased high due to oil range product overlap.

CERTIFICATE OF ANALYSIS

CLIENT:	WA State Department of Ecology 12121 NE 99th St, Suite 2100 Vancouver, WA 98682	DATE: ALS SDG#: WDOE ACCREDITATION:	5/5/2021 EV21040103 C601
CLIENT CONTACT:	Craig Rankine		
CLIENT PROJECT:	Ecology Kosmos - MIC J264C 00		

LABORATORY BLANK RESULTS

MBG-042121S2 - Batch 164977 - Soil by NWTPH-GX

ANALYTE	METHOD	RESULTS	UNITS	REPORTING LIMITS	ANALYSIS DATE	ANALYSIS BY
TPH-Volatile Range	NWTPH-GX	U	MG/KG	3.0	04/21/2021	KLS

U - Analyte analyzed for but not detected at level above reporting limit.

MB-042121S2 - Batch 164977 - Soil by EPA-8021

ANALYTE	METHOD	RESULTS	UNITS	REPORTING LIMITS	ANALYSIS DATE	ANALYSIS BY
Benzene	EPA-8021	U	MG/KG	0.030	04/21/2021	KLS
Toluene	EPA-8021	U	MG/KG	0.050	04/21/2021	KLS
Ethylbenzene	EPA-8021	U	MG/KG	0.050	04/21/2021	KLS
Xylenes	EPA-8021	U	MG/KG	0.20	04/21/2021	KLS

U - Analyte analyzed for but not detected at level above reporting limit.

MBLK-R382972 - Batch R382972 - Soil by NWVPH

ANALYTE	METHOD	RESULTS	UNITS	REPORTING LIMITS	ANALYSIS DATE	ANALYSIS BY
C5-C6 Aliphatics	NWVPH	U	MG/KG	5.0	04/28/2021	KLS
>C6-C8 Aliphatics	NWVPH	U	MG/KG	5.0	04/28/2021	KLS
>C8-C10 Aliphatics	NWVPH	U	MG/KG	5.0	04/28/2021	KLS
>C8-C10 Aromatics	NWVPH	U	MG/KG	5.0	04/28/2021	KLS
Hexane	NWVPH	U	MG/KG	0.20	04/28/2021	KLS

U - Analyte analyzed for but not detected at level above reporting limit.

MB-042221S - Batch 164985 - Soil by NWTPH-DX

ANALYTE	METHOD	RESULTS	UNITS	REPORTING LIMITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range	NWTPH-DX	U	MG/KG	25	04/22/2021	JNF
TPH-Oil Range	NWTPH-DX	U	MG/KG	50	04/22/2021	JNF

U - Analyte analyzed for but not detected at level above reporting limit.

MB-043021W - Batch 165398 - Rinsate Extract by NWTPH-DX

ANALYTE	METHOD	RESULTS	UNITS	REPORTING LIMITS	ANALYSIS DATE	ANALYSIS BY
TPH-Diesel Range (Rinsate)	NWTPH-DX/1311MOD	U	UG/L	130	05/05/2021	JNF
TPH-Oil Range (Rinsate)	NWTPH-DX/1311MOD	U	UG/L	250	05/05/2021	JNF

U - Analyte analyzed for but not detected at level above reporting limit.

CERTIFICATE OF ANALYSIS

CLIENT:	WA State Department of Ecology 12121 NE 99th St, Suite 2100 Vancouver, WA 98682	DATE:	5/5/2021
		ALS SDG#:	EV21040103
		WDOE ACCREDITATION:	C601
CLIENT CONTACT:	Craig Rankine		
CLIENT PROJECT:	Ecology Kosmos - MIC J264C 00		

LABORATORY BLANK RESULTS

MBLK-R382971 - Batch R382971 - Soil by NWEPH

ANALYTE	METHOD	RESULTS	UNITS	REPORTING LIMITS	ANALYSIS DATE	ANALYSIS BY
>C10-C12 Aliphatics	NWEPH	U	MG/KG	270	04/29/2021	EBS
>C12-C16 Aliphatics	NWEPH	U	MG/KG	270	04/29/2021	EBS
>C16-C21 Aliphatics	NWEPH	U	MG/KG	270	04/29/2021	EBS
>C21-C34 Aliphatics	NWEPH	U	MG/KG	270	04/29/2021	EBS
>C10-C12 Aromatics	NWEPH	U	MG/KG	270	04/29/2021	EBS
>C12-C16 Aromatics	NWEPH	U	MG/KG	270	04/29/2021	EBS
>C16-C21 Aromatics	NWEPH	U	MG/KG	270	04/29/2021	EBS
>C21-C34 Aromatics	NWEPH	U	MG/KG	270	04/29/2021	EBS

U - Analyte analyzed for but not detected at level above reporting limit.

MB-042821S - Batch 165192 - Soil by EPA-8270 SIM

ANALYTE	METHOD	RESULTS	UNITS	REPORTING LIMITS	ANALYSIS DATE	ANALYSIS BY
Naphthalene	EPA-8270 SIM	U	UG/KG	20	04/28/2021	JMK
2-Methylnaphthalene	EPA-8270 SIM	U	UG/KG	20	04/28/2021	JMK
1-Methylnaphthalene	EPA-8270 SIM	U	UG/KG	20	04/28/2021	JMK
Acenaphthylene	EPA-8270 SIM	U	UG/KG	20	04/28/2021	JMK
Acenaphthene	EPA-8270 SIM	U	UG/KG	20	04/28/2021	JMK
Fluorene	EPA-8270 SIM	U	UG/KG	20	04/28/2021	JMK
Phenanthrene	EPA-8270 SIM	U	UG/KG	20	04/28/2021	JMK
Anthracene	EPA-8270 SIM	U	UG/KG	20	04/28/2021	JMK
Fluoranthene	EPA-8270 SIM	U	UG/KG	20	04/28/2021	JMK
Pyrene	EPA-8270 SIM	U	UG/KG	20	04/28/2021	JMK
Benzo[A]Anthracene	EPA-8270 SIM	U	UG/KG	20	04/28/2021	JMK
Chrysene	EPA-8270 SIM	U	UG/KG	20	04/28/2021	JMK
Benzo[B]Fluoranthene	EPA-8270 SIM	U	UG/KG	20	04/28/2021	JMK
Benzo[K]Fluoranthene	EPA-8270 SIM	U	UG/KG	20	04/28/2021	JMK
Benzo[A]Pyrene	EPA-8270 SIM	U	UG/KG	20	04/28/2021	JMK
Indeno[1,2,3-Cd]Pyrene	EPA-8270 SIM	U	UG/KG	20	04/28/2021	JMK
Dibenz[A,H]Anthracene	EPA-8270 SIM	U	UG/KG	20	04/28/2021	JMK
Benzo[G,H,I]Perylene	EPA-8270 SIM	U	UG/KG	20	04/28/2021	JMK

SURROGATE	METHOD	%REC	CONTROL LIMITS MIN	CONTROL LIMITS MAX	ANALYSIS DATE	ANALYSIS BY
Terphenyl-d14	EPA-8270 SIM	**167 GS4**	**28.9**	**157**	04/28/2021	JMK

GS4 - Surrogate outside of control limits with a high bias. Associated compounds non-detect. No corrective action taken.

U - Analyte analyzed for but not detected at level above reporting limit.

CERTIFICATE OF ANALYSIS

CLIENT:	WA State Department of Ecology 12121 NE 99th St, Suite 2100 Vancouver, WA 98682	DATE: ALS SDG#: WDOE ACCREDITATION:	5/5/2021 EV21040103 C601
CLIENT CONTACT:	Craig Rankine		
CLIENT PROJECT:	Ecology Kosmos - MIC J264C 00		

LABORATORY BLANK RESULTS

MBLK-R382394 - Batch R382394 - Soil by EPA-7196

ANALYTE	METHOD	RESULTS	UNITS	REPORTING LIMITS	ANALYSIS DATE	ANALYSIS BY
Chromium (VI)	EPA-7196	U	MG/KG	5.0	04/26/2021	EBS

U - Analyte analyzed for but not detected at level above reporting limit.

MBLK-R382400 - Batch R382400 - Soil by EPA-7471

ANALYTE	METHOD	RESULTS	UNITS	REPORTING LIMITS	ANALYSIS DATE	ANALYSIS BY
Mercury	EPA-7471	U	MG/KG	0.020	04/21/2021	RAL

U - Analyte analyzed for but not detected at level above reporting limit.

MBLK-R382970 - Batch R382970 - Rinsate Extract by EPA-7470

ANALYTE	METHOD	RESULTS	UNITS	REPORTING LIMITS	ANALYSIS DATE	ANALYSIS BY
Mercury	EPA-7470	U	MG/L	0.00020	04/30/2021	RAL

U - Analyte analyzed for but not detected at level above reporting limit.

MB-042121S - Batch 164936 - Soil by EPA-6020

ANALYTE	METHOD	RESULTS	UNITS	REPORTING LIMITS	ANALYSIS DATE	ANALYSIS BY
Arsenic	EPA-6020	U	MG/KG	0.20	04/21/2021	RAL
Cadmium	EPA-6020	U	MG/KG	0.10	04/21/2021	RAL
Chromium	EPA-6020	U	MG/KG	0.10	04/21/2021	RAL
Copper	EPA-6020	U	MG/KG	0.10	04/21/2021	RAL
Lead	EPA-6020	U	MG/KG	0.10	04/21/2021	RAL
Nickel	EPA-6020	U	MG/KG	0.10	04/21/2021	RAL
Zinc	EPA-6020	U	MG/KG	0.88	04/21/2021	RAL

U - Analyte analyzed for but not detected at level above reporting limit.

MBLK-R382968 - Batch R382968 - Rinsate Extract by EPA-6020

ANALYTE	METHOD	RESULTS	UNITS	REPORTING LIMITS	ANALYSIS DATE	ANALYSIS BY
Arsenic	EPA-6020	U	MG/L	0.031	04/30/2021	RAL
Cadmium	EPA-6020	U	MG/L	0.031	04/30/2021	RAL
Chromium	EPA-6020	U	MG/L	0.031	04/30/2021	RAL
Copper	EPA-6020	U	MG/L	0.031	04/30/2021	RAL
Lead	EPA-6020	U	MG/L	0.031	04/30/2021	RAL
Nickel	EPA-6020	U	MG/L	0.031	04/30/2021	RAL
Zinc	EPA-6020	U	MG/L	0.031	04/30/2021	RAL

CERTIFICATE OF ANALYSIS

CLIENT:	WA State Department of Ecology 12121 NE 99th St, Suite 2100 Vancouver, WA 98682	DATE: ALS SDG#: WDOE ACCREDITATION:	5/5/2021 EV21040103 C601
CLIENT CONTACT:	Craig Rankine		
CLIENT PROJECT:	Ecology Kosmos - MIC J264C 00		

LABORATORY BLANK RESULTS

MBLK-R382968 - Batch R382968 - Rinsate Extract by EPA-6020

U - Analyte analyzed for but not detected at level above reporting limit.

CERTIFICATE OF ANALYSIS

CLIENT: WA State Department of Ecology
12121 NE 99th St, Suite 2100
Vancouver, WA 98682
CLIENT CONTACT: Craig Rankine
CLIENT PROJECT: Ecology Kosmos - MIC J264C 00

DATE: 5/5/2021
ALS SDG#: EV21040103
WDOE ACCREDITATION: C601

LABORATORY CONTROL SAMPLE RESULTS

ALS Test Batch ID: 164977 - Soil by NWTPH-GX

					LIMITS		ANALYSIS DATE	ANALYSIS BY
SPIKED COMPOUND	**METHOD**	**%REC**	**RPD**	**QUAL**	**MIN**	**MAX**		
TPH-Volatile Range - BS	NWTPH-GX	**93.2**			66.5	122.7	04/21/2021	KLS
TPH-Volatile Range - BSD	NWTPH-GX	**93.5**	**0**		66.5	122.7	04/21/2021	KLS

ALS Test Batch ID: 164977 - Soil by EPA-8021

					LIMITS		ANALYSIS DATE	ANALYSIS BY
SPIKED COMPOUND	**METHOD**	**%REC**	**RPD**	**QUAL**	**MIN**	**MAX**		
Benzene - BS	EPA-8021	**86.2**			67.7	124	04/21/2021	KLS
Benzene - BSD	EPA-8021	**85.7**	**1**		67.7	124	04/21/2021	KLS
Toluene - BS	EPA-8021	**85.4**			71	123	04/21/2021	KLS
Toluene - BSD	EPA-8021	**83.9**	**2**		71	123	04/21/2021	KLS
Ethylbenzene - BS	EPA-8021	**84.7**			69.8	117	04/21/2021	KLS
Ethylbenzene - BSD	EPA-8021	**83.5**	**1**		69.8	117	04/21/2021	KLS
Xylenes - BS	EPA-8021	**85.7**			70	119	04/21/2021	KLS
Xylenes - BSD	EPA-8021	**84.8**	**1**		70	119	04/21/2021	KLS

ALS Test Batch ID: R382972 - Soil by NWVPH

					LIMITS		ANALYSIS DATE	ANALYSIS BY
SPIKED COMPOUND	**METHOD**	**%REC**	**RPD**	**QUAL**	**MIN**	**MAX**		
C5-C6 Aliphatics - BS	NWVPH	**89.6**			70	130	04/28/2021	KLS
C5-C6 Aliphatics - BSD	NWVPH	**83.3**	**7**		70	130	04/28/2021	KLS
>C6-C8 Aliphatics - BS	NWVPH	**106**			70	130	04/28/2021	KLS
>C6-C8 Aliphatics - BSD	NWVPH	**103**	**3**		70	130	04/28/2021	KLS
>C8-C10 Aliphatics - BS	NWVPH	**113**			70	130	04/28/2021	KLS
>C8-C10 Aliphatics - BSD	NWVPH	**109**	**3**		70	130	04/28/2021	KLS
>C8-C10 Aromatics - BS	NWVPH	**100**			70	130	04/28/2021	KLS
>C8-C10 Aromatics - BSD	NWVPH	**98.5**	**1**		70	130	04/28/2021	KLS
Hexane - BS	NWVPH	**84.8**			70	130	04/28/2021	KLS
Hexane - BSD	NWVPH	**83.8**	**1**		70	130	04/28/2021	KLS

ALS Test Batch ID: 164985 - Soil by NWTPH-DX

					LIMITS		ANALYSIS DATE	ANALYSIS BY
SPIKED COMPOUND	**METHOD**	**%REC**	**RPD**	**QUAL**	**MIN**	**MAX**		
TPH-Diesel Range - BS	NWTPH-DX	**117**			75.5	122.1	04/22/2021	JNF
TPH-Diesel Range - BSD	NWTPH-DX	**99.4**	**16**	SR1	75.5	122.1	04/22/2021	JNF

SR1 - RPD outside of control limits.

CERTIFICATE OF ANALYSIS

CLIENT: WA State Department of Ecology
12121 NE 99th St, Suite 2100
Vancouver, WA 98682
CLIENT CONTACT: Craig Rankine
CLIENT PROJECT: Ecology Kosmos - MIC J264C 00

DATE: 5/5/2021
ALS SDG#: EV21040103
WDOE ACCREDITATION: C601

LABORATORY CONTROL SAMPLE RESULTS

ALS Test Batch ID: 165398 - Rinsate Extract by NWTPH-DX

					LIMITS			
SPIKED COMPOUND	**METHOD**	**%REC**	**RPD**	**QUAL**	**MIN**	**MAX**	**ANALYSIS DATE**	**ANALYSIS BY**
TPH-Diesel Range (Rinsate) - BS	NWTPH-DX/1311MOD	**84.5**			67	125.2	05/03/2021	JNF
TPH-Diesel Range (Rinsate) - BSD	NWTPH-DX/1311MOD	**95.1**	**12**		67	125.2	05/03/2021	JNF

ALS Test Batch ID: R382971 - Soil by NWEPH

					LIMITS			
SPIKED COMPOUND	**METHOD**	**%REC**	**RPD**	**QUAL**	**MIN**	**MAX**	**ANALYSIS DATE**	**ANALYSIS BY**
>C10-C12 Aliphatics - BS	NWEPH	**79.9**			70	130	04/29/2021	EBS
>C10-C12 Aliphatics - BSD	NWEPH	**79.0**	**66**	SR1	70	130	04/29/2021	EBS
>C12-C16 Aliphatics - BS	NWEPH	**90.2**			70	130	04/29/2021	EBS
>C12-C16 Aliphatics - BSD	NWEPH	**84.2**	**61**	SR1	70	130	04/29/2021	EBS
>C16-C21 Aliphatics - BS	NWEPH	**96.9**			70	130	04/29/2021	EBS
>C16-C21 Aliphatics - BSD	NWEPH	**89.0**	**59**	SR1	70	130	04/29/2021	EBS
>C21-C34 Aliphatics - BS	NWEPH	**99.4**			70	130	04/29/2021	EBS
>C21-C34 Aliphatics - BSD	NWEPH	**91.6**	**59**	SR1	70	130	04/29/2021	EBS
>C10-C12 Aromatics - BS	NWEPH	**87.2**			70	130	04/29/2021	EBS
>C10-C12 Aromatics - BSD	NWEPH	**77.4**	**12**		70	130	04/29/2021	EBS
>C12-C16 Aromatics - BS	NWEPH	**91.0**			70	130	04/29/2021	EBS
>C12-C16 Aromatics - BSD	NWEPH	**82.9**	**9**		70	130	04/29/2021	EBS
>C16-C21 Aromatics - BS	NWEPH	**89.6**			70	130	04/29/2021	EBS
>C16-C21 Aromatics - BSD	NWEPH	**81.9**	**9**		70	130	04/29/2021	EBS
>C21-C34 Aromatics - BS	NWEPH	**87.2**			70	130	04/29/2021	EBS
>C21-C34 Aromatics - BSD	NWEPH	**86.4**	**1**		70	130	04/29/2021	EBS

SR1 - RPD outside of control limits due to accidental double-spking of Aliphatic BSD.

ALS Test Batch ID: 165192 - Soil by EPA-8270 SIM

					LIMITS			
SPIKED COMPOUND	**METHOD**	**%REC**	**RPD**	**QUAL**	**MIN**	**MAX**	**ANALYSIS DATE**	**ANALYSIS BY**
Naphthalene - BS	EPA-8270 SIM	**92.9**			20	150	04/28/2021	JMK
Naphthalene - BSD	EPA-8270 SIM	**88.8**	**5**		20	150	04/28/2021	JMK
2-Methylnaphthalene - BS	EPA-8270 SIM	**95.8**			20	150	04/28/2021	JMK
2-Methylnaphthalene - BSD	EPA-8270 SIM	**92.5**	**4**		20	150	04/28/2021	JMK
1-Methylnaphthalene - BS	EPA-8270 SIM	**95.8**			20	150	04/28/2021	JMK
1-Methylnaphthalene - BSD	EPA-8270 SIM	**90.2**	**6**		20	150	04/28/2021	JMK
Acenaphthylene - BS	EPA-8270 SIM	**97.7**			20	150	04/28/2021	JMK
Acenaphthylene - BSD	EPA-8270 SIM	**95.4**	**2**		20	150	04/28/2021	JMK
Acenaphthene - BS	EPA-8270 SIM	**95.2**			41	107	04/28/2021	JMK
Acenaphthene - BSD	EPA-8270 SIM	**93.2**	**2**		41	107	04/28/2021	JMK
Fluorene - BS	EPA-8270 SIM	**103**			20	150	04/28/2021	JMK

CERTIFICATE OF ANALYSIS

CLIENT:	WA State Department of Ecology 12121 NE 99th St, Suite 2100 Vancouver, WA 98682	DATE: ALS SDG#: WDOE ACCREDITATION:	5/5/2021 EV21040103 C601
CLIENT CONTACT:	Craig Rankine		
CLIENT PROJECT:	Ecology Kosmos - MIC J264C 00		

LABORATORY CONTROL SAMPLE RESULTS

SPIKED COMPOUND	METHOD	%REC	RPD	QUAL	LIMITS MIN	LIMITS MAX	ANALYSIS DATE	ANALYSIS BY
Fluorene - BSD	EPA-8270 SIM	**101**	**2**		20	150	04/28/2021	JMK
Phenanthrene - BS	EPA-8270 SIM	**98.7**			20	150	04/28/2021	JMK
Phenanthrene - BSD	EPA-8270 SIM	**94.4**	**4**		20	150	04/28/2021	JMK
Anthracene - BS	EPA-8270 SIM	**105**			20	150	04/28/2021	JMK
Anthracene - BSD	EPA-8270 SIM	**103**	**2**		20	150	04/28/2021	JMK
Fluoranthene - BS	EPA-8270 SIM	**113**			20	150	04/28/2021	JMK
Fluoranthene - BSD	EPA-8270 SIM	**109**	**3**		20	150	04/28/2021	JMK
Pyrene - BS	EPA-8270 SIM	**103**			18	136	04/28/2021	JMK
Pyrene - BSD	EPA-8270 SIM	**101**	**2**		18	136	04/28/2021	JMK
Benzo[A]Anthracene - BS	EPA-8270 SIM	**86.6**			20	150	04/28/2021	JMK
Benzo[A]Anthracene - BSD	EPA-8270 SIM	**82.6**	**5**		20	150	04/28/2021	JMK
Chrysene - BS	EPA-8270 SIM	**117**			20	150	04/28/2021	JMK
Chrysene - BSD	EPA-8270 SIM	**116**	**0**		20	150	04/28/2021	JMK
Benzo[B]Fluoranthene - BS	EPA-8270 SIM	**86.5**			20	150	04/28/2021	JMK
Benzo[B]Fluoranthene - BSD	EPA-8270 SIM	**84.0**	**3**		20	150	04/28/2021	JMK
Benzo[K]Fluoranthene - BS	EPA-8270 SIM	**106**			20	150	04/28/2021	JMK
Benzo[K]Fluoranthene - BSD	EPA-8270 SIM	**108**	**2**		20	150	04/28/2021	JMK
Benzo[A]Pyrene - BS	EPA-8270 SIM	**86.9**			20	150	04/28/2021	JMK
Benzo[A]Pyrene - BSD	EPA-8270 SIM	**104**	**18**		20	150	04/28/2021	JMK
Indeno[1,2,3-Cd]Pyrene - BS	EPA-8270 SIM	**105**			20	150	04/28/2021	JMK
Indeno[1,2,3-Cd]Pyrene - BSD	EPA-8270 SIM	**105**	**1**		20	150	04/28/2021	JMK
Dibenz[A,H]Anthracene - BS	EPA-8270 SIM	**92.0**			20	150	04/28/2021	JMK
Dibenz[A,H]Anthracene - BSD	EPA-8270 SIM	**93.4**	**1**		20	150	04/28/2021	JMK
Benzo[G,H,I]Perylene - BS	EPA-8270 SIM	**86.3**			20	150	04/28/2021	JMK
Benzo[G,H,I]Perylene - BSD	EPA-8270 SIM	**92.9**	**7**		20	150	04/28/2021	JMK

ALS Test Batch ID: R382394 - Soil by EPA-7196

SPIKED COMPOUND	METHOD	%REC	RPD	QUAL	LIMITS MIN	LIMITS MAX	ANALYSIS DATE	ANALYSIS BY
Chromium (VI) - BS	EPA-7196	**98.0**			91	114	04/26/2021	EBS
Chromium (VI) - BSD	EPA-7196	**98.0**	**0**		91	114	04/26/2021	EBS

ALS Test Batch ID: R382400 - Soil by EPA-7471

SPIKED COMPOUND	METHOD	%REC	RPD	QUAL	LIMITS MIN	LIMITS MAX	ANALYSIS DATE	ANALYSIS BY
Mercury - BS	EPA-7471	**108**			81.8	117	04/21/2021	RAL
Mercury - BSD	EPA-7471	**109**	**1**		81.8	117	04/21/2021	RAL

CERTIFICATE OF ANALYSIS

CLIENT:	WA State Department of Ecology 12121 NE 99th St, Suite 2100 Vancouver, WA 98682	DATE: ALS SDG#: WDOE ACCREDITATION:	5/5/2021 EV21040103 C601
CLIENT CONTACT:	Craig Rankine		
CLIENT PROJECT:	Ecology Kosmos - MIC J264C 00		

LABORATORY CONTROL SAMPLE RESULTS

ALS Test Batch ID: R382970 - Rinsate Extract by EPA-7470

SPIKED COMPOUND	METHOD	%REC	RPD	QUAL	LIMITS MIN	LIMITS MAX	ANALYSIS DATE	ANALYSIS BY
Mercury - BS	EPA-7470	**107**			85	115	04/30/2021	RAL
Mercury - BSD	EPA-7470	**107**	**0**		85	115	04/30/2021	RAL

ALS Test Batch ID: 164936 - Soil by EPA-6020

SPIKED COMPOUND	METHOD	%REC	RPD	QUAL	LIMITS MIN	LIMITS MAX	ANALYSIS DATE	ANALYSIS BY
Arsenic - BS	EPA-6020	**100**			80	120	04/21/2021	RAL
Arsenic - BSD	EPA-6020	**101**	**1**		80	120	04/21/2021	RAL
Cadmium - BS	EPA-6020	**111**			80	120	04/21/2021	RAL
Cadmium - BSD	EPA-6020	**112**	**1**		80	120	04/21/2021	RAL
Chromium - BS	EPA-6020	**103**			80	120	04/21/2021	RAL
Chromium - BSD	EPA-6020	**104**	**1**		80	120	04/21/2021	RAL
Copper - BS	EPA-6020	**104**			80	120	04/21/2021	RAL
Copper - BSD	EPA-6020	**105**	**1**		80	120	04/21/2021	RAL
Lead - BS	EPA-6020	**99.4**			80	120	04/21/2021	RAL
Lead - BSD	EPA-6020	**102**	**3**		80	120	04/21/2021	RAL
Nickel - BS	EPA-6020	**107**			80	120	04/21/2021	RAL
Nickel - BSD	EPA-6020	**108**	**1**		80	120	04/21/2021	RAL
Zinc - BS	EPA-6020	**105**			80	119	04/21/2021	RAL
Zinc - BSD	EPA-6020	**107**	**1**		80	119	04/21/2021	RAL

ALS Test Batch ID: R382968 - Rinsate Extract by EPA-6020

SPIKED COMPOUND	METHOD	%REC	RPD	QUAL	LIMITS MIN	LIMITS MAX	ANALYSIS DATE	ANALYSIS BY
Arsenic - BS	EPA-6020	**93.0**			89.1	110	04/30/2021	RAL
Arsenic - BSD	EPA-6020	**93.0**	**0**		89.1	110	04/30/2021	RAL
Cadmium - BS	EPA-6020	**94.0**			89.4	109	04/30/2021	RAL
Cadmium - BSD	EPA-6020	**94.0**	**0**		89.4	109	04/30/2021	RAL
Chromium - BS	EPA-6020	**95.0**			86.2	107	04/30/2021	RAL
Chromium - BSD	EPA-6020	**96.0**	**1**		86.2	107	04/30/2021	RAL
Copper - BS	EPA-6020	**96.0**			85.4	109	04/30/2021	RAL
Copper - BSD	EPA-6020	**97.0**	**1**		85.4	109	04/30/2021	RAL
Lead - BS	EPA-6020	**95.0**			87.5	107	04/30/2021	RAL
Lead - BSD	EPA-6020	**96.0**	**1**		87.5	107	04/30/2021	RAL
Nickel - BS	EPA-6020	**92.0**			85.4	109	04/30/2021	RAL
Nickel - BSD	EPA-6020	**93.0**	**1**		85.4	109	04/30/2021	RAL
Zinc - BS	EPA-6020	**93.0**			88.2	111	04/30/2021	RAL
Zinc - BSD	EPA-6020	**94.0**	**1**		88.2	111	04/30/2021	RAL

CERTIFICATE OF ANALYSIS

APPROVED BY

Glen Perry

Laboratory Director

CHAIN OF CUSTODY

EV21040103
SR#

1317 South 13th Ave., Kelso, WA 98626 | +1 360 577 7222 | +1 800 695 7222 | +1 360 636 1068 (fax)

PAGE 1 OF 1 COC#

PROJECT NAME Ecology Kosmos ~~MIC J262#~~ sm
PROJECT NUMBER MIC J264C 00
PROJECT MANAGER Craig Rankine
COMPANY NAME Ecology
ADDRESS 12121 NE 99St Ste 2100
CITY/STATE/ZIP Vancouver WA 98663
E-MAIL ADDRESS cran461@ecy.wa.gov
PHONE # 360 216 7394 FAX #
SAMPLER'S SIGNATURE

SAMPLE I.D.	DATE	TIME	LAB I.D.	MATRIX	NUMBER OF CONTAINERS		Semivolatile Organics by GC/MS 625☐ 8270☐ 8270LL☐ SIM PAH☒	Volatile Organics 624☐ 8260☐ 8021☒ BTEX☒	Hydrocarbons (*see below) Gas☒ Diesel☒ Oil☒	Oil & Grease/TRPH 1664 HEM☐ 1664 SGT☐	~~PCBs Aroclors☐ Congeners☐~~ Dx TCLP	Pesticides/Herbicides 608☐ 8081☐ 8151☐	Chlorophenolics - 8151M Tri☐ Tetra☐ PCP☐	Metals, [✓ Total] or Dissolved (See List below)	Cyanide☐ Hex-Chrom☒	(circle) pH, Cond., Cl, SO_4, PO_4, F, NO_2, NO_3, BOD, TSS, TDS, Turb.	(circle) NH_3-N, COD, TKN, TOC, DOC, NO_2+NO_3, T-Phos	TOX 9020☐ AOX 1650☐ 506☐	Alkalinity☐ CO_3☐ HCO_3☐	Dioxins/Furans 1613☐ 8290☐	Dissolved Gases RSK 175☐ Methane☐ Ethane☐ Ethene☐ CO_2☐	EPH/VPH (WA)	~~BTEX~~	Leach (see below) Metals TCLP	REMARKS
~~Ecot~~	2021																								
① Kosmos4162021NW	4/16	11:45		Soil	3		X	+	X		X			X	+							X	~~X~~	+	

REPORT REQUIREMENTS

___ I. Routine Report: Method Blank, Surrogate, as required
___ II. Report Dup., MS, MSD as required
___ III. CLP Like Summary (no raw data)
___ IV. Data Validation Report
___ V. EDD

INVOICE INFORMATION

P.O. #
Bill To:

TURNAROUND REQUIREMENTS

___ 24 hr. ___ 48 hr.
X 5 day BTEX, Dx Gx
___ Standard (15 working days)
___ Provide FAX Results

Requested Report Date

Circle which metals are to be analyzed:

Total Metals: Al [✓ As] Sb Ba Be B Ca [✓ Cd] Co [✓ Cr] [✓ Cu] Fe [✓ Pb] Mg Mn Mo [✓ Ni] K Ag Na Se Sr Tl Sn V [✓ Zn] [✓ Hg]

Dissolved Metals: Al As Sb Ba Be B Ca Cd Co Cr Cu Fe Pb Mg Mn Mo Ni K Ag Na Se Sr Tl Sn V Zn Hg

***INDICATE STATE HYDROCARBON PROCEDURE:** AK CA WI [✓ NORTHWEST] OTHER: ________ (CIRCLE ONE)

SPECIAL INSTRUCTIONS/COMMENTS:

Extract w/ ~~te~~ DI water for TCLP leach procedure, Ran extract for same analytes, No EPH/VPH analysis on TCLP extract. EDD ~ basic excel spreadsheet

Ⓧ 4/27/21 - Craig added on Std TAT. sm

☐ Sample Shipment contains USDA regulated soil samples (check box if applicable)

RELINQUISHED BY:		RECEIVED BY:		RELINQUISHED BY:		RECEIVED BY:	
Craig Rankine	4/16/2021	Howard Holmes	4/16/21	KMorrow	4/19/21	Glen Perry	4/20/21
Signature	Date/Time	Signature	Date/Time	Signature	Date/Time 1320	Signature	Date/Time
Craig Rankine	Ecology	Howard Holmes	ALS	ALS Kelso		Glen Perry	ALS
Printed Name	Firm	Printed Name	Firm	Printed Name	Firm	Printed Name	Firm

APPENDIX E

Tacoma Power's Water Quality Protection Plan, Tables 1 and 2, Revised September 9, 2021

Table 1. WQPP for Kosmos activities 9 September 2021 (riverine)

Parameters, analytical methods, detection limits (DLs) and quantitation levels (QLs) shown below, shall be used for water quality monitoring when the project site is **not** backwatered by Riffe Lake (water levels below elevation 720 feet, 2 feet above the bottom of the cap). Other methods may be used but must produce measurable results in the sample and be an EPA-approved method in 40 CFR Part 136. If an alternative method is used that is not specified in the list below the test method, DL, and QL will be defined in lab and/or monitoring reports and approved by Ecology's Water Quality Program Toxicologist prior to use of an alternative methodology. Indicator level values at or below those specified in the table are within compliance. This table is part of a Water Quality Protection Plan required by the Water Quality Certification and FERC License (P-2016).

Pollutant & CAS No. (if available)	**Sampling Frequency**	**Sample Type**	**Indicator Level, µg/L (unless noted)**	**Required Analytical Protocol**	**Detection Level, µg/L**	**Quantitation Level, µg/L**
METALS						
Arsenic, Total (7440-38-2)	When discharge occurs*	Grab	360[a]	200.8	0.1	0.5
Chromium, (hex) (18540-29-9)	When discharge occurs*	Grab	15[b]	SM3500-Cr C	0.3	1.2
Lead, Total (7439-92-1)	When discharge occurs*	Grab	23.5[a]	200.8	0.1	0.5
Cadmium (7440-43-9)	When discharge occurs*	Grab	1.5[a]	200.8	0.05	0.25
Mercury (7439-97-6)	When discharge occurs*	Grab	2.10[a]	1631E/245.1	0.0002	0.0005
Copper (7440-50-8)	When discharge occurs*	Grab	7.2[a]	200.8	0.4	2.0
Nickel (7440-02-0)	When discharge occurs*	Grab	652[a]	200.8	0.1	0.5
Zinc (7440-66-6)	When discharge occurs*	Grab	52.7[a]	200.8	0.5	2.5

Pollutant & CAS No. (if available)	Sampling Frequency	Sample Type	Indicator Level, µg/L (unless noted)	Required Analytical Protocol	Detection Level, µg/L	Quantitation Level, µg/L
BASE/NEUTRAL COMPOUNDS						
Benzo(a)anthracene (56-55-3)	When discharge occurs*	Grab	23.4	625.1	7.8	23.4
Benzo(b)fluoranthene (205-99-2)	When discharge occurs*	Grab	14.4	610/625.1	4.8	14.4
Benzo(k)fluoranthene (207-08-9)	When discharge occurs*	Grab	7.5	610/625.1	2.5	7.5
Benzo(a)pyrene (50-32-8)	When discharge occurs*	Grab	7.5	610/625.1	2.5	7.5
Chrysene (218-01-9)	When discharge occurs*	Grab	7.5	610/625.1	2.5	7.5
Indeno(1, 2, 3,-Cd)pyrene (193-39-5)	When discharge occurs*	Grab	11.1	610/625.1	3.7	11.1
Pyrene (129-00-0)	When discharge occurs*	Grab	5.7	625.1	1.9	5.7
NONCONVENTIONAL POLLUTANTS						
BTEX (benzene + toluene + ethylbenzene + m, o, p xylenes)	When discharge occurs*	Grab	2.0	EPA SW 846 8021/8260	1.0	2.0
PETROLEUM HYDROCARBONS						
Gasoline-Range Hydrocarbons (NWTPH-Gx)[c]	When discharge occurs*	Grab	250 [d]	NWTPH-Gx	250	250
Diesel-Range Hydrocarbons (NWTPH-Dx)[e]	When discharge occurs*	Grab	250 [d]	NWTPH-Dx	250	250

a	Acute – Freshwater Toxic Substances Criteria (WAC 173-201A-240); metals for receiving waterbody of hardness value = 40 (winter time). Hardness will need to be verified through sampling and criteria adjusted accordingly. Heavy metal toxicity general decreases in freshwater as hardness increases.
b	Indicator Level total chromium is actually for hexavalent chromium using Acute – Freshwater Toxic Substances Criteria (WAC 173-201A-240), National Toxics Rule (40 CFR 131.36).
c	NWTPH-Gx = Northwest Total Petroleum Hydrocarbons –Volatile petroleum products (includes aviation and automotive gasolines, mineral spirits, Stoddard solvent and naphtha).
d	No surface water standard, value is laboratory quantitation level.
e	NWTPH-Dx = Northwest Total Petroleum Hydrocarbons – Semi-volatile (“diesel”) for diesel range organics and heavy oils (includes jet fuels, kerosene, diesel-oils, hydraulic fluids, mineral oils, lubricating oils, and fuel oils). Indicator level is the sum of all the oils present.
f	Or equivalent.
*	Sampling to occur when discharges occur from stockpile area, when oil ledge is exposed to stormwater/lake water, when there is a sheen on standing water, or more frequently when Riffe Lake elevation fluctuates. Frequency and parameters assessed will be modified as specified by Ecology.

Table 2. WQPP for Kosmos activities 9 September 2021 (lake)

Parameters, analytical methods, detection limits (DLs) and quantitation levels (QLs) shown below, shall be used for water quality monitoring when the project site is backwatered by Riffe Lake (water levels above elevation 720 feet). Other methods may be used but must produce measurable results in the sample and be an EPA-approved method in 40 CFR Part 136. If an alternative method is used that is not specified in the list below the test method, DL, and QL will be defined in lab and/or monitoring reports and approved by Ecology's Water Quality Program Toxicologist prior to use of an alternative methodology. Indicator level values at or below those specified in the table are within compliance. This table is part of a Water Quality Protection Plan required by the Water Quality Certification and FERC License (P-2016).

Pollutant & CAS No. (if available)	Sampling Frequency	Sample Type	Indicator Level, µg/L (unless noted)	Required Analytical Protocol	Detection Level, µg/L	Quantitation Level, µg/L
METALS						
Arsenic, Total (7440-38-2)	When discharge occurs*	Grab	360[a]	200.8	0.1	0.5
Chromium, (hex) (18540-29-9)	When discharge occurs*	Grab	15[b]	SM3500-Cr C	0.3	1.2
Lead, Total (7439-92-1)	When discharge occurs*	Grab	15.1[a]	200.8	0.1	0.5
Cadmium (7440-43-9)	When discharge occurs*	Grab	1.0[a]	200.8	0.05	0.25
Mercury (7439-97-6)	When discharge occurs*	Grab	2.10[a]	1631E/245.1	0.0002	0.0005
Copper (7440-50-8)	When discharge occurs*	Grab	5.0[a]	200.8	0.4	2.0
Nickel (7440-02-0)	When discharge occurs*	Grab	467.5[a]	200.8	0.1	0.5
Zinc (7440-66-6)	When discharge occurs*	Grab	37.7[a]	200.8	0.5	2.5

Pollutant & CAS No. (if available)	Sampling Frequency	Sample Type	Indicator Level, µg/L (unless noted)	Required Analytical Protocol	Detection Level, µg/L	Quantitation Level, µg/L
BASE/NEUTRAL COMPOUNDS						
Benzo(a)anthracene (56-55-3)	When discharge occurs*	Grab	23.4	625.1	7.8	23.4
Benzo(b)fluoranthene (205-99-2)	When discharge occurs*	Grab	14.4	610/625.1	4.8	14.4
Benzo(k)fluoranthene (207-08-9)	When discharge occurs*	Grab	7.5	610/625.1	2.5	7.5
Benzo(a)pyrene (50-32-8)	When discharge occurs*	Grab	7.5	610/625.1	2.5	7.5
Chrysene (218-01-9)	When discharge occurs*	Grab	7.5	610/625.1	2.5	7.5
Indeno(1, 2, 3,-Cd)pyrene (193-39-5)	When discharge occurs*	Grab	11.1	610/625.1	3.7	11.1
Pyrene (129-00-0)	When discharge occurs*	Grab	5.7	625.1	1.9	5.7
NONCONVENTIONAL POLLUTANTS						
BTEX (benzene + toluene + ethylbenzene + m, o, p xylenes)	When discharge occurs*	Grab	2.0	EPA SW 846 8021/8260	1.0	2.0
PETROLEUM HYDROCARBONS						
Gasoline-Range Hydrocarbons (NWTPH-Gx)[c]	When discharge occurs*	Grab	250 [d]	NWTPH-Gx	250	250
Diesel-Range Hydrocarbons (NWTPH-Dx)[e]	When discharge occurs*	Grab	250 [d]	NWTPH-Dx	250	250

a	Acute – Freshwater Toxic Substances Criteria (WAC 173-201A-240); metals for receiving waterbody of hardness value = 27 (winter time). Hardness will need to be verified through sampling and criteria adjusted accordingly. Heavy metal toxicity general decreases in freshwater as hardness increases.
b	Indicator Level total chromium is actually for hexavalent chromium using Acute – Freshwater Toxic Substances Criteria (WAC 173-201A-240), National Toxics Rule (40 CFR 131.36).
c	NWTPH-Gx = Northwest Total Petroleum Hydrocarbons –Volatile petroleum products (includes aviation and automotive gasolines, mineral spirits, Stoddard solvent and naphtha).
d	No surface water standard, value is laboratory quantitation level.
e	NWTPH-Dx = Northwest Total Petroleum Hydrocarbons – Semi-volatile (“diesel”) for diesel range organics and heavy oils (includes jet fuels, kerosene, diesel-oils, hydraulic fluids, mineral oils, lubricating oils, and fuel oils). Indicator level is the sum of all the oils present.
f	Or equivalent.
*	Sampling to occur when discharges occur from stockpile area, when oil ledge is exposed to stormwater/lake water, when there is a sheen on standing water, or more frequently when Riffe Lake elevation fluctuates. Frequency and parameters assessed will be modified as specified by Ecology.